Appendix 4.10-2:

Paleontological Evaluation Report, Greentree, Vacaville, California

GREENTREE
VACAVILLE, CALIFORNIA

PALEONTOLOGICAL EVALUATION REPORT

SUBMITTED TO
Mr. Mike Loewke
Loewke Planning Associates, Inc.
1907 Vintage Circle
Brentwood, CA 94513

PREPARED BY
ENGEO Incorporated

May 20, 2021

PROJECT NO.
16018.001.001

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Project No.
16018.001.001

May 20, 2021

Mr. Mike Loewke
Loewke Planning Associates, Inc.
1907 Vintage Circle
Brentwood, CA 94513

Subject: Greentree
Leisure Town Road
Vacaville, California

PALEONTOLOGICAL EVALUATION REPORT

Dear Mr. Loewke:

This report has been prepared by or under the supervision of the following Professional Geologist. The Professional Geologist attests to the technical information contained herein and has judged the qualifications of any technical specialists providing geological data upon which paleontological recommendations, conclusions, and decisions are based.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Stephen Blakely, PG

Robert H. Boeche, CEG

sb/rhb/jf

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1.0 INTRODUCTION

1.1 PURPOSE OF STUDY

This Paleontological Evaluation Report (PER) details the results of an assessment of potential impacts to paleontological resources (fossilized remains, traces, or imprints of organisms) associated with earth-moving activities in support of the Greentree project (Project) in Vacaville, California. The purpose of this report is to determine whether paleontological resources are present at the site of the proposed Project and if construction activities would impact those resources, and if adverse impacts to significant resources are identified, to propose mitigation measures.

This report meets all requirements of the National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA), and the standard procedures for mitigating adverse construction-related environmental impacts on paleontological resources established by the Society of Vertebrate Paleontology (SVP 1996, 2010).

1.2 PROJECT LOCATION

The Project is approximately 185 acres in area and is identified as Assessor's Parcel Numbers (APN) 134-020-380, 134-480-110, 133-120-190, 134-020-360, 134-020-240, 134-020-450, 134-020-180, 134-020-460, and 133-120-340. Two known addresses are associated with the site: 640 and 999 Leisure Town Road. The Project is on the site of a former golf course located at the east edge of the Vacaville city limits, just south of Interstate 80. Orange Drive and Leisure Town Road border the northwest and east edges of the site, respectively, while the remaining perimeter is bordered by existing light-commercial and residential structures. The northernmost tip of the site is bordered by a channelized waterway, Horse Creek. A small natural stream, Ulatis Creek, borders the southernmost portion of the Project site. Based on a review of available topographic maps, the existing topography is relatively level, decreasing from approximately elevation 95 feet in the southwest section to approximately elevation 80 feet in the northeast section (WGS84). The site is bisected by Sequoia Drive.

1.3 PROJECT DESCRIPTION

Based on the Greentree Development Project – Project Description Summary dated March 3, 2021, the Project will consist of two distinct neighborhoods. Higher density residential, commercial retail, and a family-oriented park are the primary uses planned north of Sequoia Drive, and detached, single-family senior residential development and a senior-oriented park are the primary proposed uses south of Sequoia Drive (See Exhibit 1.3-1 below). We were provided cut/fill maps prepared by CBG Engineers, dated April 21, 2021, for both the northern and southern portions of the site. We discuss our review of the maps in the following sections.

EXHIBIT 1.3-1: Site Plan

Modified from: Loewke Planning, May 11, 2021

North of Sequoia: The North of Sequoia area is 107½ acres in area and will include six medium- to high-density residential blocks and three commercial blocks. The development will include new roadways, parks, open spaces, and detention/water quality basins. A proposed city sewer pump station is shown in the southeastern portion of the area, and a city well site is shown in the western portion. A review of the North of Sequoia Cut/Fill Map (CBG 2021) indicates cuts/fills up to approximately 12 feet and 11 feet, respectively, with three detention basins planned in the area.

South of Sequoia: The South of Sequoia area is approximately 78 acres in area and will include a total of 199 lots for an active adult residential community. The development will include new roadways, parks, open spaces, and detention/water quality basins. The South of Sequoia Cut/Fill Map (CBG 2021) shows cuts and fills up to approximately 17 feet and 12 feet, and three detention basins planned in that area.

2.0 REGULATORY CONTEXT

Paleontological resources are classified as non-renewable scientific resources and are protected by several federal and state statutes (California State Historic Preservation Office 1983; Marshall 1976; West 1991; Gastaldo 1999), most notably by the 1906 Federal Antiquities Act and other subsequent federal legislation and policies and by the State of California Environmental Quality Act (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts on paleontological resources have been established by the SVP (2010). Design, construction, and operation of the proposed Project need to be conducted in accordance with laws, ordinances, regulations, and standards (LORS) applicable to paleontological resources. Therefore, these LORS are briefly summarized below, together with SVP professional standards.

2.1 FEDERAL LAWS AND REGULATIONS

2.1.1 Antiquities Act of 1906

The Antiquities Act of 1906 (Public Law [P.L.] 59-209; 16 United States Code [USC] 431-433, 34 Statute 225) has been cited in past efforts to protect paleontological resources on federal lands, and requires protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal lands. The Antiquities Act of 1906 forbids

disturbance of any object of antiquity on federal land without a permit issued by the responsible managing agency.

2.1.2 National Environmental Policy Act of 1969

The National Environmental Policy Act of 1969 (NEPA), as amended (USC section 4321 et seq.; 40 CFR section 1502.25) requires federal agencies to consider the impact of their actions (including the issuance of entitlements or permits, or financial support, to a project) on important historic, cultural, and natural aspects of our national heritage.

2.1.3 Paleontological Resources Preservation Act of 2009

The Paleontological Resources Preservation Act (16 USC 470aaa-aaa-11) requires the U.S. Department of Agriculture and the Department of the Interior to manage and protect paleontological resources on Federal land using scientific principles and expertise. The law includes criminal and civil penalties for fossil theft and vandalism on federal lands and provides authority for issuing permits for collecting paleontological resources.

