

Appendix 3.7-3

Paleontological Inventory Report

PALEONTOLOGICAL INVENTORY REPORT

LAS CAMAS SOLAR PROJECT, MERCED COUNTY, CALIFORNIA



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1.0 EXECUTIVE SUMMARY

This Paleontological Inventory Report (PIR) presents the results of the paleontological technical study conducted by Paleo Solutions, Inc. (Paleo Solutions) in support of the EDPR CA Solar Park III LLC (EDPR) Las Camas Solar Project (Project) located in Merced County, California (see Figures 1 and 2). Paleo Solutions was contracted by ICF Jones & Stokes, Inc (ICF) to conduct an analysis of existing paleontological data and field survey and to provide recommendations for mitigation based on the geological and paleontological data. This analysis was prepared to support the Environmental Impact Report (EIR) analysis for the Project under the California Environmental Quality Act (CEQA). The Merced County Planning and Community Development Department (County) is the CEQA lead agency for the Project. The PIR was prepared in compliance with state and local regulations and best practices in mitigation paleontology (Murphey et al., 2019).

EDPR proposes to develop up to 200 megawatts alternating current (MW_{AC}) of solar photovoltaic (PV) capacity from ground-mounted, single axis tracking arrays and up to 100 megawatts direct current (MW_{DC}) or MW_{AC} of lithium-ion battery storage on an approximately 1,741-acre vacant site in Merced County (Project area). The Project includes solar development with associated PV panels, inverters, converters, generators, foundations, and transformers and battery storage with associated enclosures. The Project also includes internal access roads, perimeter fencing and gating, and a new substation with a 230 kilovolt (kV) generation tie (gen-tie) line that will travel approximately 0.4-mile west to connect the Project to Pacific Gas and Electric Company's (PG&E's) Los Banos Substation. The Project also includes transmission system improvements in and around the Los Banos substation, including connecting the substation to the Project's gen-tie line, installing a new bay with new circuit breakers, and constructing a new control building. The Project area, gen-tie line, and Los Banos Substation are within the Volta and San Luis Dam, California, United States Geological Survey (USGS) 7.5-minute topographic quadrangles. The area surrounding the Project area is characterized by agricultural land and low population density. The Billy Wright Landfill is adjacent to the Project site, south of Billy Wright Road.

The Project area and a half-mile buffer that includes the gen-tie route and PG&E's Los Banos Substation (the Project study area) were evaluated to assess their paleontological sensitivity based on an analysis of existing paleontological data. The three components of the analysis included a geologic map review, a literature search, and a paleontological record search conducted at the University of California Museum of Paleontology (UCMP). Paleontological sensitivity assignments for geologic units mapped within the Project area and a half-mile buffer were developed following the Potential Fossil Yield Classification (PFYC) system (Bureau of Land Management [BLM], 2016; see Section 5.2) and best practices in mitigation paleontology (Murphey et al., 2019). Geologic mapping by Dibblee and Minch (2007) indicates that the Project area surface is mapped mostly as latest Cretaceous-age Moreno Shale clay shale or claystone (Km) (high paleontological potential [PFYC 4]), late Cretaceous-age Panoche Formation clay shale or claystone (Kp) (moderate paleontological potential [PFYC 3]), late Cretaceous-age Panoche Formation sandstone (Kps) (PFYC 3), and late Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt) (PFYC 3) with lesser amounts of late Pliocene- to early Pleistocene-age Tulare Formation marl (QTm) (PFYC 3), Pleistocene-age older alluvial gravel and sand (Qoa) (PFYC 3), and Holocene-age alluvial gravel, sand, and clay (Qa) (low paleontological potential [PFYC 2]) (see Figure 3). According to the analysis of existing data, there are 13 previously recorded invertebrate fossil localities and one plant fossil locality that lie within or in close proximity to the Project area, as well as numerous fossil localities that are recorded within the vicinity of the Project area (i.e., the same or adjacent sections, townships, and ranges) and other areas of California from sediments similar to those mapped within the Project area.

The analysis of existing data was supplemented with a pedestrian field survey of the 1,741-acre Project area. Although no *in-situ* fossils were observed at the Project area surface, displaced large boulder- to cobble-sized concretions from the latest Cretaceous-age Moreno Shale clay shale or claystone (Km), the late Cretaceous-



age Panoche Formation clay shale or claystone (Kp), and/or the late Cretaceous-age Panoche Formation sandstone (Kps) sediments contained microfossils of crinoids, bivalves, and coral. Additionally, sediments conducive to fossil preservation are exposed at the surface or are near the surface.

During Project construction, grading, excavation, and drilling activities that are conducted with an auger that is 3 feet or greater in diameter and disturb geologic units with moderate paleontological potential (PFYC 3) to high paleontological potential (PFYC 4), as shown in Figure 3, including latest Cretaceous-age Moreno Shale clay shale or claystone (Km), late Cretaceous-age Panoche Formation clay shale or claystone (Kp), late Cretaceous-age Panoche Formation sandstone (Kps), late Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt), late Pliocene- to early Pleistocene-age Tulare Formation marl (QTm), and Pleistocene-age older alluvial gravel and sand (Qoa), should be monitored by a professional paleontologist in order to ensure that potential adverse impacts on scientifically important paleontological resources do not occur.

Recommended modifications to the frequency of monitoring should be provided as needed by the Principal Paleontologist to EDPR and the County based on the sediment types, depths, and distributions observed during monitoring during the life of the Project. Monitoring efforts should be reduced or halted if it is determined that only low paleontological potential (PFYC 2) sediments are being impacted, or if sediments are deemed to be non-conductive to fossil preservation (e.g., high energy [very coarse-grained], heavily oxidized [indicating long sediment exposure at the surface], etc.).

Prior to construction, a Paleontological Mitigation Plan (PMP) should be prepared to implement the recommendations above. It should provide a description of a worker training program; detailed recommended monitoring locations; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other Project personnel. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated by a professional paleontologist as described in the PMP. The PMP should be reviewed and approved by the Merced County Community and Economic Development Department prior to the issuance of any grading permits. Implementation of the PMP would ensure that adverse impacts on paleontological resources would not occur.



2.0 INTRODUCTION

This PIR presents the results of the paleontological technical study conducted by Paleo Solutions in support of the EDPR Las Camas Solar Project located in Merced County, California (see Figures 1 and 2). Paleo Solutions was contracted by ICF to conduct an analysis of existing paleontological data and field survey and to provide recommendations for mitigation based on the geological and paleontological data. This analysis was prepared to support the EIR analysis for the Project under CEQA. The County is the CEQA lead agency for the Project. The PIR was prepared in compliance with state and local regulations and best practices in mitigation paleontology (Murphey et al., 2019). A Project summary is provided in Table 1.

2.1 Project Description

EDPR proposes to develop up to 200 MW_{AC} of solar PV capacity from ground-mounted, single axis tracking arrays and up to 100 MW_{DC} or MW_{AC} of battery storage. The Project includes solar development with associated PV panels, inverters, converters, generators, foundations, and transformers and battery storage with associated enclosures. The Project also includes internal access roads, perimeter fencing and gating, and a new Project substation with a 230 kV gen-tie line that will travel approximately 0.4-mile west to connect to PG&E's Los Banos Substation. The Project also includes transmission system improvements in and around the Los Banos substation, including connecting the substation to the Project's gen-tie line, installing a new bay with new circuit breakers, and constructing a new control building.

It should be noted that the Project includes two off-site components that will be evaluated in the proposed Project's CEQA document but are outside the scope of this PIR, as follows:

- **Off-Site Mitigation Site.** The Project would establish a minimum 1,498-acre off-site mitigation site for San Joaquin kit fox (*Vulpes macrotis mutica*), and other covered species, as necessary. The mitigation site, which would be near the eastern and southern edges of Los Banos Reservoir, would be placed into a conservation easement in perpetuity, with the land managed to provide habitat for San Joaquin kit fox and other covered species, as necessary. Establishment and management of the mitigation site would not involve construction activities. Impacts on paleontological resources at the off-site mitigation site will be evaluated in the proposed Project's CEQA document and are not addressed further in this PIR.
- **Off-Site Residential Redesignation Area.** The Project includes an amendment to the Merced County General Plan to redesignate roughly 202.8 acres immediately south of the Project area from single-family residential to high-density/medium-density residential. The proposed redesignation would preserve the supply of medium-density and/or high-density units in the county during the life of the Project. The Project does not propose any development within the off-site residential redesignation area. Future development in this area would be subject to independent review under CEQA. Impacts to paleontological resources at the proposed residential redesignation area will be evaluated in the proposed Project's CEQA document and are not addressed further in this PIR.

2.2 Project Location

The Project area includes approximately 1,741 acres of private, undeveloped land located in western Merced County, central California. The Project area is east of the Diablo Range on lands that gradually slope downward from the west to the east. It is approximately 6 miles west of the City of Los Banos and approximately 30 miles southwest of the City of Merced. Other communities in the vicinity of the Project area include Santa Nella in Merced County approximately 3 miles north of the Project area.

