Chapter 3.1
Geology, Seismicity, and Soils

Introduction

This chapter provides a discussion of the geology, seismicity, and soils issues related to the Proposed Project and the 130-Unit Alternative in Carmel Valley. This chapter includes a review of existing conditions based on available literature and field surveys; a summary of local, state, and federal policies and regulations related to geology, seismicity, and soils; and an analysis of direct and indirect environmental impacts of the Project and 130-Unit Alternative. Where feasible, mitigation measures are recommended to reduce the level of impacts.

Impact Summary

The geology, seismicity, and soils impacts from the Proposed Project and the 130-Unit Alternative are summarized in **Table 3.1-1** below. The Proposed Project and the 130-Unit Alternative would not have any significant short- or long-term adverse impacts related to geologic, seismic, and soil conditions and hazards in the project area with mitigation. The Project and the 130-Unit Alternative would be designed in accordance with applicable seismic design standards to reduce the risk of damage during an earthquake. Likewise, standard engineering practices would be used to overcome the geologic constraints associated with the expansive soils and unstable hillslopes that were identified in the project area during geotechnical investigations performed for the Project (ENGEO 2005).

Table 3.1-1. Geology, Seismicity, and Soils Impact Summary

Impact	Proposed Project Level of Significance	130-Unit Alternative Level of Significance	Mitigation Measure	Level of Significance after Mitigation
A. Seismic Hazards				
GEO-1: Substantial Adverse Effects Resulting From Fault Rupture	NI	NI	None Required	–
GEO-2: Substantial Adverse Effects Resulting from Earthquake-Induced Ground Shaking	LTS	LTS	None Required	–
GEO-3: Substantial Adverse Effects Resulting from Seismic-Related Ground Settlement	Potentially Significant	Potentially Significant	GEO-1: Design All Proposed Structures in Accordance with the Requirements of the California Building Code, Current Edition, and Recommendations Contained in the Site-Specific Geologic and Geotechnical Reports	LTS
GEO-4: Substantial Adverse Effects Resulting from Earthquake-Induced Liquefaction	LTS	LTS	None Required	–
B. Landslides and Slope Stability				
GEO-5: Substantial Adverse Effects Resulting from Landsliding	Potentially Significant	Potentially Significant	GEO-2: Conduct Additional Site-Specific Investigation Relative to Lot 130 and Implement Recommended Grading and Slope Design Criteria of the Site-Specific Geotechnical Reports	LTS
C. Erosion				
GEO-6: Accelerated Soil Erosion and Sedimentation	Potentially Significant	Potentially Significant	GEO-3: Prepare and Implement an Erosion and Sediment Control Plan	LTS

Impact	Proposed Project Level of Significance	130-Unit Alternative Level of Significance	Mitigation Measure	Level of Significance after Mitigation
D. Soil Constraints				
GEO-7: Substantial Adverse Effects Resulting from Expansive Soils	Potentially Significant	Potentially Significant	GEO-1: Design All Proposed Structures in Accordance with the Requirements of the California Building Code, Current Edition, and Recommendations Contained in the Site-Specific Geologic and Geotechnical Reports GEO-4: Remove Localized Zones of Overly Loose Materials GEO-5: Prepare a Geotechnical Report for Lot 130 Concerning Expansive Soils (130-Unit Alternative only)	LTS
GEO-8: Substantial Adverse Effects Resulting from Loss of Topsoil	LTS	LTS	None Required	–
GEO-9: Effects of Septic Systems on Soils	NI	NI	None Required	-
LTS = Less than Significant, NI = No Impact				

Environmental Setting

Research Methods

Information on the existing conditions was derived from sources in the published geologic and soils literature and from the geotechnical report prepared for the project. No additional fieldwork was performed for this Recirculated Draft Environmental Impact Report (EIR).

Geotechnical Investigations

In order to obtain baseline information on existing geologic, seismic, and soil conditions, a series of site-specific geotechnical investigations were conducted by ENGEO on October 20, 2003, March 3, 2004, and July 22 and 23, 2004. The resulting geotechnical report, prepared by ENGEO on April 20, 2004 and subsequently revised on September 14, 2005, is summarized and supplemented with additional information herein. These reports were prepared for the Proposed Project.

Literature Reviewed

The following literature was reviewed to assess the geologic, seismic, and soil conditions found in the project area.

- California Building Standards Commission. 2013. *California Building Code*.
- California Division of Mines and Geology. 2000. Digital images of official maps of the Alquist-Priolo earthquake fault zones of California, Central Coast Region. (California Division of Mines and Geology. 2000.
- California Geological Survey. Seismic Hazards Mapping Program website. Accessed October 2014, http://www.conservation.ca.gov/cgs/shzp. 2014.
- Monterey County. 2007. *General Plan Update*. Chapter 4.4 Geology, Soils, and Seismicity.
- ENGEO. 2005. Geotechnical Exploration, Rancho Cañada Village, Carmel Valley, California. Prepared for Lombardo Land Group-1. San Ramon, CA.[1]
- Hart, E. W., Bryant, W. A. 1997. *Fault-Rupture Hazard Zones in California – Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps*. (Special Publication 42.) Sacramento, CA: California Division of Mines and Geology.
- Monterey County. 1986. *Carmel Valley Master Plan*. Amended November 5, 1996. Monterey County, CA.
- Monterey County. 1982. *Monterey County General Plan*. Monterey County, CA.
- U.S. Department of Agriculture Soil Conservation Service. 1978. Soil Survey: Monterey County, California.
- U.S. Department of Agriculture Soil Conservation Service. Web Soil Survey website. Accessed October 2014, http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. 2014.

Geologic Setting

The project area is located in the Carmel Valley, a broad alluvial low that drains westward via the Carmel River into the Pacific Ocean. The rolling hills that immediately surround the valley lie within the Coast Ranges geomorphic province, which is characterized by a series of northwest trending mountains and valleys.

