Appendix E

Paleontological Resources Survey Report

Paleontological Identification Report for the Athos Renewable Energy Project Riverside County, California

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draft

Paleontological Identification Report for the Athos Renewable Energy Project, Riverside County, California

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draft

EXECUTIVE SUMMARY

At the request of the Aspen Environmental Group, Applied EarthWorks, Inc. (Æ) provided paleontological resource identification services for the Athos Renewable Energy Project (Project) in Riverside County, California. The Project will construct a utility-scale photovoltaic solar electrical generating facility and associated infrastructure to connect to the statewide electricity transmission grid. The power produced by the Project will be conveyed to the local power grid via interconnection to the Southern California Edison Red Bluff Substation, an existing facility.

The Project Area is located on both sides of State Route 177 and Interstate 10 near the town of Desert Center in Townships 4 and 5 South, Ranges 16 and 17 East as summarized in the following table.

Project Area Locational Information

Township (South)	Range (East)	Section	U.S. Geological Survey 7.5-minute Topographic Quadrangle
4	16	19, 30, 31	East of Victory Pass, CA
5	16	4, 5, 6,7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 22, 23, 24, 25, 26, 27, 28, 33	East of Victory Pass, CA
5	16	4, 5, 6,7, 8, 9, 16, 17, 18, 21, 22, 22, 23, 24, 25, 26, 27, 28, 33	Corn Springs, CA
5	17	19, 20, 29, 30	Sidewinder Well, CA

The Project is primarily on private land, and the County of Riverside (County) is the lead agency for compliance with the California Environmental Quality Act (CEQA). Portions of the generation tie-line (gen-tie) are on public lands managed by the Bureau of Land Management (BLM) Palm Springs-South Coast Field Office. The BLM is the lead agency for federal compliance.

This PIR was produced for compliance with the CEQA, using County guidelines for paleontological sensitivity. Æ's Paleontology Program Manager, Dr. Amy Ollendorf, PG (Minnesota #30084) oversaw the production of this PIR by Æ Staff Paleontologists Christopher Shi, Christopher Shea, and Scott Rohlf. Rohlf is Æ's Project paleontologist as he meets the Society of Vertebrate Paleontology qualifications standards.

This PIR was prepared through the successful completion of desktop and field tasks. Desktop studies included searches of museum collection records maintained by the Natural History Museum of Los Angeles County and the online database maintained by the University of California Museum of Paleontology as well as a review of all pertinent literature and geologic maps readily available online. The purpose of the desktop studies was to identify the geologic units in the Project Area and to determine whether previously recorded paleontological localities occur either within the Project boundaries or within the same geologic units outside of the

Project Area. The Records Search Area consisted of a 5-mile-wide buffer around the Project Area.

Following the desktop studies, Æ conducted fieldwork to accomplish several additional goals:

- Conduct surface reconnaissance for the presence/absence of exposed fossils.
- Evaluate geologic exposures in and near the Project Area for their potential to contain subsurface fossil material.
- Examine subsurface geology exposed in geotechnical trenches to refine lithologic descriptions and to ascertain the presence/absence of buried fossils.

Published geologic maps indicate that surface deposits found within the Project Area consist of Pleistocene- to Holocene-age alluvium. Museum records and online database entries show there are no previously recorded fossil localities directly within the Project Area; however, a few fossil localities are recorded ex situ nearby in similar alluvial deposits or in other geologic units that may underlie the Project Area at unknown depths. Furthermore, Æ recorded one fossil ex situ during reconnaissance of the ground surface in the Northeast Development Block. No fossils were observed in the excavations of 40 geotechnical trenches to a depth of 10 feet below the present ground surface. However, reddish sediments may be derived from the fossiliferous Pinto Formation thought to underlie parts of the Project Area, particularly in the central portion. Comparatively fine-grained sediments observed in Test Pit (TP) 33 (South) and TP 37 (Southeast) may be associated with fossiliferous deposits at depth from ancient Ford Dry Lake.

The Pinto Formation and older Quaternary alluvium have previously yielded significant paleontological material outside of but near the Athos Project Area. Given the presence of highly sensitive (Ha) geologic units and units of undetermined paleontological sensitivity mapped from surface exposures in and near the Project Area, several management measures are recommended to mitigate adverse impacts to paleontological resources, if present:

- Prior to the start of construction, as part of a complete Worker Environmental Awareness Program all field personnel should be briefed regarding the possible types of fossils that could be found in the Project Area and the procedures to follow should paleontological resources be encountered.
- In general, disturbance of the top 10 feet by construction activities warrants only spot-check monitoring across the entire Project Area. The major exceptions to this general rule are the Northeast Development Block, West Development Block, and the southern portion of the East Development Block. If no paleontological finds are made during full-time monitoring in those locations, then the paleontological monitor may switch to spot-check monitoring at the direction of the Project paleontologist.
- For depths below 10 feet, Æ recommends full-time monitoring initially since the subsurface geology is yet undocumented. If no paleontological finds are made during full-time monitoring at depths greater than 10 feet, then the paleontological monitor may switch to spot-check monitoring at the direction of the Project paleontologist.

- Any significant fossils collected during fieldwork will be prepared in a properly equipped paleontology laboratory to a point ready for curation. At the conclusion of laboratory work and curation, a final report will be prepared to describe the results of the paleontological inventory and evaluation. If fossils are collected and prepared for curation, a copy of the report will be submitted to the curation institution along with the fossil assemblage.

