4.6 Geology and Soils

This section describes the existing geological setting of the project site, identifies associated regulatory requirements, evaluates potential impacts, and identifies mitigation measures as necessary related to implementation of the Pacifica Project (proposed project or project). The following analysis is based on the Preliminary Geotechnical Evaluation Report that was prepared by Geotek Inc. in January 2022, included in this environmental impact report (EIR) as Appendix F. Appendix F1 also identifies the potential for impacts to paleontological resources.

In consideration of the analysis herein, it should be noted that impacts of the environment on a project or plan (as opposed to impacts of a project or plan on the environment) are beyond the scope of required California Environmental Quality Act (CEQA) review. "[T]he purpose of an EIR is to identify the significant effects of a project on the environment, not the significant effects of the environment on the project" (*Ballona Wetlands Land Trust v. City of Los Angeles* [2011] 201 Cal.App.4th 455, 473).

4.6.1 Existing Conditions

4.6.1.1 Regional Geologic Setting

The project site is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. It extends approximately 975 miles from the north and northeast adjacent to the Transverse Range geomorphic province to the tip of the Baja California Peninsula. This province varies in width from about 30 to 100 miles. It is bounded to the north by the Transverse Ranges, to the west by the Pacific Ocean, to the south by the Gulf of California, and to the east by the Colorado Desert Province.

4.6.1.2 Site Geology

Soil and Geologic Conditions

Field investigations of the project site were performed, which consisted of a site reconnaissance and subsurface exploration. Further detail regarding the subsurface exploration is included in Appendix F of this EIR.

Based on subsurface exploration, available geologic maps, technical literature, and site-specific exploration, the project site is underlain by artificial fill, Quaternary-age alluvium, and Tertiary-age Santiago Formation sedimentary bedrock (Kennedy et al. 2007; Appendix F). A brief description of the geologic units encountered on the site are presented below.

Artificial Fill (Af)

Artificial fill soils were documented in each of the test borings. These soils were found to consist of silty fine to coarse sands with occasional clayey sands (SM/SC soil type based upon the Unified Soil Classification System), ranging from yellow-brown to dark brown in color with various other heterogeneous inclusions, dry to moist, and loose to medium dense. Artificial fill was encountered to depths ranging between 2 to 25.5 feet below existing grade with the average depth across all the borings being roughly 10 to 15 feet deep.

Quaternary Alluvium (Qal)

Quaternary (Holocene, less than ~11,700 years old) alluvium was encountered in six of the test borings ranging in depths between 11 to 46.5 feet below ground surface, with the average depth being roughly 13 to 21.5 feet deep (Cohen et al. 2022). These soils consisted of various concentrations of silty sands and clayey sands and were found to be various gray-blacks and browns in color, slightly moist to saturated, silty fine to coarse-grained sands. The soil behavior type of the cone penetration testing sounding is interpreted to be variations of clays and silts. Moisture was noted to increase with depth and became saturated near a groundwater table located approximately 45 feet below existing grades. Some of the alluvium contained roots that brought an organic odor with them.

Tertiary-Age Santiago Formation (Tsa)

Tertiary-age Santiago Formation (sedimentary bedrock) was encountered in eight of the test borings at depths between 2 to 26.5 feet below ground surface. The middle Eocene-age (~49–40 million years old) sedimentary bedrock has also been mapped to underlie the subject property on a regional geologic map reviewed for the area (Kennedy et al. 2007; Cohen et al. 2022). The Santiago Formation is regionally described to consist of medium to coarse-grained, moderately well indurated, massive and broadly cross-bedded sandstone. The sedimentary formation as encountered at the site was a yellow to light brown, fine to coarse sandstone with orange oxidation. The weathered bedrock varied in moisture (dry to very moist) depending on the boring location and was found to be dense to very dense.

Geologic Hazards

Faulting and Seismicity

The geologic structure of the entire Southern California area is dominated mainly by northwest–southeast oriented fault blocks. Several major fault zones are found in this province. The site is in a seismically active region. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest–southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeastern margin of the province. No active or potentially active fault is known to exist at this site nor is the site situated within an Alquist-Priolo Earthquake Fault Zone or a Special Studies Zone. The nearest known active fault to the project site is the Rose Canyon-Newport-Inglewood fault (offshore), which is located approximately 9 miles to the southwest of the property. A potential earthquake with a magnitude (maximum credible earthquake) of up to 6.9 may result from this fault.