The Coast Range province is geologically complex. Regional geomorphic features within the Carmel and Monterey areas are related to complex tectonics of the San Andreas fault/plate boundary system. West of the San Andreas Fault Zone, the core of the Coast Ranges is underlain by Cretaceous granitic basement rock referred to as the Salinian block. Overlying the Salinian Block is a thick layer of Cretaceous and Tertiary sedimentary rocks, which are, in turn, overlain by late Pleistocene or early Holocene alluvial deposits consisting of poorly consolidated clay, silt, sand, and gravel (ENGEO 2005).

Soils

Soils on the West Course at Rancho Cañada Golf Club have been mapped primarily as Pico fine sandy loam. The soils underlying Lot 130 are mapped as primarily Lockwood shaly loam, 2 to 9% slopes, and Santa Ynez fine sandy loam, 2 to 9% slopes (U.S. Department of Agriculture 2014). Floodplain areas adjacent to the river channel are situated on Metz fine sandy loam and Tujunga fine sand, 0 to

[1] This report was conducted for the Proposed Project. Its applicability to the 130-Unit Alternative pertains only to the areas where the Proposed Project and 130-Unit Alternative overlap.

5% slopes, while areas located nearer to Carmel Valley Road consist of Santa Ynez fine sandy loam, 2 to 9% slopes (U.S. Department of Agriculture 2014). The following sections provide additional information on the soil units of the project site.

Pico Fine Sandy loam

Pico fine sandy loam is a nearly level soil that is found primarily on flood plains. The surface layer typically consists of a grayish-brown, mildly to moderately alkaline fine sandy loam about 18 inches thick. Soils in this series are well-drained; permeability is moderately rapid and runoff is slow. The shrink-swell potential of Pico fine sandy loam is typically low. Risk of corrosion is high for uncoated steel and low for concrete (U.S. Soil Conservation Service 1978).

Metz Fine Sandy Loam

Metz fine sandy loam is a nearly level soil on flood plains. The surface layer typically consists of light brownish gray, moderately alkaline, stratified fine sand, sand, and very fine sandy loam extending to a depth of more than 60 inches. Soils of this series have a moderate permeability in the upper layers, but drain more rapidly at depths of 48 inches or more in some places. Runoff is typically slow, and erosion hazard is slight. The shrink-swell potential of Metz fine sandy loam is typically low. Risk of corrosion is high for uncoated steel and low for concrete (U.S. Soil Conservation Service 1978).

Tujunga Fine Sand, 0 to 5% Slopes

Soils in the vicinity of the Carmel River are mapped as Tujunga fine sand, 0 to 5% slopes, which typically occur on flood plains and alluvial fans, mainly in small, narrow areas along drainage ways. The surface layer consists of light brownish gray, slightly acid fine sand about 10 inches thick, which is underlain by pale brown and light gray, slightly acid and mildly alkaline fine sand and sand that extends to a depth of more than 60 inches. Tujunga fine sand is somewhat excessively drained; runoff is very slow, and the erosion hazard is slight, but some channel erosion does occur. The shrink-swell potential of Tujunga fine sand, 0 to 5% slopes is typically low. Risk of corrosion is low for uncoated steel and low for concrete (U.S. Soil Conservation Service 1978).

Santa Ynez Fine Sandy Loam, 2 to 9% Slopes

The Santa Ynez soil series consists of moderately well drained soils on alluvial terraces. The surface layer is grayish brown and gray, medium acid fine sandy loam about 20 to 30 inches thick and is underlain by a 2-inch subsurface layer of light brownish gray, medium acid fine sandy loam. Runoff is slow or medium, and the erosion hazard is slight or moderate. The shrink-swell potential of Santa Ynez fine sandy loam, 2 to 9% slopes is typically low. Risk of corrosion is moderate for uncoated steel and low for concrete (U.S. Soil Conservation Service 1978).

Lockwood Shaly Loam, 2 to 9% Slopes

Lockwood shaly loam is a gently sloping to moderately sloping soil on alluvial fans and terraces. The surface layer is either gray very strongly acid to neutral shaly loam about 26 inches thick or shaly clay loam in some places. The subsoil is gray, neutral shaly heavy loam and brown, mildly alkaline shaly clay loam that extends to a depth of 82 inches. Lockwood shaly loam is well drained, runoff is slow or medium, and the erosion hazard is slight or moderate. The shrink-swell potential of

Lockwood shaly loam, 2 to 9% slopes is typically moderate. Risk of corrosion is high for uncoated steel and low for concrete (U.S. Soil Conservation Service 1978).

Seismicity

Primary Seismic Hazards—Surface Fault Rupture and Groundshaking

Numerous active[2] faults have been mapped in the regional vicinity of the project area. The project area lies within the *Low to Very High* seismic hazard zone in Figure 8a of the *Monterey County General Plan* (Monterey County 2010). The Uniform Building Code (UBC) (International Conference of Building Officials 1997), which recognizes as active some faults that are not currently included under the Alquist-Priolo Act, shows no active faults in the immediate site vicinity. The risk of surface rupture in the project area is thus considered minimal.

The project area does, however, have the potential to experience strong groundshaking as a result of seismic activity on any of the area's principal active faults; **Figure 3.1-1** shows the project location in relation to principal faults of the Central Coast region. Nearby active or potentially active faults include the Tularcitos fault, located about 3 miles northeast of the site; the San-Gregorio-Palo Colorado fault, located approximately 5 miles west of the site; and the Rinconada fault, located approximately 12 miles east of the site (ENGEO 2005).

Secondary Seismic Hazards—Liquefaction and Ground Settlement

Liquefaction is a process by which soils and sediments lose shear strength and fail during episodes of intense seismic ground shaking. The susceptibility of a given soil or sediment to liquefaction is primarily a function of local groundwater conditions and certain soil and sediment properties such as particle size distribution and bulk density. Water-saturated fine sands and silts located within 50 feet of the surface are typically considered most susceptible to liquefaction. Unsaturated, well-consolidated soils and sediments that consist of coarser or finer materials are generally less susceptible to liquefaction. The potential for liquefaction to occur in a given area is a function of a soils susceptibility to liquefaction and ground shaking potential (i.e., proximity to active faults).

