

Throughout this Application, all references to Federal Power, Federal Power Avenal, LLC, and Federal Power Avenal refer to Avenal Power Center, LLC.

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6.8 PALEONTOLOGICAL RESOURCES

Paleontological resources are the fossilized remains of prehistoric plant and animal organisms, as well as the mineralized impressions (trace fossils) left as indirect evidence of the form and activity of such organisms. This section describes the existing conditions in the vicinity of the Site that are relevant to the potential for paleontological resources to occur, as well as Project design measures to assure there is no adverse impact to significant paleontological resources. Based on literature research and field surveys of the Site and surrounding area, there is no evidence that significant paleontological resources occur at the Site or in the Site vicinity, including the Project linear corridors. The Project design includes excavation monitoring, where a trained paleontologist monitors excavations during Project construction, so if unknown significant paleontological resources are found, they can be collected, studied, and preserved.

6.8.1 EXISTING CONDITIONS

Paleontological analysis was conducted by LSA Associates, Inc. (LSA), to determine the sensitivity of the Project area with regard to paleontological resources and the potential for important resources to occur, in accordance with the Rules of Practice and Procedure & Power Plant Site Certification Regulations (California Code of Regulations Title 20). This analysis also complies with 1989 guidelines and significance criteria specified by the Society for Vertebrate Paleontology (SVP), a national professional organization. The paleontological technical report on which this section is based is provided in Appendix 6.8-1. The Appendix provides details on study methods used and qualifications of persons conducting the analysis.

Based on literature and field studies performed for the Project, there are no known paleontological resources in the Site vicinity. Therefore, there are no specific resource locations to report to the Commission under request of confidentiality.

6.8.1.1 Project Area

The Site is located in the San Joaquin Valley Physiographic Province (Figure 6.3-1), approximately 2 miles east of Interstate 5 and the Kettleman Hills, near the Kings/Fresno County line. The Site and associated linear facilities are located on relatively flat land with thick soils overlying a deep alluvial basin. The region is predominantly in intensive agriculture. The Site and surrounding vicinity is planted primarily with row crops, orchards and vineyards. Construction and operation of the Project, including linear facilities, will occur entirely on lands

where extensive surface disturbance has occurred from agricultural activities and existing roadways, so there will be no new surface disturbance.

6.8.1.2 Geologic Setting and Stratigraphy

Geologic studies and mapping in the area have been carried out by English (1921), Ferguson (1943), Gester (1917), Goudkoff (1943), Hoots (1930), Nomland (1917 a, b), Pack (1920), Page (1983), Porter (1943), Woodring and others (1932, 1941), Young (1943) and in U.S.D.A. Soil Surveys.

The geology of the region is described in Section 6.3 of this AFC. The Site and Project linear facilities occur entirely within the deep alluvial basin of the western San Joaquin Valley. The only geologic unit exposed in the area is Holocene (0 to 11,000 year old) alluvium. The closest surface exposure of Pleistocene (11,000 to 2,000,000 years before present) or older sediments is in the Kettleman Hills west of Interstate 5 (Jenkins, 1953). Geologic units that will be disturbed by the Project include Holocene alluvium and, possibly, Pleistocene alluvium at depths below 5 feet (e.g., excavations for grading and footings).

6.8.1.3 Paleontologic Sensitivity

Paleontologic sensitivity is the potential for a geologic unit to produce scientifically significant fossils, as determined by rock type, past history of the rock unit in producing fossil materials, and fossil sites that are recorded in the unit. A paleontologic sensitivity rating is derived from fossil data from the entire geologic unit, not just from a specific survey area.

A three-fold classification of sensitivity, labeled as high, low and indeterminate, is used in California and recommended by the SVP, as follows:

- **High Sensitivity** - Indicates fossils are currently observed onsite, localities are recorded within the study area and/or the unit has a history of producing numerous significant fossil remains.
- **Low Sensitivity** - Indicates significant fossils are not likely to be found because of random fossil distribution pattern, extreme youth of the rock unit and/or the method of rock formation, such as alteration by heat and pressure.
- **Indeterminate Sensitivity** - Unknown or undetermined status indicates that the rock unit either has not been sufficiently studied or lacks good

exposures to warrant a definitive rating. After study or monitoring, the unit may fall into one of the other categories.

