F-4: Line 406/407 Paleontological Survey

PALEONTOLOGICAL SURVEY AND ANALYSIS FOR THE PACIFIC GAS AND ELECTRIC COMPANY (PG&E) LINE 406 AND 407 EXPANSION PROJECT IN YOLO, SUTTER, SACRAMENTO AND PLACER COUNTIES CALIFORNIA

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Summary of Findings

This report presents the findings of paleontological research, analysis and field survey of the PG&E Line 406 and Line 407 Expansion Project (project) in California's Central Valley in Yolo, Sutter, Sacramento, and Placer Counties.

The purposes of this investigation were to identify the potential impacts to paleontological resources in the PG&E Line 406 and Line 407 Expansion areas that run east to west across the northern Central Valley, and to recommend procedures for avoidance or mitigation of adverse effects to potentially significant resources. The scope of work comprised background research and a survey of the project areas. Fieldwork was conducted in April of 2007.

GANDA recommends monitoring of project ground-disturbing activities for the Line 406, Line 407 East, Powerline Road Extension project areas and the portion of the Line 407 West project area west of Yolo, California, to mitigate the potential impact of project activities on paleontologically sensitive geological units and paleontological resources (fossils). GANDA recommends initial ground-disturbance monitoring followed by spot-check monitoring for the portion of Line 407 West project area west of Yolo, California and east of Powerline Road.

Data associated with the proposed project are on file at GANDA's San Anselmo office under Job No. 482-7.

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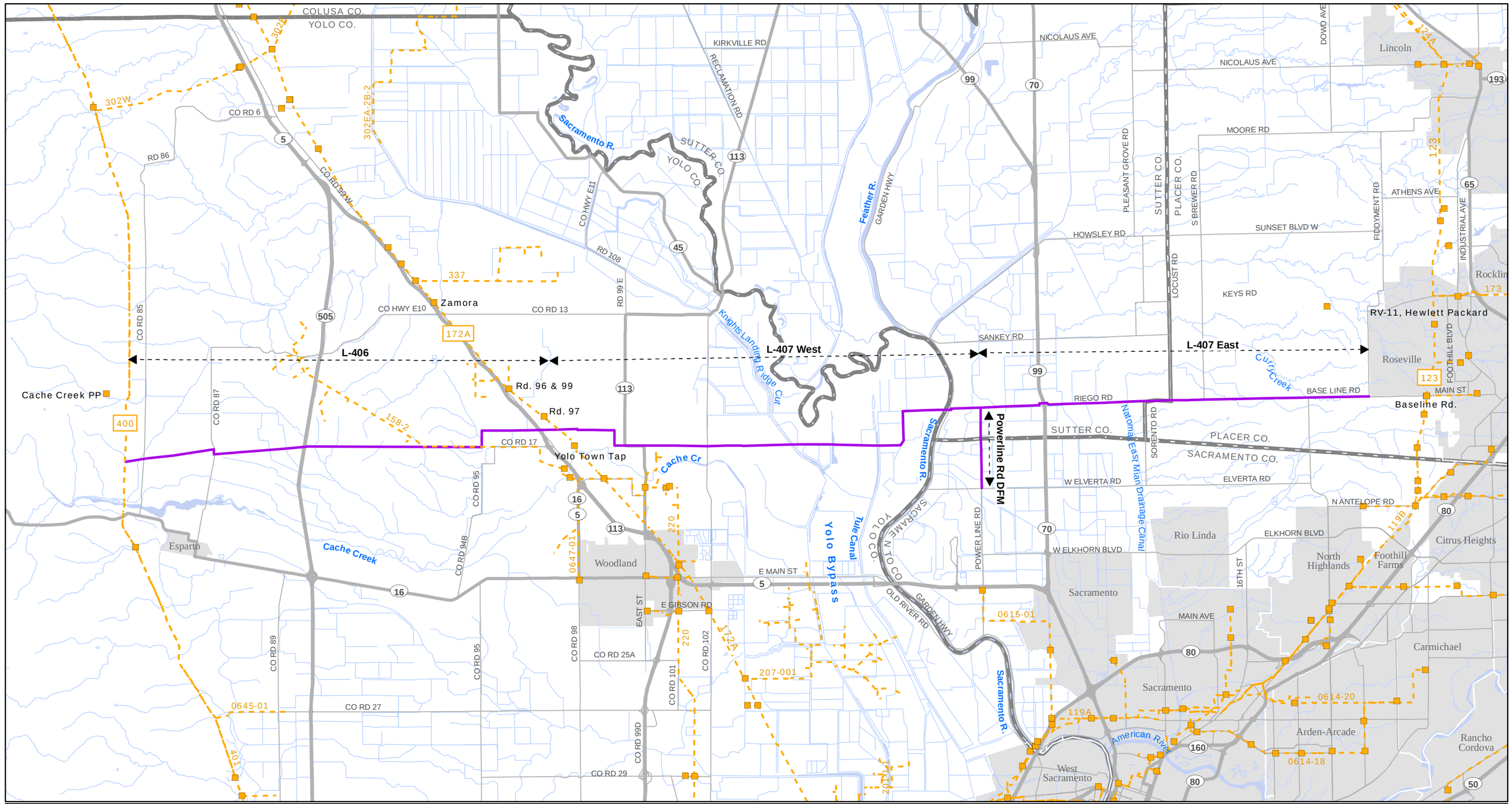
1.0 Introduction