The site-specific geotechnical investigation performed for the project site suggests that most soils and sediments underlying the site do not have a high susceptibility to liquefaction or liquefaction-induced ground failure. In one area south of the West Course at Rancho Cañada Golf Club, the investigation encountered a thick liquefiable subsurface layer, overlain by an insufficient layer of nonliquefiable surface materials that was judged as having the potential to induce ground failure during a very strong seismic groundshaking event. However, the location of the deposit was determined to be of little consequence to the area overlapped by Proposed Project and 130-Unit Alternative, since ground failure in that location would primarily affect an area of open space (ENGEO 2005).

In addition to the liquefaction hazards discussed previously, the investigation found that densification of the sandy soils above and below groundwater levels could result in ground settlement during an earthquake. Since some of the surface materials have densities ranging from

[2] An active fault is defined by the State Mining and Geology Board as one that has had surface displacement within Holocene time (defined by the state as including about the last 11,000 years) (California Department of Conservation. No Date).

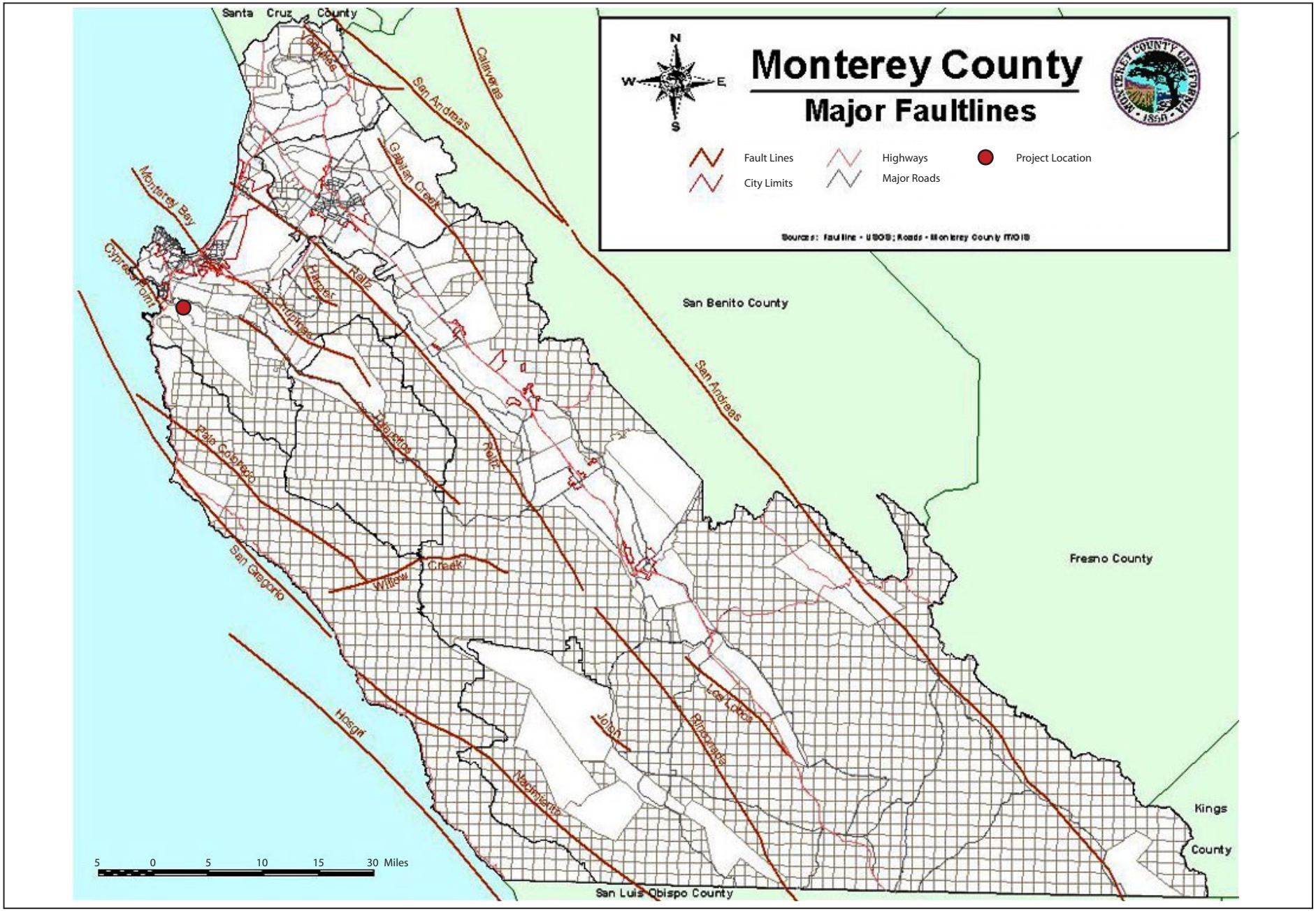

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Figure 3.1-1
Regional Faultlines and Seismicity

loose to medium and are potentially liquefiable, it is estimated that up to 4 inches of settlement may occur as a result of densification within the residential development area (ENGEO 2005).

Landslide Hazards

Slope gradients in the immediate vicinity of the project area are gentle, and existing risk of slope failure, including seismically induced landslides, is low. Slope gradients in the project area are generally between 0 and 19%. Slope gradients north of Lot 130 and Carmel Valley Road are steeper, slopes can be as much as 50%, and risk of seismically induced landslides is moderate. A few areas on the project area have slopes between 20 and 30%, which correspond to the riverbanks and other water features of the existing golf course. Very few areas have slopes with gradients above 30%.

Regulatory Setting

This section discusses the local, state, and federal policies and regulations that are relevant to the analysis of geology, seismicity, and soils impacts of the Proposed Project and the 130-Unit Alternative.

Federal Policies and Regulations

There are no relevant federal policies that regulate geologic, soils, or seismic-related resources that would apply to the Proposed Project and 130-Unit Alternative.