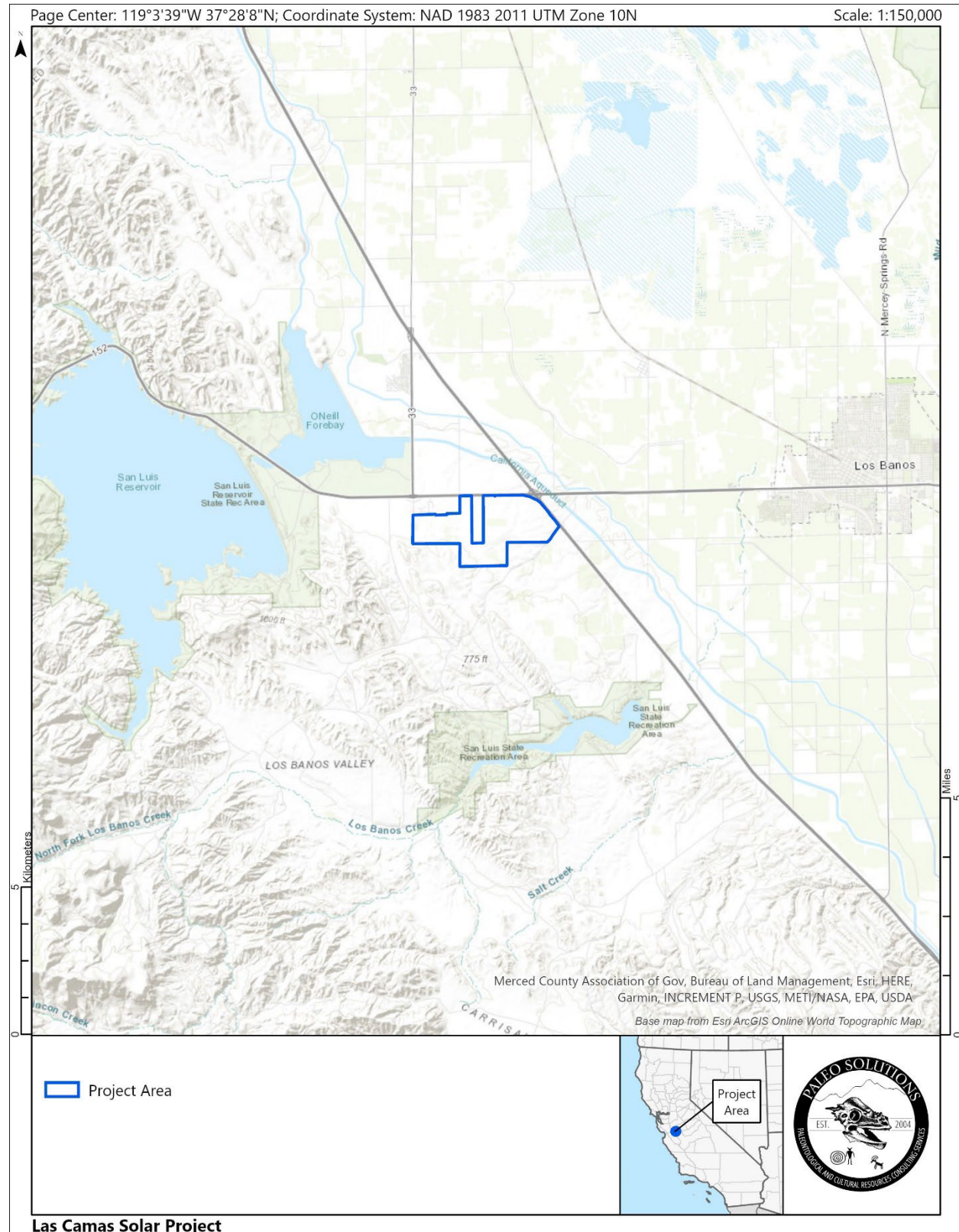


Figure 1. Project Location Map.

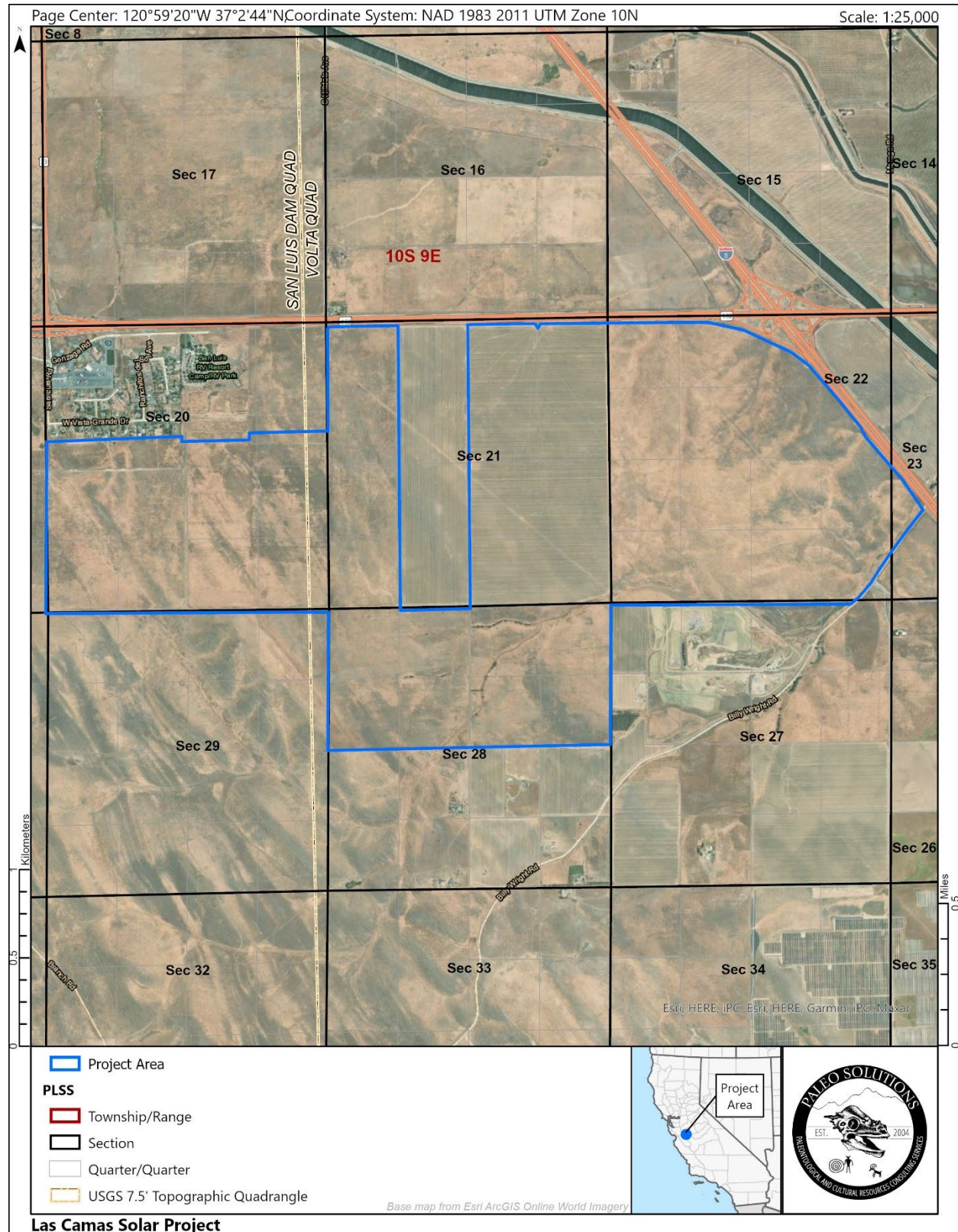


Figure 2. Project Overview Map.



The Project area is at the southwest corner of the intersection of State Route (SR) 33/152 and Interstate 5 (I-5) and can be accessed via Billy Wright Road off of SR 33/152. The Project area is generally bounded by Billy Wright Road to the south, SR 33/152 to the north, Jasper Sears Road to the west, and I-5 to the east.

The Project area is within the Volta and San Luis Dam, California, USGS 7.5-minute topographic quadrangles. The Los Banos substation and proposed gen-tie line are within the San Luis Dam USGS 7.5-minute topographic quadrangle. The area surrounding the Project area is characterized by agricultural land and low population density. Existing development in the area includes rural access roads, scattered rural residences, open range grazing, graded and plowed fields, Billy Wright Landfill to the southeast, and a small residential community and commercial buildings to the northwest by the Los Banos Substation. There is an existing and permitted, renewable energy and transmission project to the south of the region where the Project area is located. The Project area is predominantly zoned for Single-Family Residential (R-1-5000) and Multi-Family Residential (R-3) use. Other zoning designations on the Project area include higher-density Multi-Family Residential (R-4), Neighborhood Commercial (C-1), General Commercial (C-2), Light Manufacturing (M-1), General Agriculture (A-1), Exclusive Agricultural (A-2), Highway Interchange Center (H-I-C), and Rural Residential (R-R).

Table 1. Las Camas Solar Project Summary

Project Name	Las Camas Solar Project			
Project Description	EDPR proposes to develop up to 200 MW _{AC} of solar PV capacity from ground-mounted, single axis tracking arrays and up to 100 MW _{DC} or MW _{AC} of battery storage. The Project includes solar development with associated PV panels, inverters, converters, generators, foundations, and transformers and battery storage with associated enclosures. The Project also includes internal access roads, perimeter fencing and gating, and a new Project substation with a 230 kV gen-tie line that will travel approximately 0.4-mile west to connect to PG&E's Los Banos Substation. The Project also includes transmission system improvements in and around the Los Banos substation, including connecting the substation to the Project's gen-tie line, installing a new bay with new circuit breakers, and constructing a new control building.			
Project Area	The Project is generally located in western Merced County, central California. The Project area is generally bounded by Billy Wright Road to the south, SR 33/152 to the north, Jasper Sears Road to the west, and I-5 to the east.			
Total Acreage	~1,741 acres			
Location (Public Land Survey System [PLSS]): Solar Facility Main Boundary and Substation	Quarter-Quarter / Government Lot No.	Section	Township	Range
	NENE, SESE	Sec.19	10S	9E
	SWNW, SENW, SWNE, SENE, NWSW, NESW, NWSE, NESE, SWSW, SESW, SWSE, SESE	Sec.20		
	NWNW, NWNE, NENE, SWNW, SWNE, SENE, NWSW, NWSE, NESE, SWSW, SWSE, SESE	Sec.21		
	NWNW, NESW, NWNE, NENE, SWNW, SENW, SWNE, SENE, NWSW, NESW, NWSE, NESE, SWSW, SESW, SWSE, SESE	Sec.22		
	NWSW, SWSW	Sec.23		
	L1, L2, L3, L4	Sec.27		
	NWNW, NESW, NWNE, NENE, SWNW, SENW, SWNE, SENE	Sec.28		
	NWNW, NESW, NWNE, NENE	Sec.29		
	NENE	Sec.30		



Land Owner/Surface Management Agency	Private		
Topographic Map(s)	USGS San Luis Dam (2016) and Volta (2018) 7.5-minute topographic quadrangles		
Geologic Map(s)	Geologic map of the San Luis Dam and Volta quadrangles, Merced County, California (Dibblee and Minch, 2007)		
Mapped Geologic Unit(s) and Age(s)	Geologic Unit and Map Symbol	Age	Paleontological Potential (PFYC)
	Alluvial gravel, sand, and clay (Qa)	Holocene	2 (Low)
	Older alluvial gravel and sand (Qoa)	Pleistocene	3 (Moderate)
	Tulare Formation claystone (QTt)	Late Pliocene to early Pleistocene	3 (Moderate)
	Tulare Formation marl (QTm)	Late Pliocene to early Pleistocene	3 (Moderate)
	Moreno Shale clay shale or claystone (Km)	Latest Cretaceous	4 (High)
	Panoche Formation clay shale or claystone (Kp)	Late Cretaceous	3 (Moderate)
	Panoche Formation sandstone (Kps)	Late Cretaceous	3 (Moderate)
Surveyor(s)	Vincent Zhao, M.S., and Anthony Papaccio, B.S.		
Survey Date(s)	Surveying of the 1,741- acre Project area took place on June 18, 2021 (see Section 7.0)		
Geologic Units Surveyed	latest Cretaceous-age Moreno Shale clay shale or claystone (Km), late Cretaceous-age Panoche Formation clay shale or claystone (Kp), late Cretaceous-age Panoche Formation sandstone (Kps), late Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt), late Pliocene- to early Pleistocene-age Tulare Formation marl (QTm), Pleistocene-age older alluvial gravel and sand (Qoa), and Holocene-age gravel, sand, and clay (Qa)		
Permits	No paleontological permits were required for the work conducted.		
Previously Documented Fossil Localities within the Project area	A record search was requested from the UCMP, the results of which yielded 13 invertebrate localities and one plant locality from either the latest Cretaceous-age Moreno Shale clay shale or claystone (Km), late Cretaceous-age Panoche Formation clay shale or claystone (Kp), or late Cretaceous-age Panoche Formation sandstone (Kps). Precise locations of the discoveries are not available, but they were recovered from Sections 15, 20, 22, 26, 27, 30 and 35, T10S R9E (see Section 6.2; Appendix A).		
Paleontological Results	Although no <i>in-situ</i> fossils were observed at the Project area surface, displaced large boulder- to cobble-sized concretions from the latest Cretaceous-age Moreno Shale clay shale or claystone (Km), the late Cretaceous-age Panoche Formation clay shale or claystone (Kp), and/or the late Cretaceous-age Panoche Formation sandstone (Kps) sediments contained non-significant microfossils of crinoids, bivalves and coral. Additionally, sediments conducive to fossil preservation are exposed at the surface or are near the surface.		
Disposition of Fossils	No fossils were collected during the survey.		
Recommendation(s)	During solar Project construction, grading, excavation, and drilling activities that are conducted with an auger that is 3 feet or greater in diameter and disturb geologic units with geologic units with moderate paleontological potential (PFYC 3) to high paleontological potential (PFYC 4), as shown in Figure 3, including latest Cretaceous-age Moreno Shale clay shale or claystone (Km), late Cretaceous-age Panoche Formation clay shale or claystone (Kp), late Cretaceous-age Panoche Formation sandstone (Kps), late Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt), late Pliocene- to early Pleistocene-age Tulare Formation marl (QTm), and Pleistocene-age older alluvial gravel and sand (Qoa), should be monitored by a professional paleontologist in order to ensure that potential adverse impacts on scientifically important		



