3.3 Paleontological Resources

Paleontological resources are the remains and traces of prehistoric life, exclusive of human remains, and including the localities where fossils were collected and the sedimentary formations from which they were obtained or derived. The defining character of fossils is their geologic age. Fossils or fossil deposits are generally regarded as older than 10,000 years, the generally accepted temporal boundary marking the end of the last late Pleistocene glacial event and the beginning of the current period of climatic amelioration of the Holocene.

Preservation of organic remains is extremely rare, requiring a unique combination of physical and biological factors. Skeletal tissue with a high percentage of mineral matter is the most readily preserved; soft tissues not intimately connected with the skeletal parts are least likely to be preserved. For this reason the fossil record contains a biased selection not only of types of organisms but also of parts of organisms. The best preserved fossils are of those organisms that lived within a sedimentary environment or were buried by sediment shortly after death, thus partially insulating them from destructive chemical and physical processes.

Fossil remains commonly include marine shells, bones and teeth of fish and mammals, leaf assemblages, and petrified wood. Fossil traces include internal and external molds (impressions) and casts. Trace fossils (i.e., ichnofossils) include evidence of past activities of fossil organisms, such as footprints and trackways, burrows and boreholes, coprolites, nests and (packrat) middens. Fossils, fossil traces, and trace fossils are found in the sedimentary rocks and unconsolidated sediments of natural ancient environments such as the oceans, rivers, lakes, deltas, beaches, and lagoons.

A geologic formation is a body of rock identified by its lithic (rock) characteristics (e.g., grain size, texture, color, mineral content) and stratigraphic position. Formations are mappable at the Earth's surface or traceable in the subsurface and are formally named and described in the geologic literature. The fossil content may also be a characteristic of that formation.

There is a direct relationship between fossils and the geologic formations within which they are enclosed; therefore, with sufficient knowledge of the geology and stratigraphy of a particular area and the paleontological resource potential, it is possible to reasonably predict where fossils might or might not be found.

San Diego County is underlain by a number of distinct geologic rock units (i.e., formations) that record portions of the past 450 million years of Earth's history (Abbott 1999, Walawender 2000). In general, time periods late in geologic history are better represented than periods further back in time, because younger rocks are less likely to be covered by other rocks and the younger rocks are less likely to have been eroded away or metamorphosed. In San Diego County, the record is most complete for parts of the past 75 million years, represented by the Cretaceous Period, the Eocene, Oligocene, and Pliocene Epochs of the Tertiary Period, and the Pleistocene Epoch of the Quaternary Period.

3.3.1 Discussion of Existing Conditions Relating to Paleontological Resources

Otay Mesa is within the Coastal Plain Geomorphic Region of San Diego County, which is bounded on the west by the Pacific Ocean and on the east by the foothills of the Peninsular Ranges. The Coastal Plain Geomorphic Region is characterized by interbedded marine and non-marine sedimentary rock units deposited over the last 140 million years. The sedimentary rocks overlie a buried topography of

plutonic crystalline rocks composed of granite, granodiorite, etc. Many of the level surfaces in the coastal areas, including most of the mesa tops and coastal benches, are elevated marine terraces, and these, as well as the broad, level floodplains of river valleys, are characteristic features of the Coastal Plain Region (Bergen et al. 1996).

Based on the results of a site-specific geotechnical investigation by GEOCON (GEOCON 2004) surficial materials and geologic formations observed or expected to occur within the proposed project site include undocumented fill, topsoil/colluvium and alluvium soils, an unnamed Tertiary fanglomerate, the Tertiary Otay Formation, and the Jurassic Santiago Peak Volcanics. Tertiary layers are less than 65 million years old, and the Jurassic are approximately 140 to 200 million years old.

Significant paleontological resources can occur in any of the rocks of San Diego County other than igneous (volcanic) rocks, which have no potential for containing paleontological resources. Paleontological resources occur in parent rock below the soil layers (horizons). Soils are derived from the parent bedrock below them and the organic material on the surface. The percolation of water into the parent material erodes the rock and allows roots to penetrate. These processes break down the parent material to form soil, and can cause fossils to decompose within the soil horizon. Below the soil horizons the parent material is intact. Soil horizons are identified as follows:

- Organic Horizon: occurs at the surface and contains vegetation and organic materials;
- Surface Horizon: occurs below the Organic Horizon and contains organic materials;
- Subsoil Horizon: occurs below the Surface Horizon but above the Substratum Horizon. Organic materials are present but in lesser quantity than in the Surface Horizon.
- Substratum Horizon: occurs at the deepest level of soils and is below the major soil horizons. Fossils may be present in and below the substratum.

