Paleontological Resource Assessment for 407 Spreckels Avenue City of Manteca, San Joaquin County, California

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MANAGEMENT SUMMARY

Applied EarthWorks, Inc. (Æ), at the request of T&B Planning, Inc., assessed the potential for impacts to significant paleontological resources for the 407 Spreckels Avenue Project in the city of Manteca, San Joaquin County, California (Project). The Project involves development of a 14.83-acre vacant lot for construction purposes within Assessor's Parcel Number 221-250-350, west of Spreckels Avenue and south of Norman Drive. The proposed Project includes the construction of a warehouse and distribution center with a modern 289,499 square foot warehouse and office building with 46 loading docks, approximately 184 parking spaces (of which 8 would be accessible parking spaces), and 8 electric vehicle stalls at the time of Project opening, with 69 capable stalls to accommodate future demand. The anticipated depth of construction is 15 feet below surface. Æ prepared this Paleontological Resource Assessment (PRA) in partial satisfaction of California Environmental Quality Act (CEQA) requirements. The City of Manteca is the lead agency for CEQA compliance.

This PRA was completed from a combination of desktop studies and fieldwork. The desktop studies included a review of published and unpublished literature and maps, as well as museum records searches. The purpose of these studies was to identify the geologic units in the Project area and to determine whether previously recorded paleontological localities are found either within the Project area or within the same geologic units nearby but outside the Project area. As a result of the desktop studies and fieldwork, Æ has determined that the Project area has High Sensitivity based on the Society of Vertebrate Paleontology's sensitivity rankings.

Æ recommends preparation of a Paleontological Resource Impact Mitigation Program (PRIMP) by a qualified professional paleontologist (Paleontological Principal Investigator, Project Paleontologist) as defined by mitigation paleontology industry standards and/or the Society of Vertebrate Paleontology. The PRIMP will specify the steps to be taken to mitigate impacts to paleontological resources. For instance, Worker's Environmental Awareness Program training should be prepared prior to the start of Project-related ground disturbance and presented in person to all field personnel to describe the types of paleontological resources that may be found and the procedures to follow if any are encountered. The PRIMP also will include a monitoring plan that indicates where construction monitoring will be required and the frequency of required monitoring (i.e., full-time, spot-checks, etc.) to ensure adverse impacts to paleontological resources will be reduced to a less-than-significant level in accordance with CEQA.

CONTENTS

1 INTRODUCTION 1
- 1.1 PROJECT DESCRIPTION 1
- 1.2 PURPOSE OF INVESTIGATION 1
- 1.3 KEY PERSONNEL 4
- 1.4 REPORT ORGANIZATION 4

2 REGULATORY ENVIRONMENT 5
- 2.1 STATE 5
  - 2.1.1 California Environmental Quality Act 5
  - 2.1.2 CEQA Implementation 5
- 2.2 LOCAL 6
  - 2.2.1 San Joaquin County 6
  - 2.2.2 City of Manteca 6

3 PALEONTOLOGICAL RESOURCE ASSESSMENT GUIDELINES 8
- 3.1 DEFINITION OF PALEONTOLOGICAL RESOURCES AND SIGNIFICANCE CRITERIA 8
- 3.2 PROFESSIONAL STANDARDS AND CLASSIFICATION OF PALEONTOLOGICAL RESOURCE SENSITIVITY 8

4 METHODS 10
- 4.1 LITERATURE REVIEWS AND MUSEUM RECORDS SEARCHES 10
- 4.2 FIELD SURVEY 10

5 GEOLOGY AND PALEONTOLOGY 11
- 5.1 REGIONAL GEOLOGY 11
- 5.2 GEOLOGY AND PALEONTOLOGY OF THE PROJECT AREA 11
  - 5.2.1 Modesto Formation (Qmu) 12

6 RESULTS AND ANALYSIS 14
- 6.1 GEOTECHNICAL REPORT 14
- 6.2 RECORDS SEARCHES 14
- 6.3 FIELD SURVEY RESULTS 14
- 6.4 DETERMINATION OF PALEONTOLOGICAL RESOURCE POTENTIAL WITHIN THE PROJECT AREA 16

7 RECOMMENDATIONS 18

8 REFERENCES CITED 19

APPENDIX A: Qualifications of Key Personnel

FIGURES AND TABLE

Figure 1-1 Project vicinity in San Joaquin County, California....2
Figure 1-2 Project location on USGS Manteca 7.5-minute topographic quadrangle....3
Figure 5-1 Geologic map for the Project area and vicinity....13
Figure 6-1 Overview of the Project area from the northwest corner, facing southeast....15
Figure 6-2 East end of the Project area adjacent to Spreckels Avenue, facing north....15
Figure 6-3 Representative view of 75 percent ground visibility within the northern third of the Project area, facing east....16
Figure 6-4 Paleontological sensitivity of the Project area....17

Table 3-1 Paleontological Sensitivity Classifications....9

1
INTRODUCTION

Applied EarthWorks, Inc. (Æ), at the request of T&B Planning, Inc., assessed the potential for impacts to significant paleontological resources for the 407 Spreckels Avenue Project (Project) in the city of Manteca, San Joaquin County, California. Æ prepared this Paleontological Resource Assessment (PRA) in partial satisfaction of California Environmental Quality Act (CEQA) requirements. The City of Manteca (City) is the lead agency for CEQA compliance.

1.1 PROJECT DESCRIPTION

The Project area is in the central portion of the city of Manteca, in San Joaquin County (Figure 1-1). Specifically, the Project area is west of Spreckels Avenue and south of Norman Drive. The Project area is mapped in the northwest quarter of Section 3 and the northeast quarter of Section 4 in Township 2 South, Range 7 East, as shown on the U.S. Geological Survey (USGS) Manteca 7.5-minute topographic quadrangle map (Figure 1-2). It should be noted, however, that Figure 1-2 shows Spreckels Road before the realignment and name change to Spreckels Avenue.

T&B Planning (Applicant) is applying for a Conditional Use Permit and Site Plan Review from the City for the Project. The Project Applicant plans to redevelop the Project site with a modern 289,499 square foot, 30-foot-tall warehouse and office building with 46 loading docks, approximately 184 parking spaces (of which 8 would be accessible parking spaces), and 8 electric vehicle stalls at the time of Project opening, with 69 capable stalls to accommodate future demand. Of the total square footage for the building, the Project would allocate 279,499 square feet for warehouse and distribution and 10,000 square feet for office uses. The anticipated depth of construction is 15 feet. Currently, the Project site is vacant and undeveloped, consisting primarily of ruderal vegetation, which appears to be regularly disked, with six trees in the northwest corner of the site. An 8-foot tall, solid sound wall extends along the western site boundary, and the Manteca Tidewater Bikeway extends along the eastern site boundary.

1.2 PURPOSE OF INVESTIGATION

This PRA is designed to accomplish several goals: (1) identify the geologic units within the Project area and assess their paleontological resource potential; (2) determine whether the Project has the potential to adversely impact scientifically significant paleontological resources; (3) provide Project-specific management recommendations for paleontological resources, as necessary; and (4) demonstrate compliance with state laws and local regulations. Section 1.4 describes the ways in which this PRA meets the stated goals.

