8.8 Paleontological Resources

Paleontological resources (fossils) are the remains or traces of prehistoric animals and plants. This section assesses the potential that earth-moving activities associated with construction of the proposed Humboldt Bay Repowering Project (HBRP) will affect scientifically important fossil remains. Section 8.8.1 discusses the existing environmental setting, including relevant paleontological records and the geologic context of the project. Section 8.8.2 discusses the potential environmental effects of construction and operation. Section 8.8.3 evaluates any cumulative impacts to paleontological resources resulting from this project when combined with other projects. Section 8.8.4 describes proposed mitigation measures during construction. Section 8.8.5 presents applicable laws, ordinances, regulations, and standards (LORS). Section 8.8.6 references agency contacts. Section 8.8.7 discusses permit requirements and schedules. Section 8.8.8 provides a list of references cited.

This Paleontological Resources Section of the Application for Certification (AFC) summarizes the potential impacts on paleontological resources that may result from construction at the HBRP. It meets all requirements of the California Energy Commission (CEC, 2000) and conforms with the recommendations of the Society of Vertebrate Paleontology (SVP, 1991, 1995, 1996) that address paleontological resources assessments and mitigating impacts resulting from earth moving activities. Subsequent to presenting the results of the paleontological sensitivity assessment, measures are described to mitigate adverse impacts from earth moving on paleontological resources at the project site.

8.8.1 Affected Environment

8.8.1.1 The Nature of Paleontological Resources

Paleontological resources (fossils) are the remains or traces of prehistoric plants and animals. They may range from the actual bones and shells of ancient organisms, to mineral replacements of a once-living organism, to simple impressions. They range in size and abundance from many thousands per cubic centimeter for microfossils such as pollen, diatoms, and radiolaria, to very rare large-mammal bones exceeding a meter in length. Fossils are important scientific and educational resources because of their use in (1) documenting the presence and evolutionary history of particular groups of now extinct organisms, (2) reconstructing the environments in which these organisms lived, and (3) in determining the relative ages of the strata in which they occur and the geologic events that resulted in the deposition of the sediments that formed these strata. In this project's area, the fossils of marine organisms as well as those of terrestrial animals and plants are important to the paleontological as well as geological record. They have helped define the age and sequences of deposition and uplift along Humboldt County's geologically active shoreline, contributing data to a better understanding of the physiographic and ecological development of California.

8.8.1.2 Geographic Location and Physiographic Environment

Humboldt Bay resides in the North Coast Ranges physiographic province of California (California Geological Survey [CGS], 2002; Wahrhaftig and Birman, 1965). The North Coast Ranges physiographic province is composed of northwest-trending mountain ranges and valleys that run subparallel to the San Andreas Fault. To the west is the Pacific Ocean,

where a narrow coastline between the sea and the mountains is no more than a few miles wide, and is frequently uplifted, terraced, and wave-cut. The North Coast Ranges are composed of thick sequences of Mesozoic and Cenozoic rock dominated by the Franciscan Complex (CGS, 2002). Immediately west, deformed sediments of Miocene to Pleistocene age occupy several structural basins in a belt about 10 to 30 miles wide from about 55 miles south of Eureka to about 40 miles north of Eureka. The marine to estuarine nature of most of these sediments demonstrate that this belt, which includes the project vicinity, consisted of largely submerged ocean floor during the Pliocene, and has experienced considerable deformation and uplift since then (Wahrhaftig and Birman, 1965). Younger Quaternary near-shore and continental sediments rest atop these Tertiary marine strata.

Humboldt Bay is a long and narrow estuarine bay separated from the Pacific Ocean by a sand spit that ranges from about 0.2 to 0.8 mile wide. The Bay itself is about 14 miles long from near the mouth of the Mad River in the north-northeast, to where Salmon Creek debouches into Hookton Slough in the south-southwest. Extensive mud flats and sand bars are exposed during low tides, with low-lying sloughs and salt-water marshes common in this estuarine environment. The site for the construction of the proposed HBRP is in a topographic low at the southeastern foot of Buhne Point Hill. A subdued ridge extending east from the summit of Buhne Point Hill for about 1,500 feet separates the HBRP site from the shore. Buhne Point is on the eastern shore of Humboldt Bay nearly opposite the bay's opening to the Pacific Ocean. The summit of Buhne Point Hill is about 75 feet above sea level, and its shoreward foot is at high-tide line. While the northern and western flanks of Buhne Point Hill drop off steeply, the southern and eastern sides of the hill slope more gradually. To the west of the hill is the village of King Salmon which is built on fill over tidal marsh and beach deposits that extend more than 1,600 feet into the bay (PG&E, 2003).

8.8.1.3 Resource Inventory Methods

To develop a baseline paleontological resource inventory of the HBRP project area and surrounding lands, and to assess the paleontological sensitivity or productivity of the stratigraphic units that may be present, published as well as available unpublished geological and paleontological sources were reviewed. These included geological maps, satellite and aerial photography, technical and scientific reports, and assessments of existing conditions in relevant environmental documents. A great deal of information on local geology was obtained from the *Site Characterization* chapter of the *Safety Analysis Report* for the Independent Spent Fuel Storage Installation (ISFSI) Project (PG&E, 2003). In addition, a records search was performed using the University of California at Berkeley's Museum of Paleontology's (UCMP) website. The Department of Geology at Humboldt State University, Arcata, was also contacted, and it was determined that currently it does not maintain paleontological records for the project area. The project area was surveyed on April 10, 2006. These tasks are in compliance with CEC (2000) and SVP (1991, 1995) guidelines for assessing paleontological resources in areas potentially affected by construction-related excavations.