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1
INTRODUCTION

At the request of the Aspen Environmental Group, Applied EarthWorks, Inc. (Æ) provided paleontological resource identification services for the Athos Renewable Energy Project (Project) in Riverside County, California. IP Athos, LLC, a wholly owned subsidiary of Intersect Power, Inc. (IP), proposes to construct, operate, and decommission the Project, which will be a utility-scale photovoltaic solar electrical generating facility and associated infrastructure to connect to the statewide electricity transmission grid. The power produced by the Project will be conveyed to the local power grid via interconnection to the Southern California Edison (SCE) Red Bluff Substation, an existing facility.

The Project Area is located north and south of State Route (SR) 177 and Interstate 10 (I-10) near the town of Desert Center (Figure 1-1) in Townships 4 and 5 South, Ranges 16 and 17 East as shown in Figure 1-2 and summarized in Table 1-1.

Table 1-1
Project Area Locational Information

Township (South)	Range (East)	Section	U.S. Geological Survey 7.5-minute Topographic Quadrangle
4	16	19, 30, 31	East of Victory Pass, CA
5	16	4, 5, 6,7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 22, 23, 24, 25, 26, 27, 28, 33	East of Victory Pass, CA
5	16	4, 5, 6,7, 8, 9, 16, 17, 18, 21, 22, 22, 23, 24, 25, 26, 27, 28, 33	Corn Springs, CA
5	17	19, 20, 29, 30	Sidewinder Well, CA

The Project is primarily on private land and the County of Riverside (County) is the lead agency for compliance with the California Environmental Quality Act (CEQA). Portions of the generation tie-line (gen-tie) are on public lands managed by the Bureau of Land Management (BLM) Palm Springs-South Coast Field Office. The BLM is the lead federal agency.

This PIR was produced for compliance with the CEQA using County of Riverside (2015a) guidelines for paleontological sensitivity. Æ's Paleontology Program Manager, Dr. Amy Ollendorf, oversaw the production of this PIR by Æ Staff Paleontologists Christopher Shi, Christopher Shea, and Scott Rohlf. Rohlf is Æ's Project paleontologist as he meets the Society of Vertebrate Paleontology (SVP) qualifications standards (Society of Vertebrate Paleontology (SVP), 2010).

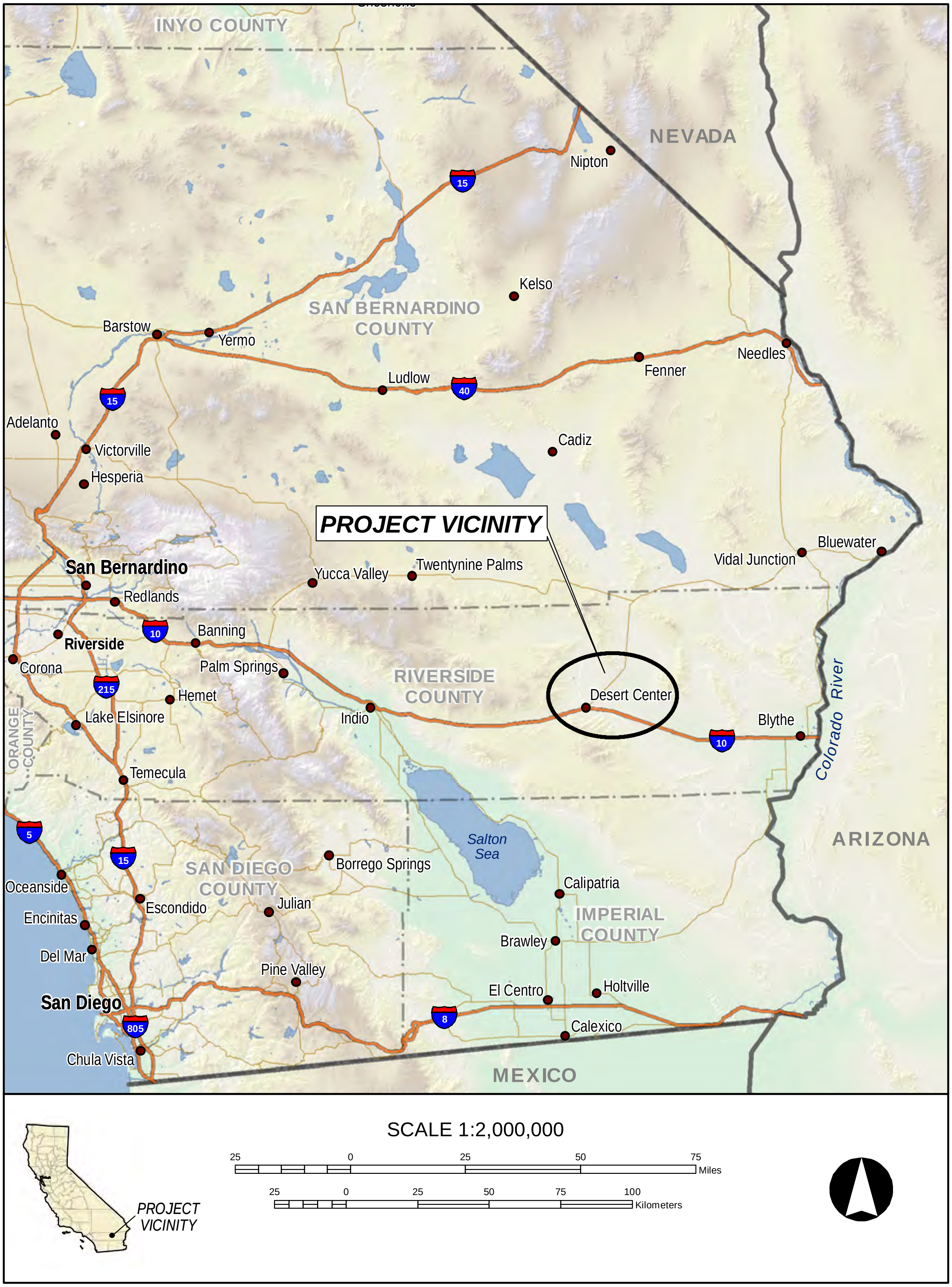

Figure 1-1 Project vicinity in Riverside County, California.