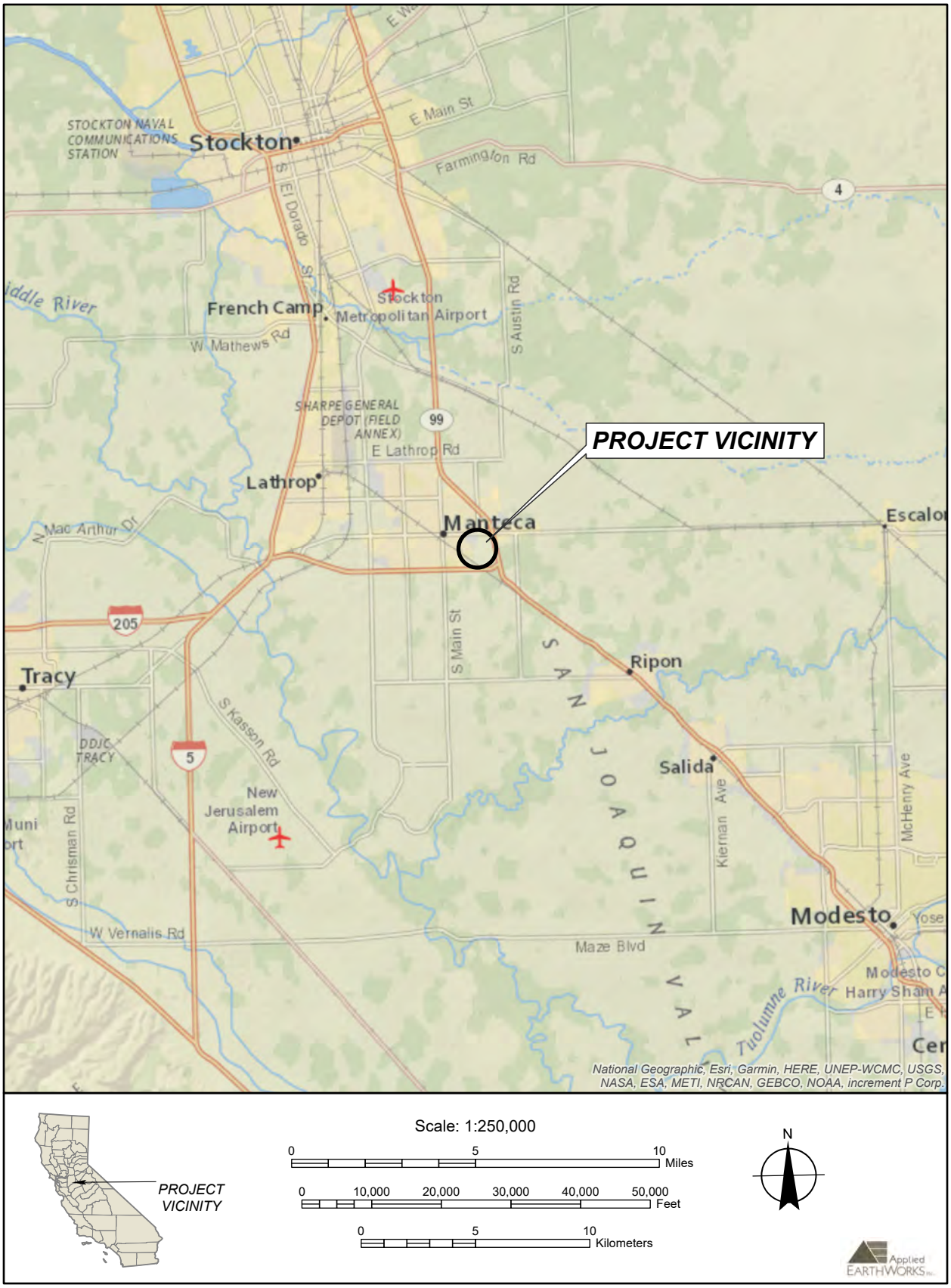

Figure 1-1 Project vicinity in San Joaquin County, California.

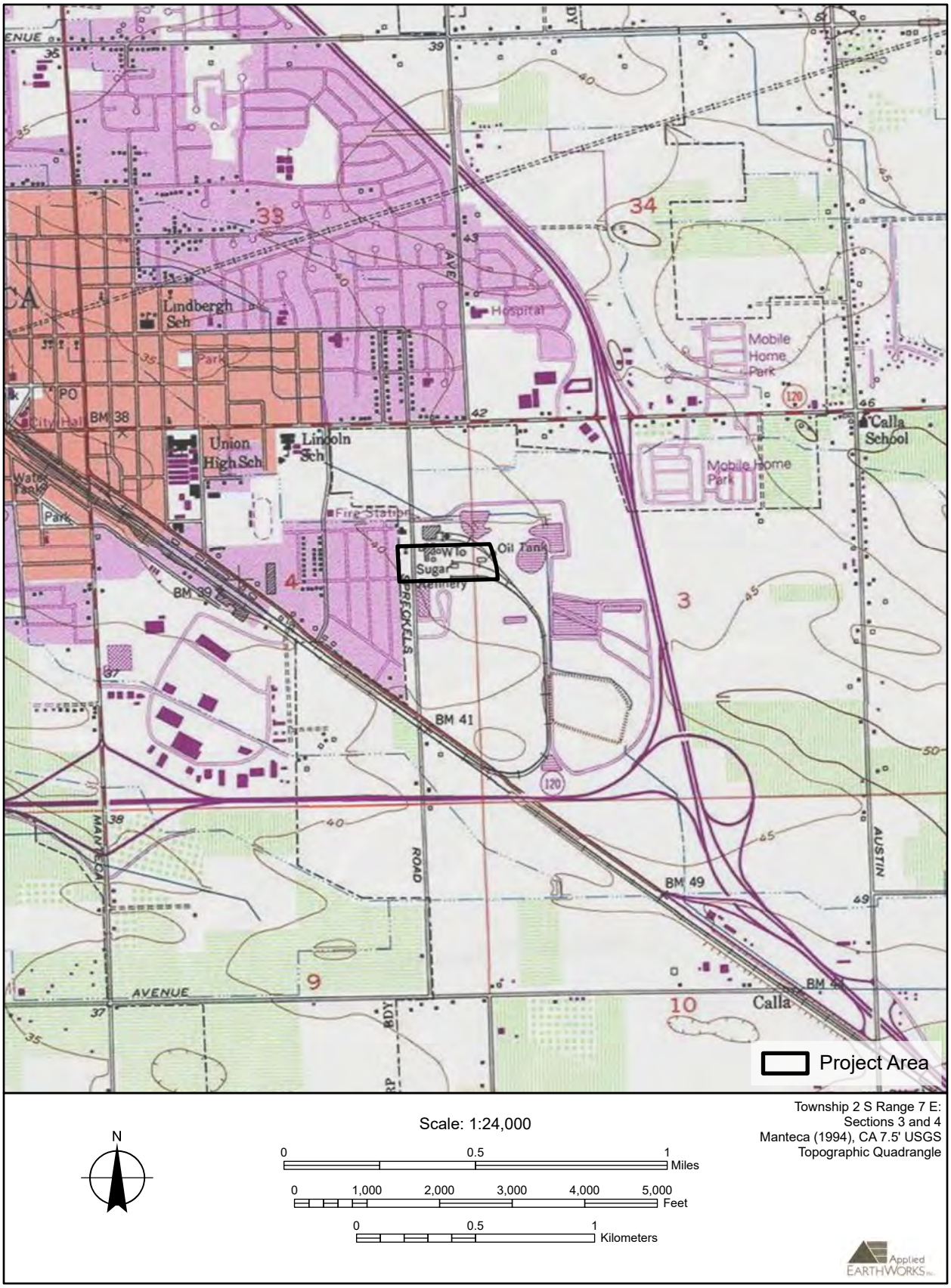

Figure 1-2 Project location on USGS Manteca 7.5-minute topographic quadrangle.