2.2 STATE LAWS AND REGULATIONS

2.2.1 California Environmental Quality Act

Appendix G of the Guidelines provides an Environmental Checklist of questions that a lead agency should normally address if relevant to a project's environmental impacts. One of the questions to be answered in this Environmental Checklist (CCR Section 15063; Appendix G, Section VII, f) is the following: "*Would the project directly or indirectly destroy a unique paleontological resource or site…?*" CEQA Guidelines Section XXI of the Environmental Checklist asks a second question equally applicable to paleontological resources: "*Does the project have the potential to… eliminate important examples of the major periods of California history or pre-history?*" Fossils are important examples of the major periods of California prehistory. To be in compliance with CEQA, environmental impact assessments, statements, and reports must answer both these questions in the Environmental Checklist. If the answer to either question is yes or possibly, a mitigation and monitoring plan must be designed and implemented to protect significant paleontological resources.

The CEQA lead agency that has jurisdiction over a project is responsible to ensure that significant paleontological resources are protected in compliance with CEQA and other applicable statutes. CEQA Section 21081.6 requires that the lead agency demonstrate project compliance with mitigation measures developed during the environmental impact review process.

2.2.2 Public Resources Code Section 5097.5

California Public Resources Code Section 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 and specifies that state agencies may undertake surveys, excavations, or other operations as necessary on publicly owned lands to preserve or record paleontological resources." 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.

Section 30244 requires reasonable mitigation for impacts on paleontological resources where development might adversely impact paleontological resources, as identified by the State Historic Preservation Officer.

2.3 LOCAL LAWS, ORDINANCES AND STATUTES

California Planning and Zoning Law require each county and city jurisdiction to adopt a comprehensive, long-term general plan for its development. The general plan is a policy document designed to give long-range guidance to those making decisions affecting the future character of the planning area. It represents the official statement of the community's physical development as well as its environmental goals. The general plan also acts to clarify and articulate the relationship and intentions of local government to the rights and expectations of the general public, property owners, and prospective investors. Through its general plan, the local jurisdiction informs these groups of its goals, policies, and development standards; thereby communicating what must be done to meet the objectives of the general plan.

Paleontological resources are addressed in the Conservation and Open Space Element of the 2035 Vacaville General Plan under Cultural Resources. The Element identifies that "*The deposits underlying the Vacaville area comprise a variety of rock types dating from various geologic periods, with certain formations containing fossils, some of which may be paleontologically significant.*" The General Plan sets forth the following Goals and Policies in regards to paleontological resources:

- Goal COS-6: Protect and enhance cultural resources for their aesthetic, scientific, educational, and cultural values.
    - Policy COS-P6.4: Requires that if cultural resources, including archaeological or paleontological resources, are uncovered during grading or other on-site excavation activities, construction shall stop until appropriate mitigation is implemented.
    - Policy COS-P6.5: Requires that any archaeological or paleontological resources on a development project site be either preserved in their sites or adequately documented as a condition of removal. When a development project has sufficient flexibility, avoidance and preservation of the resource shall be the primary mitigation measure, unless the City identifies superior mitigation. If resources are documented, coordinate with descendants and/or stakeholder groups, as warranted.

2.4 PROFESSIONAL STANDARDS

The SVP, a national scientific organization of professional vertebrate paleontologists, has established standard procedures (SVP 2010) that outline acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Most practicing professional paleontologists in the nation adhere closely to the SVP's assessment, mitigation, and monitoring requirements as specifically spelled out in its standard procedures. The SVP's standard procedures were approved by a consensus of professional paleontologists and are the standard against which the adequacy of all paleontological monitoring and mitigation programs are judged. Many federal and state regulatory agencies have either formally or informally adopted the SVP's "standard procedures" for the mitigation of construction-related adverse impacts on paleontological resources, including both federal (FERC, USFS, BLM, NPS, etc.) and state agencies (CEC, CPUC, Caltrans, etc.).

Briefly, SVP standard procedures require that each project have literature and museum archival reviews, a field survey, and, if there is a high potential for disturbing significant fossils during project construction, a mitigation plan that includes monitoring by a qualified paleontologist to salvage fossils encountered, identification of salvaged fossils, determination of their significance, and placement of curated fossil specimens into a permanent public museum collection (such as the designated California state repository for fossils, the University of California Museum of Paleontology [UCMP]).

3.0 PALEONTOLOGICAL POTENTIAL/SENSITIVITY

The SVP (2010), in common with other environmental disciplines such as archaeology and biology (specifically in regard to listed species), considers any vertebrate fossil specimen significant, unless demonstrated otherwise, and, therefore, protected by environmental statutes. This position is held because vertebrate fossils are uncommon and only rarely will a fossil locality yield a statistically significant number of specimens representing the same species. In fact, vertebrate fossils are so uncommon that, in many cases, each fossil specimen found will provide additional important information about the characteristics or distribution of the species it represents.

A stratigraphic unit (such as a formation, member, or bed) known to contain significant fossils is considered to be "sensitive" to adverse impacts if there is a high probability that earth-moving or ground-disturbing activities in that rock unit will either disturb or destroy fossil remains. This definition of sensitivity differs fundamentally from that for archaeological resources.

"*It is extremely important to distinguish between archaeological and paleontological resources when discussing the paleontological potential of rock units. The boundaries of archaeological resource site define the areal/geographic extent of an archaeological resource, which is generally independent from the rock unit on which it sits. However, paleontological sites indicate that the containing rock unit or formation is fossiliferous. Therefore, the limits of the entire rock unit, both areal and stratigraphic, define the extent of paleontological potential*" (SVP 2010).

This distinction between archaeological and paleontological sites is important. Most archaeological sites have a surface expression that allow for their geographic location. On the other hand, fossils are an integral component of the rock unit below the ground surface, and, therefore, are not observable unless exposed by erosion or human activity. Thus, a paleontologist cannot know either the quality or quantity of fossils present before the rock unit is exposed as a result of natural erosion processes or earth-moving activities. The paleontologist can only make conclusions on sensitivity to impact based upon what fossils have been found in the rock unit in the past, along with a judgment on whether or not the depositional environment of the sediments that compose the rock unit was likely to result in the burial and preservation of fossils.

Fossils are seldom uniformly distributed within a rock unit. Most of a rock unit may lack fossils, but at other locations within the same rock unit concentrations of fossils may exist. Even within a fossiliferous portion of the rock unit, fossils may occur in local concentrations. Since it is unfortunately not possible to determine where fossils are located without actually disturbing a rock unit, monitoring of excavations by an experienced paleontologist during construction increases the probability that fossils will be discovered and preserved.