8.8.1.4 Resource Inventory Results

Predominately two geologic provinces cover Humboldt County: the dominant Coast Ranges province and the Klamath Mountains province. The Coast Ranges province is found in the central and southwest sections of the county, which is composed mainly of the Franciscan complex inland and sand and other alluvial deposits closer to the coast. The Klamath

Mountains province is found in the northeast, and is composed generally of older rocks, many of which are sedimentary or metasedimentary (e.g., sandstone, chert, slate, and schist). The South Fork Fault, about 30 miles to the east of the HBRP site, generally marks the boundary between the two provinces. The predominant rock types are the Franciscan Complex and schists, which cover more than over a million acres in Humboldt County, and the Tertiary-Cretaceous Coastal Belt rocks, which cover about 340,000 acres (Humboldt County, 2002).

The history of sedimentation in the Buhne Point area during the Cenozoic (the last 64 million years) has been governed by local tectonism as well as fluctuations of global sea level. At times when the relative position of the land surface was below sea level, deposition of fossil-bearing marine sediments occurred. Erosion occurred at other times when the land surface was above sea level, and these periods are usually represented by gaps in the rock-stratigraphic record and less often by terrestrial sediments.

The oldest sedimentary units in the area belong to the Mesozoic and early Tertiary Franciscan complex. The Franciscan represents an accretionary complex of largely metamorphic rocks formed by the long-term subduction of an oceanic plate under the western margin of North America. The Franciscan complex is composed of three discernible belts: the eastern belt, the central belt, and the coastal belt. The age and the metamorphic grade of the belts decreases to the west (Blake and Jones, 1981). Formation of the accretionary complex began during the late Jurassic in the eastern belt and has continued into the Miocene along the western coastal belt. The complex trends northwest and is bound by the San Andreas Fault to the east and by the Pacific to the west.

The coastal belt of the Franciscan complex is composed of the youngest and least deformed units and is composed primarily of graywacke sandstones interbedded with siltstone and shale (Evitt and Pierce, 1975). These sedimentary rocks suggest a depositional environment of deep-sea fan systems. Parts of the belt show evidence of later metamorphism, primarily due to subduction. Low-grade blueschist mineral facies are indicated by the presence of minerals such as laumonite and prehnite-pumpellyite (Blake and Jones, 1981). The rock is usually not fossiliferous due to folding, faulting, and metamorphism but the rare fossils that are found provide important data on the age of the strata making up the Franciscan complex.

The Yager formation, which comprises the similarly named Yager terrane, is the oldest unit within the Coastal Belt Franciscan Complex. The Yager formation is composed of argillite, sandstone, and conglomerate forming thin-beds of turbiditic mudstones interbedded with sandstone (McLaughlin et al., 2000. The Yager formation is strongly folded and cut by numerous faults. During the middle Tertiary, the Yager Formation was accreted to the western margin of North America and juxtaposed against rocks of the Central Belt mélange along the Freshwater fault and Coastal belt thrust (Carver, 2000; Clarke, 1992).

The Franciscan basement rocks in the onshore Humboldt Bay region are unconformably overlain by a sequence of late Tertiary and Quaternary onlap deposits. Their depositional history includes sedimentation in deep-trench and lower-slope basin environments during the Miocene, and subsequent progressive shoaling through the Pliocene, to shelf and shallow marine depositional settings during the early Pleistocene. Collectively these

sediments are named the Wildcat Group (Ogle, 1953), which consists of five lithofacies. In ascending order they are:

- **Pullen Formation**—Ogle (1953) described the Pullen formation as consisting mostly of diatomaceous siltstone and mudstone with some ferruginous limestone nodules and a few thin glauconitic sandstone beds. The lowest layers appear to have been deposited in nearly 6,500 feet of water (McLaughlin et al., 2000). Marine invertebrates and whale fossils have been found in the upper strata of this formation which suggest a shallowing of the sea (Stanley, 1995).
- **Eel River Formation**—Dating of volcanic ash layers places the Pullen to Eel River age at about 3.4 million years ago (mya) (Clifton and Leithold, 1991), and the Eel River formation is entirely Pliocene in age. This formation is composed of gray to black mudstones, siltstones, and sandstones (Ogle, 1953).
- **Rio Dell Formation**—The Rio Dell formation is a massive marine siltstone with claystone and very fine-grained, poorly-sorted sandstone.
- **Scotia Bluffs Formation**—The Scotia Bluffs formation, sometimes called the Scotia Bluffs sandstone, overlies and interfingers with the upper Rio Dell formation in the Eel River area. Ogle (1953) describes the Scotia Bluffs formation as consisting mostly of massive fine- to medium-grained shallow-marine sandstones with lesser amounts of pebbly conglomerate and siltstone indicating deposition in a fluvial environment.
- **Carlotta Formation**—The Carlotta formation overlies and interfingers with the Scotia Bluffs formation. Volcanic ash layers found in the interfingered Scotia Bluffs sandstone and the Carlotta formation date to the Early Pleistocene, about 1.3 to 1.5 mya (Clifton and Leithold, 1991). East of the Eel River and Fortuna, this formation consists of massive course-grained conglomerate, poorly sorted sandstone, bedded and massive blue-gray siltstone, and blue-gray mudstone. South of Ferndale, along Wildcat Ridge, the formation consists mostly of massive sandstone containing thin pebbly conglomerate. Coarse, massive conglomerate is limited to near the base of the formation.
- **Hookton Formation**—This late Tertiary to early Quaternary, mostly marine sedimentary sequence is unconformably overlain by the largely estuarine and continental Hookton formation. Based on exposures in the Table Bluff, approximately 5.6 miles south of the HBRP, Ogle (1953) describes the Hookton formation as a yellow-orange gravel, sand, silt, and clay. The Hookton contains an ash layer dated to about 450,000 B.P. (years before present) (Clifton and Leithold, 1991).

Although Ogle (1953) included the marine terraces in the vicinity as part of the Hookton formation, these marine terraces also can be separated into distinct units. The marine terrace deposits of concern here are geologically young clay, sand, and gravel often of fluvial origin (California's Groundwater Bulletin [CGB], 2004a) deposited on constructional features (terraces) developed on older sediment such as the Hookton formation. Generally, they occur as uplift associated with a local tectonic event elevates a wave-cut landform above the high tide line. The sequence of terraces in the area records Pleistocene uplift and deformation associated with the growth of faults and folds in the upper plate of the Cascadia subduction zone (Carver and Burke, 1992).