1.3 KEY PERSONNEL

Qualifications for Æ's key paleontology personnel can be found in Appendix A. Æ Paleontology Program Manager Amy Ollendorf served as the Principal Investigator for the paleontological investigation. She oversaw each task required for this PRA, including quality control. Ollendorf qualifies as a principal investigator for paleontology per industry standards (Murphey et al., 2019). She has interdisciplinary doctor of philosophy and master of science degrees involving geology and a bachelor of science degree in geology and anthropology (double major), all of which focused on paleontological subject matter. Ollendorf is the principal investigator for paleontology on Æ's 2021–2024 California Statewide Paleontological Resource Use Permit (CA-21-06P) from the U.S. Bureau of Land Management. She also is a Registered Professional Archaeologist (RPA 12588) with over 40 years of experience.

Æ Senior Paleontologist Melissa Macias wrote the PRA with desktop research contributions from Paleontological Laboratory Supervisor, Danielle Oberg. Macias has a master's degree in geology with a focus on mammalian paleontology and biogeography. She has over 14 years of experience in geology and paleontology, including the past 9 years in paleontological monitoring, recovery and preparation of fossil remains, laboratory analysis, and report preparation. She is a qualified paleontologist who meets the Society of Vertebrate Paleontology (2010) professional qualifications standards for Project Paleontologist. Dr. Oberg has doctor of philosophy and master of science degrees in geology that focus on vertebrate paleontology and deep-time climate change. They have 10 years of geology/paleontology experience, including research and data collection, museum work, and participating in and leading field expeditions. Æ Paleontological Field Technician Michael George completed the paleontological field survey through Macias' remote supervision. George has a bachelor's degree in geology with a focus on paleontology. He has 10 years of experience in the discipline, including the past 5 years of experience in paleontological monitoring, recovery, and preparation of fossil remains.

1.4 REPORT ORGANIZATION

Chapter 1 has described the Project, defined the purpose of the investigation, and provided a description of Æ's key personnel for this PRA. Chapter 2 discusses the regulatory framework governing the Project. Chapter 3 presents the paleontological sensitivity criteria and resource guidelines used for this assessment. Chapter 4 provides the methods employed, and Chapter 5 describes the geology and paleontology of the Project area. The results of the desktop studies, and paleontological sensitivity assessment are presented in Chapter 6. Management recommendations can be found in Chapter 7, and references cited are listed in Chapter 8. Appendix A provides qualifications of key personnel.

2
REGULATORY ENVIRONMENT

Paleontological resources (i.e., fossils) are considered nonrenewable because when they are destroyed, they cannot be replaced. As such, paleontological resources are afforded protection under various federal, state, and local laws. This Project is not subject to federal laws. Consequently, all resources are protected under state and local laws, as described in the following sections.

2.1 STATE

California is among the states that protect significant paleontological resources. CEQA is the legal framework through which this protection is accomplished. Enacted in 1970, CEQA does not directly regulate land uses but instead requires state and local agencies within California to follow a protocol of analysis and public disclosure of unavoidable environmental impacts of proposed projects and to adopt all feasible measures to mitigate those impacts.

2.1.1 California Environmental Quality Act

This Project is subject to Section 15002(a)(3) of the Guidelines for Implementation of CEQA (California Code of Regulations [CCR], Title 14, Chapter 3), which states one of the basic purposes of CEQA is the intention to "prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible." Therefore, CEQA requires detailed studies that analyze the environmental effects of a proposed project.

If a project is determined to have a potential significant environmental effect, the act requires that alternative plans and mitigation measures be considered. Specifically, Section VII(f) of Appendix G of the CEQA Guidelines, the Environmental Checklist Form, poses the question, "Will the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" If paleontological resources are identified as being within the proposed project area, the sponsoring agency must take those resources into consideration when evaluating project effects. The level of consideration may vary with the importance of the resource.

2.1.2 CEQA Implementation

Guidelines for implementation of CEQA are codified in 14 CCR 15000 et seq., which requires state and local public agencies to identify the environmental impacts of proposed discretionary activities or projects, determine if the impacts will be significant, and identify alternatives and mitigation measures that will substantially reduce or eliminate significant impacts to the environment. The various agencies within state government all have their own guidance documents to assist with CEQA compliance. The City of Manteca is the government agency responsible for CEQA compliance for the Project.

2.2 LOCAL

In addition to state-level implementing regulations, policies, and guidance, various counties and municipalities throughout California also have developed environmental goals, policies, and guidance that pertain to paleontological resources. The following sections list all relevant goals, objectives, and policies.

2.2.1 San Joaquin County

Policies pertinent to paleontological resources are excluded from the San Joaquin County (County) *General Plan*, *Natural and Cultural Resources Element* (Mintier Harnish Planning Consultants, 2016). However, the 2016 General Plan update includes Natural and Cultural Resources Element (NCR) NCR-N, which implements Policy NCR-6.5:

> The County shall update the Development Title to include archaeological, paleontological, and historic resource regulations, which will specify procedures to be followed in the event that significant resources are discovered during the development process.

2.2.2 City of Manteca

Paleontological resources are covered in the City of Manteca's *General Plan* Resource Conservation (RC) Goal RC-10 (De Novo Planning Group, 2024). To meet Goal RC-10, specific implementation actions are provided; those pertinent to paleontological resources are:

> **Implementation RC-10a:** Require a records search for any proposed development project, to determine whether the site contains known archaeological, historic, cultural, or paleontological resources and/or to determine the potential for discovery of additional cultural or paleontological resources. This requirement may be waived if determined by the City that the proposed project area is already sufficiently surveyed.
>
> **Implementation RC-10b:** Require a cultural and archaeological survey prior to approval of any project which would require excavation in an area that is sensitive for cultural or archaeological resources and require a paleontological survey in an area that is sensitive for paleontological resources. If significant cultural, archaeological, or paleontological resources, including historic and prehistoric resources, are identified, appropriate measures shall be implemented, such as documentation and conservation, to reduce adverse impacts to the resource.
>
> **Implementation RC-10j:** Require all new development, infrastructure, and other ground disturbing projects to comply with the following conditions in the event of an inadvertent discovery of cultural resources or human remains:
>
> - If construction or grading activities result in the discovery of significant historic or prehistoric archaeological artifacts or unique paleontological resources, all work within 100 feet of the discovery shall cease, the Development Services Director shall be notified, the resources shall be examined by a qualified archaeologist, paleontologist, or historian for recommended protection and preservation

> measures; and work may only resume when recommended protections are in place and have been approved by the Development Services Director.