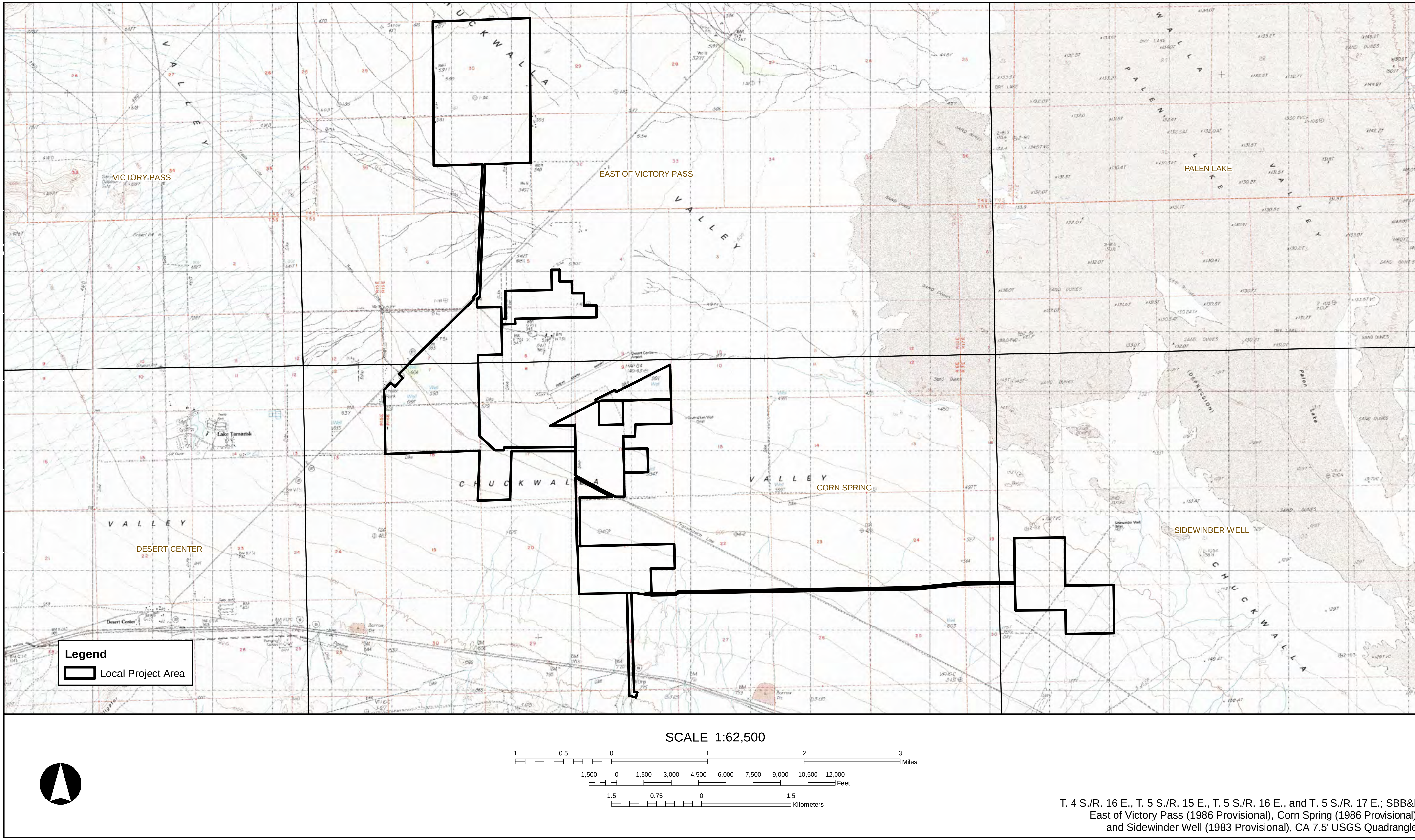

Figure 1-2 Project location on the USGS Corn Springs, East Victory Pass, and Sidewinder Well 7.5-minute quadrangles (reduced scale).

1.1 PROJECT DESCRIPTION

The Project is approximately 47 miles west of Blythe, 66 miles east of Palm Springs, 3 miles north of the Chuckwalla Mountains, and just north of I-10 within the Riverside East Solar Energy Zone (SEZ) of BLM's Western Solar Plan and within the Desert Renewable Energy Conservation Plan Development Focus Area, which amends the California Desert Conservation Area Plan.

The Project contains approximately 3,395 acres that span seven noncontiguous development blocks for solar arrays to be linked by proposed gen-tie lines that will terminate at the existing Red Bluff Substation on the south side of I-10. The proposed solar arrays and substation facilities will occupy 65 parcels (3,237 acres) on privately owned land, which makes up approximately 95 percent of the total Project. The remaining 25 parcels (158 acres) will be utilized for an 11.1-mile-long 220 kilovolt (kV) gen-tie to link the facility to the Red Bluff Substation. Specifically, 7.8 miles (134 acres) of gen-tie will be on federal lands managed by the BLM and 3.3 miles (24 acres) will be on privately owned land.

The maximum height of the solar panels will be up to 12 feet, and the maximum height of the gen-tie and substation dead-end towers will not exceed 150 feet. Maximum depth of disturbance is anticipated to be 35 feet.

