4.10 PALEONTOLOGICAL RESOURCES

This section focuses on paleontological resources within the project site and summarizes a technical report entitled "Paleontological Resource Assessment, Gregory Canyon Landfill Site" prepared by the San Diego Natural History Museum (1997). The technical document is included in the Appendix M, and is on file with the County of San Diego Department of Environmental Health.

Paleontological resources represent a limited, nonrenewable, and impact-sensitive scientific and educational resource. As defined in this section, "paleontological resources" (i.e., fossils) are the remains and/or traces of prehistoric plant and animal life exclusive of man. Fossil remains such as bones, teeth, shells, and leaves are found in the geologic deposits (rock formations) where they were originally buried. Paleontological resources include not only the actual fossil remains, but also the collecting localities, and the geologic formations containing those localities.

A review was conducted of relevant published geological reports (Larsen, 1948; Jahns, 1952; Rogers, 1965; Weber, 1963), unpublished geotechnical reports (GeoLogic Associates, 1997), and museum paleontological site records (Department of Paleontology, San Diego Natural History Museum). A field survey of the landfill footprint was carried out by Museum staff to verify the results of the literature and record search.

4.10.1 EXISTING SETTING

The project site occupies a portion of the San Luis Rey River Valley and extends both north and south into rugged hilly terrain. The southern portion of the site includes the steep western slopes of Gregory Mountain, the alluviated drainage of Gregory Canyon, and the low rolling hills to the west of Gregory Canyon. Bedrock is well exposed on Gregory Mountain, becomes largely covered by colluvium and alluvium within Gregory Canyon and the channel of the San Luis Rey River, and is obscured by vegetation and recent regolith and soil to the west of Gregory Canyon.

The general geology of the project site consists of a complex of Mesozoic metamorphic and plutonic basement rocks overlain by unconsolidated sediments of Quaternary age. For a more detailed discussion of the site geology, see Section 4.2, Geology and Soils. These deposits can be subdivided into the following four lithologic units (beginning with the oldest unit) discussed below.

4.10.1.1 Metamorphic Rocks

Metamorphic rocks underlying the eastern and central portions of Gregory Canyon on the western flanks of Gregory Mountain were originally mapped as Bedford Canyon Formation by Larsen (1948). This represents a southern extension of this rock unit, which was originally named for exposures to the north in the Santa Ana Mountains. The Bedford Canyon Formation in the Santa Ana Mountains is a tectonically disturbed flysch sequence consisting of unmetamorphosed to weakly metamorphosed sandstones and argillaceous shales with lesser limestone, conglomerate, diamictite, and chert (Criscione, Davis, and Ehlig, 1978). The age of the Bedford Canyon Formation is based upon multiple parameters all derived from fieldwork in the Santa Ana Mountains. Paleontological evidence consisting primarily of marine invertebrates recovered from lenses of limestone support a Triassic (Smith, 1898, 1914) to upper Jurassic age (Silberling and others, 1961) for the Bedford Canyon Formation (i.e., 200-150 million years

before the present; Ma). Rb/Sr isochron radiometric ages for fine-grained sediments in the Bedford Canyon Formation further support a middle Jurassic age (i.e., 180 Ma) for the younger portion of the formation (Criscione and others, 1978).

Metasedimentary sequences of Mesozoic age in the Peninsular Ranges have been referred to the Bedford Canyon Formation by Larsen (1948) and Jahns (1952) including the highly metamorphosed rocks southwest of Pala, on Gregory Mountain. The report of GeoLogic Associates (1997), however, documented amphibolites and metavolcanics in the metamorphic rock sequence within the project area and suggested that these rocks more closely resembled the Santiago Peak Volcanics than the Bedford Canyon Formation. The Santiago Peak Volcanics overlies the Bedford Canyon Formation in the Santa Ana Mountains and represents a complex unit of metasedimentary rocks of late Jurassic age (i.e., 145 Ma) and metavolcanic rocks of early Cretaceous age (i.e., 125 Ma). The high grade of metamorphism observed for the metamorphic rocks in the project area is unlike conditions typical for outcrops of the Santiago Peak Volcanics in coastal San Diego County. However, the metamorphic deposits in the project area will be referred to under the general category of Metamorphic Rocks.

