5.8 Paleontological Resources

5.8.1 Introduction

This chapter evaluates the potential effect to paleontological resources (fossils) from the construction and operation of the Turlock Irrigation District (TID) Almond 2 Power Plant (A2PP). The facility will be located within the city limits of Ceres, Stanislaus County, California, on a 4.6-acre parcel adjacent to the existing 48-megawatt TID Almond Power Plant (see Figure 1.1-3). The facility itself will be sited entirely on previously disturbed soils transported to the site and recompacted to fill a construction borrow area (see Section 5.4, Geologic Hazards and Resources). Excavations exceeding 6.5 feet depth at the A2PP site itself, and excavations for the natural gas pipeline for the project, will likely disturb previously undisturbed sediments.

The A2PP will include a new natural gas supply that will be provided via one of two routes: an approximately 9.1-mile-long gas line that runs south along Crows Landing Road (Alternate A), or an approximately 11.1-mile-long gas line that runs south along Carpenter Road (Alternate B).[1] The natural gas pipeline alternatives extend south to the eastern margin of the San Joaquin River floodplain (Figure 5.8-1). Additionally, the A2PP will be interconnected to the TID system via two 115-kilovolt (kV) transmission lines (Corridor 1, approximately 0.9 mile long, and Corridor 2, approximately 1.2 miles long), which will extend south to the proposed Grayson Substation.[2] The project will also require that TID reconductor 2.9 miles of an existing 69-kV sub-transmission line that currently serves the City of Ceres; no subsurface ground disturbance will occur from this reconductoring.

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 impacts to 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 provides involved agencies and permits, and Section 5.8.8 provides the references cited.

This section meets all Siting Regulations of the California Energy Commission (CEC) (2000, 2007) and conforms with the recommendations of the Society of Vertebrate Paleontology (SVP, 1991; 1995; 1996) that address the assessment and mitigation of impacts to paleontological resources resulting from earth-moving activities. This paleontological resources inventory and impact assessment was conducted by W. Geoffrey Spaulding, Ph.D. a senior paleontologist with CH2M HILL. Dr. Spaulding has advanced degrees in geology with emphasis in paleobiology, and is a recognized expert on the Pleistocene environments

[1] Pacific Gas & Electric Company (PG&E) is currently examining the relative strengths of the two alignments. In order to allow the AFC to proceed, the two possible alternatives are presented in this AFC with same level of detail to allow complete evaluation of both alternatives. TID anticipates that PG&E will select a preferred route in late spring or early summer 2009. At that time, the route not selected will provide information for the California Energy Commission's Alternatives analysis.

[2] The proposed Grayson Substation is a component of the TID Hughson-Grayson 115-kV Transmission Line and Substation Project. In addition to the substation, the Hughson-Grayson project consists of an approximately 10-mile-long, 115-kV transmission line; a 0.5-mile-long, 69-kV transmission line from the existing TID Almond Power Plant; and a second 69-kV transmission line that extends 0.8 mile east from the proposed substation. An Environmental Impact Report for the Hughson-Grayson project (State Clearinghouse Number 2009012075) is currently being prepared. The Notice of Preparation was issued on January 26, 2009, and reissued February 10, 2009. The Draft Environmental Impact Report is anticipated to be issued in July 2009.

of the American West. He previously has completed paleontological resource surveys, paleontological resource impact assessments, and conducted mitigation programs in support of energy generation and other large construction projects in California, including multiple projects in the San Joaquin Valley where the A2PP project is located.