In addition to the solar arrays (Facility) and gen-tie lines, access roads will be utilized. Access to the Project will be provided from SR 177, except for the easternmost group of parcels, which would be accessed from Corn Springs Road. Seven new access road segments, totaling approximately 10 miles long, will be constructed to provide primary and secondary access to the seven Project development blocks. BLM open routes and agricultural roads also are proposed to be improved as part of the Project. All new and improved access roads would be 24 feet wide with a 2-foot-wide shoulder on each side, for a total width of approximately 30 feet, including allowances for side slopes and surface runoff control. In addition, all roads with the exception of one main access road will be located within the proposed Facility.

Most of the Project components are to be located on disturbed retired agricultural land to minimize ground disturbance and impacts to resources. Within the established SEZ, the existing Desert Sunlight and approved Desert Harvest solar projects are northwest of the northernmost parcels of the proposed Project Area, and the proposed Palen Solar Project is adjacent to the easternmost parcels of the proposed Project Area. The proposed Victory Pass Solar Project is directly west of the Project Area, and there are several other solar projects and associated gen-tie lines proposed on private and BLM-administered land in the area.

A portion of the gen-tie line would be sited within the Section 368 Federal Energy Corridor as established by the Westwide Energy Corridor Final Programmatic Environmental Impact Statement (PEIS) and Record of Decision. South of I-10, the gen-tie line would also cross the Chuckwalla Area of Critical Environmental Concern, paralleling an existing overhead transmission corridor. To further minimize disturbance and other environmental impacts, the proposed Athos gen-tie lines have been routed to most directly connect its project substations and to run parallel to the gen-tie lines associated with other existing and proposed solar projects in the area to the maximum extent feasible.

1.2 PURPOSE OF INVESTIGATION

The purpose of this investigation is to: (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; and (3) provide Project-specific management recommendations for paleontological resource mitigation, as necessary.

1.3 REPORT ORGANIZATION

This PIR documents the results of Æ's paleontological resource assessment efforts in the Project Area. Chapter 1 has introduced the scope of work, identified the Project location, described the Project, and defined the purpose of the investigation. Chapter 2 outlines 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 museum records search and paleontological sensitivity assessment are discussed in Chapter 6. Findings and management recommendations are presented in Chapter 7 and references cited are listed in Chapter 8. Appendix A contains résumés of key personnel.

2
REGULATORY ENVIRONMENT

Paleontological resources (i.e., fossils) are considered nonrenewable scientific resources because when they are destroyed, they cannot be replaced. As such, paleontological resources are afforded protection under various federal, state, and local laws. Laws pertinent to this project are discussed below.

2.1 STATE LAW, REGULATIONS, AND GUIDELINES

2.1.1 California Environmental Quality Act of 1970 (Public Resources Code [PRC] Section 21000 et seq.)

The Project is subject to compliance with CEQA statute, as amended, and the associated guidelines. The CEQA Guidelines, Article 1, Section 15002(a)(3) states that the CEQA is intended 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." CEQA further states that public or private projects financed or approved by the state are subject to environmental review by the state. All such projects, unless entitled to an exemption, may proceed only after this requirement has been satisfied.

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, in Section V(c) of Appendix G of the CEQA Guidelines, the Environmental Checklist Form, the question is posed, "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 study 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 Public Resources Code Section 5097.5

No person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, 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. Violation of this section is a misdemeanor. As used in this section, "public lands" means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

2.2 RIVERSIDE COUNTY

Paleontological resources are also addressed within the state at a county level. There are several policies covering paleontological resources within the County's General Plan, Multipurpose Open Space (OS) Element (County of Riverside 2015b, p. OS-51):

1. **OS 19.6:** Whenever existing information indicates that a site proposed for development has high paleontological sensitivity as shown on Figure OS-8, paleontological resource impact mitigation program (PRIMP) shall be filed with the Riverside County Geologist prior to site grading. The PRIMP shall specify the steps to be taken to mitigate impacts to paleontological resources.

2. **OS 19.7:** Whenever existing information indicates that a site proposed for development has low paleontological sensitivity as shown on Figure OS-8, no direct mitigation is required unless a fossil is encountered during site development. Should a fossil be encountered, the Riverside County Geologist shall be notified and a paleontologist shall be retained by the project proponent. The paleontologist shall document the extent and potential significance of the paleontological resources on the site and establish appropriate mitigation measures for further site development.

3. **OS 19.8:** Whenever existing information indicates that a site proposed for development has undetermined paleontological sensitivity as shown on Figure OS-8, a report shall be filed with the Riverside County Geologist documenting the extent and potential significance of the paleontological resources on site and identifying mitigation measures for the fossil and for impacts to significant paleontological resources prior to approval of that department.

4. **OS 19.9:** Whenever existing information indicates that a site proposed for development has undetermined paleontological sensitivity as shown on Figure OS-8, a report shall be filed with the Riverside County Geologist documenting the extent and potential significance of the paleontological resources on site and identifying mitigation measures for the fossil and for impacts to significant paleontological resources prior to approval of that department.

3
PALEONTOLOGICAL SENSITIVITY AND SIGNIFICANCE

3.1 DEFINITION OF PALEONTOLOGICAL RESOURCES AND SIGNIFICANCE CRITERIA

Paleontology, the scientific study of past life, exclusive of the study of human fossil remains, is a natural science closely associated with geology and biology. Fossils, the remains of past vertebrate, invertebrate, and plant life are usually found in sedimentary and metasedimentary deposits. Evidence of past life can also be represented by trackways, imprints, and burrows, known as trace fossils, within sedimentary and metasedimentary deposits. In general, fossils are greater than 5,000 years old (older than Middle Holocene) (Society of Vertebrate Paleontology, 2010).

Significant paleontological resources are defined as “identifiable” vertebrate fossils, uncommon invertebrate, plant, and trace fossils that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, or biochronological data (Society of Vertebrate Paleontology, 2010). These data 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 (Scott and Springer, 2003).