Using SVP (2010) criteria, the paleontological importance or potential (high, low, undetermined, or no potential) of each rock unit exposed in a project site or surrounding area is the measure

most amenable to assessing the significance of paleontological resources because the areal distribution of each rock unit can be delineated on a topographic or geologic map. The paleontological sensitivity of a stratigraphic unit reflects: (1) its potential paleontological productivity (and thus sensitivity), and (2) the scientific significance of the fossils it has produced. This method of paleontological resources assessment is the most appropriate because discrete levels of paleontological importance can be delineated on a topographic or geologic map.

3.1 SVP CATEGORIES OF PALEONTOLOGICAL POTENTIAL OF ROCK UNITS

In its standard procedures for assessment and mitigation of adverse impacts to paleontological resources, the SVP (2010) established four categories of paleontological potential for rock units: high, low, undetermined, and no potential, which are defined in Table 3.1-1 below.

TABLE 3.1-1: SVP Paleontological Potential

SVP SENSITIVITY DESIGNATION	CHARACTERISTICS OF GEOLOGIC UNITS IN THIS CATEGORY
High Potential	Rock units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources. Rocks units classified as having high potential for producing paleontological resources include, but are not limited to, sedimentary formations and some volcaniclastic formations (e. g., ashes or tephras), and some low-grade metamorphic rocks which contain significant paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Paleontological potential consists of both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, plant, or trace fossils and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data. Rock units which contain potentially datable organic remains older than late Holocene, including deposits associated with animal nests or middens, and rock units which may contain new vertebrate deposits, traces, or trackways are also classified as having high potential.
Undetermined Potential	Rock units for which little information is available concerning their paleontological content, geologic age, and depositional environment are considered to have undetermined potential. Further study is necessary to determine if these rock units have high or low potential to contain significant paleontological resources. A field survey by a qualified professional paleontologist to specifically determine the paleontological resource potential of these rock units is required before a paleontological resource impact mitigation program can be developed. In cases where no subsurface data are available, paleontological potential can sometimes be determined by strategically located excavations into subsurface stratigraphy.
Low Potential	Stratigraphic units that are not sedimentary in origin or that have not been known to produce fossils in the past are considered to have low sensitivity. Rock units with low potential typically will not require impact mitigation measures to protect fossils.
No Potential	Some rock units, such as plutonic igneous rocks or high-grade metamorphic rocks, have no potential to produce fossils. Rock units with no potential require no protection nor impact mitigation measures relative to paleontological resources.

4.0 RESOURCE CONTEXT

4.1 REGIONAL GEOGRAPHIC AND GEOLOGIC SETTING

The site is located within the Coast Ranges Geomorphic Province. The Coast Range Geomorphic Province consists of a complex series of mountain ranges and alluvial-filled basins that lie approximately parallel to the California coast and the San Andreas Fault System. This province owes much of its physiographic character to the San Andreas Fault system where two adjoining tectonic plates that form the Earth's surface, the Pacific plate on the west and the North American plate on the east, are moving past each other in opposing directions. Diverse crustal movements within this tectonic framework are responsible for the morphology of the area. Bedrock in the region has been folded and faulted during regional uplift beginning in the Pliocene period, about 4 million years before present.

More specifically, the site is located near the eastern margin of the Coast Ranges, where the topographic relief that characterizes the physiographic province begins to give way to the much lower relief of the Great Valley Geomorphic Province. The Great Valley is an elongate, northwest-trending structural trough bound by the Coast Ranges on the west and the Sierra Nevada on the east. The Great Valley has been and is presently being filled with sediments primarily derived from surrounding mountain ranges.

Geological materials underlying the Project site consist of sedimentary deposits ranging in age from Pleistocene to recent overlying Neogene age bedrock (Graymer et al. 2002). Geologic units mapped at the site include Pleistocene alluvium (Modesto Formation) and unnamed Holocene alluvial, levee, or channel deposits. The bedrock underlying the site is mapped as Tehama Formation, which is an extensive sedimentary deposit recording deposition from erosion of the Coast Ranges during the Pliocene.