Liquefaction and Seismic Settlement

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, settlement of loose sediments, sand boils, and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates. As indicated in Appendix F, due to the depth of groundwater (45 feet below existing ground surface), ground acceleration of 0.48 g (PGA_M; peak ground acceleration mean) and mean earthquake event (6.57), seismically induced liquefaction or settlement is not anticipated to occur at the project site.

Landslides

Several formations within the San Diego region are particularly prone to landslide. These formations generally have high clay content and mobilize when they become saturated with water. Other factors, such as steeply dipping bedding that project out of the face of the slope and/or the presence of fracture planes, will also increase the potential for landslides. No landslides or indications of deep-seated landslide were indicated at the site during the field exploration.

Flood Hazard

According to a Federal Emergency Management Agency flood insurance rate map (06073C0468H), the project site is not located within a floodplain identified as part of a Special Flood Hazard Area (FEMA 2022).

Surface Water and Groundwater

Surface water was not observed during the recent exploration. If encountered during earthwork operations, surface water on this site is the likely result of precipitation, irrigation, or possibly some minor surface runoff from immediately surrounding properties. Overall, the site drainage is directed toward the west to southwest with localized variations.

Groundwater was encountered in one exploration boring at a depth of 45 feet below existing ground surface. Due to the depth of encountered groundwater and absence of groundwater in the rest of the subsurface borings, groundwater is not expected to be encountered during construction.

4.6.1.3 Paleontological Resources

As defined by the Society of Vertebrate Paleontology (2010) guidelines, significant nonrenewable paleontological resources are:

> [F]ossils and fossiliferous deposits, here defined as consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years).

Dudek submitted a paleontological records search request with the San Diego Natural History Museum on January 26, 2023, and results were received on February 6, 2023. The museum reported no localities within the project site, or within a 1-mile radius (SDNHM 2023). The Santiago Formation has yielded significant fossil localities in other portions of San Diego County that have produced terrestrial fossil vertebrates, as well as marine and estuarine mollusks (SDNHM 2023).

Holocene alluvium is generally too young to preserve paleontological resources, and therefore has low paleontological sensitivity. However, the potential for finding paleontological resources increases with depth as the sediments may transition into older Pleistocene sediments, and therefore, the paleontological sensitivity increases to moderate or high at depth.

The middle Eocene Santiago Formation has high paleontological sensitivity (Appendix F1; SDNHM 2023; Cohen et al. 2022). Description of the sediments attributed to the Santiago Formation in the geotechnical report suggest

that the project site could be in member B or C of the formation, which have the highest potential for encountering paleontological resources.

4.6.2 Regulatory Setting

Federal

International Building Code

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

Occupational Safety and Health Administration Regulations

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

Paleontological Resources Protection Act

The Paleontological Resources Protection Act (PRPA) of 2009 directs the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on federal land using "scientific principles and expertise." The PRPA incorporates most of the recommendations of the Secretary of the Interior's report titled Assessment of Fossil Management on Federal and Indian Lands (DOI 2000) to formulate a consistent paleontological resources management framework. In passing the PRPA, congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. The PRPA codifies existing policies of the U.S. Bureau of Land Management, National Park Service, U.S. Forest Service, Bureau of Reclamation, and the U.S. Fish and Wildlife Service, and provides the following:

- Criminal and civil penalties for illegal sale, transport, theft, and vandalism of fossils from federal lands
- Minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants)
- Definitions for "paleontological resources" and "casual collecting"
- Requirements for curation of federal fossils in approved repositories

The PRPA requires the Secretaries of the Interior and Agriculture to manage and protect paleontological resources on federal land. The PRPA furthers the protection of fossils on federal lands by criminalizing the unauthorized removal of fossils.

Federal Land Policy Management Act

The Federal Land Policy Management Act of 1976 (PL 94-579; 90 Statute 2743, USC 1701–1782) requires that public lands be managed such that the quality of their scientific values is protected. The act recognizes significant paleontological resources as scientific resources and requires federal agencies to manage public lands in a manner that protects scientific resource quality.

State

California Geologic Survey

The California Geologic Survey provides guidance with regard to seismic hazards. The California Geologic Survey's Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California (CGS 2008), provides guidance for evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigation.