There are no known fossil localities in the alluvial sediments in the Site vicinity, and field surveys of the Site and linear facilities showed no evidence that significant paleontological resources occur there. Significant paleontological resources have been discovered near Fresno, approximately 50 miles north of the Site approximately 15 feet below the surface. While near surface sediments near Fresno represent a different depositional environment, the finding demonstrates that the potential for paleontological resources to occur within alluvium at relatively shallow depths cannot be ruled out. Therefore, the sensitivity of the alluvium that underlies the Site and linear facilities was classified by LSA Associates, Inc. as indeterminate.

6.8.1.4 Research Methods

6.8.1.4.1 Records and Literature Search

LSA conducted a search for paleontological resource sites within a 2-mile radius of the Project through the University of California Museum of Paleontology (UCMP). This search did not locate any vertebrate fossil localities (Holroyd, 2001). The closest known fossil localities occur west of Interstate 5 in the Kettleman Hills, where the older Etchegoin, San Joaquin and Tulare Formations are exposed (Figure 6.3-4). In the Site vicinity, these older formations are buried thousands of feet below the ground surface and will not be impacted by the Project.

6.8.1.4.2 Field Survey

The field survey was conducted on March 28, 2001. The Site was systematically surveyed by foot traverses that were 15 meters apart. The gas pipeline interconnection route and water pipeline routes were surveyed with additional transects parallel to the line routes. An electrical interconnection route was also surveyed, but the route was subsequently modified. A subsequent field visit to inspect the realigned interconnection route was determined unnecessary because: (1) it is physically and geologically similar to the Site and other Project linear corridors that were inspected with regard to the potential for paleontological resources to occur; and (2) subsurface disturbances for construction of the electrical transmission interconnection will be minimal (e.g., tower footings).

6.8.1.5 Findings

6.8.1.5.1 Records and Literature Search

The UCMP did not have records of vertebrate fossil localities within 2 miles of the Site (Holroyd, 2001). Review of literature and library materials indicated that fossil localities occur west of Interstate 5 in the Kettleman Hills in much older (2 to 24 million year old Miocene and Pliocene Age) sediments.

While there is no known evidence of significant fossils in the Project vicinity, there is a potential for Pleistocene land mammal fossils to occur at depth in the alluvial fan deposits of the region (i.e., deeper than 5 feet). Vertebrate fossils of Irvingtonian Land Mammal Age (deposited prior to 150,000 years ago) were discovered 15 feet below the surface during construction of the Fairmead Landfill near Fresno, about 50 miles north of the Site. Fossils from late Pleistocene time (11,000 years ago) might occur at depths as shallow as 7 feet below the surface in the middle of the San Joaquin Valley (Dundas, 2001). While the depositional history and depth to various age horizons in the Site area are different, these examples show that important fossils can be found in geologically young and shallow strata.

6.8.1.5.2 Field Survey Results

The field survey did not yield evidence of significant paleontological resources. The only evidence of fossils observed was several scatters of marine invertebrate shells observed on the plowed surface of the agricultural field at the Site. These shells included: (1) gastropods and pelecypods free of sedimentary matrix; and (2) cobbles of cemented sandstone containing remains of marine mollusks. The mollusks identified included:

<i>Arca</i> sp.	(ark)	<i>Panope</i> sp?	(clam)
<i>Macoma</i> sp.	(clam)	<i>Ostrea</i> sp.	(oyster)
<i>Mya</i> sp.	(clam)	<i>Littorina</i> sp.	(snail)
<i>Mytilus</i> sp.	(mussel)	<i>Nassa</i> sp?	(snail)
<i>Solen</i> sp.	(razor)	<i>Polinices</i> sp.	(snail)
<i>Pecten</i> sp.	(scallop)	<i>Turritella</i> sp.	(snail)

These are taxa that would be expected to occur in the marine Etchegoin Formation that is mapped as occurring 3 miles to the southwest in the Kettleman Hills. These shells cannot be considered significant paleontological resources, in part because they are not within their stratigraphic context. It is likely that these shells were either: (1) eroded from Kettleman Hills and then deposited in the Site area; or (2) artificially transported to the site (e.g., as soil amendments for agricultural activities).

6.8.2 IMPACTS

6.8.2.1 Significance Criteria

Significance criteria were determined based on CEQA Guidelines, Appendix G, Environmental Checklist Form, and on performance standards or thresholds adopted by responsible agencies.

