5.8 Paleontological Resources

This section describes the existing environment and potential effects on paleontological resources (fossils) from the construction and operation of the Redondo Beach Energy Project (RBEP). 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 the recommendations of professional standards that address the assessment of and mitigating impacts on paleontological resources resulting from earth-moving activities, including the Society of Vertebrate Paleontology (SVP, 1995) and the Bureau of Land Management (BLM, 2008). This paleontological resources inventory and impact assessment was performed by Mr. James Verhoff, a staff paleontologist with CH2M HILL, and Dr. W. Geoffrey Spaulding, the paleontological resources specialist (PRS) for this project. Mr. Verhoff has experience in paleontological resources management and mitigation during both the licensing and compliance phases of a number energy projects throughout southern 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

RBEP is a 496-megawatt[1] natural-gas-fired power plant, consisting of one 3-on-1 combined-cycle gas turbine power block. The power block includes three combustion turbine generators, three supplemental-fired heat recovery steam generators, one steam turbine generator, an air-cooled condenser, and related ancillary equipment. RBEP will be constructed entirely within the existing approximately 50-acre Redondo Beach Generating Station site in Redondo Beach, California. The project will use the existing onsite potable water, natural gas, stormwater, process wastewater, and sanitary pipelines and electrical transmission facilities. No offsite linear developments are proposed as part of the project.

RBEP will use potable water, provided by the California Water Service Company, for construction water and for operational process and sanitary uses. During RBEP operation, stormwater and process wastewater will be discharged to a retention basin and then ultimately to the Pacific Ocean via an existing permitted outfall. Sanitary wastewater will be conveyed to the Los Angeles County Sanitation District via the existing City of Redondo Beach sewer connection. A new onsite 230–kilovolt (kV) transmission interconnection will connect the RBEP power block to the existing onsite Southern California Edison (SCE) 230-kV switchyard.

Construction and demolition activities at the project site are anticipated to last 60 months, from January 2016 until December 2020. The first activities to occur onsite will be the dismantling and partial removal of existing Units 1–4. The major generating equipment including steam turbines, generators, boilers, and duct work will be removed, leaving the administration building and western portion of the building that houses Units 1–4 intact. These buildings will be left standing temporarily to provide screening between the construction site of the new power block and Harbor Drive. Construction of the new power block will begin in the first quarter of 2017 and continue through to the end of the second quarter 2019, when it will be ready for commercial operation. Although operational, construction will continue through 2019 including construction of the new control building and the relocation of the Wyland Whaling Wall. The existing Units 5–8 and auxiliary boiler No. 17 will remain in service until the second quarter of 2018. Units 5–8 and auxiliary boiler No. 17 will be demolished starting the first quarter of 2019 through the fourth quarter of 2020. During the demolition and removal of Units 5–8, the Wyland

[1] Referenced to site ambient average temperature (SAAT) conditions of 63.3°F dry bulb and 58.5°F wet bulb temperature.

Whaling Wall will be dismantled and moved to a new location directly in front of the new power block. Finally, the remaining buildings and structures left standing will be demolished and removed by the end of 2020.

All laydown and construction parking areas will be located within the existing Redondo Beach Generating Station fence line, as shown in Figure 2.1-1. Approximately 17 acres onsite will be used for construction laydown and parking. All construction equipment and supplies will be trucked directly to the site.

5.8.2 Affected Environment

5.8.2.1 Physiographic Setting

The project area lies along North Harbor Drive in the city of Redondo Beach, California, on the western edge of the Los Angeles Basin and immediately east of the Pacific Ocean. 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 it reached a maximum depth of approximately 6,000 feet below sea level (Norton and Otott Jr., 1996). This basin has been heavily deformed by later regional faulting and folding, with oil and natural gas found associated with these structures (Norton and Otott Jr., 1996). The project area itself overlies the Wilmington-Torrance Anticline, which consists of deformed Miocene to Pliocene marine deposits (Norton and Otott Jr., 1996). Later erosion subdued the surface expression of these folds and produced a pronounced unconformity with overlying sediments (Norton and Otott Jr., 1996). Above this unconformity the surface geology is dominated by 1,800 feet of Late Pliocene and Pleistocene marine sediments, including sands, gravels, clays, and marls (Norton and Otott Jr., 1996), and Late Pleistocene to Holocene beach deposits, consisting primarily of fine sands and silts (Poland et al., 1959). Prior to their destruction by development, these sand deposits formed the El Segundo Sand Hills. They have been obscured by historic and modern development in the region. The Pacific Ocean lies 0.25 mile to the west, the Palos Verdes Hills lie approximately 3 miles to the south, and the southernmost extent of the Transverse Ranges lies approximately 15 miles to the north.