According to Impact 3.6-6 in the *Revised Addendum to the EIR for the Manteca General Plan* (De Novo Planning Group, 2024), following those actions would result in "General Plan implementation [that] would not directly or indirectly destroy a unique geologic feature (Less than Significant)."

3
PALEONTOLOGICAL RESOURCE ASSESSMENT GUIDELINES

Protection of paleontological resources requires assessment of the potential for geologic units to yield significant paleontological resources that could be directly or indirectly impacted or destroyed during Project development. Successful protection also involves the formulation and implementation of appropriate management measures to mitigate impacts. Mitigation measures are proportional to the potential of individual areas to yield intact and significant paleontological resources.

3.1 DEFINITION OF PALEONTOLOGICAL RESOURCES AND SIGNIFICANCE CRITERIA

The SVP guidelines define paleontological resources as fossils and fossiliferous deposits (Society of Vertebrate Paleontology, 2010). Fossils are the evidence of once-living organisms as preserved in the rock record. They include both the lithified remains of ancient plants and animals and the traces thereof (trackways, imprints, burrows, etc.). In general, the SVP considers fossils to be greater than 5,000 years old (older than middle Holocene[1]) and to typically be preserved in sedimentary rocks, although certain volcanic rocks and low-grade metamorphic rocks may be fossiliferous if formed under certain conditions.

Well-preserved and identifiable individual fossils are considered significant paleontological resources if they are a type specimen, rare, a complete specimen, or part of an important diverse fossil assemblage. Of particular importance are fossils found in situ, or in their primary geologic context. These fossils are important because they are used to examine evolutionary relationships, provide insight on the development of and interaction between biological communities, establish time scales for geologic studies, and for many other scientific purposes, including investigation into paleoenvironments and paleoclimates (Scott and Springer, 2003; Society of Vertebrate Paleontology, 2010). Among the various types of fossils, intact and in situ vertebrate fossils are usually assigned a greater significance than other types as they are comparatively rare. Consequently, more attention tends to be placed on the recovery of vertebrate fossils than other types.

3.2 PROFESSIONAL STANDARDS AND CLASSIFICATION OF PALEONTOLOGICAL RESOURCE SENSITIVITY

Most professional paleontologists in California follow the guidelines set forth by the Society of Vertebrate Paleontology (2010) to determine the course of paleontological mitigation for a given project unless specific city, county, state, or federal guidelines are available. The SVP's guidelines establish detailed protocols for the assessment of the paleontological sensitivity of a project area and outline measures to follow in order to mitigate adverse impacts to known or unknown fossil resources during project development (Society of Vertebrate Paleontology,

[1] Middle Holocene: the Holocene Epoch is subdivided into early (11,700–8,200 years ago), middle (8,200–4,200 years ago), and late (4,200 years ago–present) subepochs (Cohen et al., 2023). The Quaternary Period also includes the older Pleistocene Epoch, which is also subdivided into early (2.6–1.8 million years ago), middle (1.8 million–77,400 years ago), and late (77,400–11,700 years ago) subepochs (Cohen et al., 2023).

2010). Since neither the County nor the City has its own paleontological sensitivity map, this report uses the SVP's ranking system and mitigation measures.

Following the SVP's established process, baseline information is used to assign the paleontological sensitivity of a geologic unit(s) (or members thereof) to one of four categories—No Potential, Undetermined, Low, and High (Society of Vertebrate Paleontology, 2010). Geologic units are considered to be "sensitive" for paleontological resources and have a High Potential if vertebrate or significant invertebrate, plant, or trace fossils have been recovered anywhere in their extent, even if outside the Project area; or if the units are sedimentary rocks that are temporally or lithologically suitable for the preservation of significant fossils. The SVP considers significant fossils as those that contribute new and useful taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data (Society of Vertebrate Paleontology, 2010).

Table 3-1
Paleontological Sensitivity Classifications

SVP Sensitivity/ Potential	Criteria	Mitigation Recommendations
High	Rock units from which vertebrate or significant specimens of other fossil types have been recovered are considered to have a high potential. Rock units with high potential also may include rock units that are temporally or lithologically suitable for the preservation of fossils (e.g., Middle Holocene and older, argillaceous and carbonate-rich paleosols, fine-grained marine sandstones, etc.).	Typically, a field survey, Paleontological Resource Impact Mitigation Program (PRIMP), and on-site construction monitoring will be required. Any significant specimens discovered during monitoring will need to be prepared, identified, and curated into a museum. A final report documenting the significance of the finds will also be required.
Undetermined	In some cases, available literature on a particular rock unit will be scarce and a determination of whether or not it is fossiliferous or potentially fossiliferous will be difficult to make. Under these circumstances, further study is needed to determine the unit's paleontological resource potential.	A field survey is required to further assess the unit's paleontological potential. The survey may provide data for development of a PRIMP prior to construction.
Low	Rocks units from which few fossils have been recovered or are generally unsuitable for preservation of fossils are considered to have a low potential. These units typically yield fossils only on rare occasions and under unusual circumstances (e.g., basalt flows, recent colluvium, etc.).	Mitigation is not typically required; however, if an unanticipated paleontological resource is encountered, a qualified professional paleontologist (Principal Investigator, Project Paleontologist) may need to evaluate the resource to consider mitigation.
No Potential	Rock units that have no potential for paleontological resources are those that are formed under or exposed to immense heat and pressure, such as high-grade metamorphic rocks and plutonic igneous rocks.	No mitigation required.

Source: Society of Vertebrate Paleontology (2010)

4
METHODS

This PRA was completed through desktop studies and a field survey. The twofold purpose of the off- and on-site research was: (1) to identify the geologic units in the Project area and immediate vicinity to determine whether previously recorded paleontological localities occur either within the Project area or within the same geologic units nearby and (2) to determine the sensitivity of the geologic units in the Project area for their potential to yield paleontological resources.

4.1 LITERATURE REVIEWS AND MUSEUM RECORDS SEARCHES

In many areas, the near-surface layers of sediments and sedimentary rocks are broken down and converted to soil (pedogenesis) through chemical and physical weathering processes (Boggs, 2012). During pedogenesis, any fossils preserved within the near-surface layers often are destroyed or rendered unrecognizable. Therefore, intact and identifiable fossils are unlikely to be found in soil. Reviews of relevant geologic maps, regional geological publications, and unpublished reports are necessary to ascertain the geology and stratigraphy of a project area to determine the potential for significant subsurface paleontological resources.

To supplement the map and literature reviews, Æ requested searches of records of the invertebrate and vertebrate collections maintained by the University of California Museum of Paleontology (UCMP). Æ also completed online searches of the Paleobiology Database (PBDB), a database readily available to the public. All records searches were completed to identify known fossil localities within or near the Project area. In addition to the museum records searches, Æ examined the geotechnical investigation reports for the Project (Dunn and Harris, 2024).

4.2 FIELD SURVEY

Prior to the field survey, Macias examined recent aerial photographs of the entire Project area and vicinity in Google Earth to determine possible locations of geologic outcrops and potential survey routes. George conducted the paleontological field survey for the Project on May 13, 2024, alongside Æ Associate Archaeologist Ward Stanley, who simultaneously conducted the cultural field survey. The purpose of the paleontological survey was to confirm the presence or absence of exposed fossils on the ground surface and to evaluate geologic exposures, if any, for their potential to yield significant subsurface paleontological resources.