5.8.2 Affected Environment

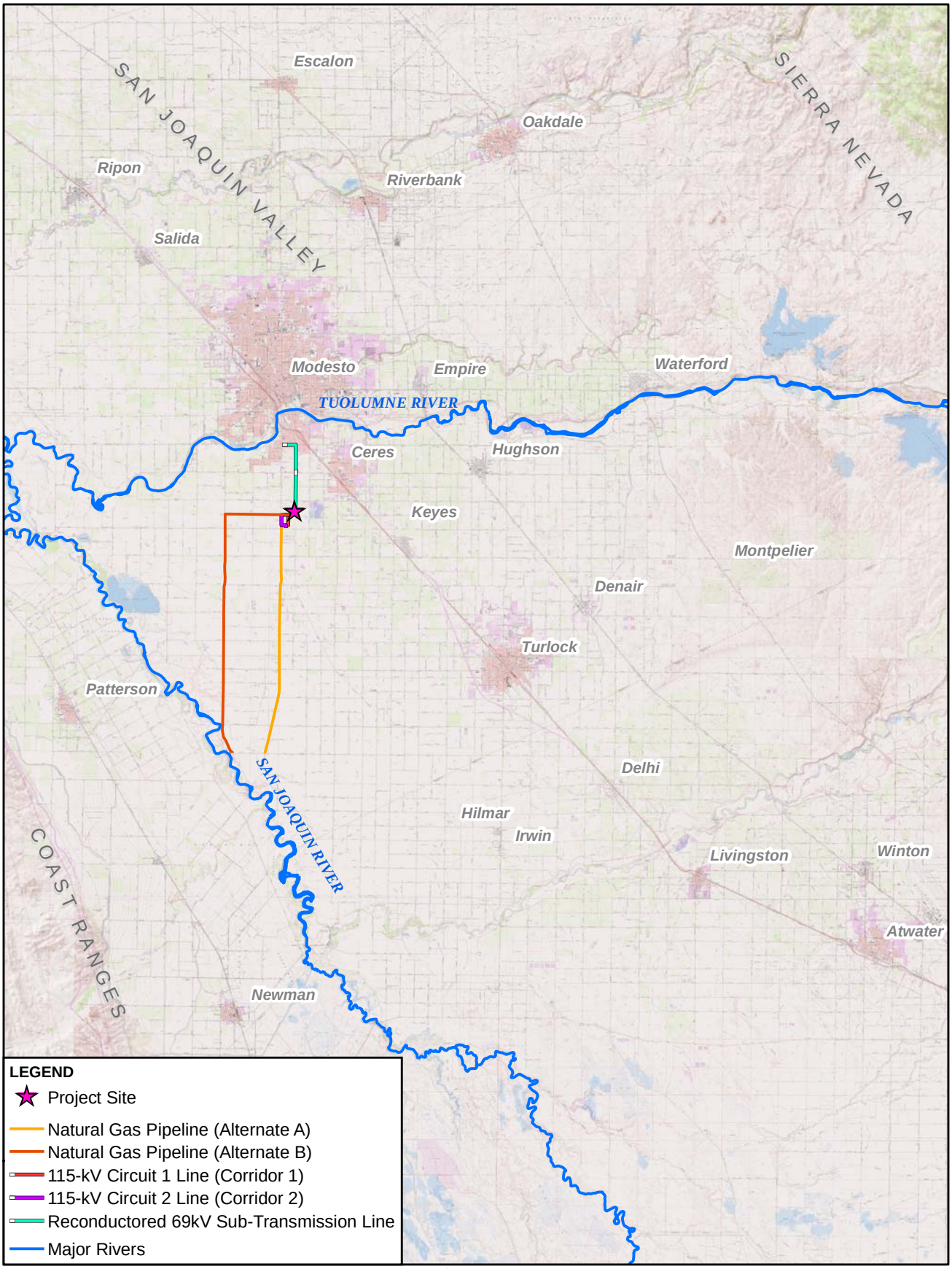
5.8.2.1 Physiographic Setting

Physiographically, the A2PP site and its laterals are in the San Joaquin Valley section of California's Great Valley, on the lower portion of the massive alluvial fan system extending west from the Sierra Nevada, about 25 miles to the east, and terminating at the floodplain of the San Joaquin River approximately 6 miles to the southwest (Figure 5.8-1). The terrain is generally level with the land surface sloping to the west-southwest at a rate of about 12 feet per mile. It is about 3.5 miles to the south of the lower Tuolumne River in Modesto. At this distance from the Sierra Nevada, the sediment comprising the alluvial fan is uniformly fine grained (gravel to silt size) and dominated by coarse to fine sands.

The Great Valley (also known as the Central Valley) physiographic province includes two elongated northwest- to southeast-trending basins: the Sacramento Valley basin to the northwest and the San Joaquin Valley basin to the southeast (Fenneman, 1931). The Great Valley describes the surface of a geologically long-lived structural trough approximately 435 miles long and 44 to 56 miles wide. The present-day basin evolved from a late Jurassic to late Cretaceous (170 to 85 million years ago) marine fore-arc basin. During the early Cenozoic marine sediments continued to accumulate in this basin until, in the middle Tertiary (25 to 30 million years ago), a change in the relative motion between the Pacific and North American plates resulted in the gradual uplift of the Coast Ranges and the eventual isolation of the basin from the ocean. More recent Miocene and lower Pliocene sediments were derived from the neighboring Coast Ranges and the Sierra Nevada. By the late Pliocene (2 to 3 million years ago), subaerial depositional conditions prevailed, and Sierra Nevada–derived sediments were deposited in the basin east of the valley axis (Wahrhaftig and Birman, 1965). The size and elevation of the Sierra Nevada to the east, relative to the Coast Ranges to the west, dictate that the alluvial fans from the Sierra are vastly larger than those from the Coast Range, and therefore they dominate the geology of the San Joaquin Valley.

