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Docket Number:	13-AFC-01
Project Title:	Alamitos Energy Center
TN #:	201620-18
Document Title:	AEC AFC 5.8 Paleontological Resources
Description:	Previously TN# 201495-17
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Organization:	CH2M Hill
Submitter Role:	Applicant Consultant
Submission Date:	2/3/2014 12:47:11 PM
Docketed Date:	2/3/2014

5.8 Paleontological Resources

This section describes the existing environment and potential effects on paleontological resources (fossils) from the construction of the Alamitos Energy Center (AEC). Section 5.8.1 describes the project setting and Section 5.8.2 discusses the affected environment, including the resource inventory and its results. Section 5.8.3 presents the environmental analysis and impact assessment. Section 5.8.4 considers cumulative effects on paleontological resources, and Section 5.8.5 presents proposed mitigation measures. Section 5.8.6 discusses applicable laws, ordinances, regulations, and standards (LORS). Section 5.8.7 lists involved agencies and agency contacts, and Section 5.8.8 lists applicable permits that will be required for construction. Section 5.8.9 provides the references consulted.

This section of the Application for Certification (AFC) meets the siting regulations of the California Energy Commission (CEC) (2000, 2007) and conforms with guidelines that address the assessment of paleontological resources and mitigating impacts resulting from earth-moving activities, including guidelines of the Society of Vertebrate Paleontology (SVP, 1995) and the Bureau of Land Management (BLM, 2008; 2009). This paleontological resources inventory and impact assessment was prepared by paleontologist James Verhoff, and Dr. W. Geoffrey Spaulding, paleontological resources specialist (PRS). Mr. Verhoff has experience in paleontological resources management and mitigation during both the licensing and compliance phases of a number energy generation projects throughout California. Dr. Spaulding has advanced degrees in geology with emphases in paleobiology, and is a recognized expert on the glacial-age environments of the American West. His qualifications as a PRS have been recognized by CEC Staff.

5.8.1 Setting

AES Southland Development, LLC (AES-SLD) proposes to construct, own, and operate the AEC—a natural-gas-fired, air-cooled, combined-cycle, electrical generating facility in Long Beach, Los Angeles County, California. The proposed AEC will have a net generating capacity of 1,936 megawatts (MW) and gross generating capacity of 1,995 MW.[1] The AEC will replace and be constructed on the site of the existing Alamitos Generating Station.

The AEC will consist of four 3-on-1 combined-cycle gas turbine power blocks with twelve natural-gas-fired combustion turbine generators, twelve heat recovery steam generators, four steam turbine generators, four air-cooled condensers, and related ancillary equipment. The AEC will use air-cooled condensers for cooling, completely eliminating the existing ocean water once-through-cooling system. The AEC will use potable water provided by the City of Long Beach Water Department (LBWD) for construction, operational process, and sanitary uses but at substantially lower volumes than the existing Alamitos Generating Station has historically used. This water will be supplied through existing onsite potable water lines.

The AEC will interconnect to the existing Southern California Edison 230-kilovolt switchyard adjacent to the north side of the property. Natural gas will be supplied to the AEC via the existing offsite 30-inch-diameter pipeline owned and operated by Southern California Gas Company that currently serves the Alamitos Generating Station. Existing water treatment facilities, emergency services, and administration and maintenance buildings will be reused for the AEC. The AEC will require relocation of the natural gas metering facilities and construction of a new natural gas compressor building within the existing Alamitos Generating Station site footprint. Stormwater will be discharged to two retention basins and then ultimately to the San Gabriel River via existing stormwater outfalls.

The AEC will include a new 1,000-foot process/sanitary wastewater pipeline to the first point of interconnection with the existing LBWD sewer system and will eliminate the current practice of treatment and discharge of process/sanitary wastewater to the San Gabriel River. The project may also require

[1] Referenced to site ambient average temperature conditions of 65.3 degrees Fahrenheit (°F) dry bulb and 62.7°F wet bulb temperature without evaporative cooler operation.

upgrading approximately 4,000 feet of the existing offsite LBWD sewer line downstream of the first point of interconnection, therefore, this possible offsite improvement to the LBWD system is also analyzed in this AFC. The total length of the new pipeline (1,000 feet) and the upgraded pipeline (4,000 feet) is approximately 5,000 feet.