State of California Division of Occupational Safety and Health, California Department of Industrial Relations

The State of California Division of Occupational Safety and Health (CalOSHA) Excavations Standard (Subchapter 4, Article 6) details requirements for excavation operations. CalOSHA requires that all excavations in which employees could potentially be exposed to cave-ins be protected by sloping or benching the sides of the excavation, supporting the sides of the excavated area, or placing a shield between the side of the excavation and the work area. Article 6 also includes specifications for a Tailgate/Toolbox Guide for Trenching Safety before and during excavation activities.

California Building Code

The CBC has been codified in the California Code of Regulations as Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating building standards. Under state law, building standards must be centralized in Title 24 to be enforceable. The purpose of the CBC is to establish minimum standards to safeguard the public health, safety, and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use, occupancy, location, and maintenance of all building and structures within its jurisdiction. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure, or any appurtenances connected or attached to such buildings or structures throughout California. The CBC describes requirements for engineering geologic reports, supplemental ground-response reports, and geotechnical reports (California Building Standards Commission 2019).

Alquist–Priolo Earthquake Fault Zoning Act

The Alquist–Priolo Earthquake Fault Zoning Act of 1972 (California Public Resources Code, Sections 2621–2630) regulates development and construction of buildings intended for human occupancy to avoid the hazard of surface fault rupture. The act helps define areas where fault rupture is most likely to occur. The act groups faults into categories of active, potentially active, and inactive. Historic- and Holocene-age faults are considered active. Late Quaternary- and Quaternary-age faults are considered potentially active, and pre-Quaternary-age faults are considered inactive. These classifications are qualified by the conditions that a fault must be shown to be sufficiently active and well defined by detailed site-specific geologic explorations in order to determine whether building setbacks should be established. Cities and counties affected by the zones must regulate certain development projects within the zones. They must withhold development permits for sites within the zones until

geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. The project site is not identified on an Alquist–Priolo Earthquake Fault Zoning Map (Appendix F).

Seismic Hazards Mapping Act

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

CEQA Paleontological Resources

Paleontological resources are limited, nonrenewable resources of scientific, cultural, and educational value and are afforded protection under state (CEQA) laws and regulations. Paleontological resources are explicitly afforded protection by CEQA, specifically in Section VII(f) of CEQA Guidelines Appendix G, the "Environmental Checklist Form," which addresses the potential for adverse impacts to "unique paleontological resource[s] or site[s] or … unique geological feature[s]." This provision covers fossils of significant importance—remains of species or genera new to science, for example, or fossils exhibiting features not previously recognized for a given animal group—as well as localities that yield fossils significant in their abundance, diversity, preservation, and so forth. Further, CEQA provides that generally, a resource shall be considered "historically significant" if it has yielded or may be likely to yield information important in prehistory (California Public Resources Code 15064.5 [a][3][D]). Paleontological resources would fall within this category. California Public Resources Code Chapter 1.7, Sections 5097.5 and 30244, also regulates removal of paleontological resources from state lands, defines unauthorized removal of fossil resources as a misdemeanor, and requires mitigation of disturbed sites.

California Public Resources Code, Section 5097–5097.6 – Archaeological, Paleontological and Historical Sites

California Public Resources Code, Section 5097–5097.6 outlines the requirements for cultural resource analysis prior to the commencement of any construction project on state lands. This section identifies that the unauthorized disturbance or removal of archaeological, historical, or paleontological resources located on public lands is a misdemeanor. It prohibits the knowing destruction of objects of antiquity without a permit (expressed permission) on public lands and provides for criminal sanctions. This section was amended in 1987 to require consultation with the California Native American Heritage Commission whenever Native American graves are found. Violations for the taking or possessing remains or artifacts are felonies.

Local

County of San Diego Code of Regulatory Ordinances Sections 87.101--87.804, Grading, Clearing, and Watercourses Ordinance

Section 87.430 of the County's Grading and Clearing Ordinance provides for the requirement of a paleontological monitor at the discretion of the County. In addition, the suspension of grading operation is required upon the discovery of fossils greater than 12 inches in any dimension. The ordinance also requires notification of the County Official (e.g., Permit Compliance Coordinator). The ordinance gives the County Official the authority to determine

the appropriate resource recovery operations, which shall be carried out prior to the County Official's authorization to resume normal grading operations.

City of Oceanside General Plan

Public Safety Element

State of California law requires that each city prepare and adopt an approved General Plan that provides comprehensive, long-term guidance for the City's future. General Plans are also required to contain specific elements regarding different areas of planning; relevant elements include land use, environmental resource management, and public safety. While each element outlines policies, plans, and goals that guide the City to maintaining and improving each area of development, the Public Safety Element specifically addresses seismic hazards and geologic conditions.