5.8.2.2 Resource Inventory Methods

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 present, published as well as available unpublished geological and paleontological literature was reviewed. Sources included geological maps, satellite and aerial photography, and technical and scientific reports. Review of the literature on the geology of the project area was augmented by reference to previous studies in the San Joaquin Valley between the Tuolumne River to the north, and the Merced River to the south (Spaulding and Naidu, 2006). For the A2PP, an updated paleontological resources records review was conducted for the project using the on-line database maintained by the University of California Museum of Paleontology at Berkeley (UCMP).



This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

FIGURE 5.8-1
PHYSIOGRAPHIC SETTING
ALMOND 2 POWER PLANT
CERES, CALIFORNIA

CH2MHILL

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Field surveys of the project area and offsite laterals were conducted on January 15 and March 5, 2009, by the project paleontological resources specialist, Dr. W. Geoffrey Spaulding. The survey consisted of judgmental selection of those portions of the electrical transmission line corridors and proposed gas pipeline rights-of-way (ROWs) where the earth was exposed by excavations such as drainage ditches and irrigation canals, and the inspection of those as well as newly plowed agricultural areas. Other areas inaccessible except by foot, including sections of the transmission line ROWs and the periphery of the plant site, were also walked to ascertain that no exposures of the subsurface were present. The entire project area lies on the alluvial fan of the Tuolumne River, while the distal portions of the natural gas alternative ROWs extend onto the floodplain of the San Joaquin River (Figure 5.8-1).

5.8.2.3 Resource Inventory Results

It is generally accepted (for example, Atwater et al., 1986; Burow et al., 2004) that episodes of sediment accumulation on the vast alluvial fans emanating from the Sierra Nevada are correlated with episodes of glacial outwash from the ice sheet that covered the Sierra during Pleistocene glaciations. The uniformity of soil sequences across large areas suggest that deposition of the alluvial units comprising the fans is followed by long periods when fan surfaces are relatively stable and undergo soil formation, particularly during interglacial periods (Marchand and Allwardt, 1981; Atwater et al., 1986).

The area has been studied by a number of scientists concerned with the geology and hydrology of the San Joaquin Valley. However, it is important to note that these studies have focused on cross-sections exposed by the major drainages issuing from the Sierra Nevada, on the geology of the hills to the east where natural relief also exposes geological sections, or on well logs. Areas such as Ceres and Turlock have little relief and therefore little geology is exposed. Attempts to remedy this situation by considering data from well logs have been made (for example, Burow et al., 2004), but the data from well logs are of relatively coarse resolution.

5.8.2.3.1 Geological Units in the Vicinity

The A2PP project site occupies the alluvial fan of the Tuolumne River, and the proposed plant is about 3.5 miles south of the channel the river has cut into its fan. The natural gas pipeline alternative ROWs both extend generally south for about 7.5 miles to the toe of the alluvial fan and the floodplain of the San Joaquin River (Figure 5.8-1). Burow et al. (2004) largely follow the lead of Marchand and Allwardt (1981) and describe three stratigraphic units relevant to this assessment that are found on all the alluvial fans in the area. The top-most and therefore youngest is the Modesto Formation, which is thought to date to the last (Wisconsin) glacial age, or from about 75,000 to 10,000 before present (B.P.)(Oxygen Isotope Stages [OIS] 2 through 4). The thickness of the Modesto Formation is usually not directly addressed, but it is mapped as largely surficial by Atwater and others (1986), and extends to depths of between 10 and 20 feet below ground surface (bgs) in the vicinity of Turlock (Unit A of Spaulding and Naidu, 2006).