To provide fast-starting and stopping, flexible generating resources, the AEC will be configured and deployed as a multi-stage generating (MSG) facility. The MSG configuration will allow the AEC to generate power across a wide and flexible operating range. The AEC can serve both peak and intermediate loads with the added capabilities of rapid startup, significant turndown capability (ability to turn down to a low load), and fast ramp rates (30 percent per minute when operating above minimum gas turbine turndown capacity). As California's intermittent renewable energy portfolio continues to grow, operating in either load following or partial shutdown mode will become necessary to maintain electrical grid reliability, thus placing an increased importance upon the rapid startup, high turndown, steep ramp rate, and superior heat rate of the MSG configuration employed at the AEC.

By using proven combined-cycle technology, the AEC can also run as a baseload facility, if needed, providing greater reliability to meet resource adequacy needs for the southern California electrical system. As an in-basin generating asset, the AEC will provide local generating capacity, voltage support, and reactive power that are essential for transmission system reliability. The AEC will be able to provide system stability by providing reactive power, voltage support, frequency stability, and rotating mass in the heart of the critical Western Los Angeles local reliability area. By being in the load center, the AEC also helps to avoid potential transmission line overloads and can provide reliable local energy supplies when electricity from more distant generating resources is unavailable.

The AEC's combustion turbines and associated equipment will include the use of best available control technology to limit emissions of criteria pollutants and hazardous air pollutants. By being able to deliver flexible operating characteristics across a wide range of generating capacity, at a relatively consistent and superior heat rate, the AEC will help lower the overall greenhouse gas emissions resulting from electrical generation in southern California and allow for smoother integration of intermittent renewable resources.

Existing Alamitos Generating Station Units 1–6 are currently in operation. All six operating units and retired Unit 7 will be demolished as part of the proposed project. Construction and demolition activities at the project site are anticipated to last 139 months, from first quarter 2016 until third quarter 2027. The project will commence with the demolition of retired Unit 7 and other ancillary structures to make room for the construction of AEC Blocks 1 and 2. The demolition of Unit 7 will commence in the first quarter of 2016. The construction of Block 1 is scheduled to commence in the third quarter of 2016 and construction of Block 2 is scheduled to commence in the fourth quarter of 2016. The demolition of existing Units 5 and 6 will make space for the construction of AEC Block 3. AEC Block 3 construction is scheduled to commence in the first quarter of 2020 and will be completed in the second quarter of 2022. The demolition of existing Units 3 and 4 will make space for the construction of AEC Block 4. AEC Block 4 construction is scheduled to commence in the second quarter of 2023 and will be completed in the fourth quarter of 2025. The demolition of remaining existing units is scheduled to commence in the third quarter of 2025.

Construction of the AEC will require the use of onsite laydown areas (approximately 8 acres dispersed throughout the existing site) and an approximately 10-acre laydown area located adjacent to the existing site. The adjacent 10-acre laydown area will be shared with another project being developed by the Applicant (Huntington Beach Energy Project [HBEP] 12-AFC-02). Due to the timing for commencement of construction for these two projects, the adjacent laydown area will already be in use for equipment storage before AEC construction begins.

5.8.2 Affected Environment

5.8.2.1 Physiographic Setting

The project area lies in the city of Long Beach, California. The project area lies in the southern portion of the Los Angeles Basin, east of the Pacific Ocean and approximately 1 mile northeast of Alamitos Bay; the San Gabriel River lies approximately 0.75 mile to the east. Physiographically, Fenneman (1931) described this area as the Angeles Section of the Pacific Border Province. The present shoreline of the Pacific Ocean is approximately 1.8 miles to the southwest, and the project site lies adjacent to one of several channelized sections of the lower San Gabriel River. Prior to development and channelization, the project area likely would have been an estuarine, lagoonal habitat near the mouth of the San Gabriel River. A largely continuous long-shore beach would have offered a barrier separating this estuarine habitat from San Pedro Bay. The plain of the Los Angeles Basin extends to the north and northwest of the project site, punctuated by isolated uplifts such as the Dominguez Hills and the Palos Verdes Hills. The basin is bounded by the Santa Monica and San Gabriel mountains to the north, the Pacific Ocean to the west and south, and the highlands of the Puente and Chino hills to the north, and the Santa Ana Mountains to the south.

The Los Angeles Basin developed in the Late Miocene in response to tectonic events encompassing regional pull-apart of a quiescent continental shelf margin, and the basin reached a maximum depth of approximately 6,000 feet (Norton and Otott Jr., 1996). The basin rapidly filled with near-shore marine sediment for the next 10 million years or more. This basin, now filled with marine sediment with a veneer of Quaternary continental sediment less than a few hundred feet thick in most cases, has been heavily deformed by regional faulting and folding, with oil and natural gas having migrated through the permeable marine sediments to become trapped by these structures (Norton and Otott Jr., 1996). During the last glacial age and during prior glacial ages that occurred during the Middle and Late Pleistocene (the last 0.7 million years), sea level was hundreds of feet below that of the present level, and consequently for much of the last million years the project area lay on a vast coastal plain, with the shoreline some distance to the west.