	paleontological resources do not occur. Recommended modifications to the frequency of monitoring should be provided as needed by the Principal Paleontologist to EDPR and the County based on the sediment types, depths, and distributions observed during monitoring during the life of the Project. Monitoring efforts should be reduced or halted if it is determined that only low paleontological potential (PFYC 2) sediments are being impacted, or if sediments are deemed to be non-conducive to fossil preservation (e.g., high energy [very coarse-grained], heavily oxidized [indicating long sediment exposure at the surface], etc.). PG&E implements standard avoidance and minimization measures (AMM) and best management practices (BMP) during construction and operation of projects in its service territory. The following AMM/BMPs would be implemented to ensure that adverse impacts on paleontological resources associated with the PG&E substation improvements do not occur. • Retain a Qualified Paleontological Principal Investigator. A paleontological resources principal investigator who meets the standards set forth by the Society of Vertebrate Paleontology will be retained to ensure that all measures related to paleontological resources are properly implemented. • Inadvertent Discoveries. If paleontological resources are discovered during construction activities, the following procedures will be followed: ○ Stop work immediately within 50 feet. ○ Contact the designated lead on staff with the Project proponents (depending on the location of the resource) immediately. The designated lead will notify the CPUC. ○ Protect the site from further impacts, including looting, erosion, or other human or natural damage. ○ The principal investigator will evaluate the discovery and make a recommendation to the CPUC as to whether or not it is a unique paleontological resource. The CPUC will have 24 hours to respond to this recommendation, and the lack of response within 48 hours will indicate concurrence with the recommendation. ○ If the resource is not a unique paleontological resource, then it will be documented appropriately, and no further measures will be required. ○ If the resource is a unique paleontological resource, the principal investigator, in consultation with the Project proponent, will recommend resource-specific measures to protect and document the paleontological resource, such as photo documentation and avoidance or collection. The CPUC will have 24 hours to respond to these measures, with no response within 48 hours indicating concurrence. Unique resources inadvertently discovered during augering will be documented as indicated above, but, due to safety concerns, any remaining resource below ground will not be salvaged. If the resource can be avoided, then CPUC concurrence will not be necessary. ○ If collection is necessary, the fossil material will be properly prepared in accordance with the Project proponents, Society of Vertebrate Paleontology guidelines, and CPUC requirements and/or curated at a recognized museum repository. Appropriate documentation will be included with all curated materials. ○ Any material discovered on private land is the property of the landowner and permission must be granted by the landowner for the material to be removed and curated. Once the resource is determined to be not unique, or appropriate treatment is completed as described above, work may resume in the vicinity. • Paleontological Construction Monitoring. Paleontological monitors, approved by the paleontological resources principal investigator, will be retained to conduct monitoring of the initial ground-disturbing activities, as described below. Monitoring requirements vary with the sensitivity of the mapped sediments. The monitor will track the sediment types during this initial ground-disturbing phase to map out the depth of the high-sensitivity formations. The type of construction activity to monitor is as follows: ○ High Surface Sensitivity – older alluvium (Qoa) ○ In locations where the ground has been previously disturbed by agricultural or other development, monitoring is required only when excavation or grading exceeds the depth of previous disturbance.
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	○ In locations where no previous disturbance exists, full-time monitoring is required when excavation, grading, or trenching exceeds 3 feet in depth. During monitoring, a qualified paleontological monitor, as determined by the principal investigator, will observe construction activity and check spoils piles to watch for the appearance of fossil resources. ○ Augering that uses a drill bit 3 feet or less in diameter will not be monitored. Small-diameter drill bits generally result in pulverized rock by the time they reach the surface; therefore, any fossils contained within will not be identifiable. Larger-diameter drill bits (i.e., greater than 3 feet) often bring up intact chunks of rocks that may contain identifiable and scientifically important fossils (particularly microfossils). All large, angled tubular-steel pole locations will be monitored. ○ During work, a portion of the excavated material will be examined visually and through screen sifting, if necessary. If screening is necessary, then a sample of spoils may be collected and processed, either on-site or off-site, as work on pole placement proceeds. Should unique fossil material be discovered, it may be recorded and collected if the resource is determined by the principal investigator to be worth salvaging. Otherwise, it will be recorded and included in the final monitoring report. Should it be determined that the type of auger or drill being used renders monitoring useless (i.e., materials come out of the hole in a pulverized powder or a silty mud), monitoring will be discontinued. ○ Because it is extremely unsafe and impractical to excavate fossils from within an auger bore or drill hole, and because doing so would unnecessarily disturb fossils further, no effort will be made to collect buried fossils indicated in spoils materials. However, the location and nature of the materials identified will be recorded. This will be documented in the final monitoring report and reported to repositories as appropriate. ○ These measures are based on currently available data. As construction proceeds and additional data become available, the principal investigator could revise the measures with CPUC concurrence. Should monitors identify fossil remains during the course of construction, PG&E AMM/BMP-12 will be implemented. ○ All monitoring activities will be documented on daily logs. Monitoring logs and reports will include a description of the activities observed, geology encountered, resources encountered, and measures taken to protect or recover discoveries. Photographs and other supplemental information will be included as necessary. A final monitoring report will be developed to document locations, methods, and the results of monitoring ● Fossil Recovery. In the event that unique paleontological resources are encountered, protection and recovery of those resources may be required. The principal investigator will oversee the recovery effort in consultation with the Project proponents (depending on the location of the resource), the CPUC, and property owners as appropriate. The principal investigator may designate a paleontologist to implement the recovery, prepare specimens for identification and preservation, and complete all field documentation in accordance with the Project proponents, Society of Vertebrate Paleontology guidelines, and CPUC requirements and/or curate at a recognized museum repository. If a fossil is not accepted by a museum for curation, then Project proponents will have fulfilled their obligation for fossil recovery. Prior to construction, a PMP for the solar Project should be prepared to implement the recommendations above. It should provide a description of a worker training program; detailed recommended monitoring locations; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other Project personnel. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated by a professional paleontologist as described in the PMP. The PMP should be reviewed and approved by the Merced County Community and Economic Development Department prior to the issuance of any grading permits. Implementation of the PMP and PG&E AMM/BMPs would ensure that adverse impacts on paleontological resources would not occur.
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3.0 DEFINITION AND SIGNIFICANCE OF PALEONTOLOGICAL RESOURCES

As defined by Murphey and Daitch (2007): “Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. Paleontological resources include not only fossils themselves, but also the associated rocks or organic matter and the physical characteristics of the fossils’ associated sedimentary matrix.

The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered non-renewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced. Fossils are important scientific and educational resources because they are used to:

- Study the phylogenetic relationships amongst extinct organisms, as well as their relationships to modern groups;
- Elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record;
- Reconstruct ancient environments, climate change, and paleoecological relationships;
- Provide a measure of relative geologic dating that forms the basis for biochronology and biostratigraphy, and which is an independent and corroborating line of evidence for isotopic dating;
- Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;
- Study patterns and processes of evolution, extinction, and speciation; and
- Identify past and potential future human-caused effects to global environments and climates.”

Fossil resources vary widely in their relative abundance and distribution and not all are regarded as significant. According to the BLM Instructional Memorandum (IM) 2009-011, a “Significant Paleontological Resource” is defined as:

“Any paleontological resource that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils. A significant paleontological resource is considered to be of scientific interest if it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has an identified educational or recreational value. Paleontological resources that may be considered not to have scientific significance include those that lack provenience or context, lack physical integrity due to decay or natural erosion, or that are overly redundant or are otherwise not useful for research. Vertebrate fossil remains and traces include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities” (BLM, 2008).



Vertebrate fossils, whether preserved remains or track ways, are classified as significant by most state and federal agencies and professional groups (and are specifically protected under the California Public Resources Code). In some cases, fossils of plants or invertebrate animals are also considered significant and can provide important information about ancient local environments.

The full significance of fossil specimens or fossil assemblages cannot be accurately predicted before they are collected, and in many cases, before they are prepared in the laboratory and compared with previously collected fossils. Pre-construction assessment of significance associated with an area or formation must be made based on previous finds, characteristics of the sediments, and other methods that can be used to determine paleoenvironmental and taphonomic conditions.



4.0 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

This section of the report presents the state and local regulatory requirements pertaining to paleontological resources that will apply to this Project.

4.1 State Regulatory Setting

4.1.1 California Environmental Quality Act (CEQA)

The procedures, types of activities, persons, and public agencies required to comply with CEQA are defined in the Guidelines for Implementation of CEQA (State CEQA Guidelines), as amended on March 18, 2010 (Title 14, Section 15000 et seq. of the California Code of Regulations) and further amended January 4, 2013 and again December 28, 2018. One of the questions listed in the CEQA Environmental Checklist is: “Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?” (State CEQA Guidelines Appendix G, Section VII, Part F).

4.1.2 State of California Public Resource Code

The State of California Public Resources Code (Chapter 1.7), Sections 5097 and 30244, includes additional state level requirements for the assessment and management of paleontological resources. These statutes require reasonable mitigation of adverse impacts on paleontological resources resulting from development on state lands, and define the excavation, destruction, or removal of paleontological “sites” or “features” from public lands without the express permission of the jurisdictional agency as a misdemeanor. As used in Section 5097, “state lands” refers to lands owned by, or under the jurisdiction of, the state or any state agency. “Public lands” is defined as lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof. There are no state or public lands located within the Project area.