Pacific Gas and Electric Company (PG&E) is planning to construct the Line 406 and Line 407 Expansion Project (project) in California's Central Valley in Yolo, Sutter, Sacramento, and Placer Counties (TRC Essex 2007). These natural gas transmission pipelines are needed to serve ongoing residential and commercial load growth projected in the area and will connect existing Lines 400/401, Line 172A, and Line 123 to provide greater capacity and service reliability to the existing gas transmission and distribution pipeline system (Figure 1).

The project extends east-west over approximately 40 miles and varies in elevation from 15 to 255 feet above sea level. The alluvial deposits that underlie the length of this project site are Holocene / late Pleistocene (100,000 years ago [ka] – recent), earlier Pleistocene (100 ka – 1.8 million years old [ma]), or Pliocene (5.3 – 1.8 ma) in age. These deposits formed as a result from erosion of the Sierra Nevada Range to the east and the Coastal Range to the west, filling the Central Valley with sediment. These alluvial deposits contain paleontological resources (fossils) and are paleontologically sensitive.

GANDA paleontologist Benjamin Matzen, M.A. conducted the background research and field survey for this project. Mr. Matzen has over four years experience conducting paleontological sensitivity assessments under the jurisdiction of CEQA.



Line 406 and Line 407 Pipeline Project
Figure 1
Overview Map

Proposed Pipeline
Gas Transmission Station
Gas Transmission Line
Highway
Major Road
Incorporated Area
County Boundary
Hydrology

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0 5 10 Miles

Scale 1: 180,000

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2.0 Project Description

PG&E has developed an investment plan that includes the construction of several new local gas transmission pipelines for the Sacramento Valley Local Transmission System (System). PG&E's current 10-year investment plan for the System includes a new transmission pipeline that extends from Lines 400/401 to Line 172A (Line 406); a new transmission pipeline that extends from Line 172A in the town of Yolo east to Line 123 in Roseville (Line 407); and a new Distribution Feeder Main (DFM) that extends from Line 407 south to the Sacramento Metropolitan Air Park (Metro Air Park).

Line 406 will be 30 inches in diameter, approximately 14 miles long, and will run between existing Lines 400/401 and existing Line 172A within Yolo County. From Lines 400/401, the pipeline will head east across agricultural fields to County Road (CR) 87, where it will jog south to CR 19. The route will proceed east under CR 87 and across more agricultural fields to Highway (Hwy) 505. After crossing under Hwy 505, the route will align with CR 17. From this point, Line 406 will continue east along CR 17 to a point at the east end of the Dunnigan Hills, where it will jog north for approximately 2,500 feet. At this point, the route will head east along farm roads to, and under, Interstate Hwy 5. On the east side of Interstate Hwy 5, Line 406 will continue east to a tie-in point with Line 172A and Line 407 West.

Line 407 West will be 30 inches in diameter and approximately 13.5 miles long. Beginning at the tie-in point with Lines 406 and 172A, Line 407 West will run east through agricultural fields to CR 98, which it will cross under before heading south to CR 16A. The pipeline will then head east along CR 16A to CR 99B, where it will head south to CR 17. At CR 17, the pipeline will turn east and follow CR 17 to Knights Landing Ridge Cut. The route will cross under this canal in a northwest direction and pass through more agricultural fields paralleling an existing electric transmission utility corridor before reaching the western levee of the Yolo Bypass. Line 407 West will cross east through the Yolo Bypass in a general alignment with CR 16 on the Bypass' east side, and will then continue along CR 16 through Sacramento River Ranch Conservation Bank lands and walnut orchards to the Sacramento River crossing site near the junction of CR 16 and CR 117. From this point, the pipeline will cross under the Sacramento River for approximately 3,000 feet and will then follow Riego Road in Sutter County past the Huffman East, Huffman West, Vestal, and Atkinson Natomas Basin Habitat Conservation tracts to the corner of Powerline and Riego Roads where it will meet the Metro Air Park DFM and Line 407 East.