George started his survey from the northwest corner of the Project area, then proceeded south and completed west-east parallel transects spaced 5–10 meters apart until he reached the southeast corner. He completed the survey with a combination of close visual inspection and spot-checking. Close visual inspection was conducted where the ground surface was visible and sediments were exposed, which was limited to areas with sparse vegetation. George used an iPad and a Global Navigation Satellite System to navigate the Project area, provided notes on his field form using the ArcGIS Survey123 application, and took photographs with the iPad to document the survey. Any fossils encountered were to be field-documented and not collected.

5
GEOLOGY AND PALEONTOLOGY

The following sections provide the geological context of the Project area, descriptions of the geologic units mapped as surface exposures within the boundaries of the Project area, and units exposed nearby and thought to be present in the subsurface. The section also includes any paleontological information reported from the units.

5.1 REGIONAL GEOLOGY

The Project area is in the San Joaquin Valley in the southern portion of the Great Valley geomorphic province[2] (California Geological Survey, 2002). The Great Valley is an alluvial plain approximately 50 miles wide and 400 miles long, bordered on the west by the Coast Ranges and on the east by the Sierra Nevada (California Geological Survey, 2002). The San Joaquin Valley occupies a trough created by the collision of the Pacific and North American plates and is subdivided into several regions by differences in tectonic deformation (Bartow, 1991; Galloway et al., 1999). Specifically, the Project area is in the relatively undeformed Northern Sierran Block, which consists of the stable east limb of the valley syncline between the Stockton fault to the north to the San Joaquin River to the south (Bartow, 1991).

A sequence of sedimentary deposits over 5.5 miles thick have accumulated almost continuously within the San Joaquin Valley since the late Jurassic Period[3], approximately 160 million years ago (Bartow, 1991). Lithologic analyses show the sediments are primarily sourced from the Sierra Nevada, with some contributions from the Coast Ranges (Bartow and Nilsen, 1990). Offshore and nearshore marine sediments are found at the base of the sequence. These are overlain by Cenozoic[4] continental sediments deposited by streams draining the mountains to the east and lakes which periodically inundated parts of the valley floor (Galloway et al., 1999).

5.2 GEOLOGY AND PALEONTOLOGY OF THE PROJECT AREA

The Project area and vicinity are mapped at various scales:

- 1:250,000: Geologic map of the San Francisco-San Jose quadrangle (Wagner et al., 1991), Geologic map of California: San Jose Sheet (Rogers, 1966)

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[2] A geomorphic province is a region of unique topography and geology that is readily distinguished from other regions based on its landforms and tectonic history (American Geological Institute, 1976).
[3] Mesozoic Era: Approximately 252–66 million years ago, subdivided into three periods—Triassic (252–201 million years ago), Jurassic (201–145 million years ago), and Cretaceous (145–66 million years ago) (Cohen et al., 2023).
[4] Cenozoic Era (formerly Tertiary): 66 million years ago–present, subdivided into three periods—Paleogene (66–23 million years ago), Neogene (23–2.6 million years ago), and Quaternary (2.6 million years ago–present). The Paleogene Period is subdivided into the Paleocene, Eocene, and Oligocene epochs; the Paleocene Epoch lasted from approximately 66 to 56 million years ago, the Eocene Epoch lasted from approximately 56 to 34 million years ago, and the Oligocene Epoch lasted from approximately 34 to 23 million years ago. The Neogene Period is subdivided into the Miocene and Pliocene epochs; the Miocene Epoch lasted from approximately 23 to 5.3 million years ago and the Pliocene Epoch lasted from approximately 5.3 to 2.6 million years ago. The Quaternary Period is subdivided into the Pleistocene and Holocene epochs; the Pleistocene Epoch, or last Ice Age, lasted from approximately 2.6 million to 11,700 years ago when the Holocene Epoch began; all dates according to Cohen et al. (2023).

- 1:100,000: Geologic and geophysical maps of the Stockton 30’ x 60’ quadrangle (Delattre et al., 2023; with accompanying pamphlet)

This report and Figure 5-1 used Delattre et al. (2023), as it is the most recent and detailed geologic map of the Project area. According to Delattre et al. (2023), the ground surface of the Project area is mapped entirely as undivided alluvium of the late Pleistocene upper member of the Modesto Formation (Qmu). Delattre et al. (2023) mapped large dune fields, dating from the latest Pleistocene to Holocene, east of the Stockton River and in the vicinity of the Project area. These dune fields consist of fine- to medium-grained sand. Although mapped in the vicinity of the Project area, these sediments are younger than the Modesto Formation, and are not expected to be present in the subsurface.

This subsection of the report also provides relevant findings from the geotechnical investigation for the Project (Dunn and Harris, 2024). The investigations included a total of two auger borings to depths of 31 feet bgs.

5.2.1 Modesto Formation (Qmu)

According to Delattre et al. (2023), the ground surface of the Project area is mapped entirely as late Pleistocene Modesto Formation, upper member, undivided alluvium (Qmu). The Modesto Formation includes poorly indurated fluvial and alluvial deposits of sand and silt with minor gravel, with subunits named based on geomorphology and sedimentology. It was first described by Davis and Hall (1959) and later redescribed by Marchand (1977), who informally divided the Modesto Formation into a lower and upper member based on topographic expression and the presence of paleosols. According to Marchand and Allwardt (1981), the Modesto Formation is present throughout the eastern San Joaquin Valley, and as far north as the Sacramento River.

The Modesto Formation is not only divided into lower and upper members, but each also is subdivided based on grain size. The upper member is composed of massive to well-bedded sand, silt, and clay, with subordinate gravel deposits. Where stratification is absent, the sedimentary structures were most likely destroyed by soil development. The lower member is predominantly composed of moderately stratified sand and silt deposits. Lenticular cross-lamination also is present in the lower member (Marchand, 1977).

Dunn and Harris (2024) did not specify geologic units represented within the subsurface by the two geotechnical borings. However, their descriptions of sediments are consistent with the Delattre et al. (2023) descriptions of Qmu.

Vertebrate fossils of Rancholabrean age, including specimens of mammoth, bison, horse, ground sloth, rodent, and snake have been reported elsewhere in the Modesto Formation (Jefferson, 1991a, 1991b; Dundas et al., 2009). However, those localities are widely scattered throughout the San Joaquin Valley and greater than 10 miles from the Project area.