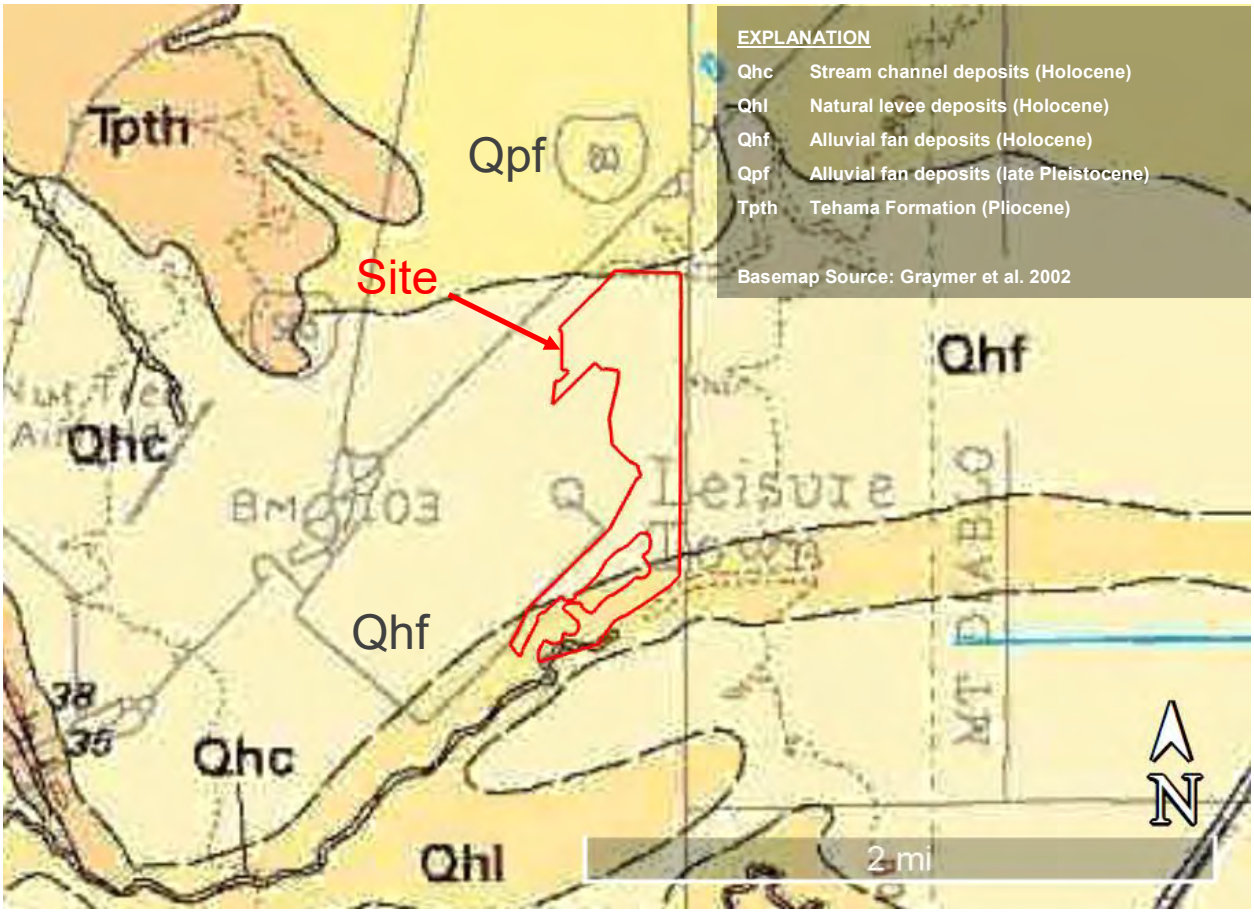
4.2 SITE GEOLOGY

A review of the preliminary geotechnical report for the site (ENGEO 2019) and available geologic maps indicates the site is underlain by Quaternary alluvium. Regional mapping by Graymer et al. (2002) shows the site as underlain by Holocene alluvial fan deposits, with Holocene natural levee and Holocene stream channel deposits crossing the southern portion of the site. The northernmost boundary of the site is mapped as late Pleistocene alluvial fan deposits, which are correlative with the late Pleistocene Modesto Formation. These deposits, while mapped at the site boundary, likely underlie the younger Holocene deposits across the site at variable depth. The Pliocene Tehama Formation is also mapped a little over ½ mile to the northeast of the site and 2½ miles to the southeast. This sedimentary rock unit underlies younger Pleistocene and Holocene alluvial deposits in the region.

Review of geologic maps and test pit logs and cone penetration test (CPT) soundings from previous explorations at the site indicated that the top of the Modesto Formation occurs at or near the surface in the northern portion of the site, and increases in depth to the south to over 20 feet below the ground surface. None of the test pits or CPTs appeared to encounter the Tehama Formation, to the maximum exploration depth of 50 feet below ground surface, although the contact elevation is likely variable. As the Tehama Formation will not be impacted by Project construction, it will not be discussed further in this report.

Exhibit 4.2-1 shows the regional geology as mapped by Graymer et al. (2002). A description of the underlying major strata follows.

EXHIBIT 4.2-1: Project Mapped Geology



4.2.1 Quaternary Stream Channel Deposits

Quaternary stream channel deposits (Qhc) are mapped along Ulatis Creek at the southernmost boundary of the site. These Holocene-age deposits are loose sand, gravel, and cobbles with minor clay and silt deposited within active, natural stream channels (Graymer et al. 2002). The sediment is derived from upland areas within the local water shed.

4.2.2 Quaternary Natural Levee Deposits

Quaternary natural levee deposits (Qhl) are Holocene-age overbank deposits that occur flanking streams, from deposition during flood events. These deposits consist of moderately to well-sorted sand with some silt and clay and are often identified by their low, channel-parallel ridge geomorphology (Graymer et al. 2002). Within the site, these deposits are mapped flanking Ulatis Creek in the southern portion of the Project.

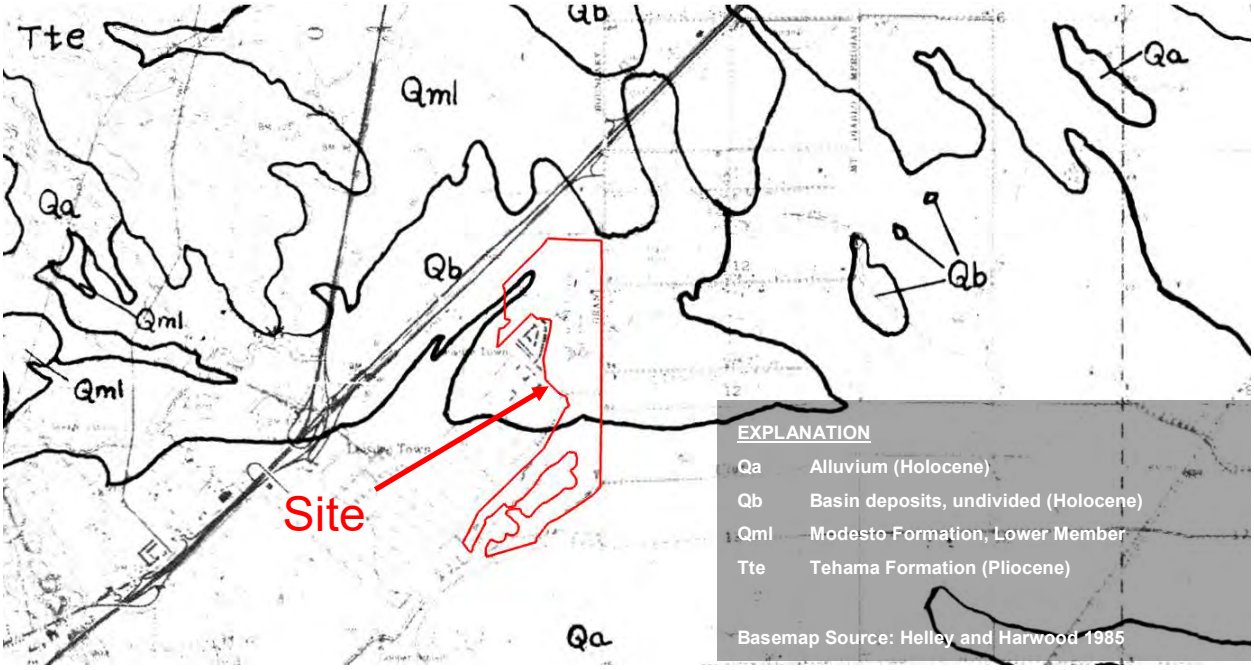
4.2.3 Quaternary Alluvial Fan Deposits (Holocene)

Quaternary alluvial fan deposits (Holocene; Qhf) are Holocene-age deposits consisting of moderately to poorly sorted and moderately to poorly bedded sand, gravel, silt, and clay deposited where streams emanate from upland regions onto more gently sloping valley floors or plains (Graymer et al. 2002). Holocene alluvial fan deposits are mostly undissected by later erosion. These deposits are mapped across the majority of the site.