An impact may be considered significant if the Project results in:

- Disturbance or destruction of an intact fossil bed or removal of portions of it in a manner inconsistent with the guidelines of the SVP.
- Disturbance or destruction of significant vertebrate fossils.
- Disturbance or destruction of a unique paleontological resource or site.

6.8.2.2 Construction Impacts

Project construction will include excavations in the plant area with foundation depths typically 4 to 6 feet deep or less. The gas pipeline interconnection will be located underground, and its construction will involve excavations to approximately 10 feet deep. Water pipelines also will be located underground, with excavations to approximately 10 feet deep.

No known significant fossil sites occur in the Project vicinity. The Holocene alluvium that occurs near the ground surface is too young to contain significant fossils. Pleistocene Age alluvium could be encountered in Project excavations that are more than 5 feet deep, and without monitoring those excavations the potential occurrence of important fossils cannot be ruled out. Consequently, a qualified Paleontologist will monitor 50 percent of the excavation work that is deeper than 5 feet. This protection measure is for open excavations and will not be applied to borings. In addition, the construction program will include sensitizing appropriate personnel to the importance of potential fossils and to watch for potential fossils in excavation areas when the Paleontologist is not present. If fossil materials are encountered, work will be halted in the immediate area, the Paleontologist will be called to investigate the site, evaluate the fossil materials and, if necessary, revise and implement the Paleontological Resource Impact Monitoring and Mitigation Program (PRIMMP) built into the Project design, a plan to collect significant scientific values from the finding. The PRIMMP is included in Appendix 6.8-1.

No Project construction impact to paleontologic resources is expected because there is no indication that significant paleontological resources occur in the area. Based on the PRIMMP plan built into Project design, the level of impacts to paleontologic resources will be maintained below a level of significance even if unknown paleontological resources are encountered. In addition to 50 percent of excavation work deeper than 5 feet being monitoring by the qualified

Paleontologist, appropriate personnel will be sensitized to the importance of fossils and to watch for potential resources and appropriate strata in excavations. Therefore, it is anticipated that significant paleontological resources, if encountered, will be collected along with associated stratigraphic and geographic data, which would reduce the impacts to paleontological resources to a level less than significant.

6.8.2.3 Operations Impacts

No Project operations impact to paleontologic resources is expected because there is no indication that significant paleontological resources occur in the area. Based on the PRIMMP built into Project design, Project operations impacts to paleontologic resources will be maintained below a level of significance even if unknown significant resources are found. If the PRIMMP activities during construction result in the finding of unknown significant paleontological resources, then appropriate PRIMMP measures will be carried forward to operations.

6.8.2.4 Cumulative Impacts

The list of activities with potential for cumulative impacts is provided in Section 6.1.4. Since the Project is not expected to have impacts to paleontological resources, no cumulative impact is expected. Moreover, the Project includes safeguards described in Section 6.8.2.2 to notify the Project Paleontologist in the event that fossils are encountered when the paleontological monitor is not present. Other projects also will be required under existing laws and regulations to mitigate significant fossils, if found. Based on these considerations, potential cumulative impacts, if any, will be less than significant.

6.8.2.5 Project Design Features to Avoid or Minimize Impacts

Since construction activities associated with the Project have an undetermined potential to impact important fossils, the following measures will be incorporated into Project construction procedures so that no significant impact to important paleontological resources will occur.

A qualified Paleontologist will be present during 50 percent of the time that excavation is occurring deeper than 5 feet below the ground surface. In addition, the construction program will include an educational program to enhance awareness of construction personnel to paleontological resources. The educational programs will include verbal and written material,

graphics or signage to sensitize construction personnel. Appropriate personnel will be instructed to watch for potential fossils in excavation areas. The following measures will be taken:

- In the event vertebrate, invertebrate or paleobotanical fossils are encountered during excavation, work shall be halted in the immediate vicinity and the Project Paleontologist shall evaluate fossil materials and, if necessary, revise, upgrade and implement the paleontological resource impact mitigation plan.
- If a mitigation plan is to be upgraded, it will follow the SVP guidelines for paleontological mitigation.

6.8.3 MITIGATION MEASURES

Based on the above analysis of impacts and measures incorporated during Project construction activities, no additional mitigation measures are required.