3.2 PROFESSIONAL STANDARDS AND CATEGORIES OF PALEONTOLOGICAL RESOURCE SENSITIVITY

Riverside County has been inventoried for geologic formations known to potentially contain paleontological resources. Lands with high, low, or undetermined potential for finding paleontological resources are mapped (see Figure OS-8 Paleontological Sensitivity Resources Map in County of Riverside, 2015a). These guidelines define the various levels of paleontological resource potential (i.e., “sensitivity”) and provide detailed protocols for the mitigation of adverse impacts to fossil resources during project development.

Using baseline information gathered during a paleontological resource assessment, the paleontological resource potential of the geologic unit(s) (or members thereof) underlying a project area is assigned to one of four categories (County of Riverside, 2015a). These categories include high, undetermined, and low potential. The criteria for each sensitivity classification, and the corresponding mitigation recommendations, are summarized in Table 3-1.

If a project area has high potential for paleontological resources following the initial assessment, then a paleontological resource impact mitigation program (PRIMP) must be developed by a qualified professional paleontologist (Society of Vertebrate Paleontology, 2010) and approved by the County Geologist prior to implementation during the construction phase of a project.

Table 3-1
Paleontological Sensitivity Classifications

Resource Potential	Criteria	Mitigation Recommendations
Low Potential	Lands for which previous field surveys and documentation demonstrate as having a low potential for containing significant paleontological resources subject to adverse impacts. The mapping of low potential was determined based on actual documentation and was not generalized to cover all areas of a particular rock unit on a geologic map.	Mitigation is not typically required unless a fossil is encountered during site development. If a fossil is encountered, the County Geologist shall be notified, and a paleontologist shall be retained by the project proponent. In such cases, the paleontologist shall document the extent and potential significance of the paleontological resources on the site and establish appropriate mitigation measures for further site development.
Undetermined Potential	Areas underlain by sedimentary rocks for which literature or unpublished studies are not available have undetermined potential for containing significant paleontological resources.	A field survey is required *prior to the commencement of construction activities* by a qualified vertebrate paleontologist to assess the unit's paleontological potential as either High or Low.
High Potential	Sedimentary rock units with high potential for containing significant non-renewable paleontological resources include rock units in which vertebrate or significant invertebrate fossils have been found or determined likely to be present. These units include, but are not limited to, sedimentary formations which contain significant non-renewable paleontological resources anywhere within their geographical extent and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. High sensitivity includes not only the potential for yielding abundant vertebrate fossils, but also for production of a few significant fossils that may provide new and significant data. High sensitivity areas are mapped as either "High A" or "High B," according to the following criteria: **High Sensitivity A (Ha):** Based on geologic formations or mapped rock units that are known to contain or have the correct age and depositional conditions to contain significant paleontological resources. These include rocks of Silurian or Devonian age and younger that have potential to contain remains of fossil fish, and Mesozoic and Cenozoic rocks that contain fossilized body elements and trace fossils such as tracks, nests and eggs. **High Sensitivity B (Hb):** Equivalent to High A, but is based on the occurrence of fossils at a specified depth below the surface. This category indicates fossils that are likely to be encountered at or below 4 feet of depth and may be impacted during construction activities.	The qualified paleontologist approved by the County ("Project Paleontologist") will create and implement a project-specific paleontological resource impact mitigation program (PRIMP) to be approved by the County Geologist *prior to the issuance of a grading permit.* Construction monitoring and details covering the treatment of fossil discoveries are included in the PRIMP. Any significant specimens discovered will need to be prepared, identified, and curated into a museum. A final report documenting the significance of the finds will also be required.

Source: County of Riverside, 2015a

Information to be contained in the PRIMP, according to County of Riverside (2015a, p. 4.9-31), at a minimum and in addition to other industry standards are:

- Description of the proposed site and planned grading operations.
- Description of the level of monitoring required for all earthmoving activities in the project area.
- Identification (name) and qualifications of the qualified paleontological monitor to be employed for grading operations monitoring.
- Identification of personnel with authority and responsibility to temporarily halt or divert grading equipment to allow for recovery of large specimens.
- Direction for any fossil discoveries to be immediately reported to the property owner who in turn will immediately notify the Riverside County Geologist of the discovery.
- Means and methods to be employed by the paleontological monitor to quickly salvage fossils as they are unearthed to avoid construction delays.
- Sampling of sediments that are likely to contain the remains of small fossil invertebrates and vertebrates.
- Procedures and protocol for collecting and processing of samples and specimens.
- Fossil identification and curation procedures to be employed.
- Identification of the permanent repository to receive any recovered fossil material. The County of Riverside must be consulted on the repository [or] museum to receive the fossil material and a written agreement between the property owner/developer and the repository must be in place prior to site grading.
- All pertinent exhibits, maps and references.
- Procedures for reporting of findings. Identification and acknowledgement of the developer for the content of the PRIMP as well as acceptance of financial responsibility for monitoring, reporting and curation fees.

Elements of the plan can be adjusted throughout the course of a project as new information is gathered and conditions change, as long as the County Geologist is consulted and all parties agree. For example, if after 50 percent of earth-disturbing activities have occurred in a particular unit or area and no fossils whatsoever have been discovered, then the Project paleontologist may be able to reduce or eliminate monitoring efforts in that unit or area.

4
METHODS

4.1 RECORDS SEARCH AND LITERATURE REVIEW

Paleontological resources are not found in soil (i.e., surface material created via the interaction of weathered geologic material and organic material) but are contained within the geological deposits or bedrock that underlie the soil layer. Therefore, in order to ascertain whether a particular project area has the potential to contain significant fossil resources at the subsurface, it is necessary to review relevant scientific literature and geologic maps to determine the underlying geology and stratigraphy of the area. Furthermore, in order to delineate the boundaries of paleontological sensitivity, it is necessary to determine the extent of the entire geologic unit because paleontological sensitivity is not limited to surface exposures of fossil material.