4.2 Local Regulatory Setting

4.2.1 Merced County

Paleontological resources are briefly mentioned in the Recreation and Cultural Resources element of the Merced County 2030 General Plan (Merced County, 2013) in “Cultural, Archeological, and Historical Resources”. Policy RCR-2.9 titled “Historical and Cultural Resources Investigation, Assessment, and Mitigation Guidelines (RDR/MPSP)” establishes and adopts mandatory guidelines for use during the environmental review processes for private and public projects to identify and protect historical, cultural, archaeological, and paleontological resources, and unique geological features. Program RCR-B: Historic and Cultural Resources Investigation, Assessment and Mitigation Guidelines (MPSP/SO) requires the County to prepare and adopt guidelines and standards for preparations of assessments pursuant to Policy RCR-2.9, with the guidelines to be consistent with Public Resources Code Section 21083.2 and State CEQA Guidelines Section 15126.4(b).



5.0 METHODS

Components of the analysis included a geologic map review, a literature search, and an institutional record search. The analysis of existing data was supplemented with a pedestrian field survey. The goal of this report is to identify the paleontological potential of the study area and make recommendations for the mitigation of potential adverse impacts on paleontological resources that may occur as a result of the proposed construction. Paleontological sensitivity assignments were determined using the PFYC system (BLM, 2016) and best practices in mitigation paleontology (Murphey et al., 2019). Vincent Zhao, M.S., completed the background research and authored this report. Courtney Richards, M.S., performed the technical review of this report and oversaw all aspects of the Project as the Project Manager and Paleontological Principal Investigator. GIS maps were prepared by Robert Fritz, B.S. and Elisa Barrios, B.S.

Copies of this report will be submitted to ICF, EDPR, and the County. Paleo Solutions will retain an archival copy of all Project information, including field notes, maps, and other data.

5.1 Analysis of Existing Data

Paleo Solutions reviewed geologic mapping of the study area (i.e., the Project area and a half-mile buffer) by T.W. Dibblee and J.A. Minch (2007). A paleontological museum record search was conducted at UCMP. Patricia A. Holroyd, Ph.D., conducted the UCMP search (dated June 14, 2021). The results of the museum record search are provided as Appendix A. Additionally, Paleo Solutions staff reviewed published and unpublished scientific papers and conducted paleontological record searches of online databases, including the UCMP database and the Paleobiology Database (PBDB). The online database searches included known fossil localities from Pleistocene- and Pliocene-age sedimentary deposits as well as Cretaceous-age deposits within Merced County, California and surrounding areas. Specific searches were conducted for geologic units with formal names, such as the latest Cretaceous-age Moreno Shale (Km), late Cretaceous-age Panoche Formation (Kp, Kps), and late Pliocene- to early Pleistocene-age Tulare Formation (QTt, QTm). However, since geologic units that are unnamed or have informal names, such as Pleistocene-age older alluvial gravel and sand (Qoa), are not responsive to searches in the databases, general searches of sedimentary units of similar ages (e.g., Pleistocene) were conducted.

5.2 Field Survey

The field survey of the 1,741-acre Project area was conducted by Paleo Solutions staff members Vincent Zhao, M.S., and Anthony Papaccio, B.S., on June 18, 2021. The paleontological survey was performed in order to determine the paleontological potential of the geologic deposits underlying the Project area. The survey was conducted after a review of aerial photographs indicated the Project area included areas of undisturbed native sediments. The pedestrian survey included inspection of the Project area with the majority of the focus occurring in areas with native sediment exposures and areas where there will likely be immediate construction impact. Sediment exposures as well as the surrounding areas were photographed and documented. Reference points were acquired using a GPS unit. Sediment lithologies were recorded and analyzed and used to better interpret the Project's paleontological potential, and thus better understand the Project's potential impact. The field survey did not include the half-mile buffer extending beyond the Project area that comprises the remainder of the study area.

5.3 Criteria for Evaluating Paleontological Potential

The PFYC system was developed by the BLM (BLM, 2016). Because of its demonstrated usefulness as a resource management tool, the PFYC has been utilized for many years for projects across the country, regardless of land ownership. It is a predictive resource management tool that classifies geologic units on their likelihood to contain paleontological resources on a scale of 1 (very low potential) to 5 (very high potential).



This system is intended to aid in predicting, assessing, and mitigating paleontological resources. The PFYC system is summarized in Table 2.

Table 2. Summary of Paleontological Fossil Yield Classification.

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary
1 = Very Low Potential	Geologic units are not likely to contain recognizable paleontological resources.
	Units are igneous or metamorphic, excluding air-fall and reworked volcanic ash units.
	Units are Precambrian in age.
	Management concern is usually negligible, and impact mitigation is unnecessary except in rare or isolated circumstances.
2 = Low Potential	Geologic units are not likely to contain paleontological resources.
	Field surveys have verified that significant paleontological resources are not present or are very rare.
	Units are generally younger than 10,000 years before present.
	Recent aeolian deposits.
	Sediments exhibit significant physical and chemical changes (i.e., diagenetic alteration) that make fossil preservation unlikely.
	Management concern is generally low, and impact mitigation is usually unnecessary except in occasional or isolated circumstances.
3 = Moderate Potential	Sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.
	Marine in origin with sporadic known occurrences of paleontological resources.
	Paleontological resources may occur intermittently, but these occurrences are widely scattered.
	The potential for authorized land use to impact a significant paleontological resource is known to be low-to-moderate.
	Management concerns are moderate. Management options could include record searches, pre-disturbance surveys, monitoring, mitigation, or avoidance. Surface-disturbing activities may require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action could affect the paleontological resources.
4 = High Potential	Geologic units that are known to contain a high occurrence of paleontological resources.
	Significant paleontological resources have been documented but may vary in occurrence and predictability.
	Surface-disturbing activities may adversely affect paleontological resources.
	Rare or uncommon fossils, including nonvertebrate (such as soft body preservation) or unusual plant fossils, may be present.
	Illegal collecting activities may impact some areas.
	Management concern is moderate to high depending on the proposed action. A field survey by a qualified paleontologist is often needed to assess local conditions. On-site monitoring or spot-checking may be necessary during land disturbing activities. Avoidance of known paleontological resources may be necessary.
5 = Very High Potential	Highly fossiliferous geologic units that consistently and predictably produce significant paleontological resources.
	Significant paleontological resources have been documented and occur consistently.
	Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities.
	Unit is frequently the focus of illegal collecting activities.



BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary
	Management concern is high to very high. A field survey by a qualified paleontologist is almost always needed and on-site monitoring may be necessary during land use activities. Avoidance or resource preservation through controlled access, designation of areas of avoidance, or special management designations should be considered.
U = Unknown Potential	Geologic units that cannot receive an informed PFYC assignment
	Geological units may exhibit features or preservational conditions that suggest significant paleontological resources could be present, but little information about the actual paleontological resources of the unit or area is unknown.
	Geologic units represented on a map are based on lithologic character or basis of origin but have not been studied in detail.
	Scientific literature does not exist or does not reveal the nature of paleontological resources.
	Reports of paleontological resources are anecdotal or have not been verified.
	Area or geologic unit is poorly or under-studied.
	Bureau of Land Management (BLM) staff has not yet been able to assess the nature of the geologic unit.
	Until a provisional assignment is made, geologic units with unknown potential have medium to high management concerns. Field surveys are normally necessary, especially prior to authorizing a ground-disturbing activity.



6.0 ANALYSIS OF EXISTING DATA

The Project area is located within the Great Valley Geomorphic Province. A geomorphic province is a geographical area of distinct landscape character, with related geophysical features, including relief, landforms, orientations of valleys and mountains, type of vegetation, and other geomorphic attributes (Harden, 2004). The Great Valley Geomorphic Province is characterized by a north-south trending structural trough bounded by the Sierra Nevada Geomorphic Province to the east and by the Coast Ranges Geomorphic Province to the west, has had near continuous sediment deposition since the Jurassic, and is now an alluvial plain of the San Joaquin and Sacramento valleys (Norris and Webb, 1990). During the Cretaceous period, the Great Valley Geomorphic Province occupied the role of the fore-arc basin to the volcanic fore-arc setting of the Sierra Nevada Geomorphic Province which sourced the Great Valley Group deposits of deep marine shale and intercalated lenses of sandstone and conglomerate (Blakey and Ranney, 2018). By the Miocene to Pliocene, as tectonic forces shift and as the fore-arc basin filled in, the depositional environment shifted from marine to terrestrial alluvial that built up to the present-day landscape of California (Blakey and Ranney, 2018).

The Project area is situated within the western portion of the Great Valley Geomorphic Province, at the foothills of the Diablo Range at the eastern end of Pacheco Pass, overlooking the San Joaquin Valley.

6.1 Geologic Map and Literature Review

Geologic mapping by Dibblee and Minch (2007) indicates that the Project area surface is mapped mostly as latest Cretaceous-age Moreno Shale clay shale or claystone (Km) (PFYC 4), late Cretaceous-age Panoche Formation clay shale or claystone (Kp) (PFYC 3), late Cretaceous-age Panoche Formation sandstone (Kps) (PFYC 3), and Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt) (PFYC 3) with lesser amounts of early Pleistocene-age Tulare Formation marl (QTm) (PFYC 3), Pleistocene-age older alluvial gravel and sand (Qoa) (PFYC 3), and Holocene-age alluvial gravel, sand, and clay (Qa) (PFYC 2). The distribution of the geologic units underlying the Project area and half-mile buffer, as mapped by Dibblee and Minch (2007), is illustrated in Figure 3.

6.1.1 Alluvial Gravel, Sand, and Clay (Qa) (Holocene)

Alluvial gravel, sand, and clay (Qa) is Holocene in age (approximately less than 11,700 years old) and consists of surficial deposits of fluvial sediments deposited on valley floors by modern river and stream systems. Sediments consist of variable compositions of clay, silt, sand, gravel, and larger clasts. These younger sediments are generally unconsolidated, undissected, and less topographically developed than older deposits. Holocene-age alluvial gravel, sand, and clay (Qa) is mapped at the surface along modern drainages at the west and south side of the Project area (Dibblee and Minch, 2007; Figure 3).

Holocene-age deposits that are less than approximately 5,000 years old are typically too young to contain significant fossil resources (Society of Vertebrate Paleontology [SVP], 2010). Although Holocene-age alluvial gravel, sand, and clay (Qa) may comprise, in part, sediments greater than 5,000 years old, they are considered to have a low potential for producing significant paleontological resources (PFYC 2) based on BLM (2016) guidelines. However, these deposits may overlie sensitive, older (i.e., Pleistocene- and Cretaceous-age) deposits at variable depths.