The surface geology of the project area (Figures 5.4-1A and 5.4-1B in Section 5.4) has been masked by historical and modern urban development. Where native soil is present in the region it represents sands and silts associated with paralic[2] habitats, beach deposits and, further inland, estuarine silts of tidal lagoons, as well as fluvial silts and sands of the San Gabriel River (California Department of Conservation, 1998). Near-shore marine deposits also add to the array of sediments that reflect the complex interaction of the San Gabriel River and the Pacific Ocean over the past ten thousand years. Prior to that time, during the Late Pleistocene, the ocean shore and its associated habitats lay many miles farther west, and this area was a semi-arid coastal plain.

5.8.2.2 Resource Inventory

5.8.2.2.1 Methods

Published and available unpublished geological and paleontological literature was reviewed to develop a baseline paleontological resource inventory of the project area and surrounding lands, and to assess the potential paleontological productivity of the stratigraphic units that may be encountered during construction-related excavations. Sources included geological maps, satellite photography, technical and scientific reports, and available electronic databases. Subsurface investigations have recently been performed in the AEC project area (Ninyo & Moore, 2011), and were included in this analysis. A paleontological resources record review was conducted for the project using the online database maintained by the University of California Museum of Paleontology (UCMP) and the PaleoBiology Database (2013). In addition to these online resources, the Los Angeles County Museum of Natural History (LACM) performed a review of their vertebrate paleontology archives (LACM, 2013).

[2] "Paralic" is a term used by geologists to describe the complex of sedimentary environments associated with the sea shore, and it is intended to include the transitions from wave zone to beach to dune environments, and from there to estuarine and lagoonal habitats as well.

Because the entire project area is highly developed and only fill is exposed at the surface, no intensive paleontological resources survey was conducted.

5.8.2.2.2 Results

Available geologic maps (Poland et al., 1959; California Department of Conservation, 1998; Figure 1) indicate that the project area is underlain by active or recently active eolian (sand dune and sand sheet) deposits and Recent and Older alluvial and stream deposits. Marine terrace deposits lie approximately 3 miles to the southeast (Poland et al., 1959), on what appears to have been the southern edge of the broad deltaic zone created by the San Gabriel River mouth. Older surfaces with marine terraces are not recorded closer to the project site, and instead in this area Holocene sediments extend to some depth. The nearest outcrops of consolidated rock units lie about 11 miles to the west, in the Palos Verdes Hills (Poland et al., 1959). The project area has been heavily graded, and fill was also imported to level the surface and reclaim estuarine habitat in the mid-twentieth century. This stratum of fill extends 6 to 9 feet below ground surface (bgs; Ninyo & Moore, 2011).

Prior to development, the uppermost sediments in the project area consisted predominantly of alluvial and fluvial sediments of the San Gabriel River further inland, with minor paralic (near-shore and beach) deposits, dominated by recent (Holocene) eolian sands (Poland et al., 1959; California Department of Conservation, 1998). The San Gabriel River, as well as the Los Angeles River whose mouth is approximately 7 miles farther west along the shore, are the ultimate sources of these sands; channelized courses of the San Gabriel River lie to both the east and west of the project site. More than 50 feet below the surface (Ninyo & Moore, 2011), these younger paralic and alluvial deposits give way to Late to Middle Pleistocene sediments. The thickness of the Pleistocene sediments is highly variable and dependent (among other things) on the location of the ancient river course and local uplift associated with the Dominguez Hills, which are less than a mile to the northwest of the western terminus of the proposed wastewater line. These deposits likely grade into the Late to Middle Pleistocene marine terrace deposits, which generally consisting of red silty sand (Poland et al., 1959), and are shown as units Qopa, Qopc, and Qops in Figures 5.4-1a and 5.4-1b.

The surficial geology of the project area and a buffer extending outward a distance of 2 miles is shown in Figures 5.4-1a and 5.4-1b. Twelve separate subunits are recognized, and five are located in within the project site and along its associated pipeline corridor. One is artificial fill (af), another is younger alluvium (Qyaf), and three are different facies of older Quaternary marine terrace deposits (Qopa, Qopc, Qops). It should be noted that, at present, only disturbed sediment and artificial fill can be observed at the surface; the geology is to a large extent reconstructed pre-development conditions. Table 5.8-1 summarizes the geological units and relates them to the units employed in this assessment.