8.8.1.5 Site-Specific Geological Investigations

Several prior studies of the Humboldt Bay Power Plant area have not only addressed available geological literature, but also site-specific trench and borehole data developed by Earth Science Associates (1975, 1977) and Woodward-Clyde Consultants (1980) and two new trenches and borehole data from a recent geotechnical study (PG&E, 2003).

Disturbed areas of the project site rest, on average, over a meter of fill. Below the fill the site rests on more than 2,900 feet of late Pliocene and Quaternary deposits. Three lithostratigraphic formations separated by unconformities have been identified at the site. These are listed below from the oldest to the youngest, beginning with the uppermost members of the Wildcat group:

- The Rio Dell formation was encountered in boreholes 1,700 feet beneath the site. The Rio Dell formation contains marine fossils that indicate an age range from late Pliocene to Pleistocene. Near the uppermost section of the formation, the age is estimated to be 1.1 ± 0.2 mya making its age early Pleistocene (Woodward-Clyde Consultants, 1980).
- The Scotia Bluffs formation unconformably overlies the Rio Dell formation. The Scotia Bluffs formation is more than 1,100 feet thick under the site and is between 1.1 and 0.78 mya, making the formation largely late-early Pleistocene in age.
- Unconformably overlying the Scotia Bluffs is the Hookton formation, which is divided into an upper and lower unit here. The lower Hookton formation is more than 850 feet thick beneath the site. The uppermost part of the lower Hookton formation is about 160,000 years old based on amino acid racemization dates on fossil shell collected from clayey sediment in a road cut near the northern end of Humboldt Hill, about 0.5 mile south of the site (Woodward-Clyde Consultants, 1980). The boundary between the lower and upper members of the Hookton formation is at the base of a very dense, sandy gravel stratum that is found 50 to 75 feet beneath the northwest portion of the plant site. The upper Hookton formation was encountered during trenching in that area, and it is also identified along the sea cliff on the north side of Buhne Point Hill.
- Late Quaternary sediment and paleosols overlie the uppermost Hookton formation. These sediments have been related to the Quaternary marine terrace sequence in the area, although Buhne Point and its associated hill do not display the subhorizontal surface expected from a marine terrace. The soil developed on these terrace deposit sediments has a well-developed argillic horizon with a reddish-brown color. The development of the thick clay horizon and the reddish color indicate an age of 80,000 to 105,000 years old (late Pleistocene).

Superficial deposits are Holocene in age and consist of alluvial/estuarine marsh sediments, colluvium on the slopes, and shallow landslides. Holocene-age sediments may exceed 10 feet in thickness in the portion of the plant area designated for the HBRP because that area generally lies in a topographic low adjacent to Buhne Slough.

8.8.1.6 Results of the Records Search

In accordance with standard guidelines, a records search was conducted to identify previously recorded paleontological sites in the area. The search was for records of sites within 10 miles of the project area and was performed using the UCMP's website on

April 18, 2006. Six paleontological sites are recorded within a 3-mile radius of the project, with no additional paleontological sites recorded within a 3- to 10-mile radius. Three of the sites are attributed generically to the Wildcat Group, with 10 fossil specimens having been collected from these 3 sites.

The other three paleontological sites recorded in the search area are identified as being Pleistocene in age, and are likely fossils from the Hookton Formation. Importantly, one of these, the extinct Pleistocene bison (*Bison latifrons*), was recorded at Buhne Point itself. The other two are sites that have yielded the remains of Columbian mammoth (*Mammuthus columbi*) and the American mastodon (*Mammut americanum*). Appendix 8.8A, filed separately from this AFC under a request for confidentiality, contains a map showing the locations of the paleontological finds.

8.8.1.7 Results of Site Survey

This paleontological resources inventory and impact assessment was conducted under the direction of W. Geoffrey Spaulding, Ph.D. 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. He previously has completed paleontological resource surveys and prepared paleontological resource impact assessments in support of more than a dozen energy generation as well as large construction projects throughout California.

The site area was surveyed by Dr. Spaulding, on April 10, 2006. The ground surface over the project area is obscured by vegetation, and the only area where native sediment is exposed is along the seaward side of Buhne Point where wave and storm erosion have exposed a cliff face. Due to the local geography, the shore runs essentially east-west in this area and, viewed from the sea, the topographically highest portion of Buhne Point occupies the western-most portion of this partially vegetated sea-cliff geological exposure. The eastern end of the exposure area lies in the vicinity of the Humboldt Bay Power Plant discharge canal, about 1,500 feet along the shore.

At Buhne Point Hill, approximately 30 feet of massive dark-grey to light-grey clay is overlain by about 2 feet of well-rounded, coarsely bedded littoral sandy gravel, which in turn is capped by poorly bedded loamy sands. Lithified zones within the massive clay unit were evident, as well as common ferruginous staining. Fossils, including marine mollusks, were searched for but were not noted.

About 200 feet farther east along the sea cliff, the basal 20 feet of exposed sediment is a massive light brown (below) to grey (above) silty clay with no clasts or marine shells evident. A ferruginous soil zone appears developed at the top of the section here. This pale brown, massively bedded silty clay continues to the east, with its surface dipping gradually toward sea level. At a point approximately 150 feet west of the mouth of the discharge canal a relict peaty soil is exposed capping the silty clay unit. The soil is obviously a wet-meadow/marsh soil, and is now desiccated and eroding. No clasts or fossils were evident in the soil zone, or in the sediment below it.