State Policies and Regulations

Alquist-Priolo Earthquake Fault Zoning Act

California's Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code Section 2621 et seq.), originally enacted in 1972 as the Alquist-Priolo Special Studies Zones Act and renamed in 1994, is intended to reduce the risk to life and property from surface fault rupture during earthquakes. The Alquist-Priolo Act prohibits the location of most types of structures intended for human occupancy across the traces of active faults and strictly regulates construction in the corridors along active faults (Earthquake Fault Zones). It also defines criteria for identifying active faults, giving legal weight to terms such as *active*, and establishes a process for reviewing building proposals in and adjacent to Earthquake Fault Zones.

Under the Alquist-Priolo Act, faults are zoned and construction along or across them is strictly regulated if they are *sufficiently active* and *well-defined*. A fault is considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement during Holocene time (defined for purposes of the Act as referring to approximately the last 11,000 years). A fault is considered well-defined if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface, using standard professional techniques, criteria, and judgment (Hart and Bryant 1997).

California Building Code

The CBC is included in Title 24 of the California Code of Regulations (CCR), and composes part of the California Building Standards Code. The CBC incorporates the UBC, a widely adopted model building

code in the United States. The CBC also includes necessary California amendments and expands on the UBC by providing more stringent standards addressing reduction of earthquake risk to structures in this seismically active state.

Chapter 16 of the CBC deals with General Design Requirements, including (but not limited to) regulations governing seismically resistant construction (Chapter 16, Division IV) and construction to protect people and property from hazards associated with excavation cave-ins and falling debris or construction materials. Chapters 18 and A33 deal with site demolition, excavations, foundations, retaining walls, and grading, including requirements for seismically resistant design, foundation investigations, stable cut and fill slopes, and drainage and erosion control. Among other things, the CBC defines different building regions in the state and ranks them according to their seismic hazard potential. There are four types of these regions: Seismic Zones 1 through 4, with Zone 1 having the least seismic potential and Zone 4 having the highest seismic potential. The project site is located within Zone 4, as is much of western California. Of the four seismic zones designated in the United States, Zone 4 is expected to experience the greatest effects from earthquake ground shaking and therefore has the most stringent requirements for seismic design.

Other Laws and Regulations

Other laws pertaining to hazardous materials include the Safe Drinking Water and Toxic Enforcement Act (Proposition 65) and the California Government Code, Section 2.65962.5, which require the Office of Permit Assistance to compile a list of potentially contaminated sites throughout the state.

Local Policies and Regulations

Current County Plans and Policies

The following plans and policies are currently in effect.

2010 Monterey County General Plan

The 2010 *Monterey County General Plan* (2010 General Plan) presents goals and policies that guide the general distribution and intensity of land uses, including residential, agricultural, commercial and industrial, public facilities, and open space uses, for lands in the County outside the Coastal Zone (Monterey County 2010).The following policies from the 2010 General Plan Conservation and Open Space Element and the Safety Element are relevant to the issues addressed in this section.

Conservation and Open Space Element

Policy OS-3.1: Best Management Practices (BMPs) to prevent and repair erosion damage shall be established and enforced.

Safety Element

Policy S-1.1: Land uses shall be sited and measures applied to reduce the potential for loss of life, injury, property damage, and economic and social dislocations resulting from ground shaking, liquefaction, landslides, and other geologic hazards in the high and moderate hazard susceptibility areas.

Policy S-1.3: Site-specific geologic studies may be used to verify the presence or absence and extent of the hazard on the property proposed for new development and to identify mitigation measures for

any development proposed. An ordinance including permit requirements relative to the siting and design of structures and grading relative to seismic hazards shall be established.

Policy S-1.4: The Alquist-Priolo Earthquake Fault Zoning Act shall be enforced.

Policy S-1.5: Structures in areas that are at high risk from fault rupture, landslides, or coastal erosion shall not be permitted unless measures recommended by a registered engineering geologist are implemented to reduce the hazard to an acceptable level. Development shall be discouraged in the following areas:

a. Areas within 50 feet of active faults. Within State or County Earthquake Fault Zones, trenching or other suitable methodology shall be used to determine the location of the fault.

b. Areas within or adjacent to large active landslides. Large active landslides are those that are economically or technically infeasible to mitigate because of their rate of movement or size and volume.

Policy S-1.6: New development shall not be permitted in areas of known geologic or seismic hazards unless measures recommended by a California certified engineering geologist or geotechnical engineer are implemented to reduce the hazard to an acceptable level. Areas of known geologic or seismic hazards include:

a. Moderate or high relative landslide susceptibility.

b. High relative erosion susceptibility.

c. Moderate or high relative liquefaction susceptibility.

d. Coastal erosion and seacliff retreat.

e. Tsunami run-up hazards.

Policy S-1.7: Site-specific reports addressing geologic hazard and geotechnical conditions shall be required as part of the planning phase and review of discretionary development entitlements and as part of review of ministerial permits in accordance with the California Building Standards Code as follows:

a. Geotechnical reports prepared by State of California licensed Registered Geotechnical Engineers are required during building plan review for all habitable structures and habitable additions over 500 square feet in footprint area. Additions less than 500 square feet and non-habitable buildings may require geotechnical reports as determined by the pre-site inspection.

b. A Registered Geotechnical Engineer shall be required to review and approve the foundation conditions prior to plan check approval, and if recommended by the report, shall perform a site inspection to verify the foundation prior to approval to pour the footings. Setbacks shall be identified and verified in the field prior to construction.

c. All new development and subdivision applications in State- or County-designated Earthquake Fault Zones shall provide a geologic report addressing the potential for surface fault rupture and secondary fracturing adjacent to the fault zone before the application is considered complete. The report shall be prepared by a Registered Geologist or a Certified Engineering Geologist and conform to the State of California's most current Guidelines for evaluating the hazard of surface fault rupture.

d. Geologic reports and supplemental geotechnical reports for foundation design shall be required in areas with moderate or high landslide or liquefaction susceptibility to evaluate the potential on- and off-site impacts on subdivision layouts, grading, or building structures.

e. Where geologic reports with supplemental geotechnical reports determine that potential hazards effecting new development do not lead to an unacceptable level of risk to life and property, development in all Land Use Designations may be permissible, so long as all other applicable General Plan policies are complied with.

f. Appropriate site-specific mitigation measures and mitigation monitoring to protect public health and safety, including deed restrictions, shall be required.