TABLE 5.8-1
Geological Subunits within 2 Miles of the Project Area and Their Geological, Stratigraphic, and Age Relationships

Geologic Subunit (Refer to Figures 5.4-1a and 5.4-1b)	Geological and Stratigraphic Relationships	Age Relationships
af	Artificial fill; material transported from elsewhere. No stratigraphic relationships.	None
Qms, Qp, Qb, Qpe	Younger paralic sediments ranging from near-shore marine to estuarine habitats. Beach and fluvial sands intergrading with estuarine muds.	Chiefly Holocene, to latest Pleistocene near the base. Extends to depths of at least 30 feet; off-shore fossil records suggest erosion of older Pleistocene material in the wave zone, but this is more than one mile from the project site, in different habitat.

TABLE 5.8-1
Geological Subunits within 2 Miles of the Project Area and Their Geological, Stratigraphic, and Age Relationships

Geologic Subunit (Refer to Figures 5.4-1a and 5.4-1b)	Geological and Stratigraphic Relationships	Age Relationships
Qya, Qyfa, Qyfc, Qyfs, Qype	Younger Quaternary alluvium of distal fan slopes, fluvial sands and silts, and estuarine deposits. Fine-grained sands and silts of terrestrial origin intergrading with fluvial sands and paralic sediments.	Chiefly Holocene, to latest Pleistocene near the base. Terrestrial sediments deposited subsequent to the post-glacial return of sea-level to near-present elevations. No Pleistocene sediments present.
Qopa, Qopc, Qops	Older Quaternary paralic deposits; often pedogenically altered silts sands and clays, normally poorly sorted and presently exposed by emergent, wave-cut marine terraces ("abrasion platforms") along zones of regional uplift.	Middle to Late Pleistocene sediments, typical of Quaternary marine terraces exposed along the Pacific Coast of southern California. Subsequent to deposition these sediments were wave-cut and then uplifted. They can yield marine invertebrate fossils that can be important in geochronological studies (Lajoie et al., 1991).

Older Tertiary marine sandstones are exposed by local uplift in the Dominguez Hills less than 1 mile northwest of the western terminus of the proposed upgraded LBWD wastewater line. Because these units lie well below the depth of any anticipated construction activity in the vicinity of the project which, as noted previously, lies chiefly in the lowland, deltaic area associated with the historic San Gabriel River mouth, these units were not analyzed further.

Results of the Records Search

A search of the UCMP database on May 29, 2013, queried Quaternary fossil site records within Los Angeles and Orange counties, which lie to the west and east of the project area, respectively. Over 1,600 fossil sites in Los Angeles County are in the UCMP database (2013), and 136 sites are recorded in the PaleoBiology Database (2013). In Orange County, 939 localities are recorded in the UCMP database (2013), and 133 fossil sites are recorded in the PaleoBiology Database (2013). However, few if any of these fossil sites are representative of the project area, and most are far from the project site. Los Angeles County in particular includes several geomorphic provinces: the Transverse Ranges, the Peninsular Ranges, and Antelope Valley within the Mojave Desert. Both Los Angeles and Orange counties have extensive outcrops of fossiliferous Tertiary marine sediments uplifted and exposed in the hills, more than 10 miles from the coastal plain occupied by the project. The only fossil sites within 2 miles of the project area are located off-shore in Alamitos Bay (five localities) and on Seal Beach (20 localities). Both the UCMP and the PaleoBiology Database were also queried for records of fossils found within the formations that underlie the project area.

A summary of the results of these searches as they apply to the geological units occurring within the project area is provided below:

- **Disturbed Sediment / Artificial Fill:** These units, including artificial fill and modern surficial deposits, do not include scientifically significant fossils. Any fossils found in these units would be out of stratigraphic context and mechanically damaged, reducing their scientific significance to nil. This is the only sediment type exposed at the surface in the project area.
- **Younger Quaternary Alluvium and Paralic Deposits:** Although the available geological mapping does not show younger paralic deposits to be present in the project area, as discussed previously geotechnical borings show that they are at relatively shallow depth and intergrade with alluvial sediments. Scientifically significant fossils are rarely attributed to Holocene deposits, which constitute most of this unit. This sediment extends to a depth of approximately 50 feet in the main project area, and may include latest Pleistocene sediments near its base. Geotechnical studies of the AEC site have found root

casts and shell fragments starting at 15 feet bgs, in alluvium likely to be early Holocene in age (Ninyo & Moore, 2011). Older Pleistocene sediments are expected to be well below the maximum depth of excavations of approximately 20 feet.

- **Older Quaternary Paralic Deposits:** Although no fossil records can be directly attributed to these geological units, and marine terrace deposits are often altered by soil formation processes that generally destroy fossils, they can also yield mollusks that are useful in assigning ages to marine terraces and their uplift (e.g., Lajoie et al., 1991).