These field survey results are consistent with previous studies indicating that sediments of the Hookton formation are exposed at Buhne Point. The Hookton formation here appears to consist of estuarine and littoral facies. Sediments relating to Quaternary-age terrace deposits are exposed farther east, and they appear to overlie the Hookton at the top of Buhne Point

Hill to the west. A late Quaternary age hydric soil appears to be developed on these deposits in the vicinity of the discharge canal. This paleosol relates to a period when drainage in the vicinity must have been quite different than the area in the vicinity of those soils is presently well drained.

8.8.1.8 Paleontologically Sensitive Sediments in the Project Area

Like many other areas on the tectonically active western margin of the continent, faulting and uplift in Humboldt County have exposed a variety of fossiliferous marine and estuarine sedimentary sequences. As a result, the paleontological record of the area is rich and varied. Following the tasks discussed above, the stratigraphic units expected in the project vicinity were assigned relative levels of paleontological sensitivity based on their fossil record and geology. According to SVP (1995) standard guidelines, sensitivity comprises both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical, and (b) the importance of recovered evidence in terms of new and significant taxonomic, phylogenetic, ecologic, or stratigraphic data (Table 8.8-1).

TABLE 8.8-1
Definitions of Paleontological Sensitivity Ratings Employed in this Assessment

Sensitivity	Definition
High	Assigned to geological formations known to contain paleontological resources that include rare, well-preserved, and/or fossil materials important to scientific studies. A sedimentary unit that has produced vertebrate remains or other fossils that are directly relevant to the research of geologists, paleontologists, paleobotanists, or paleoecologists, and can represent important educational resources as well.
Moderate	Sediment that has yielded fossils that are not well-preserved, are common elsewhere, and/or that are stratigraphically wide-ranging. This evaluation can also be applied to strata that have an unproven but clear potential to yield fossil remains based on its stratigraphy and/or geomorphologic setting.
Low	Stratigraphic units that are relatively recent, or that represent high-energy and/or subaerial depositional environments 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.
Marginal and Zero	Geological units with marginal potential include pyroclastic flows and soils that might preserve traces or casts of plants roots or animals burrows. Most igneous rocks, however, have zero paleontological potential. Other stratigraphic units deposited subaerially in a high energy environment (such as alluvium) may also be assigned a marginal or zero sensitivity rating.

The fossil-bearing rock units in the vicinity were deposited in marine and, less commonly, continental environments that included estuarine and fluvial settings. These rock units include, from oldest to youngest, the following:

- **Rio Dell Formation (late Pliocene)**—Microfossils from Centerville Beach were studied by Ingle (1976), and he determined that water depths at the time when the sediments were created were about 6,000 feet at the bottom of the formation, and shallowed to about 300 feet at the top of the formation indicating a regression of the sea. Fossils typically found in this formation are snails, clams, mussels, and sand dollars. This unit

has a high paleontological sensitivity because the formation is known to contain well-preserved and scientifically important fossil materials.

- **Scotia Bluffs Formation (late Pliocene)**—The bottom of the Scotia Bluffs formation is composed of sandstones thought to represent a shallow marine environment. Fossils found in the marine facies of this formation indicate depths of 100 feet or less (Faustman, 1964). The top of the formation contains a pebbly conglomerate and siltstone indicating deposition in a fluvial environment. This depositional sequence displays the transition from a marine to a continental environment. The Scotia Bluffs Formation has a moderate paleontological sensitivity because it has yielded fossils that are moderately well-preserved, common elsewhere, or stratigraphically encompassing a long range of time.
- **Carlotta Formation (early Pleistocene)**—The presence of coarse, poorly sorted, conglomerate, the absence of marine fossils, and the presence of fossil redwood logs all suggest that the conglomeratic facies of the Carlotta formation was deposited in a predominantly continental environment. This formation has a low paleontological sensitivity because fossils from it are few, and unlikely to be well preserved and the sediment indicates a high-energy depositional environmental unfavorable for fossil preservation.
- **Hookton Formation (Pleistocene)**—This formation consists of yellow to yellow-brown loosely consolidated clay, silt, sand, and gravel interfingered with gray marine clay and silt. Although chiefly a continental sedimentary unit, the grey silty clays in portions of the Hookton formation represent distinctly marine conditions. Other strata indicate estuarine, littoral, and fluvial environments. The thickness of the formation ranges up to 100 feet (CGB, 2004b). The upper Hookton formation possesses a high paleontological sensitivity because it has yielded Pleistocene-age vertebrate fossils that have the potential to provide important material to vertebrate paleontologists seeking to understand the evolution of northern California's wildlife and ecosystems.
- **Terrace Deposits (late Pleistocene)**—Consisting of geologically young, unconsolidated fine-grained to course-grained sedimentary facie. These sediments may be comparatively thin on topographic highs such as beach ridges and terraces, and may be thicker in lowlands such as (in this area) Buhne Slough. These deposits are assigned a moderate paleontological sensitivity because they are old enough to produce Rancholabrean age fossils, although none are recorded for the area.

8.8.1.9 Paleontologically Sensitive Units Present on the Project Site

The site survey, records search, and prior geological studies were used to determine what sediments may be present at or near the project area, and to assess their level of paleontological sensitivity. Compared to the survey, which was of the sea cliff north of the Humboldt Bay Power Plant itself, the HBRP occupies a lower setting behind (to the south of) the topographic high occupied by the rest of the plant. This relative position is considered in the discussion of the paleontological sensitivity of the sediments present, or potentially present at the HBRP site:

- **Artificial Fill and Surficial Deposits:** The surface of Buhne Point terrace has been modified in several places during the construction of the power plant. Examination of low-angle, oblique aerial photographs show grading activities from south of the old security fence to the edge of the bluff. Parts of the Buhne Point terrace surface to the north

and west of the HBRP site may have been lowered by as much as 6 to 9 feet, and some of that fill may be found in the current project area. The most significant lowering occurred along the edge of the bluff and decreases towards the security fence. The layer of clayey man-made fill overlying most of the central and northern portion of the power plant site ranges from 0 to 9 feet thick (PG&E, 2003). Due to its disturbed nature, this fill has zero paleontological sensitivity. Undisturbed Holocene-age surficial deposits can be expected in other parts of the project area, and these have low paleontological sensitivity.