Policy S-1.8: As part of the planning phase and review of discretionary development entitlements, and as part of review of ministerial permits in accordance with the California Building Standards Code, new development may be approved only if it can be demonstrated that the site is physically suitable and the development will neither create nor significantly contribute to geologic instability or geologic hazards.

Policy S-1.9: A California licensed civil engineer or a California licensed landscape architect can recommend measures to reduce moderate and high erosion hazards in the form of an Erosion Control Plan.

2013 Carmel Valley Master Plan

The 2013 CVMP is part of the 2010 General Plan. As such, the policies outlined in the 2013 CVMP and summarized below must be considered in conjunction with the 2010 General Plan.

Policy CV-4.1: In order to reduce potential erosion or rapid runoff:

a. The amount of land cleared at any one time shall be limited to the area that can be developed during one construction season.

b. Motorized vehicles shall be prohibited on the banks or in the bed of the Carmel River, except by permit from the Water Management District or Monterey County.

c. Native vegetative cover must be maintained on areas that have the following combination of soils and slope:

1. Santa Lucia shaly clay loam, 30–50% slope (SfF)
2. Santa Lucia-Reliz Association, 30–75% slope (Sg)
3. Cieneba fine gravelly sandy loam, 30–70% slope (CcG)
4. San Andreas fine sandy loam, 30–75% slope (ScG)
5. Sheridan coarse sandy loam, 30–75% slope (SoG)
6. Junipero-Sur complex, 50–85% slope (Jc)

Policy CV-4.4: The County shall require emergency road connections as necessary to provide controlled emergency access as determined by appropriate emergency service agencies (Fire Department, OES). The County shall coordinate with the emergency service agencies to periodically update the list of such connections.

Monterey County Building Code

The CBC, 2001 Edition, Volumes 1 and 2, published by the California Building Standards Commission and the International Conference of Building Officials, is adopted and incorporated, with subsequent amendments, into the Monterey County Building Code. All building guidelines used for the Proposed Project and 130-Unit Alternative will be dictated by the Monterey County Building Code.

Monterey County Erosion Control Ordinance

Monterey County has a specific Erosion Control Ordinance (Chapters 16.08 through 16.12 of the County Code). The County Building Services Department enforces the ordinance. The ordinance was adopted to safeguard the health, safety and public welfare and to minimize erosion, protect fish and wildlife, and otherwise protect the natural environment. Erosion control plans are required for building, grading, and land clearing.

Grading permits are required for all projects that move 100 cubic yards or more of soil. No grading permit can be issued if a determination is made that grading will result in hazards by reason of flood, geological hazard, seismic hazard or unstable soils, or is liable to endanger any other property or result in the deposition of debris on any public way or property or drainage course, or otherwise create a nuisance. Grading/erosion control inspectors and the chief building official conduct the procedural review associated with issuance of grading permits. Erosion control measures are enforced to eliminate and prevent conditions of accelerated erosion that have led to, or could lead to degradation of water quality, loss of fish habitat, damage to property, loss of topsoil or vegetation cover, disruption of water supply, and increased danger from flooding.

As part of this permit, the Project Applicant is required to submit a grading and erosion control plan, vicinity and site maps, and other supplemental information. Standard conditions in the grading permit include an extensive list of best management practices (BMPs) similar to those contained in a stormwater pollution prevention plan (SWPPP). All grading operations for which a permit is required are subject to inspection by the Director of Building Inspection, or an engineer responsible for field inspection of his or her approved plans. In addition to meeting the conditions of the grading permit, the project applicant is required to uphold specific design standards, as adopted and/or amended by the County from the CBC, related to cuts and fills, erosion control devices or methods, and drainage facilities.

Emergency Response Planning

The County has adopted a comprehensive plan dealing with emergency response, including response to emergency earthquake, major fire, and flooding situations. The current *Monterey County Emergency Plan* is reviewed and updated yearly.

Prior County Plans and Policies

As stated in Chapter 1, *Introduction*, discussion pertaining to the 1982 General Plan and the 1986 CVMP is provided for informational purposes only.

1982 Monterey County General Plan

The 1982 *Monterey County General Plan* (1982 General Plan) contains the following policies that are intended to help avoid or mitigate geologic and seismic hazards.

Geology, Minerals, and Soils

Policy 3.1.1: Erosion control procedures shall be established and enforced for all private and public construction and grading projects.

Policy 3.1.2: The County shall support and encourage existing special district, state, and federal soil conservation and restoration programs within its borders.

Policy 3.1.3: In the absence of more detailed site specific studies, determinations of soil suitability for particular land uses shall be made according to the Soil Conservation Service's Soil Survey of Monterey County.

Seismic and Other Geologic Hazards

Policy 15.1.3: Lands within 1/8 mile of active or potentially active faults shall be treated as a fault zone until accepted geo-technical investigations indicate otherwise.

Policy 15.1.6: Prior to the construction of a new public facility or critical structure within a high hazard zone, the County shall require a full geological investigation by a registered geologist.

Policy 15.1.7: Prior to the issuance of a building or grading permit, the County shall require liquefaction investigations for proposed critical use structures and multi-family dwellings over four units when located in areas of moderate or high hazard for liquefaction or subject to the following conditions: location in primary floodways; and groundwater levels less than 20 feet, as measured in spring and fall.

Policy 15.1.8: The County should require a soils report on all building permits and grading permits within areas of known slope instability or where significant potential hazard has been identified.

Policy 15.1.12: The County shall require grading permits to have an approved site plan which minimizes grading and conforms to the recommendations of a detailed soils or geology investigation where required.