Outcrops of metamorphic rocks are found within the proposed landfill area. The observed foliated amphibolite (quartz-poor, high-grade metamorphic rock) exhibited the mineralogical and textural characteristics indicative of metasomatism within a contact aureole (zone surrounding an igneous intrusion). At one outcrop deformed, dark, cobble-sized fragments of country rock were observed suspended in a light colored felsic groundmass. The composition of the country rock appeared to have been altered by metasomatic fluids emanating from the felsic intrusion. Abundant small felsic dikes were also observed cutting the metamorphics. Based upon a very cursory field examination, the metamorphics on this parcel appear to have undergone two episodes of metamorphism—an initial phase of regional metamorphism followed by contact metamorphic processes during the emplacement of the leukogranodiorite of Gregory Mountain. With emplacement the metamorphic rocks became roof pendants within the accumulating plutonic mass that today is referred to as the Southern California Batholith.

4.10.1.2 Mesozoic Intrusive Rocks

Felsic intrusive igneous rocks form the core of Gregory Mountain. This intrusive unit, described as the Indian Mountain Leucogranodiorite (Klgd) by Larsen (1948) forms the palisades high on the flanks of Gregory Mountain (referred to as Indian Mountain by Larsen, 1948). As mapped by GeoLogic Associates (1997) the hilly terrain west of Gregory Canyon is underlain by mafic intrusive igneous rocks correlated with the Bonsall Tonalite of Larsen (1948). During the field survey outcrops in this portion of the project site appeared to consist of dark-colored migmatitic rocks intruded by felsic dikes and veins. If this interpretation is correct, these rocks may actually represent a metamorphic facies related to the Metamorphic Rocks discussed above.

4.10.1.3 Quaternary Alluvium

Recent to subRecent (early Holocene) alluvial deposits have accumulated in the channel and flood plain of the San Luis Rey River. These alluvial deposits occur to depths up to fifty feet (GeoLogic Associates, 1997).

4.10.1.4 Quaternary Colluvium

Weakly consolidated Recent to subRecent (early Holocene) deposits that have accumulated on some of the slopes and in the basin of Gregory Canyon on the west side of Gregory Mountain represent colluvial deposits. Where observed in the field they consist of unconsolidated to weakly consolidated, poorly sorted, angular detritus derived from weathering upslope bedrock that has accumulated in local depressions or slopes of reduced gradient.

At one location, well consolidated deposits best assigned to colluvium, were observed on the slope overlying the metamorphic rocks. This particular deposit was composed of unsorted detritus derived from the upslope metamorphics, but was localized in occurrence and formed a conspicuous yellowish-brown exposure on the slope. This may represent the remnants of an old terrace surface or a thick remnant of older colluvium.

4.10.2 IMPACT SIGNIFICANCE CRITERIA

A significant impact would occur if the project would disrupt or destroy a unique paleontological resource.

4.10.3 POTENTIAL IMPACTS

Impacts to paleontological resources are rated from high to low depending upon the resource sensitivity of impacted rock formations.

High sensitivity is 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 paleobiology and evolutionary history (phylogeny) of animal and plant groups. Generally speaking, highly sensitive formations produce vertebrate fossil remains or are considered to have the potential to produce such remains.

Moderate sensitivity is assigned to geologic formations known to contain paleontological localities with poorly preserved, common elsewhere, or stratigraphically unimportant fossil material. The moderate sensitivity category is also applied to geologic formations that are judged to have a strong, but unproven potential for producing important fossil remains.

Low sensitivity is assigned to geologic formations that, based on their relative youthful age and/or high-energy depositional history, are judged unlikely to produce important fossil remains. Typically, low sensitivity formations produce invertebrate fossil remains in low abundance.

Zero sensitivity is assigned to geologic formations that are entirely igneous in origin or have no potential for producing fossil remains because of their extreme youth. This sensitivity rating also applies to disturbed materials such as are found in landfills and stockpiles.

4.10.3.1 Potential Impacts by Rock Type

Metamorphic Rocks

No fossils have ever been reported from the metamorphic rocks mapped on the western flanks of Gregory Mountain within the proposed landfill footprint and no fossils were observed in these deposits during the field survey. The grade of metamorphism of these rocks is too high for the preservation of fossils, if they ever existed in any pre-existing sedimentary rocks. Since this rock

unit has no potential for yielding significant fossils it is assigned a zero paleontological resource sensitivity.

Mesozoic Intrusive Rocks

The magmatic origin and emplacement of intrusive igneous rocks is not conducive to the occurrence or preservation of fossils. Therefore, these rocks are assigned a zero paleontological resource sensitivity.