The Riverbank Formation lies below the Modesto Formation, often at depths of between 10 and 20 feet, and in this area the discontinuity between the two formations is marked by a strongly developed compound soil, including a distinct hardpan with abundant krotovina developed on the uppermost portion of the Riverbank Formation (Unit B_1 of Spaulding and

Naidu, 2006). The Riverbank Formation is commonly thought to date to the Illinoian Glacial Age (Marchand and Allwardt, 1981), or prior to about 130,000 B.P. (OIS 6). The strength of development of the soil capping the discontinuity at the top of this formation, and its compound nature, can therefore be attributed to its long formation while this unit was exposed not only during the last interglaciation (OIS 5, 130,000 to 78,000 B.P.) but also during at least part of the subsequent Wisconsin glaciation prior to the deposition of the Modesto Formation.

Finally, below the Riverbank Formation at depths of 150 to 200 feet bgs is an organic- and clay-rich stratum locally known as the "blue clay," which has been identified as the Middle Pleistocene (circa 1 million years ago to 600,000 B.P.) Corcoran Clay member of the Tulare Formation (Burow et al., 2004; Marchand and Allwardt, 1981). The Corcoran Clay is thought to represent a widespread freshwater lake and/or system of lakes and marshes that occupied the San Joaquin Valley during a long period of tectonically induced blockage of river drainage, presumably at the Carquinez Strait (Atwater et al., 1986).

Thus, the potentially fossiliferous units of the project area, including its proposed laterals, are all of Quaternary age. While the Modesto and Riverbank Formations occur close enough to the surface to be potentially affected by excavations for construction, the Tulare Formation lies below 150 feet, and would only be affected by deep drilling operations.

5.8.2.3.2 Project Components Relative to Geological Units in the Vicinity

Natural gas pipeline Alternate A runs west from the proposed A2PP for about 2,000 feet along the TID Lateral 2 ROW before turning south and paralleling Crows Landing Road (Figure 5.8-1). The Alternate B route runs west for about 2.5 miles along the same irrigation lateral ROW before turning south to parallel South Carpenter Road. The southern termini of both alternative gasline routes are at the Bradbury Road ROW. The two 115-kV transmission line alternatives (Corridor 1, approximately 0.9 mile long, and Corridor 2, approximately 1.2 miles long) extend south to the proposed Grayson substation.

No change in geology is mapped by Atwater and others (1986) in the vicinity of the A2PP plant site itself or the two transmission line alternatives; shallow Modesto Formation sediments are expected over deeper sediment of the Riverbank Formation. However, both natural gas routes extend south onto the fan-toe facies of the Tuolumne River fan, where the historic San Joaquin River and the toe of the vast Tuolumne River alluvial fan created a series of floodplain, flood basin, and interdistributary channel habitats (Marchand and Allwardt, 1981). The more westerly Alternate B route extends onto this fan-toe facies south at about Fulkerth Road, while the Alternate A route crosses onto the fan-toe facies at about West Linwood Avenue (Atwater et al., 1986).

5.8.2.3.3 Paleontological Sites and Survey

A search of the UCMP database on December 9, 2008, yielded records of 20 fossil localities within Stanislaus County; six of these sites are invertebrate collections or historic collections lacking sufficient provenience. The rest of the localities have yielded identifiable vertebrate fossils or plant megafossils. Many are from the fossiliferous Tertiary units exposed in the Coast Range foothills to the west of the San Joaquin River, and relate to a geology that is not represented in the project area. Additional locality records are from the foothills of the Sierra Nevada that start to rise about 20 miles to the east. Some are from localities within the incised course of the Tuolumne River and its tributaries. Few records appear to come from

the axial portion of the San Joaquin Valley. All locatable paleontological sites are more than a mile distant from the project site and its associated laterals.

No known paleontological sites occur within one mile of the project site or its linears. Therefore, no map of paleontological sites within one mile of the project area is provided.

To our knowledge no fossils have ever been located on the surface of the San Joaquin Valley except where deep erosion has exposed strata in profile, such as along the Tuolumne or San Joaquin rivers, or their incised tributaries. Consistent with this, during the paleontological resources survey no fossil material was encountered. Nothing was seen in the field that could inform on the paleontological sensitivity of the A2PP plant site. However, several observations were made along the natural gas routes that provide some information on subsurface conditions.