Policy 15.1.13: The County shall require septic leachfields and drainage plans to direct runoff and drainage away from unstable slopes.

Policy 15.1.15: Side castings from the grading of roads and building pads shall be removed from the site unless they can be distributed on the site so as not to change the natural landform. An exception to this policy will be made for those cases where changes in the natural landform are required as a condition of development approval.

1986 Carmel Valley Master Plan

The 1986 *Carmel Valley Master Plan* (1986 CVMP) is part of the 1982 General Plan. As such, the policies outlined in the 1986 CVMP and summarized below must be considered in conjunction with the 1982 General Plan.

Natural Resources: Geology, Minerals, and Soils

Policy 3.1.1.1: A soils report in accordance with the Monterey County Grading and Erosion Control ordinances shall be required for all changes in land use which require a discretionary approval in high or extreme erosion hazard areas as designated by the Soil Conservation Service manual, "Soil Surveys of Monterey County." This report shall include a discussion of existing or possible future deposition of upslope materials or downslope slippage for each site.

Policy 3.1.1.2: As part of the building permit process, the erosion control plan shall include these elements:

- Provision for keeping all sediment on-site.
- Provision for slow release of runoff water so that runoff rates after development do not exceed rates prevailing before development.
- Revegetation measures that provide both temporary and permanent cover.
- Map showing drainage for the site, including that coming onto and flowing off the property.
- Storm drainage facilities shall be designed to accommodate runoff from 10-year or 100-year storms as recommended by the Monterey County Flood Control and Water Conservation District.

Policy 3.1.1.3: All exposed areas within development projects subject to erosion and not involved in construction operations shall be protected by mulching or other means during the rainy season (October 15-April 15).

Policy 3.1.4: Grading shall be minimized through the use of step and pole foundations, where appropriate.

Policy 3.1.5: The amount of land cleared at any one time shall be limited to the area that can be developed during one construction season. This prevents unnecessary exposure of large areas of soil during the rainy season.

Policy 3.1.6: Site control shall be established throughout the Master Plan area, including lots of record and utilities extension, in order to minimize erosion and/or modification of landforms.

Impact Analysis

Methods for Analysis

Potential impacts related to geology, seismicity, and soils were analyzed qualitatively, based on a review of available data and information for the project area. Analysis focused on the Proposed Project's and 130-Unit Alternative's potential to increase the risk of personal injury, loss of life, and damage to property, including project facilities, as a result of existing or reasonably foreseeable geologic, seismic, and soil conditions in the project area.

Criteria for Determining Significance

In accordance with CEQA, State CEQA Guidelines, the 2010 General Plan plans and policies, the 2013 CVMP plans and policies, and agency and professional standards, a project impact would be considered significant if the project would:

A. Seismic Hazards

- Expose people or structures to potential substantial adverse effects resulting from the rupture of a known earthquake fault, seismic ground shaking, landslides, or seismic-related ground-failure, including liquefaction, and that cannot be mitigated through the use of standard engineering design techniques.

B. Landslides and Slope Stability

- Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide or slope failure.
- Be located on an existing slope with a gradient greater than 30%.

C. Erosion

- Result in substantial soil erosion or the loss of topsoil and subsequent sedimentation into local drainage facilities and water bodies.

D. Soil Constraints

- Be located on an expansive soil, as defined by the California Building Code (1997) or be subject or to other soil constraints that might result in deformation of foundations or damage to structures, creating substantial risks to life or property.
- Result in substantial soil erosion or the loss of topsoil.

- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Impacts and Mitigation Measures

A. Seismic Hazards

Impact GEO-1: Substantial Adverse Effects Resulting from Fault Rupture (no impact)

Proposed Project

No active or inactive faults cross the project site; the site is not within any Earthquake Fault Zone designated by the state under the Alquist-Priolo Earthquake Fault Zoning Act (California Division of Mines and Geology 2000). Consequently, the Proposed Project is unlikely to increase exposure of people or structures to hazards related to surface fault rupture. Therefore, there would be *no impact* and no mitigation is required.

130-Unit Alternative

Similar to the Proposed Project, the 130-Unit Alternative site, including Lot 130, is not within any Earthquake Fault Zone designated by the state under the Alquist-Priolo Earthquake Fault Zoning Act (California Division of Mines and Geology 2000);. Consequently, the 130-Unit Alternative would not increase exposure of people or structures to hazards related to surface fault rupture. Therefore, there would be *no impact.* No mitigation is required.

Impact GEO-2: Substantial Adverse Effects Resulting from Earthquake-Induced Ground Shaking (less than significant)

Proposed Project

The project site has the potential to experience strong ground shaking as a result of seismic activity on any of the region's principal active faults, and could expose people or structures to potential substantial adverse effects. All structures are required to be designed to meet or exceed the Monterey County Building Code requirements as adopted from the CBC. These codes include a wide variety of stipulations relevant to reducing earthquake-related risk, including foundation and structural design, and structural tolerances. Conformance to these codes does not constitute a guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake, but it would reduce the potential for structural damage resulting from a major earthquake to a less-significant level. Therefore, this impact would be *less than significant*. No mitigation is required.

130-Unit Alternative

Similar to the Proposed Project, the 130-Unit Alternative site, including Lot 130, would experience strong groundshaking as a result of seismic activity on any of the region's principal active faults, and could expose people or structures to potential substantial adverse effects. All structures for the 130-Unit Alternative would be designed to meet or exceed the Monterey County Building Code requirements as adopted from the CBC. Conformance to these codes does not constitute a guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake, but it would reduce the potential for structural damage resulting from a major

earthquake to a less-significant level. Therefore, the impact would be *less than significant*. No mitigation is required.