- **Terrace Deposits:** Sediment mantling the Hookton formation on terraces includes material that has accumulated during the last glacial age, and is composed of eolian sands and fluvial deposits. Should any organic remains or fossils be encountered in this unit, they may be paleontologically significant. They may provide data on the age of the terrace before the last episode of tectonic uplift, as well as paleoenvironmental data on the last glacial age. Therefore, as noted above, these deposits have moderate paleontological sensitivity.
- **Hookton Formation:** This formation extends to near the top of the geological cross section exposed in the sea cliff to the north of the present power plant site, and is expected to dip to the east and south, following the topography as it drops to near sea level away from Buhne Point Hill. This sediment is anticipated to underlie the artificial fill and terrace deposits throughout the site, and it possesses high paleontological sensitivity. Drill logs suggest that in some areas the Hookton formation may be as shallow as 3 feet below the surface.

8.8.2 Environmental Consequences

The environmental impacts on paleontological resources from both construction and operation of the HBRP project are presented in the following sections.

8.8.2.1 Paleontological Resource Significance Criteria

Appendix G of the California Environmental Quality Act (CEQA) addresses significance criteria with respect to paleontological resources (Public Resources Code Sections 21000 et seq.). Appendix G(V)(c) asks if the project will "directly or indirectly destroy a unique paleontological resource or site or unique geologic feature." Although CEQA does not define "a unique paleontological resource or site," Section 21083.2 defines "unique archaeological resource" 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:
>
> 1. contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
> 2. it has a special and particular quality such as being the oldest of its type or the best available example of its type.
> 3. is directly associated with a scientifically recognized import prehistoric or historic event.

In the absence of more specific guidance, this definition is applicable to recognizing "a unique paleontological resource or site." This analogy to archaeological resources is reasonable because both paleontological and archaeological resources are non-renewable resources from which a large part of their public resource value stems from their potential to yield information or knowledge important in science. Therefore, an impact on a fossil would be significant if it would damage a significant fossil or fossils and prevent the recovery of significant scientific information.

In its standard guidelines for assessment and mitigation of adverse impacts to 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 type or topotypic specimen, (7) a member of a rare species, (8) a species that is part of a diverse assemblage, and/or (9) a skeletal element different from, or a specimen more complete than, those now available for that species. For example, identifiable land mammal fossils are considered scientifically important because of their potential use in evolutionary studies, in determining the age of the unit and its geological history, and in providing data for paleoenvironmental reconstructions. Moreover, vertebrate remains are comparatively rare in the fossil record. Fossil plants are also important in this regard and, as sedentary organisms are actually more sensitive indicators of environment conditions and therefore more important than mobile mammals for paleoenvironmental reconstructions. Invertebrate fossils from marine sediments are scientifically important for the same reasons that land mammal and/or land plant fossils are valuable in terrestrial deposits; they provide information on paleoenvironmental conditions, data for evolutionary studies, and they inform on the age of the geological unit.

To establish the paleontological sensitivity of the stratigraphic units likely to be present in or near the project site, the recorded and potential paleontological productivity of those formations was assessed based on the abundance of fossil remains from that unit elsewhere in Humboldt County and the nature of the sediment (Sections 8.8.1.8 and 8.8.1.9, above). Using the criteria of the SVP (1995) and the sensitivity ratings established above, the significance of potentially adverse impacts of earth-moving on the paleontological resources was assessed. This assessment reflects the paleontological importance (sensitivity) of the stratigraphic unit and the potential for fossils to be encountered during earth-moving.

8.8.2.2 Paleontological Resource Impact Assessment

Potential impacts on paleontological resources resulting from implementation of the HBRP can be divided into construction-related impacts and impacts related to plant operation. Construction-related impacts to paleontological resources primarily involve terrain modification (excavations and drainage diversion measures). No impacts to paleontological resources are expected to occur from the continuing operation of the HBRP or any of its ancillary facilities.

The significance of potential adverse 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. All project-related laterals are anticipated to be within the boundary of the existing Humboldt Bay Power Plant. Excavations associated with the construction of the new generation facility and its onsite laterals will take place primarily in

the topographically low area on the southeastern portion of the existing Pacific Gas and Electric Company (PG&E) plant site near Buhne Slough.

It is assumed that excavations for foundation emplacement and any potential soil remediation may extend as deep as 10 feet below ground surface, drilling and pile driving may disturb sediments as deep as 100 feet below current ground surface, while the installation of other facility components will require only shallow (< 5 feet) excavations, or no excavation at all. Activities disturbing paleontologically sensitive sediment include those amenable to monitoring, such as trenching, where both the back dirt as well as the sediment excavated in place (the wall of the trench) can be observed. Other activities such as pile driving and drilling, are less amenable to monitoring because sediments impacted cannot be observed and, in some cases, no back dirt is produced.

- **Artificial Fill and Surficial Deposits:** Construction-related excavations within artificial fill and Holocene surficial deposits will not have any adverse impacts to paleontological resources because scientifically significant fossils are not anticipated in these sediments. Reworked and disturbed fossil material may be present in the artificial fill, but lack of stratigraphic context and likely mechanical damage would compromise all scientific values. This would apply to sediments within 2 to 6 feet of current ground surface, and will apply to depths of at least 10 feet in portions of the project site that have been more deeply excavated, such as those areas in the immediate vicinity of existing buildings on the project site, such as the Storage Building, MEPPs diesel tanks, and Sandblast and Paint Facility. Preservation of organic material may be good in the sediment of Buhne Slough, should it be encountered during the build-out of the HBRP, but it is likely to be of middle to late Holocene age and therefore too young to contain paleontologically significant materials.