Quaternary Alluvium

Although there is no record of any fossils being recovered from the Quaternary alluvial deposits within the project boundaries, the older alluvium occurring at depth may be old enough to contain vertebrate remains of great enough antiquity to be considered fossils (i.e., greater than 10,000 years old). When fossils do occur in Quaternary alluvial deposits, they are considered significant as they may provide evolutionary and paleoenvironmental information about a time in the not too distant past (Lindsay and Tessman, 1974). Based on this limited potential these deposits are assigned a low paleontological resource sensitivity. Therefore, because of the potential, although low, of fossils being located in the Quaternary Alluvium, mitigation measures to provide monitoring and handling of resources, if discovered, are provided in Section 4.10.4 (see Mitigation Measures 4.10-1a through 4.10-1d).

Quaternary Colluvium

No fossils were observed in deposits of colluvium during the field survey. This unit is of such recent age that it is highly improbable that any fossil material would be preserved in it. In addition, due to its limited geographic distribution within the project site there is little probability that any fossils will be exposed if it is disturbed during development of the landfill and associated facilities. Based on this extremely remote potential, this unit is assigned a zero paleontological resource sensitivity.

There is a very limited potential that landfill-related land uses will produce negative impacts to sensitive paleontological resources during development of the project site. These potential impacts are confined to excavations in the Quaternary alluvial deposits, which underlie the borrow sites and bridge footings tentatively proposed for areas within the channel and flood plain of the San Luis Rey River. The land uses proposed for the landfill footprint, stockpile area, and facilities area will encounter Metamorphic Rocks, Quaternary Colluvium, and/or possibly Mesozoic Intrusive Rocks.

4.10.3.2 Site Closure Impacts

Upon closure of the landfill, the potential for impacts to unique paleontological resources at the project site will be eliminated.

4.10.3.3 First San Diego Aqueduct Relocation

The impacts to paleontological resources from the relocation of the SDCWA Aqueduct would be similar to those of the project. The same mitigation measures in Section 4.10.4 would apply.

4.10.4 MITIGATION MEASURES

Impact 4.10-1: *The proposed project could disrupt or destroy unique paleontological resources during construction of the proposed landfill and related facilities. Such resources are potentially preserved in the Quaternary alluvium.*

MM 4.10-1a: Prior to issuance of the grading permit by the County, the applicant shall retain a qualified paleontologist to monitor excavations on site. Initially monitoring shall occur eight hours per week (e.g., two four-hour days or four two-hour days) during earthmoving activities in the Quaternary Alluvium. (This earthwork is to occur during construction of the bridge footings and roads and the excavation of the borrow sites.) The contractor shall notify the qualified paleontologist at the time such activities will be initiated so that a monitor can be present. (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.) The applicant shall submit a letter to the Department of Environmental Health identifying the monitor. Weekly letters shall be prepared by the monitor and provided to the Department of Environmental Health.

MM 4.10-1b: If unique fossils are discovered, the applicant shall have a qualified paleontologist (or paleontological monitor) recover them. If an extended salvage period is required, the paleontologist (or paleontological monitor) shall be allowed to temporarily direct, divert, or halt grading to allow recovery of fossils in a timely manner. If necessary, the paleontologist shall be allowed to set up a screen-washing operation to process the matrix to bulk sample selected geologic beds. If unique fossils are found, the applicant's paleontologist shall provide a letter to the Department of Environmental Health documenting the find and procedures followed on-site.

MM 4.10-1c: The applicant shall have a qualified paleontologist clean, repair, and catalog any fossil remains collected during monitoring and salvage operations. 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 shall be accompanied by financial support from the applicant for initial specimen storage. If fossil remains are found, the Department of Environmental Health shall review the preserved materials.

MM 4.10-1d: The applicant shall have a qualified paleontologist prepare regular biannual progress reports during earth moving activities in the Quaternary Alluvium (this earthwork to occur during construction of the bridge footings and roads and the excavation of the borrow sites) and a final summary report that outline the results of the resources mitigation program. These reports shall include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and the significance of

recovered fossils. These reports shall be submitted to the Department of Environmental Health.

4.10.5 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of the mitigation measures in Section 4.10.4 will reduce the potential impacts to paleontological resources to a less than significant level. No significant unavoidable adverse impacts will remain.