Impact GEO-3: Substantial Adverse Effects Resulting from Seismic-Related Ground Settlement (less than significant with mitigation)

Proposed Project

Site settlement due to densification of sandy soils onsite could result in differential settlement of up to 4 inches within the residential development area. The differential ground settlement would expose people and structures to the adverse effects from seismic-related ground settlement. Exposure to the effects of ground settlement is considered a *potentially significant* impact. Implementation of **Mitigation Measure GEO-1**, described below, would reduce this impact to a *less-than-significant* level.

130-Unit Alternative

Similar to the Proposed Project, the 130-Unit Alternative, including Lot 130, could experience site settlement due to densification of sandy soils, resulting in differential settlement. This is considered a *potentially significant* impact. Implementation of **Mitigation Measure GEO-1**, described below, would reduce this impact to a *less-than-significant* level.

> **Mitigation Measure GEO-1: Design All Proposed Structures in Accordance with the Requirements of the California Building Code, Current Edition, and Recommendations Contained in the Site-Specific Geologic and Geotechnical Reports**
>
> To minimize the potential for damage from seismic-related ground settlement, prior to construction the Project Applicant will assure that all proposed structures are designed in accordance with the current and appropriate California Building Code standards and with recommendations made by the geotechnical reports prepared for the project (ENGEO 2006). In addition, the applicant will implement any recommendations made by the engineer of record during the final stages of project design.

Impact GEO-4: Substantial Adverse Effects Resulting from Earthquake-Induced Liquefaction (less than significant)

Proposed Project

As discussed in the *Environmental Setting* section, one area south of the proposed development envelope contains a thick liquefiable subsurface layer, overlain by an insufficient layer of nonliquefiable surface materials that has the potential to induce ground failure during a very strong seismic groundshaking event. However, the location of the deposit was determined to be of little consequence to the Proposed Project because ground failure in that location would primarily affect an area of open space and would not pose a substantial risk to any habitable structures. This impact would be *less than significant*. No mitigation is required.

130-Unit Alternative

Similar to the Proposed Project, one area of the 130-Unit Alternative site, including Lot 130, contains a thick liquefiable subsurface layer, overlain by an insufficient layer of nonliquefiable surface materials that has the potential to induce ground failure during a very strong seismic groundshaking

event. However, like the Proposed Project, the location of the deposit was determined to be of little consequence to the 130-Unit Alternative because ground failure in that location would primarily affect an area of open space and would not pose a substantial risk to any habitable structures. This impact would be *less than significant*. No mitigation is required.

B. Landslides and Slope Stability

Impact GEO-5: Substantial Adverse Effects Resulting from Landsliding (less than significant with mitigation)

Proposed Project

Slope gradients in the immediate vicinity of the project site are gentle, and no existing landslide hazard has been identified. Creation of cut slopes and fill embankments during project construction could, however, lead to a risk of localized slope failure if the slopes are improperly designed or implemented. Potential construction and placement of structures on steep slopes and manufacture of steep slopes are considered *potentially significant* impacts. However, implementation of **Mitigation Measure GEO-2** would reduce impacts to a *less-than-significant* level.

130-Unit Alternative

Similar to the Proposed Project, the creation of cut slopes and fill embankments during construction could lead to a risk of localized slope failure if the slopes are improperly designed or implemented. In contrast to the Proposed Project, slopes to the north of Lot 130 are much steeper than those in the immediate vicinity of the project site. The slopes north of Lot 130 have as much as 50% gradient. Carmel Valley Road separates the lot from the steeper slope gradients. The highway is approximately 90 feet across. Slope gradients on Lot 130 are gentle to moderate. Potential construction of structures on steep slopes and manufacture of steep slopes are considered *potentially significant* impacts. Implementation of **Mitigation Measure GEO-2** would reduce this impact to a *less-than-significant* level.

Mitigation Measure GEO-2: Conduct Additional Site-Specific Investigation Relative to Lot 130 and Implement Recommended Grading and Slope Design Criteria of the Site-Specific Geotechnical Reports

The Project Applicant will conduct additional geotechnical investigation to determine if there are any direct or indirect landsliding risks, including risks from landslides north of Carmel Valley Road on proposed development of Lot 130. If landslide hazards are identified, then site-specific recommendation of the additional investigation will be incorporated into site plans.

In order to reduce the potential for slope failure to occur, specific design measures, as recommended in the geotechnical investigations (ENGEO 2005 and as required by this measure), will be incorporated into the Proposed Project and the 130-Unit Alternative by the applicant during construction. Such measures will include the following.

- The removal of loose or compressible surface soils from all areas to receive fill, followed by scarification, moisture conditioning, and recompaction to create a firm, non-yielding base, and replacement with engineered backfill.
- Grading operations will meet the requirements of the Guide Contract Specifications included in the geotechnical report (ENGEO 2005).

- The grading of cut and fill slopes to a gradient of no steeper than 2:1.
- Construction of a sub-drained keyway[3] system.
- Implementation of a site drainage plan to divert surface drainage away from potentially unstable foundation systems.

In addition to incorporating the recommendations of the site-specific geotechnical studies, all earthwork will conform to applicable design standards of the UBC and the County. All design and construction activities will be conducted by or under the supervision of a registered geological engineer or engineering geologist, and are subject to review by the County through the grading permit and construction oversight process.

C. Erosion

Impact GEO-6: Accelerated Soil Erosion and Sedimentation (less than significant with mitigation)

Proposed Project

Implementation of the Proposed Project would involve a substantial amount of earthwork to create the proposed subdivision lots and install necessary utilities. This earthwork would result in extensive soil and vegetation disturbance that would increase the potential for accelerated runoff, erosion, and sedimentation during project construction. This is considered to be a *potentially significant* impact. Implementation of **Mitigation Measure GEO-3** would reduce this impact to a *less-than-significant* level.

At project completion, there would be an increase in imperviousness in the project area. Potential downstream impacts from soil erosion and sedimentation from an increased stormwater runoff are discussed in Chapter 3.2, *Hydrology and Water Quality.*

130-Unit Alternative

Similar to the Proposed Project, the 130-Unit Alternative would involve a substantial amount of earthwork to create the proposed subdivision lots and install necessary utilities. This earthwork would result in extensive soil and vegetation disturbance that would increase the potential for accelerated runoff, erosion, and sedimentation during construction. This is considered a *potentially significant* impact, but implementation of **Mitigation Measure GEO-3** would reduce the impact to a *less-than-significant* level.