The project area in general lies in an estuarine habitat. In the lower Los Angeles River channel, a geomorphic setting similar to the project area about 9 miles to the west, Pleistocene sediments (and significant fossil material) were encountered at depths exceeding 70 feet (Los Angeles Metro, 2000). Perhaps because few excavations reach that depth, the Quaternary alluvium in and near the project site has not yielded any significant vertebrate or plant fossils records.

Along with these well-studied formations, several finds were made at or off Seal Beach, which lies approximately 1.7 miles directly south of the project area. Unfortunately, these finds were out of stratigraphic context (Miller, 1971), and it is uncertain which stratigraphic unit they originated from. They include a mammoth tooth found just above the shoreline along the beach, and mammoth skull and teeth fragments found approximately 500 feet offshore (Miller, 1971). A bison horn core was also found near these mammoth remains (Miller, 1971). It appears likely that erosion of fossiliferous sediments in the wave zone off-shore is exposing Quaternary fossil material. These sites are all more than 1 mile from the project area. All fossil records in the area relate to material of uncertain provenance, dredged from the bottom of San Pedro Bay, or cast up on Seal Beach. Therefore, no map of paleontological sites is provided because there are no records of paleontological finds in the area that possess provenance.

5.8.2.3 Paleontological Sensitivity of the Project Site including Offsite Linears

5.8.2.3.1 Assessment Criteria

Paleontological sensitivity is the qualitative assessment made by a professional paleontologist taking into account the paleontological potential of the stratigraphic units present, the local geology and geomorphology, and any other local factors that may be germane. According to SVP (1995) and BLM (2008) standard guidelines, sensitivity comprises (1) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or paleobotanical remains, and (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecological, or stratigraphic data.

The sensitivity ratings used in this assessment are consistent with SVP (1995) and BLM (2008) guidelines, and provided in Table 5.8-2.

TABLE 5.8-2
Paleontological Sensitivity Ratings Employed

	Definition
High	Assigned to geological formations known to contain paleontological resources that include rare, well-preserved, and/or fossil materials important to ongoing paleoclimatic, paleobiological and/or evolutionary studies. They have the potential to produce, or have produced vertebrate remains that are the particular research focus of many paleontologists, and can represent important educational resources.
Moderate	Stratigraphic units that have yielded fossils that are but moderately well preserved, are common elsewhere, and/or that are stratigraphically long ranging would be assigned a moderate rating. This evaluation also can be applied to strata that have an unproven but strong potential to yield fossil remains based on the stratigraphy and/or geomorphologic setting.

TABLE 5.8-2
Paleontological Sensitivity Ratings Employed

	Definition
Low	Sediment that is relatively recent, or that represents a high-energy subaerial depositional environment where fossils are unlikely to be preserved. A low abundance of invertebrate fossil remains, or reworked marine shell from other units, can occur but the paleontological sensitivity would remain low due to their lack of potential to serve as significant scientific or educational purposes. This evaluation also can be applied to strata that have been monitored and that have failed to yield scientifically significant fossil remains.
Marginal and Zero	Stratigraphic units with marginal potential include pyroclastic flows and soils that might preserve traces or casts of plants or animals. Most igneous rocks, however, have zero paleontological potential. Other stratigraphic units deposited subaerially in a high-energy environment (such as alluvium) also may be assigned a marginal or zero sensitivity rating. Manmade fill is also considered to possess zero (no) paleontological potential.

Employing these criteria, the geological and paleontological data gathered and described above were assessed and paleontological sensitivity assigned to the units underlying or potentially underlying the project area. These are discussed below.

- **Disturbed Sediment / Artificial Fill:** This material has been re-worked and removed from its original stratigraphic context. Any fossils found in these sediments will therefore be out of stratigraphic context and would likely be badly damaged, and therefore are of no scientific interest. These sediments have zero (no) paleontological sensitivity.
- **Younger Quaternary Alluvium and Paralic Deposits:** It is unlikely that the Holocene-age alluvium or paralic sediments contain any scientifically significant paleontological resources, both because of their young age and the continual re-working of the sediment in this environment, so close to the shoreline and in a historically active river channel. However, deeper strata near the base of these units may include latest Pleistocene strata, and the presence of root casts and shell fragments at depth in geotechnical drill cores indicates the potential for fossils to be found within these sediments at depth. Regardless, because records of scientifically significant paleontological resources are unknown from these units, these largely Holocene deposits have a low paleontological sensitivity.
- **Older Quaternary Paralic Deposits:** No scientifically significant paleontological resources have been definitively attributed to these sediments in the project vicinity. Fossils assumed to be from Quaternary-age alluvial and paralic deposits have been discovered in the Los Angeles Basin, however (e.g., Long, 1993; Stock, 1972; Woodring et al., 1946). In addition, mollusk faunas recovered from the marine terraces in which these sediments are exposed have provided important paleoenvironmental and geochronological information in southern California (e.g., Lajoie et al., 1991). Therefore, these deposits possess moderate paleontological sensitivity.