5.8.2.2 Resource Inventory 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. The deepest excavations anticipated during project construction (associated with driving piles) will extend approximately 40 feet below ground surface (bgs). To ensure that all geologic units potentially affected by the project were adequately analyzed, all geologic units within 1 mile of the project area were subject to review. Sources included geological maps, satellite photography, technical and scientific reports, and available electronic databases. Subsurface investigations have recently been performed in the 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 at Berkeley (UCMP) and the PaleoBiology Database (n.d.). In addition to these online resources, the Los Angeles County Museum of Natural History (LACM) performed a review of their vertebrate paleontology archives (LACM, 2012)

Reconnaissance of the project site was conducted by a staff paleontologist on September 28, 2011. Field reconnaissance rather than formal survey was conducted of the project area because the area of potential effect is heavily developed, and the native sediment is obscured by a layer of artificial fill, blacktop, and onsite structures. Only limited native sediment could be observed within the boundary of the plant site, and that sediment was highly disturbed.

5.8.2.3 Resource Inventory Results

It is important to note that during the last glacial age and during prior glacial ages that occurred during the Middle and Late Pleistocene (the last 0.7 million years ago), sea level was hundreds of feet below that of the present level, and consequently for much of the last million years the project site lay on a vast coastal plain, with the shoreline some distance to the west.

5.8.2.3.1 Geological Units in the Vicinity

Available geologic maps (Poland et al., 1959; California Department of Conservation, 1998;) indicate that the project area is underlain by ancient and recently active eolian (sand dune) deposits. Terrace deposits consisting of red sands to silty sands of Pleistocene age lie approximately 3 miles to the southeast (Poland et al., 1959). The nearest consolidated rock units lie approximately 4 miles to the south, associated with the locally uplifted crustal block comprising the Palos Verdes Hills (California Department of Conservation, 1998). The Palos Verdes Hills consist of a Jurassic-age metamorphic basement complex that is overlain by approximately 3,000 feet of fine-grained marine sediments of Miocene, Pliocene, and Pleistocene age (Woodring et al., 1946). Overlying the thick sequence of marine sediments are non-marine terrace deposits consisting of poorly sorted sand and gravels thought to be late Pleistocene to Holocene in age. Strata of the Palos Verdes Hills have produced diverse and abundant assemblages of Pleistocene fossil marine invertebrates. Arnold's (1903) and Woodring et al.'s (1946) publications on invertebrate fossils collected from the Palos Verdes Hills have contributed to one of the most important early works regarding the comprehension of Pleistocene stratigraphy and paleontology of the Palos Verdes Peninsula.

Prior to development, the uppermost sediments in the project area were dominated by coastal deposits, also known as paralic sediments, which consisted of eolian dune sands, tidal marsh deposits, and alluvium (Poland et al., 1959) ranging in age from firm Pleistocene deposits to loose Holocene deposits (Ninyo & Moore, 2011). The original thickness of these deposits is not precisely known; previous development at the project site and elsewhere in the region included the removal of a portion of this overburden. At the project site, the current thickness of these coastal dune deposits exceeds 51 feet (Ninyo & Moore, 2011).

The Pleistocene San Pedro Formation, which consists of massive, poorly consolidated marine sand deposits (California Department of Conservation, 1998), extends from the bottom of these younger paralic deposits to a depth of approximately 500 feet below sea level. This formation was defined in the Coyote Hills in the northern portion of Orange County, though the definition of this formation has undergone much revision, in part because several of the original sections have been destroyed (Powell and Stevens, 2000). Due to the difficulty in determining the exact extent of this formation, the San Pedro Formation is often defined based on its stratigraphic location, rather than its lithology; for example, the formation has been defined as lying above the Pliocene Pico Formation and below the Pleistocene Palos Verdes Sands or, if the Palos Verdes Sands are absent, below the overlying Holocene deposits in the Redondo Beach area (Poland et al., 1959). The San Pedro Formation consists of two members: an upper member consisting of coarse sandstone and cobbles, and a lower member consisting of finer-grained sandstones and siltstones (Powell and Stevens, 2000). Based on sedimentary structures and variable lithologies, the San Pedro Formation represents a wide range of depositional environments. These environments range from nearshore, shallow marine to lagoonal, to back-bay tidal flat (Woodring et al., 1946). A diverse invertebrate fauna has been collected from this formation in the Coyote Hills, and evidence from this invertebrate fauna indicates that the formation was deposited in a marine setting, at a maximum depth of 70 meters (Powell and Stevens, 2000). Thicknesses range from about 170 feet (52 meters) to 735 feet (224 meters) in measured sections within the Coyote Hills (Powell and Stevens, 2000).