6.8.4 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

No significant unavoidable adverse impacts will occur to paleontological resources since the paleontological resource impact mitigation plan is built into the Project design.

6.8.5 LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

Applicable LORS related to the identification, assessment of significance and mitigation of adverse impacts to paleontological resources are summarized in Table 6.8-1. The paleontological field surveys of the Site and surrounding area and the related analysis of potential impacts were conducted by an SVP-qualified paleontologist, consistent with procedures for compliance described in the LORS. The design and construction features incorporated in the Project and included in this section will assure that the Project is in compliance with the LORS identified in Table 6.8-1 for paleontological resources.

There are no permits or approvals required for the Project related to paleontology that are outside the jurisdiction of the Commission. No impact to paleontological resources is expected, and there is no agency that would have authority over the Project if not for the authority of the Commission to certify sites. The Commission has oversight for management of paleontological resources, if encountered, pursuant to its CEQA-equivalent process. Therefore, no agency contact information is required for paleontological resources.

TABLE 6.8-1

PALEONTOLOGICAL RESOURCES LORS AND COMPLIANCE

JURIS-DICTION	LORS/ AUTHORITY	ADMINISTERING AGENCY ⁽¹⁾	REQUIREMENTS/ COMPLIANCE	APPROACH TO COMPLIANCE	AFC SECTION
Federal	None applicable.	None applicable.	None applicable.	None applicable.	Section 6.8
State	California Environmental Quality Act (CEQA); PRC §21083.2; 14 CCR §15064.5, 15126.4, 15331, Appendix G.	Commission.	Requires findings by state lead agency regarding project-related effects to important cultural resources.	This AFC provides the basis for findings to be developed by the Commission.	Sections 6.8.2, 6.8.2.1 through 6.8.2.5, 6.8.3, 6.8.4 Page 6.8-5 to 6.8-7
	Guidelines for the Implementation of the CEQA (14 Cal. Admin. Code: 15000 et seq).	Commission.	Requires mitigation of significant adverse impacts to a Paleontological site.	Monitoring by a qualified paleontologist is proposed as part of Project design.	Section 6.8.2.5 Pages 6.8-6 to 6.8-7
Industry	Society of Vertebrate Paleontology (SVP).	None applicable.	Meet SVP guidelines.	Paleontological baseline studies described in the AFC were performed in conformance with SVP guidelines. No paleontological sites are known based on literature search and field survey. Monitoring by a qualified paleontologist is proposed as part of Project design. If fossils are discovered and mitigation is found to be necessary, it will follow the SVP guidelines.	Sections 6.8.1, 6.8.2.5 Pages 6.8-1 to 6.8-4, 6.8-6, 6.8-7

⁽¹⁾ Pursuant to CCR Title 20, Appendix B(i)(1)(B): Each agency with jurisdiction to issue applicable permits and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the Commission to certify sites and related facilities.

6.8.6 REFERENCES

- California Energy Commission. *Rules of Practice and Procedure and Power Plant Site Certification Regulations*. 2000.
- Dundas. University of California Museum of Paleontology. Personal communication. May 11, 2000.
- English, W.A. *Geology and Petroleum Resources of Northwestern Kern County, California*. U.S. Geological Survey Bulletin 721:1-48. 1921.
- Ferguson, G.C. *Correlation of the Oil Field Formations on East Side San Joaquin Valley*. California Division of Mines and Geology Bulletin, 118:239-246. 1943.
- Gester, G.C. *Geology of a Portion of the McKittrick District, a Typical Example of the West Side San Joaquin Valley Oil Fields, and a Correlation of the Oil Sands of the West Side Fields*. Proceedings, California Academy of Sciences, 4th Series, 7(8):207-227. 1917.
- Goudkoff, P.P. *Correlation of the Oil Field Formations on West Side San Joaquin Valley*. California Division of Mines and Geology Bulletin, 118:247-252. 1943.
- Holroyd. University of California Museum of Paleontology. Personal communication. May 10, 2001.
- Hoots, H. W., T.L. Bear, and W.D. Kleinpell. *Geological Summary of the San Joaquin Valley, California, in Geology of Southern California*, R.H. Jahns, ed. California Division of Mines Bulletin, 170(2):113-129. 1954.
- Hoots, H.W. *Geology and Oil Resources Along the Southern Border of San Joaquin Valley*. U.S. Geological Society Bulletin 812. 1930.
- Jenkins, O. P. *Geologic Map of Kings County, California Showing Mines and Holes Drilled for Oil and Gas*. California Journal of Mines and Geology, Vol. 49, No. 3, Plate 4. 1953.
- Jennings, C.W. and R.G. Strand. *Geologic Map of California, Santa Cruz Sheet, Scale 1:250,000*. 1958.
- Miller, W. E. *Pleistocene vertebrates of the Los Angeles Basin and Vicinity (exclusive of Rancho La Brea)*. Bulletin of the Los Angeles County Museum of Natural History, Science Series 10:1-121. 1971.
- Nomland, J.C. *Fauna of the Santa Margarita Beds in the North Coalinga Region of California*. University of California Publications, Department of Geology Bulletin, 10(18): 293-326. 1917b.
- Nomland, J.C. *The Etchegoin Pliocene of Middle California*. University of California Publications, Department of Geology Bulletin, 10(14): 191-254. 1917a.