Soil horizons vary in depth considerably across the County, depending on the type of bedrock, organic material, climate, surface waters, groundwater and other conditions of the area. The results of the geotechnical investigation, surficial materials observed or expected to occur within the proposed project site include undocumented fill, topsoil/colluvium and alluvium soils.

3.3.2 Guidelines for the Determination of Significance

The following guideline and discussion are based on the Guidelines for Determining Significance and Report Content Requirements for Paleontological Resources, approved by DPLU on March 19, 2007.

The proposed project would have a potentially significant environmental impact to paleontological resources if it would:

1. The project proposes activities directly or indirectly damaging to a unique paleontological resource or site. A significant impact to paleontological resources may occur as a result of the project, if grading excavates the substratum or parent material below the major soil horizons in any paleontologically sensitive area (high, moderate, low, or marginal) of the County.

With an understanding of the geology of the County, it is possible to reasonably predict whether paleontological resources might be present. A map of detailed geologic and paleontological

information overlain with the project footprint is the first level of review to determine if paleontological resources may occur on a project site, and this map is included in the geotechnical investigation report (Appendix K).

Based on the geologic formations in San Diego County, levels of paleontological resource potential and sensitivity have been developed (Deméré and Walsh 1993). Paleontological resource potential and sensitivity are defined below.

High resource potential and high sensitivity are assigned to geologic formations known to contain paleontological localities with rare, well preserved, critical fossil materials for stratigraphic or paleoenvironmental interpretation, and fossils providing important information about the paleoclimatic, paleobiological and/or evolutionary history (phylogeny) of animal and plant groups. In general, formations with high resource potential are considered to have the highest potential to produce unique invertebrate fossil assemblages or unique vertebrate fossil remains and are, therefore, highly sensitive.

Moderate resource potential and moderate sensitivity are assigned to geologic formations known to contain paleontological localities. These geologic formations are judged to have a strong, but often unproven, potential for producing unique fossil.

Low resource potential and low sensitivity are assigned to geologic formations that, based on their relatively young age and/or high-energy depositional history, are judged unlikely to produce unique fossil remains. Low resource potential formations rarely produce fossil remains of scientific significance and are considered to have low sensitivity. However, when fossils are found in these formations, they are often very significant additions to our geologic understanding of the area.

Marginal resource potential and marginal sensitivity are assigned to geologic formations that are composed either of volcaniclastic (derived from volcanic sources) or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain formations at localized outcrops. In volcaniclastic rocks, organisms may have been fossilized by being covered by ash, dust, mud, or other debris from volcanoes. In metasedimentary rocks, sedimentary rocks have been metamorphosed by heat and/or pressure caused by volcanoes or plutons. If these sedimentary rocks had paleontological resources within them, the resources may have survived the metamorphism and may still be identifiable within the metasedimentary rock. These formations are marginally sensitive.

"No resource potential" is assigned to geologic formations that are composed entirely of volcanic or plutonic igneous rock, such as basalt or granite, and therefore do not have any potential for producing fossil remains. These formations have no paleontological resource potential, i.e. they are not sensitive.

3.3.3 Analysis of Project Effects and Determination as to Significance

The proposed project is located on geologic formations that have the potential to contain paleontological resources, as indicated by geologic mapping of the project site (Appendix K) and a review of associated paleontological resource potential. Much of the project site is underlain by the Otay Formation, which exhibits a high paleontological resource sensitivity rating, and the Santiago Peak Volcanics Formation, which exhibits a moderate paleontological resource sensitivity rating. According to the geologic investigations (Appendix K) conducted for the project, the Santiago Peak

Volcanics likely underlie (are beneath) the Otay Formation. Other materials observed or expected to occur on site have low resource sensitivity and are unlikely to produce any fossil remains.