In order to determine whether fossil localities have been previously discovered within a project area or a particular rock unit, a search of pertinent local museum repositories for paleontological localities within and near the project area should be performed. For this Project, a museum records search was conducted at the Natural History Museum of Los Angeles County (NHMLAC). The museum records search was supplemented by a search of the University of California Museum of Paleontology's online database (UCMPDB) for Riverside County as well as a review of previous technical reports of work conducted in the vicinity. The Records Search Area consisted of a 5-mile buffer around the Project Area and included portions of the Victory Pass, East of Victory Pass, Palen Lake, Sidewinder Well, Corn Springs, and Desert Center U.S Geological Survey (USGS) 7.5-minute topographic quadrangle maps.

4.2 FIELDWORK

Æ completed two field investigations during the preconstruction phase of the Project to ascertain the paleontological potential of the Project Area. The first investigation consisted of reconnaissance of the ground surface and the second consisted of observations of geotechnical trenching.

4.2.1 Surface Reconnaissance Survey

The purpose of the field reconnaissance survey was to identify the presence/absence of exposed fossils on the ground surface and to evaluate geologic exposures for their potential to yield subsurface fossil material. On May 4 and 5, 2018, two Æ paleontologists were guided by Æ's Archaeological Field Director, Evan Mills, who used a Global Positioning System (GPS) Trimble Geo XH throughout the Project Area.

The survey was completed by a combination of systematic pedestrian walkover and spot-checking to inspect the ground surface for evidence of paleontological resources. During the systematic survey, close inspections were completed insofar as possible along transects oriented north–south within subareas of each proposed development block mapped as high or undetermined paleontological sensitivity (see Section 6.3). Æ's field crew also inspected locations where subsurface stratigraphy was exposed from incision by ephemeral streams or previous disturbance (e.g., excavated trenches). In contrast, only spot-checking was completed in locations with low sensitivity for paleontological resources.

Æ's field crew kept notes on the encountered geology and sedimentology, and took photographs to document the survey. Observed fossils, if any, were field documented and not collected.

4.2.2 Geotechnical Trenching

To supplement the surface survey, Æ also examined subsurface geology exposed in geotechnical trenches to refine lithologic descriptions and to ascertain the presence/absence of buried fossils. Terracon Consultants, Inc. (Terracon) was contracted directly by IP Athos, LLC to conduct the geotechnical trenching at 40 locations throughout the Project Area (Figure 4-1). Each trench was 10 feet long by 2 feet wide by 10 feet deep.

At each trench location, Terracon excavated in 2-foot increments downward while laying out each sequential bucketful in stratigraphic order in a safe location adjacent to the trench. After a single representative stratigraphic profile had been laid out on the ground surface, Æ's paleontologist completed sedimentological documentation and paleontological examination for the presence/absence of fossils while Terracon's crew continued excavating the trench for geotechnical purposes (i.e., put the spoils elsewhere nearby).

In addition to the stratigraphic profiling at every trench, Æ's paleontologist also examined all geotechnical spoils piles for the presence/absence of fossils. The presence/absence of fossils was to be determined visually for large-fraction fossils as well as by screening through a 2-millimeter mesh sieve for small-fraction fossils at every trench location. Photo-documentation was completed by Æ, and all trenches were backfilled by Terracon at the conclusion of the field investigations at any given trench.

4.3 KEY PERSONNEL

Æ's Paleontology Program Manager Dr. Amy Ollendorf, oversaw the production of this PIR. Æ Staff Paleontologist Christopher Shi wrote the PIR with Ollendorf assisted by two other Æ staff paleontologists, Scott Rohlf and Christopher Shea. Cari Inoway and Jessica Jones provided GIS mapping. Rohlf and one of Æ's paleontological field technicians, Jorge Mendieta, conducted the field reconnaissance survey. Shi subsequently completed the paleontological field assessments during the geotechnical trenching. Ollendorf also provided overall quality control of all desktop, field, and production output.

Rohlf is also Æ's Project paleontologist as he meets the SVP (2010) qualifications standards. Both Shi and Shea have graduate degrees in geology; they both also possess familiarity and proficiency with paleontology, sedimentology, and stratigraphy, and Shi has 1.5 years of paleontological monitoring experience in California. Mendieta has a bachelor's degree in geosciences and 2 years of paleontological monitoring experience in California. As Managing Principal, Ollendorf is a Licensed Professional Geologist (Minnesota #30084) with 30 years of environmental compliance experience across the United States and abroad. Résumés for key personnel can be found in Appendix A.