6.1.2 Older Alluvial Gravel and Sand (Qoa) (Pleistocene)

Older alluvial gravel and sand (Qoa) is Pleistocene in age (approximately 2.59 million to 11,700 years old). These older deposits consist of fluvial sediments deposited on broad canyon and valley floors by ancient and modern river and stream systems. Sediments consist of medium- to coarse-grained silt, sand, and gravel from alluvial fans derived from the uplift of adjacent mountains. Compared with younger deposits, Pleistocene-age older sedimentary deposits typically have moderately- to well-developed soil horizons, are more

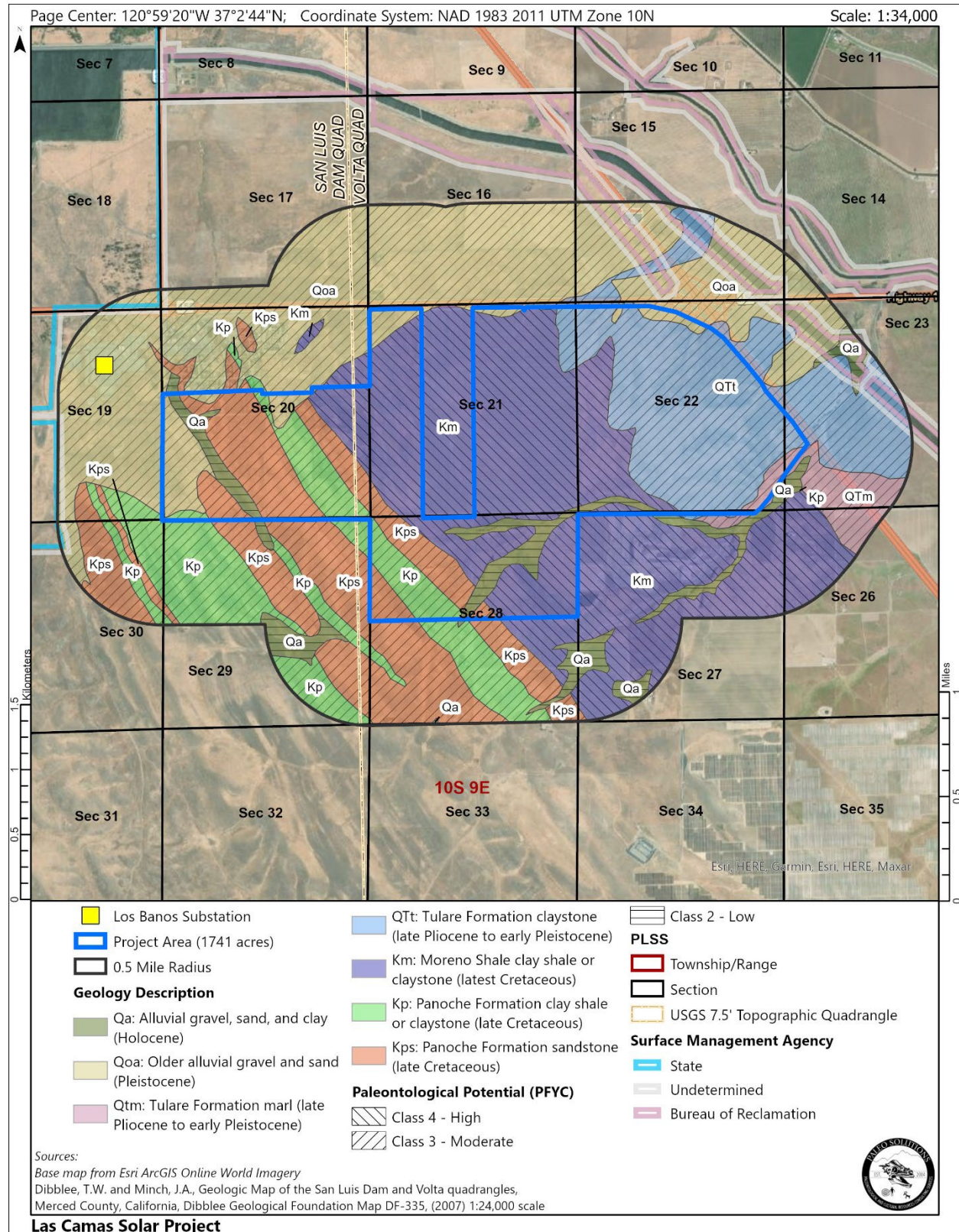


Figure 3. Project Geology Map.



topographically developed, and have moderately to well dissected surfaces, except where obscured by erosion. Pleistocene-age older alluvial gravel and sand (Qoa) is mapped at the surface along the western and northern margins of the Project area (Dibblee and Minch, 2007; Figure 3).

Numerous fossil taxa have been recovered from Pleistocene-age deposits of Merced County, many at the nearby San Luis Dam and San Luis Canal, including specimens of extinct bird (*Aves*), bison (*Bison*), camel (*Camelops*), elephant (*Elephas*), horse (*Equus*), ground sloth (*Glossotherium harlani*), American mastodon (*Mammut americanum*), and Colombian mammoth (*Mammuthus columbi*) (UCMP, 2021; Table 3).

Pleistocene-age older alluvial gravel and sand (Qoa) is considered to have a moderate potential for producing significant paleontological resources (PFYC 3) based on BLM (2016) guidelines.

6.1.3 Tulare Formation (QTt, QTm) (Late Pliocene to Early Pleistocene)

The Tulare Formation is late Pliocene to Pleistocene in age and consists of alluvial claystone (QTt) and marl (QTm). Portions of the Tulare Formation within the Project area are specifically identified as being early Pleistocene to possibly latest Pliocene in age (approximately 3.6 million to 0.8 million years old) by Dibblee and Minch (2007). These nonmarine deposits, with the claystone (QTt) being more fluvial and the marl (QTm) being more lacustrine represents the transition from the underlying marine San Joaquin Formation (Woodring, et al., 1941). These two separate units or members of the late Pliocene- to early Pleistocene-age Tulare Formation are mapped on the east end of the Project area (Dibblee and Minch, 2007; Figure 3).

Numerous fossil taxa have been recovered from the Tulare Formation in Alameda, Fresno, Kings, Kern, and San Joaquin counties including specimens of extinct birds (*Aves*; *Branta*), fishes (Chondrichthyes, Osteichthyes, *Orthodon*, *Acipenser*, *Archoplites*), canid (*Borophagus diversidens*), saber-tooth cat (*Ischyrosmilus ischyurus*), horse (*Equus occidentalis*), dolphin (*Parapontoporia*), turtle (*Actinemys marmorata*), and tortoise (*Geochelone*) (UCMP, 2021; Table 3).

The late Pliocene- to Pleistocene-age Tulare Formation claystone (QTt), and marl (QTm) are considered to have a moderate potential (PFYC 3) for producing significant paleontological resources based on BLM (2016) guidelines.

6.1.4 Moreno Shale (Km) (Latest Cretaceous)

The Moreno Shale is latest Cretaceous in age (approximately 100.5 million to 66 million years old) and is the upper formation of the Chico Group (Anderson and Pack, 1915). Within the Project area, the Moreno Shale consists of clay shale or claystone (Km). These marine deposits are vaguely bedded, micaceous and argillaceous. The deposits are usually crumbly, but the argillaceous sections have concretions.

Numerous fossil vertebrate taxa have been recovered from the Moreno Formation in Merced, Fresno, Siskiyou, and Stanislaus counties including specimens of extinct sharks (*Odontaspis*, *Heptranchias*), fishes (*Enchodus ferox*, *Saurodon*, *Bonnerichthys gladius*, *Protosphyrina*), mosasaur (*Halisaurus*, *Plesiotylosaurus crassidens*, *Plotosaurus bennisoni*, *Plotosaurus tuckeri*, *Prognathodon waiparaensis*), plesiosaur (*Hydrotherosaurus alexandrae*, *Morenosaurus stocki*), terrestrial turtle (*Basilemys*), and sea turtle (*Euclastes*) (UCMP, 2021; Table 3). Additionally, numerous invertebrate and plant fossils has been recovered as well (UCMP, 2021).

The latest Cretaceous-age Moreno Shale clay shale or claystone (Km) is considered to have a high potential (PFYC 4) for producing significant paleontological resources based on BLM (2016) guidelines.



6.1.5 Panoche Formation (Kp, Kps) (Late Cretaceous)

The Panoche Formation is late Cretaceous in age (approximately 100.5 million to 66 million years old) and is the lower formation of the Chico Group (Anderson and Pack, 1915). Within the Project area, the Panoche Formation consists of clay shale or claystone (Kp) and sandstone (Kps). The late Cretaceous-age Panoche Formation clay shale or claystone (Kp) is well bedded, micaceous, and argillaceous with thin layers of sandstone. The late Cretaceous-age Panoche Formation sandstone (Kps) is a hard, fine to medium grain arkosic sandstone that includes large hard dark brown concretion and minor amount of shale similar to the Panoche Formation clay shale or claystone (Kp).

The Panoche Formation has produced one fossil vertebrate reptile (Reptilia) tooth but has produced numerous invertebrate and plant localities (UCMP, 2021).

The late Cretaceous-age Panoche Formation clay shale or claystone (Kp) and sandstone (Kps) are considered to have a moderate potential (PFYC 3) for producing significant paleontological resources based on BLM (2016) guidelines.

6.2 Paleontological Record Search Results

Paleo Solutions requested a paleontological search of records maintained by UCMP. The museum responded on June 14, 2021 that there are no previously documented vertebrate fossil localities that lie within the Project area but there are 13 invertebrate localities and one plant locality in close proximity to, and potentially within, the Project area. The museum acquired the fossils from the United States Geological Survey Collections and precise location information for the discoveries is not available. However, the museum does have records indicating that the fossils are from Sections 15, 20, 22, 26, 27, 30 and 35, T10S R9E (Holroyd, 2021; Appendix A). Two localities are from the Panoche Formation, ten are from the Moreno Shale Formation, and two are from unknown late Cretaceous-age formations. Additionally, UCMP noted that the Moreno Shale and Panoche formations are generally fossiliferous where they outcrop (Holroyd, 2021; Appendix A).

Table 3. Paleontological Literature and Record Search Results

Institutional Locality Number/ Name	Geologic Formation	Taxon	Common Name	Location	Source
UCMP -2049, V3720, V6321, V6401, V6806, V69172, V69194	Pleistocene- age older alluvial gravel and sand (Qoa)	Aves Bison <i>Camelops</i> <i>Elephas</i> <i>Equus</i> <i>Glossotherium harlani</i> <i>Mammut Americanum</i> <i>Mammuthus columbi</i>	bird bison camel elephant horse ground sloth American mastodon Colombian mammoth	Merced County	UCMP, 2021
UCMP -1365, A3164, A3164, V5337, V5804, V6327, V67215, V6810, V70122, V70123, V7079, V7080	Pliocene- to Pleistocene- age Tulare Formation	Aves Branta <i>Chondrichthyes</i> <i>Osteichthyes</i> <i>Orthodon</i> <i>Acipenser</i> <i>Archophiles</i> <i>Borophagus diversidens</i> <i>Ischyrosmilus ischyrs</i> <i>Equus occidentalis</i> <i>Parapontoporia</i> <i>Actinemys marmorata</i> <i>Geochelone</i>	bird bird fish fish fish fish fish canid saber-tooth cat horse dolphin turtle tortoise	Alameda, Fresno, Kings, Kern, and San Joaquin counties	UCMP, 2021