The Public Safety Element includes the following seismic and geologic hazard objectives:

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

The Public Safety Element includes the Public Safety Plan that provides definitions, maps, and mitigation information for seismic and geologic hazards that exist within the City (City of Oceanside 2002a).

Environmental Resource Management Element

The Environmental Resource Management Element includes the following policy for soil, erosion, and drainage:

1. Consider appropriate engineering and land use planning techniques to mitigate rapid weathering of the rocks, soil erosion, and the siltation of the lagoons.

The Environmental Resource Management Element also provides a general map of soil types within the City (see Figure ERM-3, Soil and Land Forms, in City of Oceanside 2002b).

Land Use Element

The Land Use Element contains the following objectives and policies regarding geology and soils (City of Oceanside 2002c):

> 3.14 Grading and Excavations: To provide mitigation recommendations for grading and excavations in the City of Oceanside.
>
> Policy 3.14A**:** Investigation and evaluation of currently affected areas will indicate the measures to be included, such as the following measures:
>
> 1. Keep grading to a minimum, leave vegetation and soils undisturbed wherever possible.
> 2. Plant bare slopes and cleared areas with appropriate vegetation immediately after grading.
> 3. Chemically treat soils to increase stability and resistance to erosion.

4. Install retaining structures where appropriate.
5. Construct drainage systems to direct and control rate of surface runoff.
6. Construct silt traps and settling basins in drainage systems.
7. Construct weirs and check dams on streams.

3.23 Paleontological Resources: Recovery, retention and evaluation of paleontological resources.

Policy 3.23A: Paleontological survey reports shall be prepared by a qualified paleontologist approved by the City for all proposed projects that are located in the area designated as having a high potential for fossils on the City's natural resource management data base system.

City of Oceanside Building Code

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

City of Oceanside Grading Ordinance

City of Oceanside Grading Ordinance (City of Oceanside 1992) requires that all grading, clearing, brushing, or grubbing on natural or existing grade must have a grading permit from the City Engineer. A landscape and irrigation plan is required for developments including, but not limited to, commercial, grading permits, grading slopes, industrial, parking lots, planned residential developments, remodeling that requires a permit, and subdivisions. Plans shall include details regarding landscaping, erosion control, and irrigation features. Section 1501(d) of the City's Grading Ordinance details requirements and practices of the Erosion Control System to reduce or avoid the potential for sediment runoff and erosion.

4.6.3 Thresholds of Significance

The significance criteria used to evaluate the project impacts to geology and soils are based on CEQA Guidelines Appendix G (14 CCR 15000 et seq.). According to Appendix G, a significant impact related to geology and soils would occur if the project would:

1. Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:
    a. Rupture of a known earthquake fault, as delineated on the most recent Alquist–Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to Division of Mines and Geology Special Publication 42.)
    b. Strong seismic ground shaking.
    c. Seismic-related ground failure, including liquefaction.
    d. Landslides.
2. Result in substantial soil erosion or the loss of topsoil.
3. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
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.

5. Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.
6. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

4.6.4 Impacts Analysis

Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: (a) rupture of a known earthquake fault, as delineated on the most recent Alquist–Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area based on other substantial evidence of a known fault (Refer to Division of Mines and Geology Special Publication 42); (b) strong seismic ground shaking; (c) seismic-related ground failure, including liquefaction; or (d) landslides?

(a) As described under Section 4.6.1.2, Site Geology, the project site is located within a seismically active region, as is all of Southern California. However, the project site is not located within an Alquist–Priolo Earthquake Fault Zone, and there are no known active or potentially active faults transecting or projecting toward the project site (Appendix F). The nearest active faults are the Rose Canyon and Newport Inglewood Faults, located approximately 9 miles southwest of the project site. Therefore, ground rupture because of active faulting is not likely to occur on site due to the absence of known active faults. Cracking of building foundations and walls due to shaking from distant seismic events is not considered an existing significant hazard, although it is a possibility at any site in Southern California. Implementation of recommendations outlined in Appendix F and adherence to the CBC requiring specific performance standards to address geologic hazards would ensure impacts related to faulting and seismicity would remain **less than significant**.