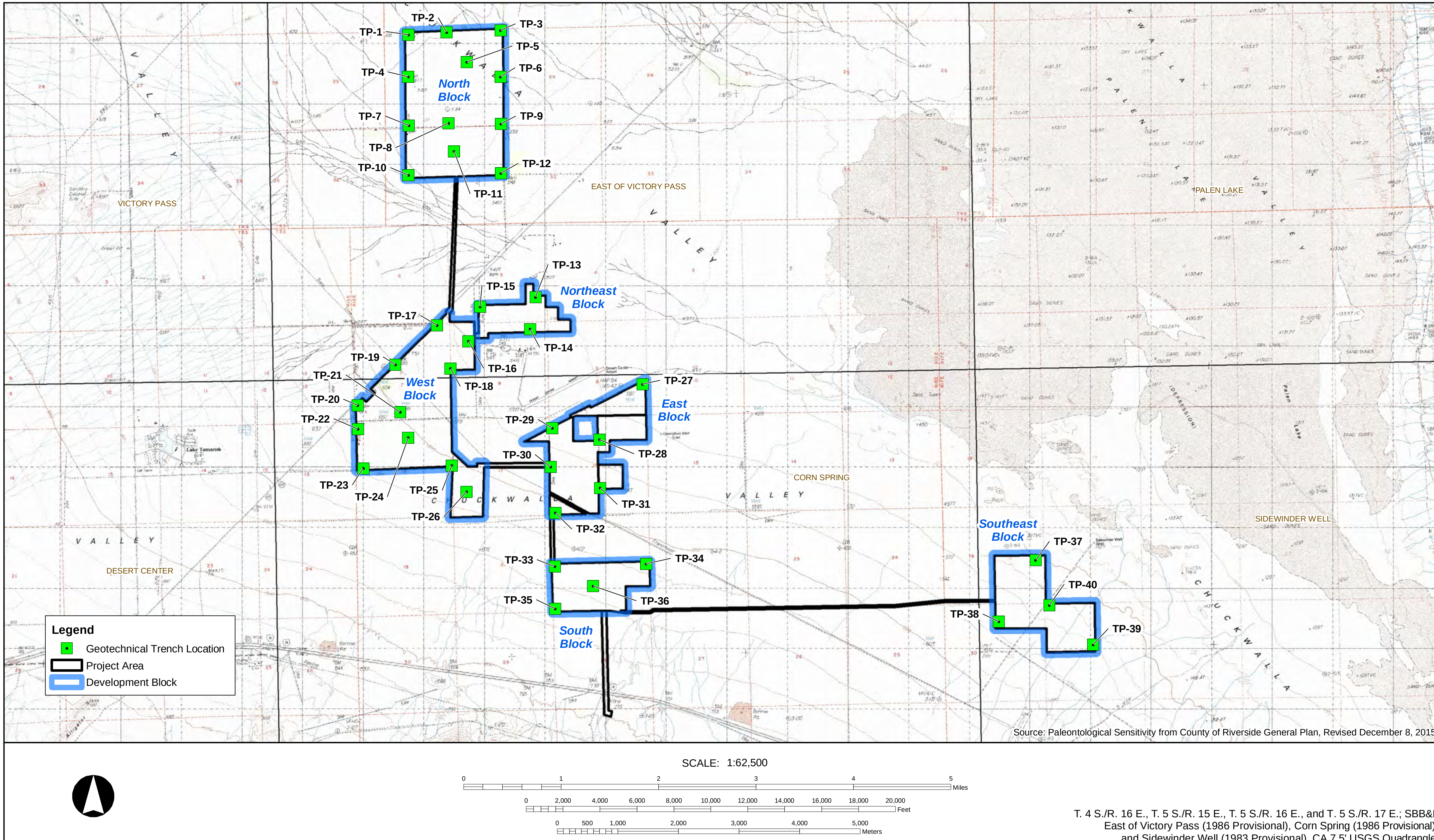

Figure 4-1 **Locations of geotechnical trenches.**

5
GEOLOGY AND PALEONTOLOGY

The information presented in the chapter is based on recent Æ projects in the Mojave Desert in general and in the Desert Center area in particular (Tennyson, 2017). The section on geology and paleontology of the Project Area is original.

5.1 REGIONAL GEOLOGY

The Project is located in the Chuckwalla Valley of eastern Riverside County at the boundary between the Mojave Desert and eastern Transverse Range geomorphic provinces (California Geological Survey, 2002; Hall, 2007). Basin and range topography, typical of the eastern Mojave Desert and eastern California, extends to the north and east (California Geological Survey, 2002), while mountains comprising part of the eastern Transverse Ranges occur to the west and south (Powell, 1981). Mountain ranges surrounding the Chuckwalla Valley and the Project include the Palen and Coxcomb ranges to the north, the Eagle Mountains to the west, and the Chuckwalla Mountains to the south (Jennings, 1967). The Palen and Coxcomb ranges exhibit typical basin and range topography, characterized by narrow faulted mountain chains separated by subsiding flat alluvial basins (Peterson, 1980), a pattern that continues north into the Mojave Desert Geomorphic Province. The Eagle Mountains are within the easternmost extent of the Transverse Ranges (Hall, 2007, p. 180; Powell, 1981).

The oldest rock units in this region are Proterozoic-age gneiss and granite, forming the core of the Chuckwalla and Big Maria mountains. These units may be overlain by Paleozoic-age quartzite, silicate rocks, marble, and schist and Triassic- or Jurassic-age sedimentary rocks including shallow-water (marine and nonmarine) strata of schist, quartzite, and metaconglomerate (Stone, 2006). Large intrusive masses of Triassic and Jurassic granites are found in many ranges (Jennings, 1967; Stone, 2006; Dibblee, 2010). Regionally extensive Jurassic volcanics consist of highly deformed and metamorphosed rocks of intermediate to silicic composition (such as rhyolite). Limited exposures of Tertiary-age rocks in the valley include fanglomerates and sedimentary breccias (Stone, 2006) and undifferentiated volcanics (Jennings, 1967). Tertiary volcanics include olivine basalt flows and dikes in the Palen Pass area, rhyolitic to basaltic lava flows, flow breccias, airfall tuff, ash-flow tuff, domes of the Chuckwalla Mountains, and felsic intrusive rocks consisting of hypabyssal rhyolitic to dacitic composition (Stone and Pelka, 1989).

The Chuckwalla Valley is a broad, alluviated, and enclosed tectonic basin or bolson (Peterson, 1980), which is an alluvium-filled internally drained structural depression with outlets blocked by alluvial divides (American Geological Institute, 1976; Peterson, 1980). The valley is filled with Pliocene- to Quaternary-age deposits divided into the Pliocene Bouse Formation, Pleistocene Pinto Formation, and Pleistocene and Quaternary alluvium (California Department of Water Resources, 2003). The Pliocene Bouse Formation is generally a limestone overlain by interbedded clay, silt, sand, and tufa; the Pinto Formation is composed of coarse fanglomerate with boulders interbedded with lacustrine clay; and the overlying alluvium is fine to coarse sands interbedded with gravel, silt, and clay (California Department of Water Resources, 1963, 2003; Metzger et al., 1973; Everett, 2013).