5.8.3 Environmental Analysis

The subsurface of the project area consists of a sequence of deposits recording a relative decline in sea level, ranging (from oldest to youngest) from marine deposits of the Tertiary and Pleistocene to alluvial and eolian deposits of the Holocene. The uppermost portion of this sedimentary sequence is covered by artificial fill, and the sediment to a depth of at least 2 to 3 feet (and much deeper in places) is highly re-worked. An analysis of potential impacts to paleontological resources from excavation of the project area is presented in the following sections.

5.8.3.1 Paleontological Resource Significance Criteria

In its standard guidelines for assessment and mitigation of adverse impacts on paleontological resources, the SVP (1995) notes that an individual fossil specimen is considered scientifically important and significant

if it is: (1) identifiable, (2) complete, (3) well preserved, (4) age-diagnostic, (5) useful in paleoenvironmental reconstruction, (6) a member of a rare species, (7) a species that is part of a diverse assemblage, or (8) a skeletal element different from, or a specimen more complete than, those now available for that species. In general, the value or importance of different fossil groups varies depending on the age and depositional environment of the stratigraphic unit that contains the fossils, their abundance in the record, and their degree of preservation.

For example, identifiable land mammal fossils are considered scientifically important because of their potential use in determining the age and paleoenvironment of the sediments in which they occur. Moreover, vertebrate and plant remains are comparatively rare in the fossil record. For marine sediments, invertebrate megafossils (e.g., mollusks, cephalopods) are individually infrequently scientifically important because individual species are generally widely represented in academic archives. Marine microfossils such as foraminifera or diatoms are very common, and consequently usually not considered for resource protection because of their relative abundance.

Using these criteria and the sensitivity ratings provided above, the significance of potentially adverse impacts of excavations on the paleontological resources was assessed. Absent mitigation, an impact on a fossil site, or on a fossil-bearing rock unit of high or moderate sensitivity, could be considered potentially significant.

5.8.3.2 Potential to Affect Paleontological Resources

The significance of impacts of project-related activities on the paleontological resources of each stratigraphic unit anticipated to be present at the project site is presented in this section. This assessment includes the entirety of the project area. As stated previously, detailed subsurface studies have not been performed within the project area; therefore, some of these units may be partially removed or completely absent from the subsurface.

- **Previously Disturbed Sediment/Fill**: Construction-related excavations that do not extend beyond sediments disturbed by previous construction will not result in any adverse impacts on paleontological resources. Reworked and disturbed fossil material can be present in previously disturbed sediment or fill, but lack of stratigraphic context and likely mechanical damage would compromise all scientific value. Therefore, excavations into these sediments have no chance of affecting paleontological resources.
- **Younger Quaternary Alluvium and Paralic Deposits**: Excavations extending to depths below the artificial fill within the project area may affect these younger deposits. These units have not yielded scientifically significant paleontological resources in the past, and the depths that may contain latest Pleistocene sediments lay well below the maximum depth of project excavations (approximately 20 feet bgs). There is therefore no appreciable chance that excavations in these sediments will affect paleontological resources.
- **Older Quaternary Paralic Deposits:** These deposits range in age from the Late to Middle Pleistocene. While these sediments are often pedogenically altered marine mollusks do occur and can provide scientifically significant information. Geological mapping places these deposits, below artificial fill and disturbed sediments, in the northwest corner of the plant site, and along the part of the western portion of the LBWD wastewater line that may have to be upgraded. Excavations into these sediments have the potential to affect paleontological resources of moderate sensitivity.

The potential for this project to affect paleontological resources is directly proportional to the paleontological sensitivity of the geologic units encountered during construction-related excavations. Most sediments that will be affected by construction of this project are not paleontologically sensitive. No paleontological sites with secure provenance are known for the area, although it is evident that erosion of Pleistocene sediments is occurring off-shore in the shallows of San Pedro Bay. This is however more than a mile from the project area, in a different geological setting. Within the project area, only those excavations disturbing older paralic sediments (subunits Qopa, Qopc, and Qops) have the potential to affect

paleontological resources. But because these sediments are often altered by weathering, and usually yield only marine mollusks, they possess only moderate paleontological sensitivity. Supporting this is the fact that no paleontological sites are recorded in the vicinity of the project, other than the marine fossils localities discussed previously.