Institutional Locality Number/ Name	Geologic Formation	Taxon	Common Name	Location	Source
UCMP V3621, V3622, V3718, V3735, V3736, V5605, V5606, V5607, V5608, V5609, V5610 V5696, V5779, V5780, V5781, V5872, V6214, V6418, V6598, V67238, V75075, V77104, V79052, V79053, V79088, V82046, V82056, V82057, V82058, V82075, V82076, V82077, V82078, V82079, V82080, V82081, V82282, V82283, V82284, V87002, V87003, V87004, V87005, V87006, V87007, V87008, V87009, V87010, V87011, V87012, V87013, V87014, V90061 V91101, V91102, V91106, V91107, V91111, V91134, V91169, V91170, V92067, V92070, V92071, V93022, V93069, V93138, V93188	Latest Cretaceous-age Moreno Formation	<i>Odontaspis</i> <i>Heptranchias</i> <i>Enchodus ferox</i> <i>Saurodon</i> <i>Bonnerichthys gladius</i> <i>Protosphyrina</i> <i>Halisaurus</i> <i>Plesiotylosaurus crassidens</i> <i>Plotosaurus bennisoni</i> <i>Plotosaurus tuckeri</i> <i>Prognathodon waiparaensis</i> <i>Hydrotherosaurus alexandrae</i> <i>Morenosaurus stocki</i> <i>Basilemys</i> <i>Euclastes</i>	shark shark fish fish fish fish mosasaur mosasaur mosasaur mosasaur mosasaur plesiosaur plesiosaur terrestrial turtle sea turtle	Merced, Fresno, Siskiyou, and Stanislaus counties	UCMP, 2021
UCMP V6670	Late Cretaceous-age Panoche Formation	Reptilia	reptile	Contra Costa County	UCMP, 2021



7.0 FIELD SURVEY

The Project is located approximately 6 miles west of the City of Los Banos, and 3 miles south of the community of Santa Nella in Merced County, California. The terrain consists of low to moderate relief hills and drainages in an overall low relief valley floor with mountains to the west (Figure 4). Existing ground disturbances include rural access roads, open range grazing, graded and plowed fields, transmission lines, gas pipeline, water well, and miscellaneous debris (Figures 4 and 5). Additionally, most of the Project area surface is covered in grasses (Figures 4, 5, and 6). Geologic exposures were observed as topsoil float, along the surface, as well as in drainages and areas of higher topographic relief. Large concretions of the underlying Cretaceous formations were noted to be gathered along, and delineated, property/PLSS lines. An exposed road cut and natural outcropping of the late Cretaceous-age Panoche Formation sandstone (Kps) was found in the far southwestern corner of the Project area.

Paleo Solutions conducted a paleontological survey of the 1,741-acre Project area on June 18, 2021. The results of the survey are incorporated into the following Geology and Paleontology subsections (sections 7.1 and 7.2, respectively).

7.1 Geology

Generally, the geology was observed from the topsoil and aided by float of the underlying formations of the Project area.

Holocene-age alluvial gravel, sand, and clay (Qa) was observed along major drainages of the Project area and consists of light yellowish-brown, poorly to moderately sorted, very poorly to poorly compacted, angular to subrounded, silt, very fine- to very coarse-grained sand with granules and pebbles composed of metamorphic and igneous clasts. The observed thickness of this unit was 1 foot, and no bottom contact was observed.

Pleistocene-age older alluvial gravel and sand deposits (Qoa) were observed along the northern and western portion of the Project area, and sediments consist of pale reddish-brown, moderately sorted, very poorly compacted, angular to subangular, fine- to very coarse-grained sand with granules. The observed thickness of this unit was 1 foot, and no bottom contact was observed.

Late Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt) was observed along the western area of the Project area and consists of dark gray, moderately sorted, poorly compacted, angular to subrounded, silt, very fine- to fine sand with granules topsoil (Figures 7). The observed thickness of this unit was 1 foot thick, and no bottom contact was observed.

Latest Cretaceous-age Moreno Shale clay shale or claystone (Km) was observed along the central portion of the Project area and consists of gray, moderately sorted, poorly to moderately compacted, angular to subrounded, silt, very fine- to fine sand with granules (Figures 8). Displaced, very hard, gray to reddish gray concretions of likely latest Cretaceous-age Moreno Shale clay shale or claystone (Km) are scattered around the PLSS boundaries and range from cobble- to boulder-sized (Figure 9). They contain crinoid microfossils and coral imprints (Figures 10 and 11). The observed thickness of this unit was 1 foot thick, and no bottom contact was observed.

Late Cretaceous-age Panoche Formation clay shale or claystone (Kp) and sandstone (Kps) were observed along the central and western portion of the Project area and consist of brown, moderately sorted, poorly to moderately compacted, angular to subrounded, silt, very fine- to fine sand with granules to cobbles. Displaced, very hard, gray to dark brown concretions of likely late Cretaceous-age Panoche Formation sandstone (Kps) are scattered around the PLSS boundaries and range from cobble- to boulder-sized (Figure 12). Typically, a fine- to medium-grained sandstone but also has abundant conglomerate with clasts from



pebble to cobble sized, and rare claystone (Figure 13). In the southwestern-most corner, a road cut and natural outcrop was observed with gray to dark gray fine- to medium-grained sand with some clay shale (Figure 14, 15 and 16). This outcrop and road cut suggest that the topsoil in the region may be thin, especially in the hills but potentially in the fields as well. Boulder sized concretions made of likely late Cretaceous-age Panoche Formation sandstone (Kps) conglomerate contain rare bivalve shell fragments in the central field (Figure 17). The observed thickness of this unit was 4 feet thick, and no bottom contact was observed.

7.2 Paleontology

Displaced, very hard, gray to reddish gray concretions of likely latest Cretaceous-age Moreno Shale clay shale or claystone (Km) are scattered around the PLSS boundaries and range from cobble- to boulder-sized. They contain crinoid microfossils and coral imprints (Figures 10 and 11). Additionally, displaced boulder-sized concretions made of likely late Cretaceous-age Panoche Formation sandstone (Kps) conglomerate contain rare bivalve shell fragments in the central field (Figure 17).

The observed fossils were discovered out of context (i.e., removed from the area of original deposition) and are non-significant discoveries; however, they demonstrate the paleontological potential of the late Cretaceous-age formations within the Project area. No paleontological resources were collected during the survey.



Figure 4. Overview of Project area showing low topographic relief, ground cover, and existing infrastructure. View north.



Figure 5. Overview of Project's central area with displaced concretions, primitive road, and grassy ground cover. View north.



Figure 6. Overview of Project's eastern area with low to moderate topographic relief, sparse ground cover and gas pipeline markers. View south.



Figure 7. Close up of gray to brown topsoil derived from late Pliocene- to early Pleistocene-age Tulare Formation (QTt) that has been excavated by a burrowing animal. View down.



Figure 8. Close up of dark gray topsoil derived from latest Cretaceous-age Moreno Shale clay shale or claystone (Km). View down.



Figure 9. Overview of displaced cobbles of likely latest Cretaceous-age Moreno Shale clay shale or claystone (Km). View east.

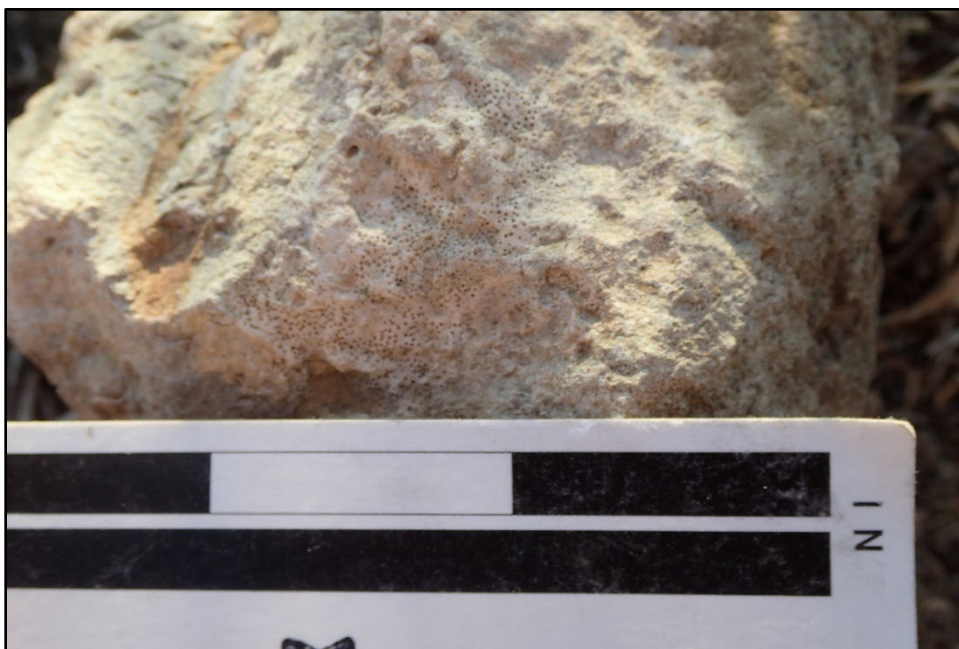


Figure 10. Close up of a likely latest Cretaceous-age Moreno Shale clay shale or claystone (Km) concretion with probable coral imprints. View down.



Figure 11. Close up of crinoid fragments in a likely latest Cretaceous-age Moreno Shale clay shale or claystone (Km) concretion. View down.



Figure 12. Overview of a line of displaced late Cretaceous-age Panoche Formation sandstone (Kps) concretions. View south.



Figure 13. Overview of a conglomeratic displaced late Cretaceous-age Panoche Formation sandstone (Kps) concretions. View down.



Figure 14. Outcrop and road cut of late Cretaceous-age Panoche Formation sandstone (Kps) concretion conglomerate. View west.



Figure 15. *In-situ* concretions of late Cretaceous-age Panoche Formation sandstone (Kps). View south.



Figure 16. Close up of late Cretaceous-age Panoche Formation sandstone (Kps). View down.

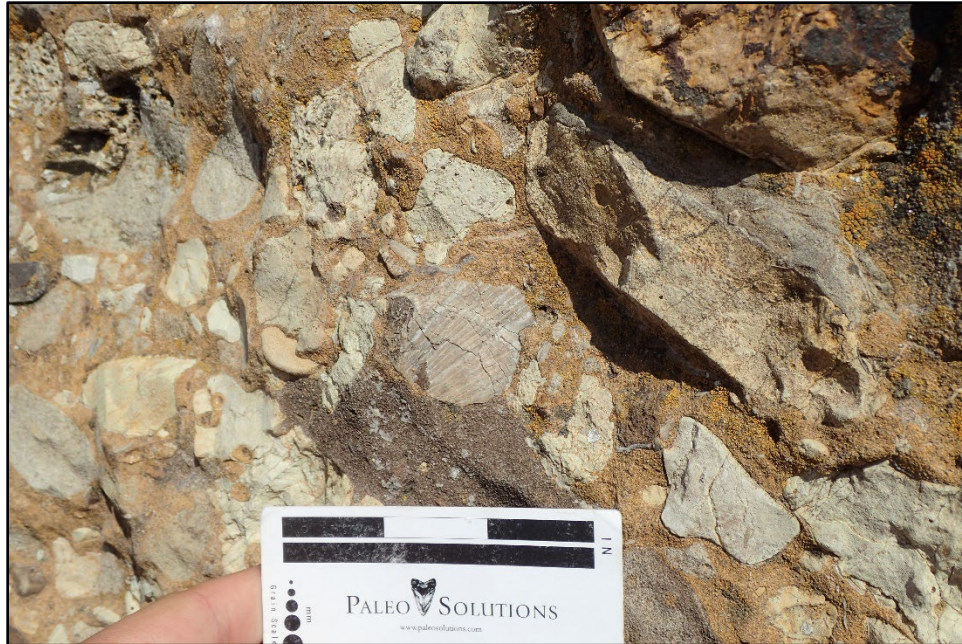


Figure 17. Closeup of a bivalve shell fragments in a displaced late Cretaceous-age Panoche Formation sandstone (Kps) concretion conglomerate. View down.