A 10-inch DFM will be constructed in conjunction with Line 407 East and will run approximately 2.5 miles along Powerline Road in Sacramento County to provide natural gas to the Metro Air Park development and North Natomas.

Line 407 East will extend east from the junction of Line 407 West and the Metro Air Park DFM along Riego/Baseline Road in Sutter and Placer Counties. The route crosses a number of irrigation canals, including the North Drainage Canal and the Natomas East Main Drainage Canal (Steelhead Creek). Line 407 East will parallel the northern border of the Placer Vineyards Specific Plan area before connecting with Line 123 at the intersection of Baseline and Fiddyment Roads.

The project will also include the construction of additional appurtenances necessary for operation of the four line segments. Four fenced, aboveground pressure limiting, pressure regulating, and metering stations will be constructed along Line 406 and Line 407 to ensure that proper pressures are maintained in the transmission system and to reduce the pressure of the gas before delivering it to the distribution pipeline system. Two pressure limiting stations, located at the connection of Lines 400/401 and Line 406, and at the connection of Line 172 and Line 407 West, will cover an area of approximately 100 feet by 100 feet. Two pressure regulating stations, located near the corner of Powerline Road and West Elverta Road along the Metro Air Park DFM, and near the corner of Baseline Road and Watt Avenue along the Line 407 East segment, will be constructed in yards approximately 35 feet by 75 feet. Main line bridle valves and blow-off stacks will be installed within the fenced yards. Other components necessary to the operation of the pipeline include aboveground line-markers and electrolysis test stations

3.0 Legislative Context

Paleontological resources include fossil plants and animals, and evidence of past life such as trace fossils like preserved animal tracks and burrows. Data provided by the stratigraphic location and associated geologic deposits of these resources are also invaluable to the proper interpretation of fossils.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires that a determination be made as to whether a project would directly or indirectly destroy a unique paleontological resource or site or a unique geological feature (CEQA Appendix G(V)c). If an impact is significant, CEQA requires feasible measures to minimize the impact (CEQA, Section 15126.4).

Public Resources Code § 5097.5

California Public Resources Code § 5097.5 prohibits excavation or removal of any "vertebrate paleontological site, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands." Public lands are defined to include lands owned by or under the jurisdiction of the state or any city, county, district, authority or public corporation, or any agency thereof. Section 5097.5 states that any unauthorized disturbance or removal of archaeological, historical, or paleontological materials or sites located on public lands is a misdemeanor.

Fossil Significance Criteria

The Society of Vertebrate Paleontology (SVP) identifies vertebrate fossils, their taphonomic and associated environmental data, and fossiliferous deposits as significant nonrenewable paleontological resources. Botanical and invertebrate fossils and assemblages may also be considered significant (Conformable Impact Mitigation Guidelines Committee 1995). Due to the rarity of fossils and the scientific information they provide, a resource can be considered significant if it meets any one of the following criteria (Scott and Springer 2003).

- The paleontological resource provides data on the evolutionary relationships and developmental trends among organisms, both living and extinct;
- The paleontological resource provides data useful in determining the age(s) of the geologic unit or sedimentary stratum, as well as timing of associated geological events;
- The paleontological resource provides data on a community level;
- The paleontological resource demonstrates unusual or spectacular circumstances in the history of life; and / or
- The paleontological resource is not abundant or found in other geographic locations and may be in danger of being depleted or destroyed by the elements or vandalism.

Significant paleontological resources must be diagnostic, or identifiable, to determine if many of the criterion above are applicable. Proper identification of paleontological resources is often impossible in the field, therefore the recovery, preparation and analysis of paleontological resources is necessary to determine their significance (Scott and Springer 2003). This process must be done by, or under the supervision of, a qualified paleontologist (Conformable Impact Mitigation Guidelines Committee 1995). Microvertebrate fossils are generally not visible to the naked eye in the field and are recovered in the laboratory through processing of bulk samples from paleontologically sensitive geologic units (Conformable Impact Mitigation Guidelines Committee 1995; Scott and Springer 2003).