Marine sedimentary units extending from the Pliocene to the Miocene, including numerous oil-bearing strata, underlie the project area from the base of the San Pedro Formation to a depth of several thousand feet below ground surface (Poland et al., 1959). Because these formations lie far below the maximum depth of any anticipated construction-related excavations, these geologic units and those underlying them are not considered further.

5.8.2.3.2 Results of the Records Search

A search of the UCMP database on January 4, 2012, queried Quaternary fossil site records within Los Angeles County. Over 1,600 fossil sites have been found in the county in the UCMP database (n.d.), and 136 sites recorded in the PaleoBiology Database (n.d.). However, Los Angeles County includes several geomorphic provinces, including coastal sediments, the Transverse Ranges, and Antelope Valley within the Mojave Desert, and most of these sites are far from the project site. A map of known fossil sites within 5 miles of RBEP is provided in Appendix 5.8A, which has been submitted to the CEC under a request for confidentiality. These include both

vertebrate and invertebrate fossils from the formations that underlie, or that have the potential to underlie, the project area.

Both the UCMP and the PaleoBiology Database were queried for records of fossils found within the formations that underlie the RBEP site. As stated previously, the oil-bearing units were not analyzed, because these sediments lie several thousand feet below the project area and construction activities will not affect them. The results of the record queries are provided below. For the sake of consistency, the geologic units are given the names as they appear in geologic maps of the area (Appendix 5.8A).

- **Disturbed Sediment/Artificial Fill:** These units typically extend only 2 to 3 feet bgs; however, previous excavations at this site have locally disturbed this sediment to depths of 30 feet bgs (Miller, 1971). Disturbed sediments do not include scientifically significant fossils. Any fossils found in these units would be out of stratigraphic context and likely mechanically damaged, reducing their scientific significance to nil.

- **Quaternary Eolian Deposits/Alluvium:** The Quaternary includes both the relatively brief Holocene (the last 10,000 to 14,000 years), and the much longer Pleistocene (extending back to 2.6 million years). Its use in some geological studies, while others use the term “Pleistocene” and “Holocene,” creates difficulty because sediments dating to the former period frequently may possess some paleontological sensitivity, while those of Holocene age seldom do. No fossils were recorded in either the UCMP database (n.d.) or the PaleoBiology database (n.d.) for these sediments. However, this may be because these deposits are not formally named geologic units. Such names as “eolian deposits” do not lend themselves to database searches. The LACM (2012) has recorded three sites in Quaternary terrace deposits near the project area that have produced horse, whale, and mammoth remains.

- **San Pedro Formation:** The UCMP database (n.d.) includes 89 records of fossil sites within this formation. Of these, only five sites have produced vertebrate fossils; however, the fauna produced has been diverse, including horses, sloths, camels, saber-toothed cats and other cats, deer, rodents, squirrels, rabbits, seals, mammoths, bison, wolves, otters, birds, reptiles, amphibians, and fish (UCMP, n.d.). The PaleoBiology Database includes 10 fossil sites within the San Pedro Formation, of which five sites have produced vertebrate fossils (PaleoBiology Database, n.d.). These include a diverse assemblage, including otters, sloths, mammoths, deer, antelope, bison, camels, cetaceans, dolphins, wolves, cats, other carnivores, horses, rabbits, rodents, birds, reptiles, amphibians, and fish (PaleoBiology Database, n.d.). Both the UCMP database and the PaleoBiology Database include numerous records of invertebrate fossils as well, which have been important in determining the depositional setting of this deposit.

The paleontological site records search was augmented by a literature review. Several of the formations underlying the project area outcrop within or on the borders of the Los Angeles Basin, and those outcrops have yielded numerous fossils. The San Pedro Formation has produced a diverse invertebrate fauna, with over 170 fossils from 158 localities (Powell and Stevens, 2000), and several finds within the city of San Pedro, including proboscidean, equid, wolf, sloth, and bison (Miller, 1971), may be attributable to the San Pedro Formation. Fish fossils have also been found in the San Pedro Formation (Long, 1993).