Along one portion of the Alternate B route, back-dirt from the excavation of an adjacent irrigation ditch included large chunks of hardpan soil, or caliche. These were found on the east-west portion of Alternate B, along the undeveloped portion of the TID Lateral 2 ROW about 200 feet west of Crows Landing Road and scattered along the ROW to the west for about 400 feet. Upon examination, these fragments of hardpan are evidently from the same soil horizon that yielded scientifically significant vertebrate fossils at TID's Walnut Energy Center, about 7.5 miles to the southeast (Spaulding and Naidu, 2006), as well as the Hilmar High School site (UCMP V69194), in Merced County about 14 miles to the southeast. The uppermost Riverbank Formation at these sites has yielded a modestly diverse early Rancholabrean or late Irvingtonian mammalian assemblage including the extinct North American camel (*Camelops*), mammoth (*Mammuthus*), ground sloth (*Megalonyx*), and bison (*Bison*). While many vertebrate records from the near-surface of the San Joaquin Valley in this area are attributed to the Modesto Formation, scrutiny of the associated stratigraphic information for collections that have such data suggests that they are actually from this soil developed in the uppermost Riverbank Formation. It is a compound soil with a strongly gleyed horizon hosting discontinuous hardpan composed primarily of caliche (calcium carbonate cementing the fine-grained alluvium). The presence of a paleotopographic high along the TID Lateral 2 ROW where this soil would have been closer to the surface would account for the chunks of caliche here but not elsewhere along natural gas pipeline Alternates A and B.

In addition to the caliche soils exposed along part of natural gas pipeline Alternate B, south of about Fulkerth Road abundant calcium carbonate nodules and casts, many pseudomorphs of roots or insect burrows, can be seen in the soils comprising the fan-toe facies adjacent to the San Joaquin River (Atwater et al., 1986). Natural gas pipeline Alternate B crosses about 4.4 miles of this geology, while the more easterly (and therefore further removed from the San Joaquin River) natural gas pipeline Alternate A crosses only about 1.8 miles of this terrain. These carbonate concretions are typical of flood-basin deposits, a depositional environment that would be conducive to the preservation of paleontological materials.

5.8.2.4 Paleontological Sensitivity of the Project Area

Paleontological sensitivity is a 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 inform on the probability of encountering fossils and the nature of those fossils. According to SVP (1995) standard guidelines sensitivity comprises (1) the potential for a geological unit to yield 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 (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 as well.
Moderate	Stratigraphic units that have yielded fossils that are moderately well-preserved, are common elsewhere, and/or that are stratigraphically long-ranging would be assigned a moderate rating. This evaluation can also be applied to strata that have an unproven but strong potential to yield fossil remains based on its 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.
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) may also be assigned a marginal or zero sensitivity rating. Manmade fill is also considered to possess zero (no) paleontological potential.

As noted above, within 1 mile of the project area, including the laterals, there is a limited suite of geological units, restricted to the Modesto and Riverbank Formations overlying the Tulare Formation including the Corcoran Clay at depth. While no paleontological localities have been recorded within a mile of the A2PP site or its linears, their geological setting is the same as other sites in Stanislaus County that have yielded scientifically significant paleontological resources from the upper Riverbank and Tulare Formations.

The subsurface of the A2PP plant site is entirely occupied by previously disturbed sediment and artificial fill (sediment transported from elsewhere or fill that is a mix of materials) to a depth of 6.5 feet bgs. Elsewhere along the project linears, the depth to undisturbed sediment is expected to be variable from place to place but, generally in this area, extends at least to the bottom of the "plow zone," or about 4 feet below the surface. Artificial fill and soil from the agricultural zone has no potential to yield scientifically important materials, and

therefore possesses no paleontological sensitivity. The sensitivity ratings based on the data described above are summarized here:

- **Artificial Fill and Previously Disturbed Sediment including Agricultural Soils –** These typify the surface throughout the project area, and extend to depths of approximately 6.5 feet bgs at the A2PP site. They have no paleontological sensitivity.
- **Modesto Formation –** Alluvium of the Modesto Formation is distributed at shallow depth throughout the project area. It is doubtful that the Modesto Formation has yielded scientifically significant fossils in the region; paleontological records claimed to be from this formation generally lack supporting stratigraphic data or can be assigned to the Riverbank Formation based on the data provided. The Modesto Formation is therefore assigned a low paleontological sensitivity rating except for that portion encompassing the fan-toe facies mapped by Atwater et al. (1986). This includes the last (southernmost) 4.4 miles of the Alternate B route, and the last 1.8 miles of Alternate A. Abundant carbonate pseudomorphs (ichnofossils of some authors) in the sediment here, and the low-energy sedimentary environments of the floodplain suggest an environment conducive to fossil preservation. Therefore, the fan-toe facies of the Modesto Formation are assigned moderate paleontological sensitivity.
- **The Riverbank and Tulare Formations –** These units occur at depths exceeding 10 to 20 feet bgs, and 150 feet bgs, respectively, throughout the project area. Based on the vertebrate fossils found in the former, and the plant megafossils found in the latter, both are assigned high paleontological sensitivity.