- **Terrace Deposits:** Construction-related excavations in Pleistocene-age terrace deposits may result in significant adverse impacts to paleontological resources in the absence of mitigation, because scientifically significant fossils may be present in these sediments. General geomorphic relationships suggest that terrace deposit material is likely to be of relatively recent Pleistocene age and paleontological material from that sediment may help determine that age. Terrace deposits are likely to be relatively thick in the vicinity of the slough, thinner in the vicinity of Buhne Point Hill, and due to prior disturbance absent in the vicinity of the existing Humboldt Bay Power Plant Units 1, 2, and 3.[1]

- **Hookton Formation:** Sea-cliff exposures and prior geological investigations show that this paleontologically sensitive sedimentary unit lies at depth below fill and terrace deposits throughout the site area. In the absence of mitigation construction-related disturbance of this unit by trenching, auguring, or other means could constitute a significant adverse impact to paleontological resources because of the potential for the loss of scientifically important fossil remains constituting one or more unrecorded fossil sites, and the loss of associated specimen, geological and paleoenvironmental data.

Significant adverse impacts to paleontological resources are unlikely from shallow excavations (those disturbing soils to depths of less than 3 feet), because these would occur in previously disturbed soil, or surficial deposits with no to low paleontological sensitivity.

[1] Although drill core logs can be subject to differing interpretations, previous core logs can be interpreted to indicate that less than 3 feet of terrace deposits are present in the current plant area, but more than 20 feet may be present near Buhne Slough.

The depth to paleontologically sensitive Pleistocene sediment, however, is expected to vary across the site. Adverse impacts would result from trenching; augering for concrete pilings and the foundations for electrical towers or poles; and any other earth-moving activity that would disturb previously undisturbed fossiliferous sediment consisting of either late Pleistocene terrace deposits or older Pleistocene Hookton formation. Uncontrolled exhumation and/or mechanical destruction of fossils compromises their scientific value. Although earth-moving associated with construction of the project site would be a comparatively short-term activity, the loss of fossil remains, unrecorded fossil sites, associated specimen data, and corresponding site data would be a significant and adverse environmental impact.

The proposed HBRP plant site is located on sediment of no to low paleontological sensitivity composed of artificial fill and surficial deposits, the depth of which (and therefore the depth to the paleontologically sensitive Pleistocene-age sediments) varies across the site. Therefore construction related disturbance resulting from deeper excavations at the HBRP plant site for foundations for the electrical generators, excavations for pipelines and other facilities, as well as removal of pre-existing foundations and possible remediation associated with the site, would be activities possibly disturbing fossiliferous sediments. Thus, project-related excavations could have adverse impacts on significant paleontological resources in the absence of mitigation described below.

8.8.3 Cumulative Impacts

The late Tertiary and Quaternary sediments that speak to the evolution of the coastline, from an oceanic trough beneath hundreds of feet of water to an emergent continental margin, are largely restricted to the coastline (McLaughlin et al., 2000). This is also where the most extensive development has been occurring. Widespread development along the coastal corridor in Humboldt County has resulted in proportionately extensive impacts to paleontological resources, largely in the absence of identified mitigation measures. The extensive nature of these cumulative impacts is in part due to the widespread presence of a number of fossiliferous sedimentary units.

If paleontological resources are encountered during project-related ground disturbance, the potential contribution to adverse cumulative impacts to paleontological resources would be negligible, given implementation of the mitigation measures proposed in Section 8.8.4. Full implementation of these measures would effectively recover the value to science of significant fossils discovered during project construction. Thus, the proposed project would not cause or contribute substantively to cumulative impacts to paleontological resources.

8.8.4 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 . . .?" Significant fossils are known to occur at Buhne Point and it is also possible that significant fossils could be located onsite in the Hookton Formation. The presence or absence of such fossils is unknown and cannot be determined before excavation that would reach Hookton Formation deposits begins. It is therefore possible that impacts to

significant fossils could be encountered during construction. Mitigation measures are therefore necessary to reduce potential impacts to levels below significance.

This section describes applicant-proposed mitigation measures that would be implemented to reduce potential adverse impacts to significant paleontological resources resulting from project construction. These proposed paleontological resource impact mitigation measures would reduce, to an insignificant level, the direct, indirect, and cumulative adverse environmental impacts on paleontological resources that might result from project construction. The mitigation measures proposed below for the HBRP project are in compliance with CEC environmental guidelines (CEC, 2000) and with SVP standard guidelines for mitigating adverse construction-related impacts on paleontological resources (SVP, 1991, 1995, 1996):

- **Designated Paleontological Resources Specialist**—Before construction, a qualified paleontologist will be retained as designated Paleontological Resources Specialist (PRS) to design and implement a monitoring program during project-related earth-moving activities.
- **Paleontological Resources Monitoring and Mitigation Plan**—The PRS will develop a Paleontological Resources Monitoring and Mitigation Plan (PRMMP) for review and approval by the CEC before implementation. The PRMMP will include plans and describe procedures for: construction monitoring and coordination; emergency discovery procedures; sampling and data recovery, if needed; museum storage coordination for any specimen and data recovered; preconstruction coordination; and reporting. Reporting requirements will include monthly monitoring reports as well as a final report.
- **Further paleontological assessment**—The PRS will conduct additional paleontological assessment in conjunction with pre-construction geotechnical surveys to better define the subsurface geological features of the HBRP site. Data from drilling could help define the vertical and horizontal distribution of, paleontologically sensitive subsurface units, chiefly the Hookton formation, to provide additional data to better anticipate monitoring needs.
- **Construction Personnel Education**—The PRS will prepare a Paleontological Resources Awareness Training program. All construction personnel involved in earth-moving activities will be provided with this training program as a module in their worker environmental awareness training before they begin construction work. They will be informed that fossils may be encountered, provided with information on the appearance of fossils, the role of paleontological monitors, and on proper notification procedures.
- **Paleontological Monitoring**—Before construction, the paleontologist will review excavation plans and geotechnical data to determine where paleontologically sensitive stratigraphic units will be disturbed by project-related earth-movement. Earth-moving construction activities will be monitored where these activities will potentially disturb previously undisturbed paleontologically sensitive sediment (identified at present as the Hookton formation).