5.8.4 Cumulative Effects

Development in the Los Angeles Basin has resulted in proportionate impacts on paleontological resources (Miller, 1971; Jefferson, 1991). Measures typically implemented pursuant to state statutes (see Section 5.8.6) serve to mitigate these impacts through the recovery of the scientific and educational potential of the affected paleontological resources.

The potential of this project to contribute to cumulative impacts on paleontological resources is low. A layer of disturbed sediment and Holocene-age eolian sediments underlie the project area, and impacts to paleontological resources are only possible if construction-related excavation extends below these low-sensitivity sediments. If excavations reach depths where undisturbed sediment capable of producing fossils are encountered, the mitigation described below will reduce the contribution of the project to cumulative negative impacts on paleontological resources to negligible levels.

5.8.5 Mitigation Measures

The proposed project has the potential to affect paleontological resources of moderate sensitivity. Therefore, a paleontological resources mitigation and monitoring plan (PRMMP) should be developed and implemented.

The following proposed mitigation measures are in compliance with CEC environmental guidelines (CEC, 2000; 2007) and with SVP standard guidelines for mitigating adverse construction-related impacts on paleontological resources (SVP, 1995). Implementation of these mitigation measures would assure that the potential impacts from project-related ground disturbance on paleontological resources would be maintained at an insignificant level.

5.8.5.1 Project Paleontological Resources Specialist

No less than 60 days prior to the start of construction, the project proponent will submit the name and resume of a qualified PRS to the CEC for review and approval. This individual will prepare the paleontological resources module of the worker education program and be available during the course of ground-disturbing construction in case there is an unanticipated paleontological discovery. The name and contact information of the PRS will be provided to all construction management personnel, the compliance manager, and the cultural resource monitors (if any).

5.8.5.2 Development of a Paleontological Resources Monitoring and Mitigation Plan

Prior to construction, a PRMMP will be drafted by the PRS. This plan will provide detailed instructions regarding which strata are paleontologically sensitive, for the monitoring of construction activities, and for sampling procedures and the curation of any paleontological resources found. The PRMMP will also outline communications protocols to be used during construction, both in the case of an unanticipated discovery and to ensure adequate monitoring takes place. This plan will also outline the procedures to be used to ensure adequate curation of any discovered paleontological resources.

5.8.5.3 Construction Personnel Education

Prior to working on the project site for the first time, all personnel involved in earth-moving activities will be provided with Paleontological Resources Awareness Training. This training ideally would be provided as a module in the worker environmental awareness training. Construction personnel involved with or supervising excavations will be informed that fossils may be encountered and will be provided with information on the appearance of fossils, the role of paleontological monitors, and on proper notification

procedures. This worker training will be prepared and initially presented by the PRS. Subsequent training may be conducted via video presentation and hard-copy training materials.

5.8.6 Laws, Ordinances, Regulations, and Standards

Paleontological resources are non-renewable scientific resources and are protected by several federal and state statutes (Marshall, 1976; Fisk and Spencer, 1994), most notably by the 1906 Federal Antiquities Act and other subsequent federal legislation and policies, and by State of California environmental regulations (California Environmental Quality Act [CEQA], Section 15064.5). Professional standards for assessment and mitigation of adverse impacts on paleontological resources have been established by the SVP (1995) and BLM (2008). Design, construction, and operation of the AEC will be conducted in accordance with all LORS applicable to paleontological resources. Federal, state, and local LORS applicable to paleontological resources are summarized in Table 5.8-3 and discussed briefly below, along with professional standards for paleontological resources assessment and impact mitigation.

TABLE 5.8-3
Laws, Ordinances, Regulations, and Standards Applicable to Paleontological Resources

LORS	Applicability	AFC Reference	Project Conformity
Omnibus Public Land Management Act of 2009 (H.R. 146), Title 6, Subtitle D	Not applicable—Applies only to federal land managed by the Secretaries of the Interior and Agriculture.	—	NA
Antiquities Act of 1906	Not applicable—Applies only to federal land (federal agency or state delegates issuing federal permits will determine applicability and compliance).	—	NA
National Environmental Policy Act of 1969	Not applicable—No major federal action.	—	NA
CEQA	Applicable—Requires assessment of the potential to affect unique paleontological resources.	Sections 5.8.2, 5.8.3, and 5.8.5	Yes
CA Public Resources Code, Sections 5097.5/5097.9	Not applicable—Applies to state-owned land.	—	NA
City of Long Beach General Plan	Not applicable—Does not address paleontological resources.	—	NA