At project completion, there would be an increase in imperviousness in the project area. Potential downstream impacts from soil erosion and sedimentation from an increased stormwater runoff are discussed in Chapter 3.2, *Hydrology and Water Quality*.

Mitigation Measure GEO-3: Prepare and Implement an Erosion and Sediment Control Plan

Prior to construction, the Project Applicant, or a qualified consultant acting on behalf of the applicant, will prepare and implement an erosion and sediment control plan. The plan will be prepared in accordance with the requirements of the local erosion and sediment control

[3] A "keyway" is an excavated and backfilled trench beneath the toe of a proposed fill slope. It serves to anchor and support the fill slope.

ordinances. The plan will contain details and specifications for a variety of standard and site-specific BMP's that will be implemented to control wind and water erosion, stormwater runoff, sediment, and other construction-related pollutants during project construction. The Erosion and Sediment Control Plan will remain in effect until all areas disturbed during construction have been revegetated or otherwise permanently stabilized. Additional measures may be prescribed during the final stages of project design and construction. The Erosion and Sediment Control Plan will be submitted to Monterey County Planning and Building Inspection Department for review and approval prior to issuance of any grading permit. This measure can be combined with requirements of **Mitigation Measure HYD-2** (see Chapter 3.2, *Hydrology and Water Quality*) to prepare a SWPPP in compliance with National Pollutant Discharge Elimination System (NPDES) general construction permit requirements.

D. Soil Constraints

Impact GEO-7: Substantial Adverse Effects Resulting from Expansive Soils (less than significant with mitigation)

Proposed Project

Although the shrink-swell potential of the native soil and bedrock materials is typically low within the project area, the presence of slightly more expansive soils may be encountered as the golf course topographic mounds and swales are disturbed during grading, or if imported soils are used to establish finished building pad grades above potential flood elevations. Loose or compressible surface soils encountered during grading should be addressed and mitigated in order to create a suitable base for building pads, areas to receive fill, or for shallow cut areas that do not extend below this zone. Implementation of **Mitigation Measures GEO-1 and GEO-4** would reduce this impact to a *less-than-significant* level.

130-Unit Alternative

Similar to the Proposed Project, the majority of the 130-Unit Alternative site is located on soil with low shrink-swell potential. However, the presence of slightly more expansive soils may be encountered as the golf course topographic mounds and swales are disturbed during grading. Loose or compressible surface soils encountered during grading should be addressed and mitigated in order to create a suitable base for building pads, areas to receive fill, or for shallow cut areas that do not extend below this zone.

The 130-Unit Alternative's Lot 130 is located on soil with moderate shrink-swell potential. Because the soils may expand when wet and contract when dry, foundation structures may experience cracking when this phenomenon occurs. To avoid impacts related to expansive soils, the applicant would be required prepare a geotechnical report that tests soils for expansion potential. The results of the geotechnical report would be used to design the unit on Lot 130 according to CBC standards. Implementation of **Mitigation Measure GEO-1, GEO-4, and GEO-5** would reduce this impact to a *less-than-significant* level.

Mitigation Measure GEO-4: Remove Localized Zones of Overly Loose Materials

During construction of the Proposed Project or the 130-Unit Alternative, the Project Applicant will implement the recommended design criteria of the geotechnical report (ENGEO 2005). These criteria relating to include the following measures.

- Localized zones of overly loose materials will be removed to a firm, non-yielding base, then scarified, moisture condition, if necessary, and recompacted to create a suitable foundation soil prior to fill placement.
- The spatial extent will include at least the area encompassed by the building footprint plus a horizontal buffer of 5 feet surrounding the building footprint.
- The actual depth for reworking should be determined by a qualified geotechnical engineer at the time of grading.

The Project Applicant will also implement all other relevant soil recommendations detailed in the geotechnical report.

Mitigation Measure GEO-5: Prepare a Geotechnical Report for Lot 130 Concerning Expansive Soils

Prior to construction, the Project Applicant will prepare a geotechnical report for Lot 130 to determine soil expansion potential. Development on this lot will be designed by a qualified architect and/or engineer according to the recommended design criteria of the geotechnical report. The Project Applicant will also implement all other relevant soil recommendations detailed in the geotechnical report.

Impact GEO-8: Substantial Adverse Effects Resulting from Loss of Topsoil (less than significant)

Proposed Project

Surface soils on the existing site have undergone varying degrees of disturbance and thus offer little topsoil value. In addition to having numerous artificial mounds and depressions, the site landscaping consists of many non-native species of trees, shrubs, and grasses. Given the highly disturbed nature of the site, further disturbance by construction activities would not result in a significant loss of topsoil. Therefore, this impact would be *less than significant*. No mitigation is required.

130-Unit Alternative

Similar to the Proposed Project, surface soils on the existing site, including Lot 130, have undergone varying degrees of disturbance and thus offer little topsoil value. In addition to having numerous artificial mounds and depressions, the site landscaping consists of coast live oaks, native to California, and many non-native species of trees, shrubs, and grasses. Given the highly disturbed nature of the site, further disturbance by construction activities would not result in a significant loss of topsoil. Therefore, this impact would be *less than significant*. No mitigation is required.

Impact GEO-9: Effects of Septic Systems on Soils (no impact)

Proposed Project

Septic systems, including the use of tanks and alternative disposal systems, are not included as part of the project design. New sewer connections to the main sewer trunk located near the project area would serve the proposed housing development. Soils to adequately support wastewater disposal would not be required. Therefore, the Project would have *no impact*. No mitigation is required.

130-Unit Alternative

Similar to the Proposed Project, septic systems, including the use of tanks and alternative disposal systems, are not proposed by the 130-Unit Alternative. Therefore, this alternative would have *no impact*. No mitigation is required.