More significantly, excavations within the Redondo Beach Generating Station site have previously produced one paleontological resource (Jefferson, 1991). This was a Rancholabrian-age tooth of an extinct llama (*Hemiauchenia*) (Jefferson, 1991). This tooth was collected at a depth of approximately 30 feet bgs (Miller, 1971), which places it within the Pleistocene-age paralic deposits encountered during the geotechnical survey, and at depths that may be reached during project excavations, particularly those associated with pile driving, which is planned to extend to 40 feet bgs (Ninyo & Moore, 2011). A horse tooth was also found in a stream channel near the project area, approximately 35 feet bgs (Miller, 1971). The lithology of the sediments hosting these fossil finds was not recorded.

Because the entire project area is highly developed, a reconnaissance-level field review was conducted on September 28, 2011, by a staff paleontologist to determine if any native sediment is present onsite and to determine the history of construction at the site. During this field review it was determined that the majority of the site was covered by concrete or blacktop, with little sediment exposed. What sediment was exposed was

either artificial fill or disturbed soil, neither of which have the potential to produce scientifically significant paleontological resources.

5.8.2.3.3 Paleontological Sensitivity of the Project Site

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 to the preservation and discovery of fossils. According to SVP (1995) and BLM (2008) standard guidelines paleontological 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. A summary of the paleontological sensitivity ratings used in this report is given in Table 5.8-1.

TABLE 5.8-1
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.
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 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.

5.8.2.3.4 Paleontological Sensitivity of Geologic Units at the Site

The paleontological sensitivity of the geologic units underlying the project area is discussed below.

- **Disturbed Sediment/Artificial Fill:** During the reconnaissance-level field review it was stated that this surficial 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 will likely be badly damaged, and therefore are of no scientific interest. These sediments have zero paleontological sensitivity.

- **Quaternary Eolian Deposits/Older Alluvium:** Excavations extending to depths below the artificial fill (typically 1 to 8 feet) will affect Holocene- to Pleistocene-age eolian deposits. It is unlikely that the Holocene-age sediments contain any scientifically significant paleontological resources, both because of the young age and the continual re-working of the sediment. Further, no records of scientifically significant paleontological resources are known from these units. Therefore, these Holocene eolian deposits have a low paleontological sensitivity. The Pleistocene-age eolian deposits and alluvium, in contrast, have produced scientifically significant paleontological resources within and near the plant site (Miller, 1971; Jefferson, 1991; LACM, 2012). These Pleistocene deposits, identifiable by their firm texture, therefore have a high paleontological sensitivity.

- **San Pedro Formation:** The San Pedro Formation has produced numerous fossil sites throughout the Los Angeles Basin (Powell and Stevens, 2000; Miller, 1971; Long, 1993; and Jefferson, 1991). These fossils range from relatively common invertebrate remains to much rarer, and therefore more scientifically important, fish, mammal, lizard, and bird remains. Several of these fossil sites lie near the project area (Jefferson, 1991; LACM, 2012). Because this formation has previously produced scientifically significant paleontological resources, and has done so near the project area, it is considered to possess a high paleontological sensitivity.

5.8.3 Environmental Analysis

The subsurface of the RBEP site consists of a sequence of deposits recording a relative decline in sea level, ranging (from oldest to youngest) from marine deposits to near-shore deposits of the Pleistocene, to eolian beach deposits of the Holocene. The uppermost portion of these sediments has been stripped from the site, and the remaining sediments are covered by artificial fill and construction materials (concrete and blacktop), typically extending 1 to 8 feet bgs, although in some areas disturbed sediment can reach as much as 30 feet bgs. An analysis of potential impacts on paleontological resources from RBEP construction and operation 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. Any unmitigated impact on a fossil site, or on a fossil-bearing rock unit of high or moderate sensitivity, would be considered significant.

5.8.3.2 Potential to Affect Paleontological Resources

This section considers impacts on paleontological resources resulting from the RBEP construction. No impacts are expected during RBEP operation because no ground disturbance will occur during normal operation activities.