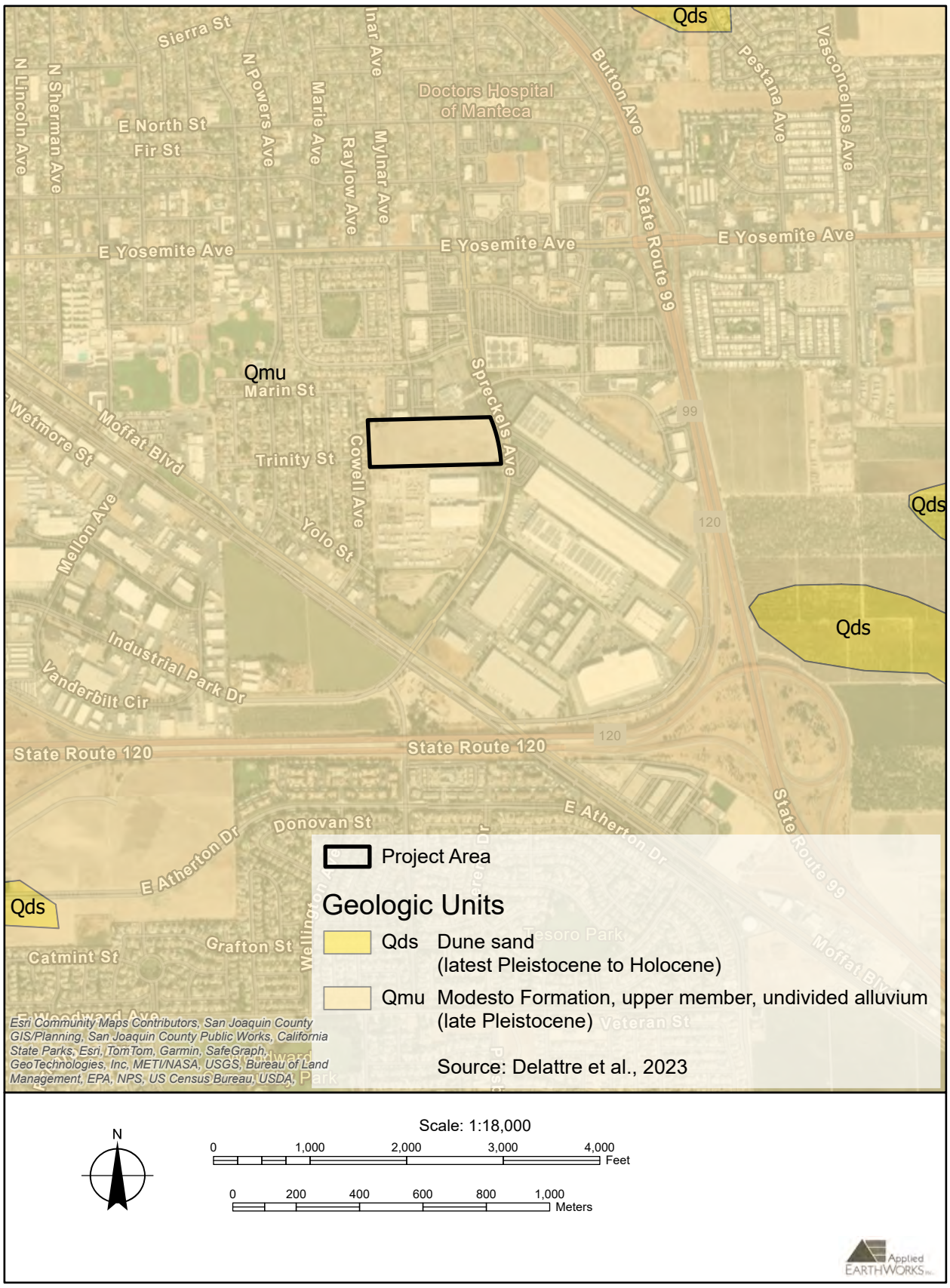

Figure 5-1 Geologic map for the Project area and vicinity.

6
RESULTS AND ANALYSIS

This chapter reports on the results of the desktop studies and fieldwork completed for this Project. Paleontological sensitivity rankings also are assigned to the geologic units mapped at the ground surface as well as those likely present at unknown depths based on the available information.

6.1 GEOTECHNICAL REPORT

The geotechnical investigations for the Project included excavation of two hollow-stem auger borings to depths of 31 feet bgs in the center of the Project area. The two borings found undocumented fill extending to 2 and 6 feet bgs, respectively, with intact sediments consistent with the upper member of the Modesto Formation found below the fill. No paleontological resources are reported in Dunn and Harris (2024), although geotechnical investigation reports rarely mention paleontological findings, if any.

6.2 RECORDS SEARCHES

The UCMP listed no paleontological resource localities within the Project area or vicinity. In addition, Æ's database and the PBDB list no localities within a 10-mile radius. The UCMP online database lists numerous Pleistocene localities within San Joaquin County and neighboring Stanislaus County, including seven within the Modesto Formation. However, none are within 10 miles of the Project area.

6.3 FIELD SURVEY RESULTS

On May 13, 2024, Æ Paleontological Field Technician Michael George conducted an intensive paleontological pedestrian survey of the entire 14.8-acre Project area (Figure 6-1). Extensive vegetation and the absence of geologic outcrops or road cuts in or near the Project area limited Æ's close field examinations of the surficial geology in the Project area. Specifically, the surficial geology was mostly visible in sparse patches between vegetation in the southeastern corner and northern third of the Project area (Figures 6-2 and 6-3).

The exposed sediments observed by George had all been disturbed previously from cultivation. He recorded these sediments as poorly sorted, subangular to subrounded gray (5YR 6/1) silty sands with angular gravels and pebbles. George did not observe any notable changes in lithology and did not encounter any paleontological resources during the survey.

Figure 6-1 Overview of the Project area from the northwest corner, facing southeast.

Figure 6-2 East end of the Project area adjacent to Spreckels Avenue, facing north.

Figure 6-3 Representative view of 75 percent ground visibility within the northern third of the Project area, facing east.

6.4 DETERMINATION OF PALEONTOLOGICAL RESOURCE POTENTIAL WITHIN THE PROJECT AREA

Using information obtained from the desktop studies, *Æ* determined the paleontological resource potential of the Project area. The field survey did not yield much useful information that would affect this determination. However, the Modesto Formation is considered High Sensitivity according to the SVP paleontological sensitivity classifications, as numerous paleontological resource localities have been documented elsewhere within the formation. In addition, the lithology of the Qmu consists of sand and silt deposited in fluvial and alluvial deposits that are conducive to the preservation of paleontological resources. Based on the findings, *Æ* recommends the assignment of High Sensitivity to the entire Project area (Figure 6-4).

Æ did not observe any exposures of unequivocally undisturbed Modesto Formation during the survey. Based on the presence of artificial fill in the boring logs and the extent of previous disturbance in the Project area, most of the sediments *Æ* observed during the survey may have been the locally derived artificial fill described in the geotechnical reports (Dunn and Harris, 2024).

Æ's desktop studies indicate significant paleontological resources deposits have been recorded in the upper member of the Modesto Formation elsewhere in the San Joaquin Valley. The geotechnical descriptions of sediments greater than 2–6 feet bgs within the center of the Project area are consistent with the descriptions of the upper member of the Modesto Formation. Although no subsurface data was available for the rest of the Project area, Delattre et al. (2023) mapped Modesto Formation, upper member deposits uniformly throughout. Additional geotechnical borings or construction monitoring may result in findings that can help to further refine our understanding of the subsurface geology of the Project area.