4.2.4 Quaternary Alluvial Fan Deposits (Late Pleistocene)

Quaternary alluvial fan deposits (late Pleistocene; Qpf) are described as poorly sorted, moderately to poorly bedded sand, gravel, silt, and clay deposited in gently sloping alluvial fans (Graymer et al. 2002), and are correlative to the late Pleistocene Modesto Formation of Helley and Harwood (1985) and others.

EXHIBIT 4.2.4-1: Helley and Harwood (1985) Mapping.



The late Pleistocene Modesto Formation was first named by Davis and Hall (1959), who designated a type section along the Tuolumne River near the City of Modesto. The Modesto Formation is composed of interbedded, largely unconsolidated and poorly sorted, buff to yellowish brown sandstone and siltstone with lesser amounts of pebble to cobble conglomerate. Aeolian dune sand deposits were reported at the top of the Modesto Formation (Marchand and Allwardt 1981, Atwater 1982). Marchand and Allwardt (1981) estimated the age of the Modesto Formation to be between about 42,400 and 12,000 years BP (late Pleistocene), although the uppermost Modesto may have an earliest Holocene age (Janda and Croft 1967, Croft 1972).

These sediments represent alluvium that was deposited on the valley floor of the Sacramento and San Joaquin valleys (Marchand and Allwardt 1981). Sedimentation within the Modesto Formation is related to glacial cycles and shows two distinct periods of deposition. Large deposits of alluvium are deposited at the end of a glacial maximum as the glaciers retreat and glacial till is re-deposited as coarser sediments at the mountain front and fine-grained sediment on the valley floor. The

deposits of coarser alluvium along the mountain front are eroded during the interglacial periods and are transported by wind and water to the valley floor as silt, clay, and dune sands.

Quaternary alluvial fan deposits (late Pleistocene) are mapped at the surface immediately north of the Project (e.g., Graymer et al. 2002), and underlie the younger Holocene deposits throughout the Project area at depths ranging from approximately 3½ to 22 feet below ground surface (ENGEO 2019). The contact between the Holocene deposits and the late Pleistocene alluvial fan deposits can generally be identified by an increase in cementation and consolidation of the sediments, and an increase in cone tip resistance and sleeve friction ratio in CPTs. These deposits are about 10% denser and have 50% greater penetration resistance than unit Qhf (Clahan et al. 2000 in Graymer et al. 2002).

4.3 PROJECT PALEONTOLOGICAL RESOURCES

No vertebrate fossil localities are known from the Project footprint. However, one of the units that could potentially be impacted by Project excavations has produced vertebrate, invertebrate, plant, and other fossils elsewhere in the region. Table 4.3-1 summarizes the paleontological potential of each geologic unit found at the site, and each unit is discussed in Sections 4.3.1 through 4.3.4.

TABLE 4.3-1: Paleontological Potential of geologic units found within the Project area.

GEOLOGIC UNIT	AGE	KNOWN PALEONTOLOGIC RESOURCES	SVP CATEGORY
Quaternary stream channel deposits (Qhc)	Holocene	No known resources	Low potential
Quaternary natural levee deposits (Qhl)	Holocene	No known resources	Low potential
Quaternary alluvial fan deposits (Qhf)	Holocene	No known resources	Low potential
Quaternary alluvial fan deposits (Qpf) / Modesto Formation	late Pleistocene	Vertebrates, invertebrates, plants, microfossils	High potential

4.3.1 Quaternary Stream Channel Deposits (Qhc)

Quaternary stream channel deposits are actively being deposited and are representative of the current depositional regime. As such, they are too young to contain fossils. These deposits, therefore, are assigned a low potential using SVP (2010) criteria.

4.3.2 Quaternary Natural Levee Deposits (Qhl)

Quaternary natural levee deposits, similar to Quaternary stream channel deposits, are too young to contain fossils, and are assigned a low potential using SVP (2010) criteria.

4.3.3 Quaternary Alluvial Fan Deposits (Qhf)

Alluvial fan deposits are known to commonly contain plant and invertebrate remains; however, Holocene-age sediments are typically too young to contain significant fossils. Due to their young age and the lack of significant fossils previously encountered within this unit, a low potential rating is assigned using SVP (2010) criteria.

4.3.4 Quaternary Alluvial Fan Deposits (Qpf) / Modesto Formation

The Modesto Formation has yielded abundant fossilized remains of late Pleistocene animals and plants from many sites across the Central Valley (Marchand and Allwardt 1981, UCMP online database). Vertebrate remains salvaged from the Modesto Formation include bison, horse, camel, mammoth, ground sloth, tapir, reptiles, and various rodents (Jefferson 1991, UCMP online database). Fossilized wood, trace fossils, and calcified root casts (Marchand and Allwardt 1981, UCMP online database) have also been reported from the Modesto Formation.

The UCMP database also contains reference to several Pleistocene fossil localities that are unassigned to specific geologic formations. These localities include specimens of mammoth, camel, horse, rodents, and invertebrate fossils.

Because the Modesto Formation has previously produced abundant vertebrates and other types of fossils, it is assigned a high potential using SVP (2010) criteria. Any additional fossils discovered in this stratigraphic unit during Project excavations could be highly significant.

5.0 IMPACT ANALYSIS

5.1 BASELINE CONSIDERATIONS

Pleistocene-aged sedimentary deposits of the Modesto Formation have produced significant fossils at numerous localities throughout their geographic extent. The presence of these fossil localities suggests that this geologic unit and sedimentary deposits have the potential to produce additional similar fossil remains during excavations within them. Therefore, they possess high sensitivity and additional identifiable fossil remains recovered from these sediments could be significant and scientifically important.