4.0 Methods

Background Research

Background research conducted for this project consisted of a literature review search and a fossil locality search. This research identified the geologic units, previous paleontological studies, fossil localities (i.e., locations at which paleontological resources have been documented), and types of fossils that may be within or adjacent to the project area. This research is based on the project description provided by TRC Essex (2007). See References Cited section for all literature reviewed.

An online fossil locality search was done on April 10, 2007 using the Berkeley Natural History Museum (BNHM) online database, specifically using data from the University of California Museum of Paleontology (UCMP) in Berkeley. This database provides fossil locality data on the County level.

Field Survey

A windshield survey was conducted for the length of the project area adjacent to roadways. Geologic units in most of the eastern portion of Line 406 and the western portion of Line 407 were not exposed and could not be examined or identified. Geologic units exposed along roadways within the project areas were inspected. All geologic units described above were identified and confirmed within the project areas where exposed.

5.0 Results

UCMP records document that Yolo County contains eight fossil localities of late Pleistocene age and 11 Pliocene age localities. Sutter County has five recorded late Pleistocene fossil localities, there are eight localities of this age in Sacramento County and one locality of that age in Placer County. These fossil localities include invertebrate, vertebrate, and plant fossils from the geologic units discussed below (BNHM 2007). UCMP paleontologists also conducted a record search based upon the project areas, and their records include three fossil localities within one mile of the western portion of Line 406.

Project Geology

The 406 – 407 pipeline project area runs over 40 miles east to west across the alluvial plains of the Central Valley. Soils in the flat, low sloping portions of the Central Valley have an average depth of 5 to 6 feet (McElhiney 1992). The sediments underlying the soil are late Pleistocene and Pliocene aged alluvium, which is generally derived from the erosion of the Sierra Nevada Range to the east and the Coastal Range to the west. Similarly aged geologic units are distinct along the western and eastern sides of the Central Valley due to their varied provenance.

Geological units are described by project area (Line 406, Line 407 East, Powerline Road Extension, then Line 407 West – Figure 1) and in stratigraphic sequence from oldest to youngest. The locations where the geologic unit will be impacted by project activity is noted with their descriptions.

The stratigraphically oldest geologic unit within the Line 406 project area (Figure 1) is the Pliocene age Tehama Formation (Helley and Harwood 1985; Wagner et al. 1987). This formation consists of sand and siltsone marked by lenses of pebbly conglomerate. This formation also contains a volcanic layer near the project area known as the Putah Tuff Member that has been K-Ar radiometric age of 3.3 ± 0.1 ma (Sarna-Wojcicki 1976). Tehama Formation sediments are exposed within the Line 406 project areas in Dunnigan Hills and in the hills just west of the project area.

Red Bluff Formation sediments, distinctive, bright-red weathered gravels, are exposed within the Line 406 project area as caps on Tehama Formation deposits in the Dunnigan Hills and in the hills just west of the project area. The age of this Pleistocene formation, between 450 ka and 1.1 ma, is known by the dating volcanic units that overlie and underlie this formation (Helley and Harwood 1985). Though younger than the Tehama formation, the Red Bluff Formation is still much older than the overlying Modesto Formation alluvium.

Loosely consolidated alluvial fan deposits Modesto Formation fill the flat, low-slope regions within the Line 406, and to a large extent the Line 407 East and the western portion of Line 407 West project areas (Helley and Harwood 1985; Wagner et al. 1987). Modesto Formation sediments consist of tan-gray gravely sand, silt, and clay. The age of this formation is approximately 12 – 40 ka based on radiocarbon dating (Marchand and Allwardt 1981).

The stratigraphically oldest geologic unit within the Line 407 East project area is the Turlock Lake Formation, exposed in the easternmost, higher-relief portions of the project area, near

the city of Roseville, California. This geologic unit consists of deeply-weathered arkosic gravels with metamorphic and quartz rock fragments (Helley and Harwood 1985; Wagner et al 1987). This formation includes the Corcoran Clay, a geologic unit that has been K-Ar dated to approximately 600 ka and may therefore have been deposited during roughly the same period as the Red Bluff Formation (Helly and Harwood 1985).

Late Pleistocene Modesto and Riverbank Formation alluvium stratigraphically overlies the older Turlock Lake Formation along the course of Line 407 East and the Powerline Road Extenstion (Figure 1). These alluvial deposits are unconsolidated gravels, those of the Riverbank Formation bearing a distinct dark-brown to reddish hue. The Riverbank Formation unconformably overlies the Turlock Lake Formation and is in turn unconformably overlain by Modesto Formation sediments within the Central Valley (Helley and Harwood 1985; Wagner et al. 1987). Riverbank sediments are likely twice as old as those of the Modesto Formation, approximately 100 ka, but has been dated between 130 – 450 ka further south in the San Joaquin Valley (Marchand and Allwardt 1981).