Implementation of these mitigation measures would reduce the potential impact from project-related ground disturbance on paleontological resources to an insignificant level by allowing for the recovery of fossil remains and associated specimen data, and corresponding geologic and paleoenvironmental site data, that otherwise might be lost to earth-moving

and to unauthorized fossil collecting. These scientific and associated educational values constitute the chief significance of the resource, and their recovery therefore mitigates the impacts to that resource.

With a well-designed and implemented PRMMP, project construction could potentially result in beneficial impacts to paleontological resources through the recovery of fossil remains that would otherwise not have been exposed; therefore, would not have been available for study. This consideration is particularly applicable to this area with its complex geological history as well as six known fossil sites located within 5 miles of the area. The recovery of fossil remains as part of project construction could help answer important questions regarding the geographic distribution, stratigraphic position, and age of fossiliferous sediments in the area.

With the implementation of the mitigation measures identified above, no significant unavoidable adverse impacts on paleontological resources are anticipated as a result of the construction and/or operation of the HBRP.

8.8.5 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's environmental regulations (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts to paleontological resources have been published by the SVP (1991, 1995, 1996).

Construction, and operation of the HBRP and its ancillary facilities, will be conducted in accordance with all LORS applicable to paleontological resources in the context of this project. Federal, state and local LORS applicable to paleontological resources are summarized in Table 8.8-2 and discussed briefly below, along with professional standards for paleontological resources assessment and impact mitigation.

TABLE 8.8-2
LORS Regarding Paleontological Resources

LORS	Applicability	AFC Reference	Project Conformity
Antiquities Act of 1906	Not Applicable because project facilities are not located on federal land	Section 8.8.5.1	-
CEQA, Appendix G	Applicable - Fossil remains may be encountered by earth-moving activities	Section 8.8.5.2	Yes
California Coastal Act Section 30244	Applicable - Fossil remains may be encountered by earth-moving activities	Section 8.8.5.2	Yes
Public Resources Code, Sections 5097.5/5097.9	Not applicable because project facilities are not located on state-owned lands	Section 8.8.5.2	-
Humboldt County General Plan, Chapter 9 "Cultural Resources"	Applicable - Calls for the identification and protection of cultural resources (including paleontological resources)	Section 8.8.5.3	Yes

8.8.5.1 Federal LORS

Federal protection for significant paleontological resources would apply to the HBRP only if construction or other related project impacts would affect federally owned or managed lands. At the present time, no project facilities involve federal land, and the federal legislation pertaining to paleontological resources is included here for completeness.

Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (PL 59-209; 16 USC 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. Federal agencies normally interpret the provisions of the Antiquities Act to prohibit the disturbance and/or collection of all vertebrate fossils by anyone except under a specific permit. These permits are normally granted only for mitigation activities and scientific research. The collection of any fossils for commercial purposes is also prohibited, while the collection of individual invertebrate fossils by amateurs is normally an allowed activity without a permit.

8.8.5.2 State of California 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 Guidelines for the Implementation of CEQA (Public Resources Code Sections 15000 et seq.) defines 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…?" Please see the discussion above in Section 8.8.2.1 regarding the definition of "unique" paleontological resource.

The CEQA lead agency having jurisdiction over a project is responsible to ensure that paleontological resources are protected in compliance with CEQA and other applicable statutes. The lead agency with the responsibility to insure that fossils are protected during construction of the proposed HBRP 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.

Other state requirements for paleontological resource management are in California Public Resources Code Chapter 1.7, Section 5097.5 (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. This statute would apply to the HBRP project only if any construction or other related project impacts occur on state owned or managed lands or if the state or a state agency were to obtain ownership of project lands during the term of the project license.

In addition, the California Coastal Act Section 30244 applies to this project. It is replicated in Section 3.18 of the Humboldt Bay Area Plan of the Humboldt County Local Coastal Plan. This section states:

> Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.

If the State Historic Preservation Officer were to determine that the HBRP would adversely impact archaeological resources, reasonable mitigation measures would be implemented.

8.8.5.3 Humboldt County LORS

The Humboldt County Updated General Plan (Humboldt County, 2002) addresses paleontological resources in Chapter 6 under Cultural Resources. "Cultural resources (including but not limited to archaeological, [and] paleontological… sites) shall be identified where feasible, assessed as to significance, and if found to be significant, protected from loss or destruction" (Humboldt County, 2002, p. 6-6, brackets added). The Humboldt County Framework Plan within the General Plan Update establishes policies for the protection of cultural resources including Policy 6 "Mitigation measures shall be required where new development would adversely impact archaeological or paleontological resources."

8.8.5.4 Professional Standards

The SVP, an international organization of professional paleontologists, has established standard guidelines (SVP, 1991, 1995, 1996) 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. Many federal and state regulatory agencies, including the CEC, have informally adopted the SVP standard guidelines.

8.8.6 Involved Agencies and Agency Contacts

No agencies have blanket jurisdiction over paleontological resources in California. The CEC has jurisdiction over paleontological resources as lead CEQA agency for this project. Because the Humboldt County General Plan places emphasis on paleontological resources, copies of the final paleontological resources report will be provided to the County Planning Department and the Department of Geology at Humboldt State College, Arcata.

8.8.7 Permits Required 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, which is privately owned by PG&E.

8.8.8 References

Blake, M.C., Jr., and D.L. Jones. 1981. The Franciscan Assemblage and Related Rocks in Northern California: A Reinterpretation, in, W.G. Ernst ed., 1981. The *Geotectonic Development of California.* Englewood Cliffs, NJ, Prentice-Hall, p. 706.

California Energy Commission (CEC). 2000. Paleontological resources: *in* Regulations pertaining to the rules of practice and procedure & power plant site certification, p. 3.