5.8.3 Environmental Analysis

The environmental impacts on paleontological resources from both construction and operation of the A2PP are presented in the following sections.

5.8.3.1 Paleontological Resource Significance Criteria

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, 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 determining the age and providing input to paleoenvironmental reconstructions for the sediments in which they occur. 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 their paleoenvironment and, thus, more important than mobile mammals for paleoenvironmental reconstructions. 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.

Using the criteria of the SVP (1995) and the sensitivity ratings provided above, the significance of potentially adverse impacts of earth moving on the paleontological resources

was assessed. Any unmitigated impact on a fossil site or a fossil-bearing rock unit of high or moderate sensitivity would be considered significant.

5.8.3.2 Paleontological Resource Impact Assessment

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 provided in this section. This assessment includes the entirety of the project area.

- **Artificial Fill and Agricultural Soils –** Construction-related excavations within artificial fill or previously disturbed sediment will not result in any adverse impacts to paleontological resources. This includes the entire A2PP site to a depth of approximately 6.5 feet. Reworked and disturbed fossil material may be present in the artificial fill and previously disturbed sediment, but lack of stratigraphic context and likely mechanical damage would compromise all scientific values. This would apply to all excavations along the project linears as well within 4 feet of current ground surface.
- **Modesto Formations –** Excavations including drilling and trenching to depths exceeding 4 feet bgs along the natural gas pipeline and the electrical transmission line to the proposed Grayson Substation, will affect alluvium of the Modesto Formation. Because fill at the A2PP site extends to a depth of approximately 6.5 feet, only excavations exceeding that depth will affect Modesto Formation sediment at the plant site. Identifiable and in situ fossils of scientific significance are not expected in the Modesto Formation, and therefore excavations within this unit for the project linears are unlikely to constitute an adverse impact to paleontological resources in most areas. An exception is the last 4.4 miles of the Alternate B route and the last 1.8 miles of Alternate A, which will affect sediments of the fan-toe facies of the Modesto Formation. These possess moderate paleontological sensitivity and therefore in the absence of mitigation, an adverse impact to paleontological resources would occur from excavation-related disturbance to these sediments.
- **Riverbank Formation –** At depths exceeding 10 feet, the Riverbank Formation may be impacted along the project laterals and at the plant site itself. Because fill at the A2PP site extends to a depth of approximately 6.5 feet, the deepest excavations there may impact the Riverbank Formation. Elsewhere, along the project linears, the excavation of the trench for the pipeline along Alternate B is anticipated to affect Riverbank Formation sediments. Field survey of the TID Lateral 2 Road ROW revealed pieces of the soil that typically caps the Riverbank Formation in this area, for a distance of about 400 feet beginning approximately 200 feet west of Crows Landing Road. Excavation for Alternate B would therefore adversely affect paleontological resources associated with the Riverbank Formation along this portion of the proposed route. Excavations for the transmission line poles are not anticipated to extend deeper than 10 feet, and therefore no impacts to the paleontologically sensitive Riverbank Formation are anticipated from these activities.
- **Corcoran Clay of the Upper Tulare Formation –** Found generally below 150 feet depth, these sediments are likely to be affected only by deep drilling. Because they have yielded scientifically significant plant megafossils, disturbance of these sediments would constitute an adverse impact. However, because no deep drilling is anticipated for this

project, no impact to paleontological resources associated with the Tulare Formation is anticipated.

Therefore, significant impacts to paleontological resources are expected to occur from subsurface excavations extending onto the floodplain facies of the Modesto Formation and into the upper Riverbank Formation. These impacts would occur in three areas:

- Along the Alternate B route west of Crows Landing Road where the Riverbank Formation appears to occur at shallow depth,
- For the last 1.8 miles of the Alternate A route, and the last 4.4 miles of Alternate B where they will affect sediments of the fan-toe facies of the Modesto Formation.
- At the A2PP plant site where excavations extend deeper than approximately 6.5 feet, the maximum depth of fill at the site.