The Line 407 West project area (Figure 1) is underlain by Holocene aged basin deposits and recent alluvium (Helley and Harwood 1985; Wagner et al. 1987). These areas are very low-relief, flat-lying regions in the center of the Central Valley. This alluvium is usually thin, varying in thickness from a few centimeters to a few meters, and often corresponds to or is the same as the soil layer. Modesto and Riverbank Formation sediments underlie this thin veneer of soils and alluvium in the center of the Central Valley.

Project Paleontological Sensitivity

Sediments of the ages that correlate to all geologic units within the Line 406 and Line 407 project areas can be called Plio-Pleistocene, and correlate to three distinct land mammal assemblages in North America: the Blancan, Irvingtonian, and Rancholabrean (Bell et al. 2004). Each geologic unit within the Line 406 and 407 project areas contains significant vertebrate fossils from these land mammal ages (Berkeley Natural History Museum 2007).

The late Pliocene Tehama Formation has a high paleontological sensitivity. This formation has produced over 40 fossil localities and hundreds of Blancan (appr. 5 – 2 ma) age vertebrate fossil specimens. Fossils of this age are similar to those of later land mammal ages, but do not include *Mammuthus*, or Columbian Mammoth (Irvingtonian) or *Bison* (Rancholabrean) fossils. Specimens include, but are not limited to horse, camel, mastodon, ground sloth, saber-toothed cat, and rodents (Bell et al. 2004).

The Pleistocene includes both the Irvingtonian (appr. 1.8 ma – 100 ka) and Rancholabrean (appr. 100 – 10 ka) land mammal assemblages. Vertebrate fossils from these assemblages include many of the same taxa, but are distinguished by the presence of *Mammuthus* fossils (Irvingtonian) and then by *Bison* fossils (Rancholabrean) in North America. Berkeley Natural History Museum records document 22 vertebrate fossil localities of these ages from the counties in which Line 406, Line 407 East and Powerline Road Extension are located; the Turlock Lake, Riverbank and Red Bluff Formations include Irvingtonian age fossils. These three geologic units have high paleontological sensitivity.

The Riverbank and Modesto Formations include fossils from the Rancholabrean land

mammal age. As stated above the Riverbank has high paleontological sensitivity, as does the Modesto Formation Vertebrate fossils from the Pleistocene include, but are not limited to, horses, mammoths, bison, camels, ground sloths, saber-toothed cats, canids, rodents, mustelids, birds, reptiles, and amphibians (Savage 1951; Stirton 1951; Bell et al. 2004).

Only the Holocene-aged basin deposits and alluvium underlying the eastern portion of Line 407 West have low paleontological sensitivity. These units are underline at shallow depth by the Modesto formation, a highly sensitive geologic unit for paleontological resources (Helley and Harwood 1985).

To summarize, Line 406, Line 407 East and the Powerline Drive Extension project lie directly on geologic units that have high paleontological sensitivity. Line 407 West from Powerline Drive to the city of Yolo is underlain by Holocene alluvium that has low paleontological sensitivity, however, these geologic units are perhaps only 5 feet thick and are underlain by geologic units with high paleontological sensitivity. The portion of Line 407 West that lies west of Yolo, California, lies on geologic units with high paleontological sensitivity.

6.0 Recommendations

Project ground-disturbing activities will affect geologic units underlying the project area, some of which have high paleontological sensitivity. This may result in significant impacts to paleontological resources (fossils). GANDA recommends the following mitigation for project ground-disturbing activities that may impact paleontologically sensitive Plio-Pleistocene alluvial deposits underlying project areas.

Prior to ground-disturbing activities the project paleontologist will provide input for inclusion in the Worker Environmental Awareness Program (WEAP). The purpose of the WEAP is to inform construction contractors and their employees about the environmental compliance requirements of this project. The WEAP will include the paleontologic resource issues associated with the PG&E Line 406 and 407 Expansion Project, including:

1) what is a fossil;
2) the types of geologic units are the project areas;
3) any known fossil locales in or adjacent to the project areas;
4) the potential of the geologic units in the project area to produce fossils;
5) measures to follow in the event fossils are discovered in the project area.