(b) Due to regional proximity to major known active fault zones such as the Rose Canyon Fault and Newport-Inglewood Fault (located approximately 9 miles southwest of the project site), the project site lies in a seismically active region. A potential earthquake with a magnitude (maximum credible earthquake) of up to 6.9 may result from this fault. The project site is likely to be subjected to strong ground motion from seismic activity similar to that of the rest of San Diego County and Southern California, due to the seismic activity of the region as a whole. With adherence to the IBC and CBC requiring specific performance standards and implementation of the Geotechnical Evaluation Report (Appendix F), project impacts related to strong seismic ground shaking would be **less than significant**.

(c) As described in Appendix F, due to the depth to groundwater at approximately 45 feet below existing ground surface and mean earthquake magnitude the site is not susceptible to liquefaction during a seismic event. Seismically induced settlement is also not anticipated to occur on the project site.

As described above, the project site is not located within a floodplain as mapped by the Federal Emergency Management Agency. As such, the potential for flooding of the project site is considered low. For the reasons stated above, potential impacts related to seismic-related ground failure are considered to be **less than significant**.

(d) There is no evidence of landslides or instability on site or in the immediate area. Therefore, potential impacts associated with significant landslides or large-scale slope instability at the project site are considered to be **less than significant**.

Overall, the project would result in a **less-than-significant** impact related to risk of loss, injury, or death involving earthquake faults, seismic ground shaking, and seismic-related ground failure with implementation of Geotechnical Evaluation Report (Appendix F) recommendations and IBC and CBC compliance.

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

The potential for erosion would increase during construction as a result of vehicles, heavy equipment, and general earth work accelerating the erosion process. Wind erosion could occur on bare soils or where vehicles and equipment cause dust. The project would be subject to compliance with the City's General Plan Grading and Excavations Objective and Policy 3.14A identified in Section 4.6.2, Regulatory Setting, above, that requires measures during grading to reduce erosion. Refer to Section 4.9, Hydrology and Water Quality, for additional details. Additionally, all recommendations outlined in the Geotechnical Evaluation Report (Appendix F) would be implemented, including recommendations related to grading activities. Potential erosion impacts would be avoided by adherence to the erosion control standards established by the City's Grading Ordinance and through implementation of best management practices required by the stormwater pollution prevention plan (refer to Section 4.9 for more information). Furthermore, the proposed project would incorporate landscaping throughout the project site and along the slopes/boundaries of the project site. The proposed landscaping features covering sloped areas would inhibit erosion, and proposed landscaping would stabilize soils, thereby reducing erosion potential on the project site. Therefore, impacts related to soil erosion are determined to be **less than significant**.

Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

Please refer to response to Threshold 1 above. With implementation of all recommendations outlined in the Geotechnical Evaluation Report (Appendix F), potential impacts related to landslides, liquefaction, spreading, subsidence, collapse, and unstable soils would be **less than significant**.

Would the project 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?

A majority of the site is underlain by materials suitable for construction, such as the Santiago Formation (Appendix F). Following site grading, the site soils are anticipated to have "low" (EI<50) to "medium" (EI<90) expansion potential. With implementation of the recommendations outlined in Section 5 of the Geotechnical Evaluation Report (Appendix F), impacts related to expansive soils would be **less than significant**.

Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

The project would be provided sewer service through the City, as discussed in Section 4.17, Utilities and Service Systems. The proposed project does not include or require the use of septic tanks or alternative wastewater disposal systems. Therefore, **no impact** would occur.

Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Direct impacts to paleontological resources occur when earthwork activities, such as mass grading operations, cut into the geological deposits (formations) within which fossils are buried. These direct impacts are in the form of physical destruction of fossil remains. Impacts to paleontological resources are typically rated from high to zero depending upon the resource sensitivity of impacted formations.

Based on the soils and geological conditions on the project site, as indicated by the paleontological records search results (SDNHM 2023), the geotechnical report (Appendix F), and geological mapping at a 1:100,000 scale (Kennedy et al. Tan

2007), it was determined that the Artificial fill materials (map unit Af) has no paleontological resource sensitivity rating; the Quaternary (Holocene) alluvium (map unit Qya) has low paleontological sensitivity, but the sensitivity increases with depth, and the sensitivity can become moderate if Pleistocene-age deposits are encountered; and the Tertiary (middle Eocene) Santiago Formation (map unit Tsa) has high paleontological resource sensitivity.

Development of the proposed project would require excavations for building foundations and utilities, and any excavations into the potentially fossil-bearing strata within the Santiago Formation and/or Pleistocene-age deposits could result in **potentially significant** impacts to paleontological resources. **Mitigation measure (MM) GEO-1** through **MM-GEO-6** would be required.