Significant impacts will not result from construction excavations at most of the A2PP facility, since this site is on fill and this previously disturbed sediment has no paleontological sensitivity. Only the deepest excavations at the plant site will penetrate through this fill and have the potential to affect paleontologically sensitive sediment. No new wells will be drilled for this project, and therefore no impacts will occur to paleontological resources of the deeply buried Corcoran Clay member of the Tulare Formation.

No impacts to paleontological resources are expected from the operation of the A2PP.

5.8.4 Cumulative Effects

Widespread development in the San Joaquin Valley has resulted in proportionately extensive impacts to paleontological resources, 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 fossiliferous sedimentary units in the area. However, measures typically implemented pursuant to state statutes 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 small proportion of those incorporate paleontological protection measures, application of paleontological monitoring and mitigation measures is common and, therefore, mitigates the cumulative as well as direct impacts of continued development.

The relative contribution to cumulative impacts on paleontological resources from project-related ground disturbance would be limited, given the limited extent of disturbance of pristine sediment by the current project. Thus, the proposed project is not expected to contribute measurably to cumulative negative impacts on paleontological resources in the absence of mitigation. With the mitigation described below, however, the impacts of the A2PP construction will not be cumulatively considerable. Moreover, if any paleontological finds are made, the application of controlled scientific recovery methods to discovered paleontological resources will constitute a beneficial impact to the extent that new scientific specimens and knowledge are generated.

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*?" These questions are answered in the negative for construction of the A2PP facility itself, based on the data and considerations provided above. Because construction of the A2PP does not have appreciable potential to adversely impact significant paleontological resources, mitigation measures beyond worker education for facility construction are not necessary. Because construction of the project laterals have the potential to affect the paleontologically sensitive upper Riverbank Formation, additional measures including monitoring and scientific recovery of discovered specimens is necessary to mitigate the adverse impacts from those activities.

This section describes the 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 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, 1991, 1995, 1996).

5.8.5.1 Construction Personnel Education

Prior to working on the site for the first time, all personnel involved in earth-moving activities will be provided with Paleontological Resources Awareness Training. This training would ideally be a module of the project-specific worker environmental awareness training. Workers and supervisory personnel will be informed that, while fossils are unlikely to be encountered at the A2PP facility site, they are nevertheless of scientific importance and should be reported immediately if they are encountered. They will also be informed that excavations associated with construction of the project laterals entail a significant likelihood of encountering scientifically significant fossils. The training will further provide information on the appearance of fossils, their importance in understanding the prehistory of California, the role of paleontological monitors, and proper notification procedures. Training will be conducted using recorded and hard copy training materials.

5.8.5.2 Paleontological Resources Monitoring and Mitigation Program

A Paleontological Resources Monitoring and Mitigation Program (PRMMP) will be developed for review and approval by the CEC prior to implementation. The PRMMP will include: construction monitoring and coordination; emergency discovery procedures; procedures for sampling and data recovery, if needed; appropriate levels of analysis of specimens; museum storage coordination for any specimens and data recovered; preconstruction coordination; and reporting. Reporting requirements will include monthly monitoring reports as well as a final report. Monitoring procedures will include measures to suspend monitoring should construction activities be restricted to previously disturbed fill,

and to adjust monitoring protocols based on updated evaluations of sensitivity subsequent to initial excavations.

Prior to construction, a qualified paleontologist will be retained as project paleontological resources specialist to design and implement a monitoring program during project-related earth-moving activities. Prior to construction, the paleontologist will review excavation plans to determine where 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 sediment of moderate to high paleontological sensitivity.

Monitoring will not be conducted in areas where the ground will not be disturbed, nor will it be conducted in areas where only fill, or sediment of low paleontological sensitivity is affected.

5.8.5.3 Impacts After Mitigation

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 data, that otherwise might be lost to earth moving or 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 and, therefore, would not have been available for study. This consideration is particularly applicable to this area with its complex geological history as well as a paucity of fossil sites on this particular terrace surface compared to those farther inland. 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.

5.8.5.4 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts on paleontological resources are anticipated as a result of the construction and/or operation of the A2PP.

5.8.6 Laws, Ordinances, Regulations, and Standards

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 of plants or animals in soft sediments later transformed to rock. 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) 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 the project area, the fossils of marine organisms as well as those of terrestrial animals and plants are important in the paleontological record. They have helped define the age and sequences of deposition and uplift along the Great Valley, where fossiliferous marine and terrestrial sedimentary rock provide important data on the development and tectonics of California's complex geology.