All workers on the project involved in project ground-disturbing activities will be required to participate in the WEAP and will be familiar with the compliance measures pertaining to paleontological resources. The worker training program shall be sufficient in scope to make the workers aware of the importance and purpose of the paleontologic monitoring program and is not intended to enable workers to discern between fossil and non-fossil material. Workers will acknowledge an understanding of the paleontologic resource constraints through completion of the WEAP training.

For areas with high paleontological sensitivity (Line 406, Line 407 East, the portion of Line 407 West west of Yolo, California, and the Powerline Road Extension) GANDA recommends monitoring of ground-disturbing activities, data recovery and analysis, preparation of a data recovery report or other reports, and accessioning recovered fossil material to an accredited paleontological repository, such as the UCMP, for those project areas lying directly on geologic units. This includes the Tehama, Red Bluff, Turlock Lake, Riverbank and Modesto Formations.

For the portion of the Line 407 West project area east of Yolo, California, GANDA recommends monitoring of initial ground-disturbing activities and continued spot-check monitoring of ground-disturbing activities, data recovery and analysis, preparation of a data recovery report or other reports, and accessioning fossil material to an accredited paleontological repository, such as the UCMP.

Implementation of the proposed mitigation will reduce the potential impact of project ground-disturbing activities to paleontological resources to a less-than-significant level.

Monitoring

Paleontological monitors would be empowered to redirect and/or halt construction activities at the location of a discovery to review the possible paleontological material and to protect the resource while it is being evaluated. Monitoring should continue at each project site until the supervising qualified paleontologist determines that significant paleontological resources are not likely to be discovered. A supervising qualified paleontologist (Conformable Impact Mitigation Guidelines Committee 1995) may adjust the level of monitoring effort according to his or her evaluation of the impact that project ground-disturbance could have on paleontologically sensitive geologic units within the project area. Directional drilling cannot be directly monitored; however, any spoils that result from directional drilling, or from any other ground-disturbing activities that cannot be directly monitored (core drilling, etc.) should be examined for paleontological resources. Communication protocols would be established between construction supervisors and qualified paleontological monitors prior to project implementation.

Qualified paleontological monitors must be able to (1) recognize and appropriately handle fossils and paleontological deposits; (2) take accurate and detailed field notes, photographs, and GPS coordinates; and (3) record data documenting project ground-disturbing activities, their location, and other relevant information. Relevant activities and observations should be recorded photographically as well. This data will be compiled as a comprehensive database for use in preparation of the data recovery report.

Reporting

A data recovery report should be prepared that documents the methods and results of monitoring and provides an analysis of the nature and significance of fossils recovered during monitoring. At a minimum this report should include the following:

- A brief introduction to the background of the project from which they were recovered;
- An account of the legislative context under which the fossils were recovered and accessioned;
- A description of the project area and location;
- A methods section detailing any background research conducted, monitoring procedures, and fossil recovery techniques;
- A description of the geological and paleontological setting in the project area;
- The results of monitoring activities, including an account of all fossil specimens recovered; and
- A discussion of the significance of the paleontological resources recovered.

Curation of Recovered Fossils

After the data recovery report is prepared, fossil material recovered during project monitoring

activities will be accessioned for curation to a recognized paleontological repository, such as the University of California Museum of Paleontology.

Fossils recovered during monitoring must be prepared for curation prior to accession (Conformable Mitigation Committee 1996). Preparation of fossil specimens for accession must be done according to specifications provided by the repository that will receive the specimens. Preparation and accession requirements vary with each repository and must be met before fossil material can be accessioned. Arrangements to accession fossil material should be made with such a repository before monitoring begins so that the repository can inform the qualified monitoring paleontologist of requirements necessary to accession the fossil material (Conformable Mitigation Committee 1996). The data recovery report (see above) should accompany fossils accessioned for curation.

Unanticipated Discoveries

If paleontological resources are discovered during project activities, all work within 25 feet of the discovery should be redirected and/or halted until a qualified paleontologist has assessed the situation and made recommendations regarding treatment of the resources. Project personnel should not move or collect any paleontological resources.

It is recommended that adverse effects to paleontological resources be avoided by project activities. If avoidance is not feasible, the paleontological resources should be evaluated for their significance. If the resources are not significant, avoidance is not necessary. If the resources are significant, adverse effects must be avoided, or such effects must be mitigated (see above).

Upon completion of project ground-disturbance, a data recovery report should be prepared documenting the methods and results of the assessment. This report should be submitted to the lead agency and to the accredited paleontological repository where the fossils are curated.

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