5.2 DEFINITION OF SIGNIFICANCE FOR PALEONTOLOGICAL RESOURCES

The SVP (2010) defines significant paleontological resources as “fossils and fossiliferous deposits, here defined as consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years).” According to the SVP’s definition, fossils may be considered to be significant if one or more of the following criteria apply.

1. The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct.

2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein.

3. The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas.

4. The fossils demonstrate unusual or spectacular circumstances in the history of life.

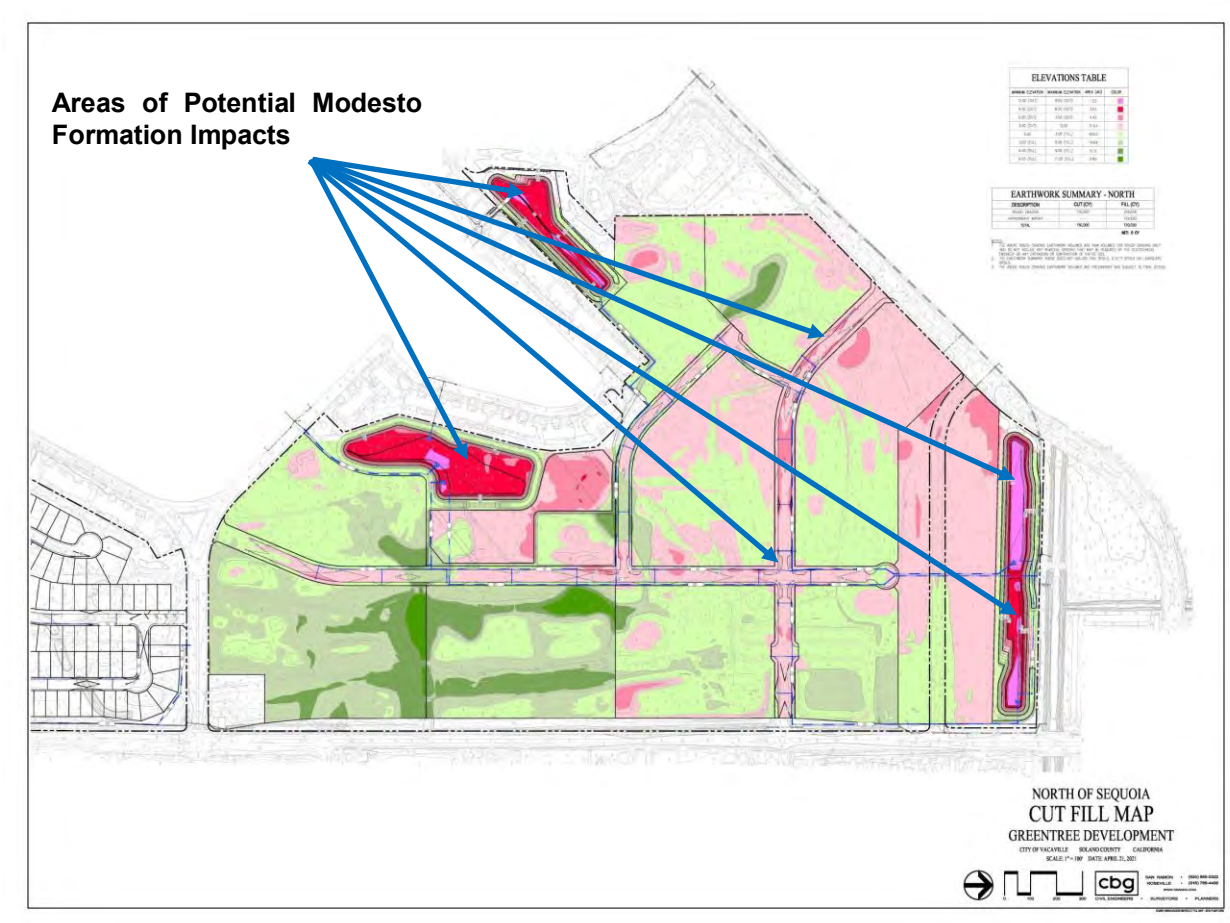
5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

5.3 SIGNIFICANCE EVALUATION

As stated previously, the Modesto Formation has produced significant fossils at numerous localities. Thus, fossil remains recovered from those sediments during construction of the proposed Project could also be significant and scientifically important. However, the potential to impact paleontological resources depends on the depths of proposed earthwork and excavations, previous site disturbances, and the presence of non-fossiliferous sediment. Quaternary stream channel deposits, natural levee deposits, and alluvial fan deposits (Holocene) will be impacted, but have a low potential to contain significant paleontological resources.

North of Sequoia – In the North of Sequoia area, the Modesto Formation is expected to be found in the shallow subsurface, from within a few feet of the surface in the northern portion and deepening to the south. Excavations for the detention basins will likely impact sediment of the Modesto Formation in the North of Sequoia area, as will excavations for some of the deeper underground utilities.