8.0 IMPACTS ON PALEONTOLOGICAL RESOURCES

Impacts on paleontological resources can generally be classified as either direct, indirect, or cumulative. Direct adverse impacts on surface or subsurface paleontological resources are the result of destruction by breakage and crushing as the result of surface disturbing actions including construction excavations. In areas that contain paleontologically sensitive geologic units, ground disturbance has the potential to adversely impact surface and subsurface paleontological resources of scientific importance. Without mitigation, these fossils and the paleontological data they could provide if properly recovered and documented, could be adversely impacted (damaged or destroyed), rendering them permanently unavailable to science and society.

Indirect impacts typically include those effects that result from the continuing implementation of management decisions and resulting activities, including normal ongoing operations of facilities constructed within a given Project area. They also occur as the result of the construction of new roads and trails in areas that were previously less accessible. This increases public access and therefore increases the likelihood of the loss of paleontological resources through vandalism and unlawful collecting. Human activities that increase erosion also cause indirect impacts on surface and subsurface fossils as the result of exposure, transport, weathering, and reburial.

Cumulative impacts can result from incrementally minor but collectively significant actions taking place over a period of time. The incremental loss of paleontological resources over time as a result of construction-related surface disturbance or vandalism and unlawful collection would represent a significant cumulative adverse impact, because it would result in the destruction of non-renewable paleontological resources and the associated irretrievable loss of scientific information.

During construction of the solar Project, grading would take place on the areas for the on-site roads, solar Project substation, battery enclosures, laydown yard, perimeter fence, and the solar PV buildable areas with north-south slopes greater than 15 percent. Approximately 50 acres would be graded in total. The solar Project would also require approximately 117,000 feet of trenching for the installation of underground cables. Construction of the PG&E substation improvements would involve the installation of new electric equipment, including new circuit breakers, bus structures, 70-kV disconnect switches, transformers, protective relaying, metering and control equipment, telemetering equipment, an electric grounding system, and underground conduits or trench systems. The yard within the existing substation property would be modified by moving the fence line approximately 500 feet south and approximately 630 feet east from the southeast corner, increasing the substation yard footprint by approximately 411,000 square feet (10.2 acres).

Excavations within the Project area and PG&E substation that impact Pleistocene-age older alluvial gravel and sand (Qoa) (PFYC 3), late Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt) (PFYC 3), late Pliocene- to early Pleistocene-age Tulare Formation marl (QTm) (PFYC 3), latest Cretaceous-age Moreno Shale clay shale or claystone (Km) (PFYC 4), late Cretaceous-age Panoche Formation clay shale or claystone (Kp) (PFYC 3), and late Cretaceous-age Panoche Formation sandstone (Kps) (PFYC 3) at the surface or at depth beneath Holocene-age alluvial gravel, sand, and clay (Qa) (PFYC 2) or their derived topsoil may result in adverse direct impacts on scientifically important paleontological resources.

Late Cretaceous-age Panoche Formation sandstone (Kps) is exposed at the surface at the southwestern portion of the Project area. The depth at which geologic units with moderate paleontological potential (PFYC 3) to high paleontological potential (PFYC 4) lie below Holocene-age alluvial gravel, sand, and clay (Qa) or topsoil throughout the remaining Project area could not be determined based on the pedestrian field survey. Surface grading or shallow excavations entirely within Holocene-age alluvial gravel, sand, and clay (Qa) and topsoil in the Project area are unlikely to uncover significant fossil remains. However, these deposits likely



shallowly overlies older sedimentary deposits. Therefore, there is the potential for adverse direct impacts on paleontological resources during substantial grading and excavations throughout the entirety of the Project area. With implementation of the mitigation recommendation provided in Section 9, adverse impacts on paleontological resources would not occur. PG&E implements standard AMM/BMPs during construction and operation of projects in its service territory. The following AMM/BMPs would be implemented to ensure that adverse impacts on paleontological resources associated with the PG&E substation improvements would not occur.

- **Retain a Qualified Paleontological Principal Investigator.** A paleontological resources principal investigator who meets the standards set forth by the Society of Vertebrate Paleontology will be retained to ensure that all measures related to paleontological resources are properly implemented.
- **Inadvertent Discoveries.** If paleontological resources are discovered during construction activities, the following procedures will be followed:
 - Stop work immediately within 50 feet.
 - Contact the designated lead on staff with the Project proponents (depending on the location of the resource) immediately. The designated lead will notify the CPUC.
 - Protect the site from further impacts, including looting, erosion, or other human or natural damage.
 - The principal investigator will evaluate the discovery and make a recommendation to the CPUC as to whether or not it is a unique paleontological resource. The CPUC will have 24 hours to respond to this recommendation, and the lack of response within 48 hours will indicate concurrence with the recommendation.
 - If the resource is not a unique paleontological resource, then it will be documented appropriately, and no further measures will be required.
 - If the resource is a unique paleontological resource, the principal investigator, in consultation with the Project proponent, will recommend resource-specific measures to protect and document the paleontological resource, such as photo documentation and avoidance or collection. The CPUC will have 24 hours to respond to these measures, with no response within 48 hours indicating concurrence. Unique resources inadvertently discovered during augering will be documented as indicated above, but, due to safety concerns, any remaining resource below ground will not be salvaged. If the resource can be avoided, then CPUC concurrence will not be necessary.
 - If collection is necessary, the fossil material will be properly prepared in accordance with the Project proponents, Society of Vertebrate Paleontology guidelines, and CPUC requirements and/or curated at a recognized museum repository. Appropriate documentation will be included with all curated materials.
 - Any material discovered on private land is the property of the landowner and permission must be granted by the landowner for the material to be removed and curated.Once the resource is determined to be not unique, or appropriate treatment is completed as described above, work may resume in the vicinity.
- **Paleontological Construction Monitoring.** Paleontological monitors, approved by the paleontological resources principal investigator, will be retained to conduct monitoring of the initial ground-disturbing activities, as described below. Monitoring requirements vary with the sensitivity of the mapped sediments. The monitor will track the sediment types during this initial ground-disturbing phase to map out the depth of the high-sensitivity formations. The type of construction activity to monitor is as follows:
 - High Surface Sensitivity – older alluvium (Qoa)
 - In locations where the ground has been previously disturbed by agricultural or other development, monitoring is required only when excavation or grading exceeds the depth of previous disturbance.



- In locations where no previous disturbance exists, full-time monitoring is required when excavation, grading, or trenching exceeds 3 feet in depth. During monitoring, a qualified paleontological monitor, as determined by the principal investigator, will observe construction activity and check spoils piles to watch for the appearance of fossil resources.
- Augering that uses a drill bit 3 feet or less in diameter will not be monitored. Small-diameter drill bits generally result in pulverized rock by the time they reach the surface; therefore, any fossils contained within will not be identifiable. Larger-diameter drill bits (i.e., greater than 3 feet) often bring up intact chunks of rocks that may contain identifiable and scientifically important fossils (particularly microfossils). All large, angled tubular-steel pole locations will be monitored.
- During work, a portion of the excavated material will be examined visually and through screen sifting, if necessary. If screening is necessary, then a sample of spoils may be collected and processed, either on-site or off-site, as work on pole placement proceeds. Should unique fossil material be discovered, it may be recorded and collected if the resource is determined by the principal investigator to be worth salvaging. Otherwise, it will be recorded and included in the final monitoring report. Should it be determined that the type of auger or drill being used renders monitoring useless (i.e., materials come out of the hole in a pulverized powder or a silty mud), monitoring will be discontinued.
- Because it is extremely unsafe and impractical to excavate fossils from within an auger bore or drill hole, and because doing so would unnecessarily disturb fossils further, no effort will be made to collect buried fossils indicated in spoils materials. However, the location and nature of the materials identified will be recorded. This will be documented in the final monitoring report and reported to repositories as appropriate.
- These measures are based on currently available data. As construction proceeds and additional data become available, the principal investigator could revise the measures with CPUC concurrence. Should monitors identify fossil remains during the course of construction, PG&E AMM/BMP-12 will be implemented.
- All monitoring activities will be documented on daily logs. Monitoring logs and reports will include a description of the activities observed, geology encountered, resources encountered, and measures taken to protect or recover discoveries. Photographs and other supplemental information will be included as necessary. A final monitoring report will be developed to document locations, methods, and the results of monitoring
- **Fossil Recovery.** In the event that unique paleontological resources are encountered, protection and recovery of those resources may be required. The principal investigator will oversee the recovery effort in consultation with the Project proponents (depending on the location of the resource), the CPUC, and property owners as appropriate. The principal investigator may designate a paleontologist to implement the recovery, prepare specimens for identification and preservation, and complete all field documentation in accordance with the Project proponents, Society of Vertebrate Paleontology guidelines, and CPUC requirements and/or curate at a recognized museum repository. If a fossil is not accepted by a museum for curation, then Project proponents will have fulfilled their obligation for fossil recovery.

No indirect impacts are anticipated since the Project will not increase public access to the site and ongoing operations of the Project will not involve ground-disturbance.

Excavation activities associated with the Project in conjunction with other projects in the area could contribute to the progressive loss of fossil remains. However, with implementation of the mitigation recommendations provided in Section 9, adverse cumulative impacts would not occur.



9.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the analysis of existing data and field survey indicate that the majority of the study area is immediately underlain by low paleontological potential (PFYC 2) Holocene-age alluvial gravel, sand, and clay (Qa) and topsoil that overlie geologic units with moderate paleontological potential (PFYC 3) to high paleontological potential (PFYC 4), likely at shallow depths. The field survey also confirmed the presence of sediments that are conducive to fossil preservation, including late Cretaceous-age Panoche Formation sandstone (Kps) (PFYC 3) at or near the surface in the Project area. Specifically, these sediments were observed exposed at the Project area surface along the western and southwestern portions.

Although no *in-situ* fossils were observed at the Project area surface, displaced large boulder- to cobble-sized concretions from either the latest Cretaceous-age Moreno Shale clay shale or claystone (Km), the late Cretaceous-age Panoche Formation clay shale or claystone (Kp), and/or the late Cretaceous-age Panoche Formation sandstone (Kps) contained microfossils of crinoids, bivalves and coral. While the observed fossils are non-significant and were not collected during the field survey, they demonstrate the paleontological potential of the Cretaceous-age formations within the Project area. Additionally, the results of the UCMP paleontological record search indicates that there are 14 previously recorded fossil localities that lies within and around the Project area. A review of additional sources indicate that numerous fossils are documented from the vicinity as well as other areas of California from sediments similar to those mapped within the Project area.