4.6.5 Cumulative Analysis

Due to the localized nature of geology and soils, cumulative projects would address potential impacts to geology and soils on a project-by-project basis, as potential geologic hazards and soil composition vary by site. Each cumulative project would be required to assess individual and site-specific geologic conditions, which would inform construction and development of each site. All cumulative development would be subject to similar requirements to those imposed and implemented for the proposed project and would be required to adhere to applicable regulations, standards, and procedures.

As described above, project impacts related to earthquakes, seismic-related ground shaking and ground failure, liquefaction, landslides, erosion, lateral spreading, expansive soils, and water disposal systems were determined to be less than significant. However, project excavations for building foundations and utilities and any excavations into the potentially fossil-bearing strata within the Santiago Formation and/or Pleistocene age deposits could result in potentially significant impacts to paleontological resources. **MM-GEO-1** through **MM-GEO-6** would be required, and impacts would be reduced to less than significant. While some of the projects on the cumulative list are located in areas that may contain paleontological resources, the presence of these resources is typically unknown prior to construction, and it is expected that mitigation measures would be included with approval of cumulative projects to ensure that impacts to paleontological resources are minimized.

Each cumulative project would be required to assess individual and site-specific geologic conditions, which would inform construction and development of each site. All cumulative development would be subject to similar requirements to those imposed and implemented for the proposed project and would be required to adhere to applicable regulations, standards, and procedures. As such, cumulative impacts related to geology and soils would be **less than significant**.

4.6.6 Mitigation Measures

Impacts related to geology and soils as a result of project implementation are determined to be less than significant, with the exception of potential impacts to paleontological resources. Implementation of **MM-GEO-1** through **MM-GEO-6** outlined below would ensure that potential impacts to paleontological resources are reduced to a less-than-significant level. **MM-CUL-1** and **MM-CUL-2** would also apply.

MM-GEO-1 A qualified paleontologist shall attend the pre-construction meeting to consult with the grading and excavation contractors concerning excavation schedules, paleontological field techniques, and safety issues (a qualified paleontologist is defined as an individual with an MS or PhD in paleontology or geology who is familiar with paleontological procedures and techniques, who is

knowledgeable in the geology and paleontology of San Diego County, and who has worked as a paleontological mitigation project supervisor in the County for at least 1 year).

MM-GEO-2 A paleontological monitor should be on site on a full-time basis during the original cutting of previously undisturbed deposits of high paleontological resource potential (Pleistocene-age deposits and the Santiago Formation) to inspect exposures for contained fossils. (A paleontological monitor is defined as an individual who has experience in the collection and salvage of fossil materials. The paleontological monitor shall work under the direction of a qualified paleontologist.)

MM-GEO-3 If fossils are discovered, the paleontologist (or paleontological monitor) shall recover them. In most cases, fossil salvage can be completed in a short period of time. However, some fossil specimens (such as a complete large mammal skeleton) may require an extended salvage period. In these instances, the paleontologist (or paleontological monitor) shall be allowed to temporarily direct, divert, or halt grading to allow recovery of fossil remains in a timely manner. Because of the potential for the recovering of small fossil remains, such as isolated mammal teeth, it may be necessary to set up a screen-washing operation on the site.

MM-GEO-4 Fossil remains collected during monitoring and salvage shall be cleaned, repaired, sorted, and cataloged as part of the mitigation program.

MM-GEO-5 Prepared fossils, along with copies of all pertinent field notes, photos, and maps, shall be deposited (as a donation) in a scientific institution with permanent paleontological collections such as the San Diego Natural History Museum. Donation of the fossils should be accompanied by financial support for initial specimen storage. Fossil lab and/or curation costs (if necessary due to fossil recovery) are the responsibility of the project proponent.

MM-GEO-6 A final summary report shall be completed that outlines the results of the mitigation program. This report shall include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and significance of recovered fossils.

4.6.7 Level of Significance After Mitigation

As described in the impact analysis throughout Section 4.6.4, impacts related to geology and soils as a result of the proposed project would be less than significant, with the exception of impacts to paleontological resources, which were determined to be potentially significant. Implementation of mitigation measures **MM-GEO-1** through **MM-GEO-6** outlined above would ensure that potential impacts to paleontological resources are reduced to less than significant. Therefore, with implementation of proposed mitigation, project impacts related to geology and soils would be **less than significant**.

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