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 (typically 1 to 8 feet bgs, but in places extending to as much as 30 feet bgs) 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 mechanical damage would compromise all scientific value. This would apply to operations such as grading and surface preparation for roads and parking areas, as well as the removal of underground utilities and other excavations

in previously disturbed sediments. Therefore, no adverse impacts on paleontological resources will occur from excavations within previously disturbed sediment.

- **Quaternary Eolian Deposits/ Alluvium**: As noted in section 5.8.2.3.2, the Quaternary includes both the Holocene and the much longer Pleistocene. Holocene-age sediments have low paleontological potential while those of the underlying Pleistocene have high paleontological potential. Excavations extending to depths below the artificial fill within the current plant compound will affect eolian deposits of Holocene age to a depth of approximately 10 feet bgs in the western portion of the site and 30 feet bgs in the eastern portion (Ninyo & Moore, 2011). These Holocene-age sediments have not yielded scientifically significant paleontological resources in the past. Excavations within Holocene-age sediments therefore have a low potential to impact scientifically significant paleontological resources. Older Pleistocene-age sediments underlie these younger deposits, and have produced a camel tooth, a llama tooth, whale remains, and horse remains (Jefferson, 1991; Miller, 1975; LACM, 2012). Because previous excavations at the project site have produced fossils, excavations within these Pleistocene-age sediments have a high potential to impact scientifically significant paleontological resources.

- **San Pedro Formation:** In the Los Angeles Basin, this formation has produced numerous birds, fish, reptiles, amphibians, and mammal fossils (UCMP, n.d.; PaleoBiology Database, n.d.). The invertebrate fossils of this formation may also be of scientific interest. While remains of invertebrate taxa are generally very common and therefore individually of little scientific importance, invertebrate fossils have been important in determining the exact definition of this formation (Powell and Stevens, 2000). Therefore, all fossils from this formation should be considered scientifically significant. Excavations into the San Pedro Formation, therefore, have a high potential to affect paleontological resources.

The potential for the project to affect paleontological resources is directly proportional to the paleontological sensitivity of the geologic units encountered. If project-related excavations extend below the sediments disturbed by previous construction and the Holocene age, loose eolian deposits, those excavations will impact the fossiliferous member of the Quaternary Alluvium and, potentially, the deeper San Pedro Formation. In general, excavations exceeding 10 feet in depth in the western portion of the site have the potential to encounter fossiliferous geologic units. The depth at which potentially fossiliferous sediments will be encountered increases to the east of the site, reaching 30 feet bgs at the eastern portion of the site. No impacts on paleontological resources are anticipated during RBEP construction because excavations are not anticipated to exceed 10 feet.

No impacts on paleontological resources are anticipated during RBEP operation because no ground disturbance is anticipated to occur during normal operation activities, including maintenance.

5.8.4 Cumulative Effects

Extensive development in the Los Angeles Basin has resulted in proportionately extensive impacts on paleontological resources (Jefferson, 1991), and this is anticipated to continue. The extensive nature of these cumulative impacts is due to this extensive development combined with the widespread presence of numerous fossiliferous sedimentary units in the region. However, 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. Although not all projects are subject to California Environmental Quality Act (CEQA) review, and only a proportion of those incorporate paleontological protection measures, application of paleontological monitoring and mitigation measures is common and therefore mitigates the cumulative and direct impacts of continued development.

The potential of this project to contribute to cumulative impacts on paleontological resources is high, given that sediments of high paleontological sensitivity lie at depths that will be impacted by project excavations (Ninyo & Moore, 2011). However, with the mitigation described below, the contribution of RBEP to cumulative negative impacts on paleontological resources will be negligible. By making previously buried paleontological resources available to researchers the project could be considered as making a positive contribution to the paleontological record of California.

5.8.5 Mitigation Measures

Guidelines for the implementation of CEQA (Public Resources Code Sections 15000 et seq.) include among the questions to be answered in the Environmental Checklist (Section 15023, Appendix G) the following: "Would the project directly or indirectly destroy a unique paleontological resource or site?" and "Does the project have the potential to…eliminate important examples of the major periods of California…pre-history?" This project has a low potential to affect paleontological resources; therefore, a mitigation and monitoring program should be developed, to be implemented if significant paleontological resources are encountered.

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 Paleontological Resources Monitoring and Mitigation Plan (PRMMP) will be drafted by or under the supervision of 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 (California Office of Historic Preservation, 1983; see also 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 (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts on paleontological resources have been established by the SVP (1995) and the BLM (2008). Design, construction, and operation of RBEP 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 5.8-2 and discussed briefly below, along with professional standards for paleontological resources assessment and impact mitigation.