During solar Project construction, grading, excavation, and drilling activities that are conducted with an auger that is 3 feet or greater in diameter and disturb geologic units with moderate paleontological potential (PFYC 3) to high paleontological potential (PFYC 4), as shown in Figure 3, including latest Cretaceous-age Moreno Shale clay shale or claystone (Km), late Cretaceous-age Panoche Formation clay shale or claystone (Kp), late Cretaceous-age Panoche Formation sandstone (Kps), late Pliocene- to early Pleistocene-age Tulare Formation claystone (QTt), late Pliocene- to early Pleistocene-age Tulare Formation marl (QTm), and Pleistocene-age older alluvial gravel and sand (Qoa), should be monitored by a professional paleontologist in order to ensure that potential adverse impacts on scientifically important paleontological resources do not occur. Recommended modifications to the frequency of monitoring should be provided as needed by the Principal Paleontologist to EDPR and the County based on the sediment types, depths, and distributions observed during monitoring during the life of the Project. Monitoring efforts should be reduced or halted if it is determined that only low paleontological potential (PFYC 2) sediments are being impacted, or if sediments are deemed to be non-conducive to fossil preservation (e.g., high energy [very coarse-grained], heavily oxidized [indicating long sediment exposure at the surface], etc.).

PG&E implements standard AMM/BMPs during construction and operation of projects in its service territory. The following AMM/BMPs would be implemented to ensure that adverse impacts on paleontological resources associated with the PG&E substation improvements would not occur.

- **Retain a Qualified Paleontological Principal Investigator.** A paleontological resources principal investigator who meets the standards set forth by the Society of Vertebrate Paleontology will be retained to ensure that all measures related to paleontological resources are properly implemented.
- **Inadvertent Discoveries.** If paleontological resources are discovered during construction activities, the following procedures will be followed:
 - Stop work immediately within 50 feet.
 - Contact the designated lead on staff with the Project proponents (depending on the location of the resource) immediately. The designated lead will notify the CPUC.
 - Protect the site from further impacts, including looting, erosion, or other human or natural damage.



- The principal investigator will evaluate the discovery and make a recommendation to the CPUC as to whether or not it is a unique paleontological resource. The CPUC will have 24 hours to respond to this recommendation, and the lack of response within 48 hours will indicate concurrence with the recommendation.
- If the resource is not a unique paleontological resource, then it will be documented appropriately, and no further measures will be required.
- If the resource is a unique paleontological resource, the principal investigator, in consultation with the Project proponent, will recommend resource-specific measures to protect and document the paleontological resource, such as photo documentation and avoidance or collection. The CPUC will have 24 hours to respond to these measures, with no response within 48 hours indicating concurrence. Unique resources inadvertently discovered during augering will be documented as indicated above, but, due to safety concerns, any remaining resource below ground will not be salvaged. If the resource can be avoided, then CPUC concurrence will not be necessary.
- If collection is necessary, the fossil material will be properly prepared in accordance with the Project proponents, Society of Vertebrate Paleontology guidelines, and CPUC requirements and/or curated at a recognized museum repository. Appropriate documentation will be included with all curated materials.
- Any material discovered on private land is the property of the landowner and permission must be granted by the landowner for the material to be removed and curated. Once the resource is determined to be not unique, or appropriate treatment is completed as described above, work may resume in the vicinity.
- **Paleontological Construction Monitoring.** Paleontological monitors, approved by the paleontological resources principal investigator, will be retained to conduct monitoring of the initial ground-disturbing activities, as described below. Monitoring requirements vary with the sensitivity of the mapped sediments. The monitor will track the sediment types during this initial ground-disturbing phase to map out the depth of the high-sensitivity formations. The type of construction activity to monitor is as follows:
 - High Surface Sensitivity – older alluvium (Qoa)
 - In locations where the ground has been previously disturbed by agricultural or other development, monitoring is required only when excavation or grading exceeds the depth of previous disturbance.
 - In locations where no previous disturbance exists, full-time monitoring is required when excavation, grading, or trenching exceeds 3 feet in depth. During monitoring, a qualified paleontological monitor, as determined by the principal investigator, will observe construction activity and check spoils piles to watch for the appearance of fossil resources.
 - Augering that uses a drill bit 3 feet or less in diameter will not be monitored. Small-diameter drill bits generally result in pulverized rock by the time they reach the surface; therefore, any fossils contained within will not be identifiable. Larger-diameter drill bits (i.e., greater than 3 feet) often bring up intact chunks of rocks that may contain identifiable and scientifically important fossils (particularly microfossils). All large, angled tubular-steel pole locations will be monitored.
 - During work, a portion of the excavated material will be examined visually and through screen sifting, if necessary. If screening is necessary, then a sample of spoils may be collected and processed, either on-site or off-site, as work on pole placement proceeds. Should unique fossil material be discovered, it may be recorded and collected if the resource is determined by the principal investigator to be worth salvaging. Otherwise, it will be recorded and included in the final monitoring report. Should it be determined that the type of auger or drill being used renders monitoring useless (i.e., materials come out of the hole in a pulverized powder or a silty mud), monitoring will be discontinued.



- Because it is extremely unsafe and impractical to excavate fossils from within an auger bore or drill hole, and because doing so would unnecessarily disturb fossils further, no effort will be made to collect buried fossils indicated in spoils materials. However, the location and nature of the materials identified will be recorded. This will be documented in the final monitoring report and reported to repositories as appropriate.
- These measures are based on currently available data. As construction proceeds and additional data become available, the principal investigator could revise the measures with CPUC concurrence. Should monitors identify fossil remains during the course of construction, PG&E AMM/BMP-12 will be implemented.
- All monitoring activities will be documented on daily logs. Monitoring logs and reports will include a description of the activities observed, geology encountered, resources encountered, and measures taken to protect or recover discoveries. Photographs and other supplemental information will be included as necessary. A final monitoring report will be developed to document locations, methods, and the results of monitoring
- **Fossil Recovery.** In the event that unique paleontological resources are encountered, protection and recovery of those resources may be required. The principal investigator will oversee the recovery effort in consultation with the Project proponents (depending on the location of the resource), the CPUC, and property owners as appropriate. The principal investigator may designate a paleontologist to implement the recovery, prepare specimens for identification and preservation, and complete all field documentation in accordance with the Project proponents, Society of Vertebrate Paleontology guidelines, and CPUC requirements and/or curate at a recognized museum repository. If a fossil is not accepted by a museum for curation, then Project proponents will have fulfilled their obligation for fossil recovery.

Prior to construction, a PMP for the solar Project should be prepared to implement the recommendations above. It should provide a description of a worker training program; detailed recommended monitoring locations; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other Project personnel. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated by a professional paleontologist as described in the PMP. The PMP should be reviewed and approved by the Merced County Community and Economic Development Department prior to the issuance of any grading permits. Implementation of the PMP and PG&E AMM/BMPs would ensure that adverse impacts on paleontological resources would not occur.



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APPENDIX A

University of California Museum of Paleontology Record Search Results

6/16/2021

Paleo Solutions Mail - Record Map Search for Las Camas Solar Project



Courtney Richards <crichards@paleosolutions.com>

Record Map Search for Las Camas Solar Project

Robert Fritz <robert@paleosolutions.com>
To: Courtney Richards <crichards@paleosolutions.com>

Wed, Jun 16, 2021 at 9:39 AM

FYI

On Mon, Jun 14, 2021 at 11:38 AM Patricia HOLROYD <pholroyd@berkeley.edu> wrote:

Dear Robert,

I have conducted a review of the University of California Museum of Paleontology records for paleontological resources in your project area. I found no previously-recorded vertebrate paleontological sites, but did find records of 13 invertebrate and one plant site from the Late Cretaceous sediments. The majority of these were acquired from the US Geological Survey collections in Menlo Park and have not been precisely georeferenced or specimens cataloged. For these, I have only section, township, and range information, and one has a brief description of the fossils found. This information is attached. I also checked to see if there were additional ledger entries for these localities or internal USGS reports, but I didn't find any in our digitized records.

The Moreno and Panoche formations are generally fossiliferous wherever they outcrop, and we have many fossils from the equivalent outcrops in Fresno County. These have been detailed in Dick Hilton's book "Dinosaurs and Other Mesozoic Reptiles of California".

Billing will arrive separately from our campus business office.

Thank you, Pat Holroyd

Patricia A. Holroyd, Ph.D.
Senior Museum Scientist
Museum of Paleontology
University of California
Berkeley, CA 94720

[Quoted text hidden]

 **Invert Localities likely within project Area.xlsx**
12K

loc_id_num	other_loc_no	period	epoch	stage	formation	map_name	township	town_dir	range	range_dir	section	collector	coll_date	loc_description	remarks
P5640	USGS Mesozoic M8658	Cretaceous	late Cretaceous	Late Campanian to Early Maastrichtian	Volta	7.5' Quad.	10 S		9 E		20	W.P. Elder	1990		
P5641	USGS Mesozoic M8659	Cretaceous	late Cretaceous		Volta	Quad.	10 S		9 E		35	W.P. Elder	1989	Just NE of pump station at center of S line of section 35, Center S quarter.	1
P5671	USGS Mesozoic M8725	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		22	A. Bennisson	1990		
P5672	USGS Mesozoic M8727	Cretaceous	late Cretaceous	Late Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		26	A. Bennisson	1990		
P5673	USGS Mesozoic M8728	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		35	A. Bennisson & W.P. Elder	1991		
P5682	USGS Mesozoic M8735	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		15	A. Bennisson	1991		
P5684	USGS Mesozoic M8738	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		35	A. Bennisson & W.P. Elder	1990		
P5691	USGS Mesozoic M8750	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		35	W.P. Elder	1990		
P5706	USGS Mesozoic M8781	Cretaceous	late Cretaceous	Campanian?	Panache	Volta 7.5' Quad.	10 S		9 E	27?		A. Bennisson & W.P. Elder	1989		
P5709	USGS Mesozoic M8784	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		22	A. Bennisson	1991		
P5711	USGS Mesozoic M8785	Cretaceous	late Cretaceous	Campanian	Panache	San Luis Dam 7.5' Quad.	10 S		9 E		20	A. Bennisson	1991		
P5720	USGS Mesozoic M8794	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		15	A. Bennisson	1987		
P5724	USGS Mesozoic M8798	Cretaceous	late Cretaceous	Maastrichtian	Moreno	Volta 7.5' Quad.	10 S		9 E		22	A. Bennisson	1991		
P3811	Volta Bed	Cretaceous	late Cretaceous	Upper Cretaceous	Moreno	San Luis Dam	10 S		9 E		30	Bennisson			2

1 Ammonites, Bivalves (Ostreaid, Calva sp., Septifer sp.), Gastropods (Naicid, Turritella webbi paymet Seuf). *Age determined by geologic maps in USGS MapView by inputting WGS84 coordinates converted from PLS data in AllTopo.

2 Coniferous fragment, with small shells; volta bed. Trimb, W., 3/2/2005.