California Geological Survey (CGS). 2002. California Geomorphic Provinces, Note 36, p. 3. www.consrv.ca.gov/cgs/information/ publications/cgs_notes/note_36/note_36.pdf.

California Office of Historic Preservation. 1983. Summary of state/federal laws protecting cultural resources, p.10.

California's Groundwater Bulletin (CGB). 2004a. Mad River Lowland Groundwater Basin, Bulletin 118, last updated 02/27/2004.

California's Groundwater Bulletin (CGB). 2004b. Eureka Plain Groundwater Basin, Bulletin 118, last updated 02/27/2004.

Carver, G.A. 2000. Paleoseismic geology of the southern part of the Cascadia subduction zone, in Clague, J., B. Atwater, K. Wang, M.M. Wang, and I. Wong (eds.), *Proceedings of the Geological Society of America Penrose Conference, Great Cascadia Earthquake Tricentennial*, June 4-8, 2000, Seaside, Oregon, p. 26-27.

Carver, G.A. and R.M. Burke. 1992. Late Cenozoic deformation on the Cascadia subduction zone in the region of the Mendocino triple junction, in Burke, R.M. and G.A. Carver (eds.), *A Look at the Southern End of the Cascadia Subduction Zone and Mendocino Triple Junction: Pacific Cell, Friends of the Pleistocene Guidebook for the Field Trip to Northern Coastal California*, p. 31-63.

Clarke, S.H., Jr. 1992. Geology of the Eel River Basin and adjacent region – implications for the late Cenozoic tectonics of the southern Cascadia subduction zone and Mendocino triple junction: *American Association of Petroleum Geologist Bulletin*, v. 76, p. 199-224.

Clifton, H.E., and E.L. Leithold. 1991. Quaternary coastal and shallow-marine facies, northern California and the Pacific Northwest, in Morrison, R.B. (ed.), *Quaternary Non-Glacial Geology: Conterminous United States: Decades of North American Geology, Geological Society of America*, v. K-2.

Earth Science Associates. 1975. Geology of the Humboldt Bay Region with Special Reference to the Geology of the Humboldt Bay Power Plant Site and Vicinity: Report Prepared for Pacific Gas and Electric Company.

Earth Science Associates. 1977. Humboldt Bay Power Plant Site Geology Investigations: Prepared for College of the Redwoods, Humboldt County, California.

Evitt, W.R., and S.T. Pierce. 1975. Early Tertiary ages from the Coastal Belt of the Franciscan Complex, northern California: *Geology,* v. 3, no. 3, P. 433-436.

Faustman, W.F. 1964. Paleontology of the Wildcat Group at Scotia and Centerville Beach: University of California Publications in *Geological Science*, v. 41, no. 2, p. 97-160.

Fisk, L.H., and L.A. Spencer. 1994. Highway construction projects have legal mandates requiring protection of paleontologic resources (fossils): p. 213-225, in: Scott F. Burns (ed), *Proceedings of the 45th Highway Geology Symposium*, Portland, Oregon, p. 258.

Humboldt County. 2002. Humboldt County Updated General Plan. Humboldt County in the 21st Century, February, 2002. Humboldt County, California.

Ingle, J.C., Jr. 1976. Late Neogene paleobathymetry and paleo-environments of the Humboldt basin, northern California, in Fritsche, A.E., Best, H.T. Jr., and Wornardt, W.W. (eds.), *The Neogene Symposium: Pacific Section, Society of Economic Paleontologist and Mineralogists*, p. 53-61.

Marshall, L.G. 1976. Paleontological salvage and federal legislation: *Journal of Paleontology,* vol. 50, p. 346-348.

McLaughlin, R.J., S.D. Ellen, M.C. Blake, Jr., A.S. Jayko, W.P. Irwin, K.R. Aalto, G.A. Carver, and S.H. Clarke. 2000. Geology of Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30 X 60 Minute Quadrangles and Adjacent Offshore Area, Northern California. Miscellaneous Field Studies MF-2336, Version 1.0. http://wrgis.wr.usgs.gov/map-mf/mf2336/ceghmf.pdf.

Ogle, B.A. 1953. Geology reconnaissance of the northern Coast Ranges and Klamath Mountains, California, with a summary of the mineral resources: *California Division of Mines Bulletin 179*, p. 80.

Pacific Gas and Electric Company (PG&E). 2003. Humboldt Bay Independent Spent Fuel Storage Installation (ISFSI), Safety Analysis Report, p. 2.6.1 – 2.6.10.

Society of Vertebrate Paleontology (SVP). 1991. Standard Measures for assessment and mitigation of Adverse Impacts to Nonrenewable Paleontological Resources. *Society of Vertebrate Paleontology News Bulletin* 152: 2-5.

Society of Vertebrate Paleontology (SVP). 1995. Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources: Standard Guidelines. *Society of Vertebrate Paleontology News Bulletin* 163: 22-27.

Society of Vertebrate Paleontology (SVP). 1996. Conditions of receivership for paleontologic salvage collections: *Society of Vertebrate Paleontology News Bulletin* 166: 31-32.

Stanley, R.G. 1995. Northern Coastal province (007), in Gautier, D.L., G.L. Dolton, K.I. Takahashi, and K.L. Varnes, (eds.), 1995 National Assessment of United States Oil and Gas Resources – Results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS – 30, 1 CD-ROM. http://certmapper.cr.usgs.gov/data/noga95/prov7/text/prov7.pdf.

Wahrhaftig, Clyde, and J.H. Birman. 1965. The Quaternary of the Pacific Mountain system in California. In *The Quaternary of the United States*, edited by H. E. Wright, Jr., and D. G. Frey, pp. 299-340. Princeton University Press, New Jersey.

Woodward-Clyde Consultants. 1980. Evaluation of the Potential for Resolving the Geologic and Seismic Issues at the HBRP Unit No. 3: Summary to Pacific Gas and Electric Company, San Francisco, p. 74 plus appendix volume.