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 laws and regulations (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts to paleontological resources have been established by the SVP (1991, 1995, 1996). Design, construction, and operation of the A2PP will be conducted in accordance with all laws, ordinances, regulations, and standards (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, Regulations, and Standards Applicable to Paleontological Resources

LORS	Applicability	AFC Reference	Project Conformity
Antiquities Act of 1906	Not applicable – No federal land involved, or federal entitlement required	—	—
National Environmental Policy Act of 1969	Not applicable – No federal land involved, or federal entitlement required	—	—
CEQA, Appendix G	Applicable – Fossil remains may be encountered by earth-moving activities	Sections 5.8.3, 5.8.4, and 5.8.6	Yes
Public Resources Code, Sections 5097.5/5097.9	Not applicable – Applies to state-owned land	—	—

5.8.6.1 Federal LORS

Federal protection for significant paleontological resources would apply to the A2PP only if any construction or other related project impacts occur on federally owned or managed lands, or if a federal entitlement or other permit were required. 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 no federally owned or managed lands will be affected by this project, and no federal entitlement or other permit is required, these statutes do not extend to paleontological resources (see Table 5.8-2).

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]). *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…?"

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 import 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."

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. The answer to these questions is "possibly" if not "yes," and therefore CEQA does apply to this project (Table 5.8-2).

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 ensure that fossils are protected during construction of the proposed A2PP 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 5097.5/5097.9 (Stats. 1965, c. 1136, p. 2792), entitled Archaeological, Paleontological, and Historical Sites. This statute defines any unauthorized disturbance or removal of a fossil site or remains on public land as a misdemeanor and specifies that state agencies may undertake surveys, excavations, or other operations as necessary on state lands to preserve or record paleontological resources. Public Resources Code, Sections 5097.5/5097.9 does not apply to the A2PP 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).

5.8.6.3 Local LORS

The *Conservation/Open Space Element* of the *Stanislaus County General Plan* (Stanislaus County, n.d.) places emphasis on the preservation of historic and cultural resources, including archaeological resources, but does not directly address paleontological resources. In a like manner, the *Ceres General Plan* (City of Ceres, n.d.) calls for the preservation and documentation of historic and cultural resources, including archaeological resources, but does not address paleontological resources.

5.8.6.4 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.

5.8.7 Involved Agencies and Agency Contacts

There are no agencies having blanket jurisdiction over paleontological resources. The CEC has jurisdiction over paleontological resources for this project. The *Conservation/Open Space Element* of the *Stanislaus County General Plan* (Stanislaus County, n.d.) and the *Ceres General Plan* (City of Ceres, n.d.) place emphasis on the preservation of historic and cultural resources, including archaeological resources, but do not directly address paleontological resources.

The Planning Division of the City of Ceres Development Department, and the Stanislaus County Planning and Community Development Department, were contacted regarding the existence of regulations or requirements pertaining to paleontological resources. Neither the City of Ceres nor Stanislaus County have specific regulations addressing paleontological resources. However, both follow CEQA and federal regulations relevant to paleontological

resources. In addition, California State University Stanislaus in Turlock has an active paleontology program.

In the event paleontological resources are encountered during construction activities, the City of Ceres and Stanislaus County should be contacted. Documentation of the finds should be provided to CSU Stanislaus and the University of California Museum of Paleontology at Berkeley (Table 5.8-3).

TABLE 5.8-3
Agency Contacts for Paleontological Resources

Issue	Agency	Contact
City of Ceres – Paleontological Resources Regulations	City of Ceres Community Development Department – Planning Division	Tom Westbrook 2220 Magnolia Street Ceres, CA 95307 (209) 538-5774
Stanislaus County – Paleontological Resources Regulations	Stanislaus County Planning and Community Development Department	Sean Purciel 1010 10th Street Suite 3400 Modesto, CA 95354 (209) 525-6330
StanislausCounty Paleontological Resources Documentation	California State University Stanislaus Department of Biology	Dr. Grant Hurlburt Department of Biology California State University Stanislaus 801 Monte Vista Ave. Turlock, CA 95832 (209) 667-3603
State of California Paleontological Resources Documentation	University of California Museum of Paleontology Berkeley, California	Dr. Patricia Holroyd Curator of Vertebrate Paleontology 1101 Valley Life Sciences Building Berkeley, 94720-4780 (510) 642-3733 pholroyd@berkeley.edu

5.8.8 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.

5.8.9 References

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