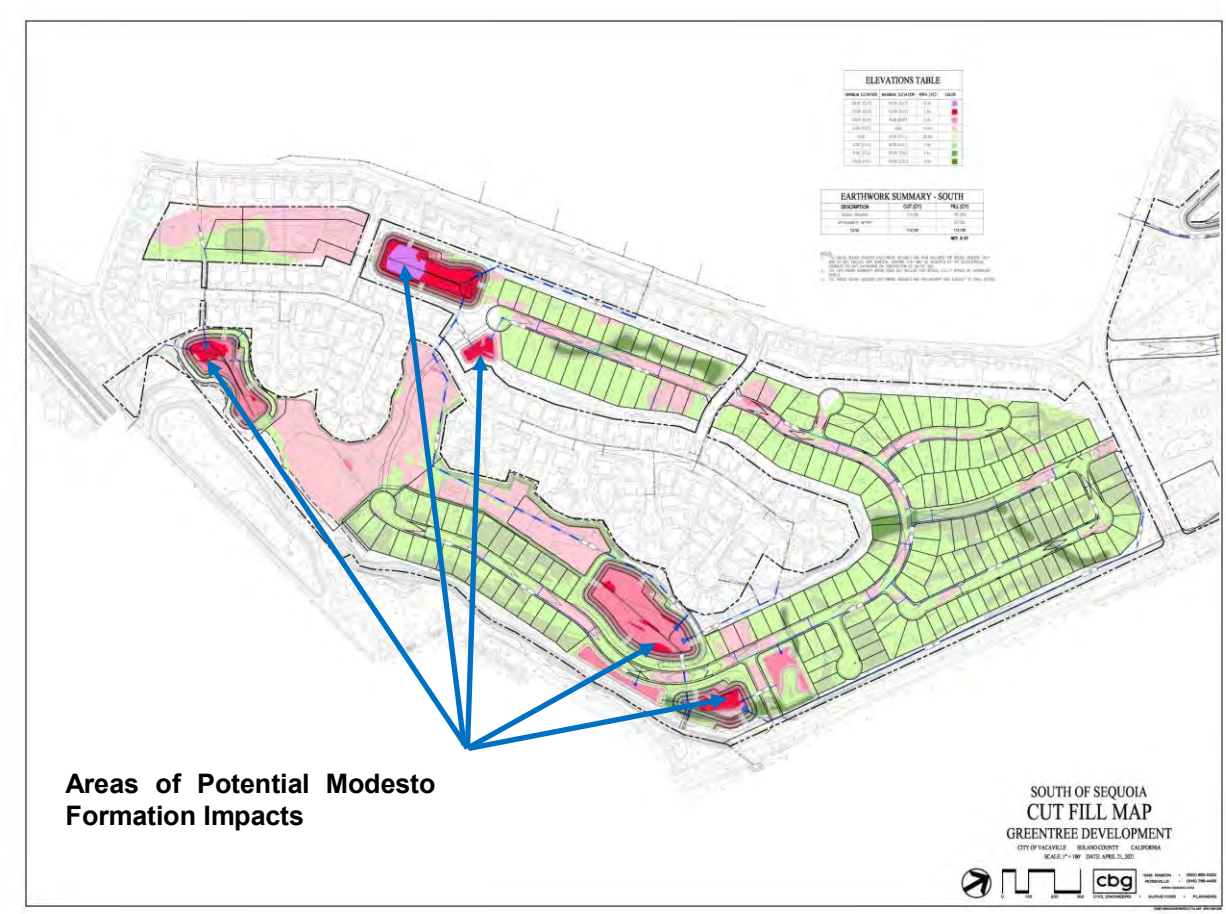
EXHIBIT 5.3-1: North of Sequoia Cut/Fill Map



Modified from: CBG Civil Engineers, April 21, 2021.

South of Sequoia - In the South of Sequoia area, the Modesto Formation is expected to be found at depths from 10 to over 20 feet. The deepest excavations (up to approximately 17 feet below ground surface) shown on the South of Sequoia Cut/Fill Map are located in the southern portion of the area, where the Modesto Formation contact is expected to be the deepest; however, the contact depth will likely vary from location to location. As such, excavations over 10 feet deep may impact the Modesto Formation in the South of Sequoia area.

EXHIBIT 5.3-2: South of Sequoia Cut/Fill Map



Modified from: CBG Civil Engineers, April 21, 2021.

Table 5.3-1 summarizes Project-related excavations that will likely impact paleontologically sensitive geologic units.

TABLE 5.3-1: Summary of Project Excavations Impacting Sensitive Geologic Units

PROJECT FEATURE	EXCAVATION ACTIVITY	GEOLOGIC UNIT
North of Sequoia - Excavation for Stormwater Detention Basins	Open Excavations, Grading	**Pleistocene Modesto Formation**
North of Sequoia - Excavation for Deep Utilities	Trenching	**Pleistocene Modesto Formation**
South of Sequoia - Excavation for Stormwater Detention Basins	Open Excavations, Grading	**Pleistocene Modesto Formation**

Note: Excavation types may vary and may change during the Design-Build process.

6.0 RECOMMENDED MITIGATION MEASURES

This section describes proposed mitigation measures that could be implemented to reduce potentially significant impacts to potentially occurring sensitive resources to a less-than-significant level resulting from Project construction. As recommended by the SVP standard procedures (SVP 2010), excavation activities that will impact geologic units with a high sensitivity/potential rating require mitigation. The mitigation measures proposed below are consistent with SVP standard procedures for mitigating adverse construction-related impacts on paleontological resources (SVP 1996, 2010).

We recommend the following mitigation measures be applied to this Project.

6.1 RETAIN A PROJECT PALEONTOLOGIST

Prior to the start of ground disturbance, a qualified professional paleontologist should be retained to both design a monitoring and mitigation program and implement the program during Project-related excavation and earth disturbance activities. The paleontological resource monitoring and mitigation program should include preconstruction coordination; construction monitoring; emergency salvage procedures; sampling and data recovery, if needed; preparation, identification, and analysis of the significance of fossil specimens salvaged, if any; museum storage of any specimens and data recovered; and reporting.

6.2 WORKER TRAINING

Prior to the start of ground disturbance, construction personnel to be involved with earth-moving activities should be informed that fossils could be discovered during excavating and that these fossils are protected by laws, on the appearance of common fossils, and on proper notification procedures should fossils be discovered. This worker training should be prepared and presented by a qualified professional paleontologist.

6.3 MONITORING

Earth-moving activities in areas expected to impact sediments of the Pleistocene Modesto Formation, as detailed in Section 5.3, should be monitored and inspected for the presence of potentially fossiliferous sediments by a qualified field paleontologist. Monitoring will not need to be conducted in sediments that have been previously disturbed or in areas where exposed sediments will be buried, but not otherwise disturbed. A monitor should be present during actual earth moving during the first few days of initial Project grading to observe the stratigraphy and any fossils exposed by excavations. If no significant fossils are discovered during this time, monitoring can be reduced, at the discretion of the Project paleontologist, to only periodic spot checking of the deepest excavations or those judged most likely to disturb fossils. Should fossils be discovered, increased monitoring should occur to protect the resource.

6.4 SALVAGE AND TREATMENT OF FOSSILS DISCOVERED

Any paleontological materials exposed during Project excavations should be salvaged and treated as described by SVP (2010). This treatment shall include preparation, identification, determination of significance, and curation into a public museum. Should sediments be discovered during monitoring that may yield microvertebrate fossils, sediment samples should be wet screened

(either on- or off-site) to recover a representative sample of the microvertebrates present per SVP standard procedures (SVP 2010).