NA = Not applicable

5.8.6.1 Federal LORS

Paleontological resources are protected by numerous federal regulations. Recently, President Obama signed into law the Omnibus Public Land Management Act of 2009 (H.R. 146), which includes provisions for protecting paleontological resources found on federal lands. Implementing regulations for this law have yet to be developed by the affected agencies. Additional federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (PL 59-209; 16 United States Code 431 et seq.; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal lands. In addition, the National Environmental Policy Act of 1969 (NEPA; United States Code, section 4321 et seq.; 40 Code of Federal Regulations, section 1502.25), as amended, requires analysis of potential environmental impacts to important historic, cultural, and natural aspects of our national heritage.

Federal protection for significant paleontological resources would apply to the AEC only if any construction or other related project impacts occur on federally owned or managed lands, or if there is a major federal

action subject to NEPA. Because no federally owned or managed lands will be affected by this project, these statutes do not apply to the AEC (see Table 5.8-3).

5.8.6.2 State LORS

As a certified regulatory program, the CEC environmental review process under the Warren-Alquist Act is considered functionally equivalent to that of CEQA (Public Resources Code Sections 21000 et seq.). CEQA requires that public agencies and private interests identify the environmental consequences of their proposed projects on any object or site of significance to the scientific annals of California (Division I, California Public Resources Code: 5020.1 [b]). The CEQA Guidelines (14 California Code of Regulations § 15000 et seq.) define procedures, types of activities, persons, and public agencies required to comply with CEQA.

Appendix G of the CEQA guidelines provides an Environmental Checklist of questions that a lead agency should normally address if relevant to a project's environmental impacts. One of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section V, part c) is the following: "Would the project directly or indirectly destroy a unique paleontological resource or site…?"

CEQA does not define what is "a unique paleontological resource or site." However, by analogy, Section 21083.2 defines "unique archaeological resources" as "…any archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

- Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information;
- Has a special and particular quality such as being the oldest of its type or the best available example of its type; and
- Is directly associated with a scientifically recognized important prehistoric or historic event.

Other state requirements for paleontological resource management are in California Public Resources Code Chapter 1.7, Section 5097.5/5097.9 (Stats. 1965, c. 1136, p. 2792), entitled Archaeological, Paleontological, and Historical Sites. This statute defines any unauthorized disturbance or removal of a fossil site or remains on public land as a misdemeanor and specifies that state agencies may undertake surveys, excavations, or other operations as necessary on state lands to preserve or record paleontological resources. Public Resources Code, Sections 5097.5/5097.9 does not apply to the AEC because construction or other related project impacts will not occur on state owned or managed lands and no state agency is intended to obtain ownership of project lands during the term of the project license (Table 5.8-3).

5.8.6.3 Local LORS

The City of Long Beach General Plan (City of Long Beach, 2002) does not address paleontological resources directly or indirectly.

5.8.6.4 Professional Standards

The SVP, an international organization of professional paleontologists, has established standard guidelines (SVP, 1995) that outline acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Most practicing paleontologists in the nation adhere to the SVP's guidelines, and extend those to address other types of fossils of scientific significance, such as invertebrate fossils and paleobotanical specimens. These standards, which are widely used by paleontologists both on federal land and elsewhere, provide for more detailed analysis of paleontological sensitivity and, therefore, more efficient paleontological resources monitoring.

5.8.7 Agencies and Agency Contacts

There are no agencies having exclusive jurisdiction over paleontological resources. The CEC is the CEQA lead agency for this project and, therefore, has jurisdiction over review of the potential environmental effects of the project on paleontological resources. If encountered, scientifically significant fossil specimens and associated site records will be curated at a federally accredited repository, likely the Los Angeles County Museum of Paleontology or the UCMP (Table 5.8-4).

TABLE 5.8-4
Agency Contacts for Paleontological Resources

Issue	Agency	Contact
Potential Paleontological Resources Documentation and Specimen Repository	UCMP	Dr. Patricia Holroyd Curator of Vertebrate Paleontology 1101 Valley Life Sciences Building Berkeley, CA 94720-4780 (510) 642-3733
Potential Paleontological Resources Documentation and Specimen Repository	Natural History Museum of Los Angeles County	Dr. Samuel A. McLeod Curator of Vertebrate Paleontology 900 Exposition Boulevard Los Angeles, CA 90007 (213) 763-3325

5.8.8 Permits and Permit Schedule

No state, county, or city agency requires a paleontological collecting permit to allow for the recovery of fossil remains discovered as a result of construction-related earth moving on this project site.

5.8.9 References

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