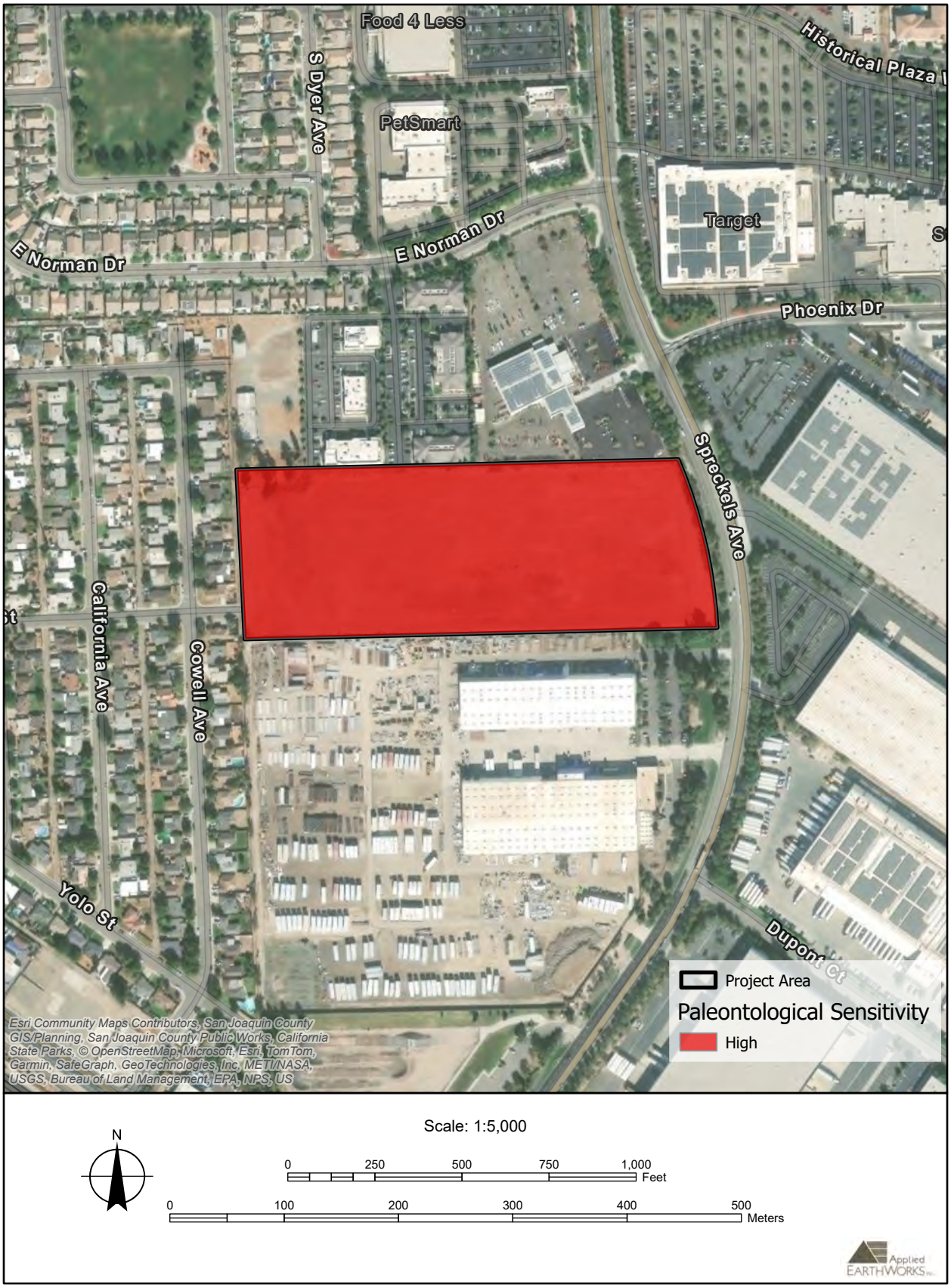

Figure 6-1 Paleontological sensitivity for the Project area.

7
RECOMMENDATIONS

Æ concludes that construction activities that extend below the depth of artificial fill may impact significant paleontological resources throughout the Project area. Æ's desktop studies indicate the Project area has High Sensitivity for paleontological resources.

Prior to the issuance of grading permits and consistent with applicable policies (De Novo Planning Group, 2023, 2024), Æ recommends a Paleontological Resource Impact Mitigation Program (PRIMP) be prepared by a qualified professional paleontologist (Paleontological Principal Investigator, Project Paleontologist) as defined by mitigation paleontology industry standards (Murphey et al., 2019) and/or the Society of Vertebrate Paleontology (2010). The PRIMP will specify the steps to be taken to mitigate impacts to paleontological resources. For instance, Worker's Environmental Awareness Program training should be prepared prior to the start of Project-related ground disturbance and presented in person to all field personnel to describe the types of paleontological resources that may be found and the procedures to follow if any are encountered.

The Project-specific PRIMP also will include a monitoring plan that will indicate where construction monitoring should occur and the frequency of required monitoring (i.e., full-time, spot-checks, etc.). In addition to construction monitoring procedures, the monitoring plan also will provide details about fossil collection, analysis, and preparation for permanent curation at an approved repository, such as the UCMP. Lastly, the monitoring plan will describe the different reporting standards to be used, such as monitoring with negative findings versus monitoring resulting in fossil discoveries.

8
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APPENDIX A

Qualifications of Key Personnel

AMY L. OLLENDORF

Vice President/Managing Principal/Paleontology Program Manager/Principal Investigator

Areas of Expertise

- Paleontology, mineralogy, and sedimentary geology
- CEQA/NEPA compliance
- Project management

Years of Experience

- 40

Education

Postdoctoral Research Associate, 2006–2007, World Heritage Studies, University of Minnesota

Ph.D., Ancient Studies,1993, University of Minnesota

M.S., Ancient Studies, 1986, University of Minnesota

B.S., Anthropology (with honors) and Geology, 1983, Beloit College

Registrations/Certifications

- Registered Professional Archaeologist #12588
- Licensed Professional Geologist, Minnesota #30084 (6/1998-6/2018, expired)
- Paleontologist Consultants List, Santa Cruz County (2022-present)
- Certified Paleontologist and Archaeologist, Orange County (2020-present)
- Paleontology and Cultural Consultant, Riverside County (2018-present)

Permits/Licensure

- BLM - California Statewide Paleontological Resources Use Permit *CA-21-06P*, Principal Investigator.

Professional Experience

2022–	Vice President, Applied EarthWorks, Inc., Pasadena, California
2018–	Managing Principal/Paleontology Program Manager, Applied EarthWorks, Inc., Pasadena, California
2015–2018	President and Senior Project Manager, ALO Environmental Associates LLC
2006–2015	Program Manager, Cultural Heritage Planning and Management, AECOM
2005–2008	President and Senior Project Manager, ALO Environmental Associates LLC
2003–2005	Director, Cultural Resources Management, Peterson Environmental Consulting, Inc.
2000–2003	Director, Cultural Resources Management, HDR Engineering, Inc.
1996–2000	Director, Cultural Resources Management, Braun Intertec Corporation, Inc

Technical Qualifications

Dr. Ollendorf has 40 years of experience in paleontology, paleoecology, environmental compliance, and geoarchaeology at the global, national, tribal, state, and local levels. She meets industry standards for principal investigator in paleontology and she is also Æ's principal investigator on Æ's California and Nevada statewide Paleontological Resource Use Permits for paleontology from the US Bureau of Land Management (BLM).

Dr. Ollendorf has supervised and/or participated in paleontological services, tribal negotiations, and agency coordination throughout her career. She also has managed EISs and EAs. Her project experience includes work in 35 states, including California and other western states, and abroad on a wide range of client projects across many different industry sectors.