TABLE 5.8-2
Laws, Ordinances, and Regulations 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	—	—
Antiquities Act of 1906	Applicable – A federal undertaking is involved; the U.S. Environmental Protection Agency (EPA) is the lead federal agency	Section 5.8.6.1	Yes
National Environmental Policy Act of 1969	Applicable – A federal undertaking is involved; EPA is the lead federal agency	Section 5.8.6.1	Yes
CEQA, Appendix G	Applicable – Requires assessment of the potential to affect paleontological resources during earth-moving activities	Sections 5.8.2, 5.8.3, 5.8.5, and 5.8.6.2	Yes
Public Resources Code, Sections 5097.5/5097.9	Not applicable – Applies to state-owned land	—	—
Los Angeles County General Plan 2005-2025	Not applicable – Paleontological resources are not addressed per se.	—	—
City of Redondo Beach General Plan	Not applicable—Does not address paleontological resources	—	—

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). 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 (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.

Because a Prevention of Significant Deterioration (PSD) permit under the federal Clean Air Act is required for the project, RBEP construction is considered a federal undertaking. As the lead federal agency for this project, it is the responsibility of the EPA to conduct the federal evaluation of potential effects of the project on paleontological resources. This AFC paleontological resources assessment has been submitted to EPA with the PSD permit application to facilitate compliance with the requirements of the federal Antiquities Act of 1906 and the National Environmental Policy Act.

5.8.6.2 State LORS

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 (Public Resources Code Sections 15000 et seq.) define procedures, types of activities, persons, and public agencies required to comply with CEQA. Appendix G in Section 15023 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…?"

Although CEQA does not define what is "a unique paleontological resource or site," 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
- Is directly associated with a scientifically recognized important prehistoric or historic event"

With only slight modification, this definition is equally applicable to recognizing "a unique paleontological resource or site." Additional guidance is provided in CEQA Section 15064.5 (a)(3)(D), which indicates "generally, a resource shall be considered historically significant if it has yielded, or may be likely to yield, information important in prehistory or history."

The CEQA lead agency having jurisdiction over a project is responsible for ensuring that paleontological resources are protected in compliance with CEQA and other applicable statutes. The lead agency with the responsibility to ensure that fossils are protected during construction of the RBEP is the CEC. California Public Resources Code Section 21081.6, entitled Mitigation Monitoring Compliance and Reporting, requires that the CEQA lead agency demonstrate project compliance with mitigation measures developed during the environmental impact review process.

Section XVII, part a, of the CEQA Environmental Checklist asks a second question equally applicable to paleontological resources: "Does the project have the potential to …eliminate important examples of the major periods of California history or pre-history?" To be in compliance with CEQA, impact assessments must answer both these questions in the Environmental Checklist. If the answer to either question is "yes" or "possibly," a mitigation and monitoring plan must be designed and implemented to protect significant paleontological resources.

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 do not apply to RBEP 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 5.8-2).

RBEP will comply with the Paleontological Resources LORS established by the State of California.

5.8.6.3 Local LORS

The Los Angeles County General Plan (County of Los Angeles, 1980) places emphasis on the preservation of historic and cultural resources, including paleontological resources. However, this Plan does not include specific guidance for the preservation of paleontological resources (Los Angeles County, 1980). RBEP will comply with the Paleontological Resources LORS set forth in the Los Angeles County General Plan.

The City of Redondo Beach General Plan (City of Redondo Beach, 2004) 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, n.d.) outlining acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures and specimen preparation, 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. More recently BLM's *Informational Memorandum 2008-009* (BLM, 2008) provided updates and elaboration on

assigning levels of paleontological sensitivity, and other procedures for paleontological inventory on federal lands. These standards are relevant to non-federal undertakings as well and they are widely used by paleontologists because they provide for more detailed analysis of paleontological sensitivity, and therefore more efficient paleontological resources monitoring.

5.8.7 Agencies and Agency Contacts

No agencies have blanket jurisdiction over paleontological resources. The CEC is the CEQA lead agency for RBEP and has jurisdiction over paleontological resources for this project. 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 5.8-3).

TABLE 5.8-3
Agency Contacts for Paleontological Resources

Issue	Agency	Persons Contacted
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 the project site.

5.8.9 References

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