6.5 PALEONTOLOGICAL MITIGATION REPORT

Following the end of Project excavations, a final Paleontological Mitigation Report should be prepared by the Project Paleontologist, summarizing the complete mitigation program, describing and illustrating any fossils recovered, along with their significance, and certifying that the paleontological resource impact mitigation program resulted in insignificant impacts on paleontological resources as required by CEQA. The acceptance of the final report by the lead agency shall complete the mitigation program.

Implementation of these mitigation measures will reduce the potentially significant adverse environmental impact of Project-related ground disturbance and earth-moving on paleontological resources to an insignificant level as required by CEQA by allowing for the salvage of fossil remains and associated specimen data and corresponding geologic and geographic site data that otherwise might be lost to earth-moving and to unauthorized fossil collecting.

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APPENDIX A

PREPARER QUALIFICATIONS

EDUCATION
Bachelors Geology
University of California at Davis

EXPERIENCE
Years with ENGEO: 3
Years with Other Firms: 11

REGISTRATIONS & CERTIFICATIONS
Nuclear Gauge Operator, CA 18541

Professional Geologist, CA 9808

Hazmat Certified as Required by USDOT and IATA, CA

40 Hour HAZWOPER Training, CA 1901111264280

ACI Concrete Field Testing Technician–Level 1, CA

Caltrans 375 Relative Compaction (AC), CA

Caltrans 231 Relative Compaction (Soil), CA

SPECIALIZATIONS
- Paleontological Assessment and Mitigation
- Geological Mapping and Exploration
- Environmental Site Assessment

AFFILIATIONS
Society of Vertebrate Paleontology

Geological Society of America

Association of Engineering Geologist

STEPHEN J. BLAKELY, PG
Project Geologist

Since joining ENGEO in 2017, Stephen has been performing environmental assessments, performing geological and geotechnical studies, and implementing paleontological resource studies. Prior to joining ENGEO, Stephen worked primarily in paleontological resource mitigation, particularly during CEQA and NEPA environmental review. With over twelve years of experience working in all aspects of mitigation paleontology, his duties included the management of paleontological resource impact assessment and mitigation projects, planning and leading field surveys, and writing technical reports. Additionally, he has been the lead monitor on numerous paleontological mitigation programs, and personally or as part of a monitoring team, salvaged hundreds, if not thousands, of paleontological resources from hundreds of localities throughout the states of California and Nevada.

SELECT PROJECT EXPERIENCE

Sacramento Commons—Sacramento, CA
Project Geologist. Stephen served as the project paleontologist and implemented the paleontological mitigation plan. As part of the plan, he coordinated mitigation activities, prepared and administered a paleontological resource environmental awareness training program, and performed site inspections. The project is a major redevelopment project in downtown Sacramento, involving the construction of several mid- and high-rise structures.

Candlestick Point Redevelopment—San Francisco, CA
Staff Paleontologist. Stephen monitored construction activities, administered environmental awareness training, salvaged fossils, prepared fossils for preservation and museum accessioning in a laboratory setting, and aided in preparation of the Paleontological Mitigation Report. The project involved the redevelopment of Candlestick Point with major grading that required paleontological mitigation.

706 Mission Street Project—San Francisco, CA
Staff Paleontologist. Stephen monitored construction activities, administered environmental awareness training, salvaged fossils, prepared fossils for preservation and museum accessioning in a laboratory setting, and aided in preparation of the Paleontological Mitigation Report. The project consisted of the construction of a 43-story high-rise building and involved foundation excavations to over 260 feet that had the potential to impact sensitive paleontological resources.

1545 Pine Street Mixed-Use Project—San Francisco, CA
Staff Paleontologist. Stephen monitored construction activities, administered environmental awareness training, and aided in preparation of the Paleontological Mitigation Report. The project consisted of the construction of a 12-story high-rise building and involved foundation excavations that impacted the fossiliferous Colma Formation.

State Route 99 Arboleda Drive Freeway Project—Merced County, CA
Lead Paleontological Monitor. Stephen led the field team on this major highway project. He coordinated monitoring and fossil salvage activities, monitored construction activities, administered environmental awareness training, salvaged hundreds of vertebrate fossils, prepared fossils for preservation and museum accessioning in a laboratory setting, and prepared the Paleontological Mitigation Report.

Plainsburg at State Route 99 Project—Merced County, CA
Staff Paleontologist. Stephen monitored construction activities, administered environmental awareness training, salvaged hundreds of vertebrate fossils, prepared fossils for preservation and museum accessioning in a laboratory setting, and prepared the Paleontological Mitigation Report for this major highway project.

Kettleman Hills B-18 Expansion Project—Kings County, CA
Staff Paleontologist. Stephen performed on-call mitigation at the Kettleman Hills Facility for several years, performed site investigations and assessments, monitored construction activities, administered environmental awareness training, salvaged fossils, prepared fossils for preservation and museum accessioning in a laboratory setting, and prepared the Paleontological Mitigation Report. The Kettleman Hills Facility is a hazardous waste treatment and storage facility that is situated amidst some of the most fossiliferous Pliocene deposits in the country.

Gunslinger Project—Elk Hills Oil Field, Kern County CA
Project Manager/Staff Paleontologist. Stephen served as project manager and lead monitor during paleontological mitigation for the Non-Unit Gunslinger Project in the Elk Hills Oil Field. He prepared mitigation plan documents, administered worker environmental training, monitored excavations during well field/pad grading, and prepared the final Paleontological Mitigation Report.

Hydrogen Energy California Project—Kings County, CA
Project Manager/Staff Paleontologist. Stephen served as project manager for the paleontological impact assessment of this proposed hydrogen energy plant. He prepared budgets, organized and lead field surveys, performed records and literature reviews, and prepared both technical reports and resource sections for the application for certification and NEPA/CEQA EIR/EIS.

California High Speed Rail Fresno to Bakersfield Project—CA
Staff Paleontologist. Stephen prepared the paleontological resources technical evaluation for the Fresno to Bakersfield Segment of the CA HSR. His duties included coordinating, planning, and leading the paleontological resource survey, conducting and tracking the geological and paleontological literature review, and preparing the technical report for this approximately 114-mile segment of the CA HSR.

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