During her career, Dr. Ollendorf has written or overseen several hundreds of compliance reports in addition to having published multiple articles in peer-reviewed professional journals and presented to a wide variety of audiences, including professional peers.

MELISSA K. MACIAS

Senior Paleontologist/Project Manager/GIS Analyst

Areas of Expertise

- Paleontology, evolutionary biology, mineralogy, and sedimentary geology
- CEQA/NEPA compliance
- Project management

Years of Experience

- 16

Education

M.S., Geosciences, Fort Hays State University, 2020

B.S., Earth Sciences, University of California, Santa Barbara, 2013

A.A., Earth and Planetary Sciences, Santa Barbara City College, 2010

Registrations/Certifications

- Paleontologist Consultants List, Santa Cruz County (2022–present)
- Certified Paleontologist, Orange County (2016-present)
- Qualified Paleontologist, Riverside County (2019-present)

Permits

Principal Investigator, California BLM Statewide Paleontological Permit CA-21-06P

Professional Affiliations

- Society of Vertebrate Paleontology
- Association of Women Geoscientists
- Geological Society of America
- The Paleontological Society

Professional Experience

2020–present	Senior Paleontologist /Project Manager/GIS Analyst, Applied EarthWorks, Inc., Pasadena, California.
2015–2020	Paleontologist, Psomas, Santa Ana, California
2015	Paleontological Monitor, Duke CRM, Lake Forest, California
2013–2015	Graduate Teaching Assistant, Fort Hays State University, Hays, Kansas
2015	Graduate Curatorial Assistant, Fort Hays State University, Hays, Kansas
2008–2013	Undergraduate Teaching Assistant, Santa Barbara City College, Santa Barbara, California

Technical Qualifications

Melissa Macias is an experienced paleontologist who meets Society of Vertebrate Paleontology and industry standards for Principal Investigator (PI) in paleontology. She is a PI on Æ's California and Nevada statewide Paleontological Resource Use Permits (PRUPs). She has a background in mammalian paleontology and biogeography as well as museum studies and collections management. Her master's degree research focused on the paleobiogeography of giant ground sloths in North America, using ArcGIS and geographic range modeling software to map habitat suitability.

Ms. Macias has 8 years of experience with CEQA and NEPA compliance as well as conducting and managing paleontological resource impact assessments. Ms.Macias has worked on paleontological resources impact mitigation programs that have required monitoring of earth-moving activities, recovery and preparation of fossil remains for collections, field personnel supervision, laboratory analysis of paleontological specimens, and final report preparation. She has also implemented paleontological and cross-trained monitor training for Æ field staff. She is OSHA Hazardous Waste Operations Worker (HAZWOPER) certified. In addition to experience in California, Ms. Macias also has paleontology and geology experience in Utah, Montana, and Colorado.

During her career, Ms. Macias has authored numerous compliance reports. She has also presented scientific research on a wide variety of vertebrate and invertebrate taxa at conferences and invited lectures.

DANIELLE E. OBERG

Paleontologist and Laboratory Supervisor

Areas of Expertise

- Paleontology
- Evolutionary biology
- Mineralogy
- Sedimentary geology
- Hydrogeology
- Isotope geochemistry

Years of Experience

- 10

Education

Ph.D., Geosciences, University of Arkansas, Fayetteville, 2024

M.S., Geosciences, East Tennessee State University, 2018

B.S., Geosciences, University of Oregon, 2015

Professional Affiliations

- Society of Vertebrate Paleontology
- Association of Women Geoscientists
- Geological Society of America
- The Paleontological Society
- American Geophysical Union

Registrations/Certifications

- Æ Annual Training for Paleontology/Cross-Trained Field Technicians, 2020 through 2024

Professional Experience

2023–	Paleontological Laboratory Supervisor, Applied EarthWorks, Inc., Pasadena, California
2019–2023	Graduate Teaching Assistant, University of Arkansas, Fayetteville, Arkansas
2018–2022	Graduate Research Assistant, University of Arkansas, Fayetteville, Arkansas
2017–2018	Graduate Museum Collections Assistant, Grey Fossil Site and Hands-On Discovery Museum, Grey, Tennessee
2016–2017	Graduate Research Assistant, East Tennessee State University, Johnson City, Tennessee
2015–2016	Post-baccalaureate Researcher, University of Oregon and Museum of Natural and Cultural History, Eugene, Oregon
2013–2015	Undergraduate Researcher, University of Oregon, Eugene, Oregon

Technical Qualifications

Danielle Oberg is a paleontologist with background in vertebrate paleontology as well as museum and collections management. Their undergraduate and master's degree research focused on systematics/taxonomy and paleobiogeography of small mammals, specifically eulipotyphlans, in North America, using 2-D geometric morphometrics and ArcGIS. Their Ph.D. research focuses on environmental, ecological, and climatic change during the end Triassic mass extinction using vertebrate paleontology and stable isotope geochemistry in South Africa and Lesotho.

Danielle has 10 years of paleontology and geology research experience including participation in remote field expeditions, recovery and preparation of fossil remains for collections, laboratory analysis of paleontological specimens, and report preparation/publication. They have also lead field expeditions in several states (Arkansas, Montana, Oregon, Tennessee, Utah, and Wyoming) as well as two countries outside North America (South Africa and Lesotho).

Danielle has presented the results of their scientific research on a variety of vertebrate taxa at conferences. Additionally, they have been contracted to conduct laboratory analyses for other institutions.

Applied EARTHWORKS Inc.

MICHAEL GEORGE

Paleontological Field/Lab Technician

Areas of Expertise

- Paleontology, mammalogy, and sedimentology

Years of Experience

- 10

Education

B.S., Geology, California State University, Stanislaus, 2018

A.S., Geology, Merced Junior College, 2014

Professional Affiliations

- Board member of the San Joaquin Valley Paleontology Foundation

Certifications

- Æ Annual Training for Paleontology/Cross-Trained Field Technicians, 2020 through 2024

Professional Experience

2019–	Paleontological Field/Lab Technician, Applied EarthWorks, Inc., Fresno, California
2017–	Lead Paleontologist/Fossil Collections Manager, Fossil Discovery Center of Madera County, Chowchilla, California
2015–2017	Undergraduate Research Assistant to Dr. Julia Sankey (Paleontologist), Geology Department, CSU, Stanislaus, California
2015–2016	Fossil Preparation Assistant to Dr. Julia Sankey (Paleontologist), Geology Department, CSU, Stanislaus, California

Summary of Qualifications

Mr. George has been trained formally as a geologist who specializes in paleontology. To date, he has completed more than 100 hours of field and laboratory training in the Earth sciences and more than 100 hours of fossil preparation, including jacketing of large vertebrate specimens, and identifying, cataloguing, and packaging of fossils for transportation and curation. George also has experience measuring stratigraphic sections, describing sedimentary geologic units, creating geologic cross-sections, and writing field reports. He completed a geological field school at California State University (CSU), Stanislaus in 2018 which provided him with experience in field mapping and exposure to the geology of the Central Valley, Sierra Nevada Mountains, Mojave Desert, Peninsular Ranges, and Coast Ranges. George also has basic knowledge of GPS equipment, ArcGIS v.10.4, and AutoCAD v.16.2.