- Pack, R.W. *The Sunset-Midway oil field, California, Part I, Geology and Oil Resources*. U.S. Geological Survey Professional Paper 116: 179 p. 1920.
- Page, R. W. *Geology of the Tulare Formation and Other Continental Deposits, Kettleman City Area, San Joaquin Valley, California*. U. S. Geological Survey Water-Resources Investigations, Report 83-4000, 24p. 1983.
- Porter, L.E. *Elk Hills Oil Field (U.S. Naval Petroleum Reserve No.1)*. California Division of Mines and Geology Bulletin, 118:512-516. 1943.
- Reynolds, R. E. *Paleontological Resource Assessment Program, Avenal Energy Project, Kings and Fresno Counties, California*, 17pp. Report included as Appendix 6.7-1 to this AFC. 2001.
- Reynolds, R. E. *The Pleistocene Beneath our Feet: Near-surface Pleistocene Fossils from Inland Southern California Basins*. San Bernardino County Museum Association Quarterly V. 38 (3 and 4), p. 41-43. 1991.
- Reynolds, R. E. *Paleontologic Mitigation Program, Midway-Sunset Cogeneration Project, Kern County, California*. Redlands, San Bernardino County Museum, 72 p. and appendices. 1990.
- Reynolds, R. E. *Paleontologic Resource Assessment, Avenal Pipeline, Kettleman Hills, Kings County, California*. Redlands, San Bernardino County Museum, for Atlantis Scientific: 32p. 1989.
- Reynolds, R. E. *Paleontologic Monitoring and Salvage, Federal Lands Along the All American and Celeron Pipeline Project, California Section*. Redlands, San Bernardino County Museum: 1128 p. 1988.
- Reynolds, R. E. *Paleontologic resource assessment, Midway-Sunset Cogeneration Project, Kern County, California*. Redlands, San Bernardino County Museum, for Southern California Edison Company: 26 p. and appendices. 1987.
- Reynolds, R. E. *All-American Pipeline, California Section, Paleontologic Resources Assessment*. Technical Report. Redlands, San Bernardino County Museum: 132 p. 1986.
- Reynolds, R. E. *Paleontologic resources, All American Pipeline, Celeron M.P. 113 to All American Pipeline M.P. 104, 12 Gauge to Emidio, California*. Redlands, San Bernardino County Museum: 12 p., map. 1985.
- Taylor, D. W. *Summary of North American Blancan Nonmarine Mollusks*. *Malacologia*, 4(1):1-172. 1966.
- Wood, P. R. and R.H. Dale. *Geology and ground water features of the Edison-Maricopa Area, Kern County, California*. U.S. Geological Survey Water-supply paper 1656: 103 p. 1964.

Woodring, W. P. and M. N. Bramlette. *Geology and Paleontology of the Santa Maria District, California*. U.S. Geological Survey Professional Paper 222:1-142. 1950.

Woodring, W. P., P. V. Roundy and H.R. Farnworth. *Geology and Oil Resources of the Elk Hills, California*. U.S. Geological Survey Bulletin 835:1-82. 1932.

Woodring, W. P., R. Stewart and R.W. Richards. *Geology of the Kettleman Hills oil field, California*. U.S. Geological Survey Professional Paper, 195: 170 p. 1941.

Young, U. *Republic Area of the Midway-Sunset Oil Field*. California Division of Mines Bulletin 118:522-525. 1943.