The geologic formations on site and their corresponding sensitivities in regards to the proposed project site are noted in Table 3.3-1, *Paleontological Resource Potential*. The Tertiary fanglomerate deposits are in the southwestern and southeastern portions of the site. Tertiary fanglomerates are assigned a moderate paleontological resource potential and sensitivity. The fanglomerates are interbedded with the Otay Formation, which is assigned a high paleontological resource potential and sensitivity, based on known occurrences of important terrestrial vertebrate fossils from the Otay Mesa area (Deméré and Walsh 1993). So many well preserved remains have been found in the fluvial sedimentary rocks of the Otay Formation in the southern Coastal Plain Geomorphic Region that it is now considered the richest source of Oligocene terrestrial vertebrates in California. Sedimentary rocks from the Otay Formation have contained the significant skeletal remains of terrestrial reptiles (tortoise and lizards), birds (cranes, quail and others), and mammals (e.g., insectivores, gophers, mice, beavers, dogs, rhinoceros, camels, chevrotains and others), along with sparse fossil impressions of freshwater plants (e.g., rushes).

Paleontological resource sensitivity for the Santiago Peak Volcanics can range from zero to moderate, depending on the nature and sensitivity of the associated units (Deméré and Walsh 1993). Specifically, this formation may contain igneous extrusives (i.e., formed at the surface from a molten origin) and metamorphosed sedimentary (metasedimentary) rocks. The Santiago Peak Volcanics are located in the northeastern portions of the proposed project site. They have a moderate potential for the occurrence of paleontological resources in the metasedimentary rocks. Jurassic metasedimentary rocks mapped as the Santiago Peak Volcanics have produced few, but important, marine invertebrate fossils, as well as some the best preserved fossil assemblages of middle and late Eocene terrestrial mammals in California.

Grading for the proposed project would involve approximately 1,882,000 cubic yards of cut. The cuts will likely impact strata below the soil horizons and impact the fanglomerate, the Otay Formation and the Santiago Peak Volcanics. Based on analysis of the Geologic Cross Sections and the proposed grading shown on the Site Plan/Geologic Map (see Appendix K), cut depths would range from 0 to 39 feet deep. The off-site sewer line would be placed at a depth of 15 to 41 feet. Off-site road improvements would require nominal cuts. Based on these conditions and the above-described Guidelines for Determining Significance, the proposed project could result in significant impacts to paleontological resources because Significance Guideline 1 would be met **(PI-1).**

3.3.4 Cumulative Impact Analysis

The geologic units that occur under the project site are also present in many other areas of the San Diego region. Development of the San Diego region has resulted in disturbance to these geologic units and the fossils that they contain. However, development has also led to the discovery of many fossil sites that have been documented and which have added to the natural history record for the region. Development of the San Diego area will continue and will have the potential to continue to disturb these geologic units; however, monitoring for paleontological resources is now typically required on a site-specific basis for projects that require significant earthwork in geologic units with higher paleontological sensitivities. Monitoring required as part of the proposed project and other future projects could yield additional information or reinforce existing knowledge of the local natural history, and as such, would prevent any cumulatively significant impacts.

3.3.5 Mitigation Measures Proposed to Minimize the Significant Effects

The proposed project could result in significant impacts to paleontological resources because the site is underlain by geologic formations with high and moderate potential to contain paleontological resources. A mitigation program is required for projects requiring discretionary permits in areas of the County that have any potential to contain paleontological resources. The mitigation program described below would reduce these impacts to less than significant levels.

PM-1 The applicant is required to retain a Project Paleontologist who will implement a mitigation program for the proposed project. The program shall include monitoring for paleontological resources during excavation, salvaging potentially unique paleontological resources, cleaning and curating the found specimens and transferring the specimens to an accredited institution, and reporting the results of the mitigation program. The Project Paleontologist will also have responsibility for supervising and directing Paleontological Monitors, attending pre-grading meetings to consult with grading contractors, and writing the Paleontological Resources Mitigation Report.

Mitigation will be deemed complete when the County's Permit Compliance Coordinator, on behalf of the Director of DPLU, approves the final report, and a letter from the accredited institution stating that the collection has been received and approved.

3.3.6 Conclusion

Implementation of the proposed project, including proposed off-site sewer improvements, would potentially result in significant impacts to paleontological resources during excavation into geologic formations that may contain unique paleontological resources. A mitigation program involving monitoring during excavation, salvaging of fossil finds, cleaning and curating the specimens and transferring them to an accredited institution, and reporting would reduce the impact to less than significant levels.

Table 3.3-1
PALEONTOLOGICAL RESOURCE POTENTIAL

AGE	GEOLOGIC FORMATION	POTENTIAL AND SENSITIVITY RATING
Tertiary (< 65 million years ago)	Fanglomerate	Moderate
Tertiary (< 65 million years ago)	Otay Formation	High
Jurassic (140 to 200 million years ago)	Santiago Peak Volcanics	Moderate

Source: Deméré and Walsh 1993.