Four dry lakes or playas present within the Chuckwalla Valley basin include Palen Lake, which is closest to the Project Area, Ford Lake, Hayfield Lake, and an unnamed playa between the McCoy Range and Mule Mountain. The eastern end of the valley is located on a drainage divide at the base of the Mule and McCoy mountains where the Palo Verde Mesa extends eastward. Alluvial fan deposits derived from these surrounding highlands fill the basin and may contain numerous dry lake beds separated by sand dunes (Norris and Webb, 1976).

Since the late Miocene Epoch, northward movement along the San Andreas fault has resulted in clockwise rotation of the eastern Transverse Ranges by approximately 41 degrees (Carter et al., 1987) with east-west displacement along these faults of roughly 40 kilometers (Langenheim and Powell, 2009; Powell, 1981), increasing the elevation of the alluvial divide and resulting in geographic separation of Ford and Palen lakes. Near the Palen Range, blocks are tilted with uplifted northern and eastern margins and dropped southern and western sides, suggesting the valley is either actively subsiding or subsided in the past (Hayhurst et al., 2010; Stone and Pelka, 1989).

The Middle and Late Pleistocene were characterized by periods of high rainfall in this part of the continent and the creation of large pluvial lakes in the Basin-Range and Mojave Desert resulting from glacial melting until about 10,000 years before present (B.P.). While not certain, it is possible that the Palen and Ford dry lake beds in the Chuckwalla Valley could represent the remnants of one of the southernmost of these pluvial lakes. It is also possible that, subsequent to 10,000 B.P., briefer periods of higher rainfall during the Holocene may have created temporary lakes in these basins. Recently, a “last high-stand” shoreline for Ford Lake, at the eastern end of the Chuckwalla Valley, was estimated to have occurred circa (ca.) 4000 B.P. (Tetra Tech, 2009, p. 4). In today’s Mojave Desert, it has been postulated that at the onset of the Late Holocene, approximately 4000 B.P., a period of greater precipitation and elevated lake levels began (Sutton et al., 2007). This coincides with the period when Ford Lake is estimated to have contained a significant volume of water. It seems reasonable to extrapolate that maximum filling of Palen Lake occurred at this time as well.

Along the northern front of the Chuckwalla Mountains, a series of coalescing alluvial fans form a broad piedmont that spreads northward toward Desert Center and northeastward, terminating at Palen Lake. The bulk of deposition on many of the alluvial fans observed in the Mojave Desert occurred during the Pleistocene, primarily during the latest part of the epoch (9,400–14,000 years ago) as a response to an increase in storm events during Pleistocene-Holocene transition (McDonald et al., 2003). Alluvial sediments underlying the Project Area are mainly sourced from Corn Spring Wash, part of the Chuckwalla Mountains piedmont, a roughly 4- to 5-mile-wide alluvial fan that extends nearly 9 miles to the basin floor passing through the Project Area toward the Palen Lake area. The western side of the upper fan consists primarily of intermediate age (mid-Pleistocene) fan remnants (Stone and Pelka, 1989) with old (early Pleistocene) fan deposits presumably near the fan apex. Young alluvial fan deposits, mid- to late-Holocene, comprise the medial fan and distal fan (Stone and Pelka, 1989) with eolian deposits mantling the fan skirt. Playa deposits are found in lowest areas of the basin, which are mantled by eolian deposits obscuring the true extent of the former lake (Jennings, 1967; Stone and Pelka, 1989).

5.2 GEOLOGY AND PALEONTOLOGY OF THE PROJECT AREA

The Project Area is mapped at a scale of 1:250,000 by Jennings (1967) and 1:62,500 by Dibblee (2010). According to these published maps, surface exposures of Pleistocene- to Holocene-age sedimentary rocks are distributed across the Project Area. The geology and paleontology of these deposits are described in the following sections and depicted in Figure 5-1.

5.2.1 Holocene-age Alluvium (Qa)

Holocene-age alluvium (Qa) covers most of the Project Area's present ground surface (Figure 5-1). This alluvium occurs in fans derived during modern washes from the surrounding mountain ranges; they typically consist of silt, sand, and gravel. In addition, active dune sands may be present at the surface in the northern and eastern portions of the Project Area (McLeod, 2018). According to McLeod (2018) and the SVP (2010), Holocene alluvial deposits similar to those mapped at the surface of the Project Area, particularly those younger than 5,000 years old, are generally too young to contain fossilized material. While these do not typically produce fossil material, they may shallowly overlie older Quaternary alluvium, which can produce significant fossil material (McLeod, 2018).

5.2.2 Pleistocene-age Surficial Deposits (Qc)

Pleistocene-age surficial deposits (Qc) mapped in the Project Area (Figure 5-1) are comprised of moderately bedded, nonmarine gravels and sands in coarse sandy matrix (Dibblee, 2010).

5.2.3 Older Pleistocene-age Subsurface Deposits (Qpb, Qoa, Qoc)

Other Pleistocene deposits near the Project Area are likely buried at unknown depths, including the lacustrine clays, sandstones, and gravels of the Pinto Formation (Qpb), which is known to be fossiliferous and red where interstratified with basalt flows (Dibblee, 2010; Scharf, 1935). In addition, paleolacustrine deposits associated with an ancient expanded Palen Lake (Qoa, Qoc) are possible at depth in the eastern and northern portions of the Project Area (McLeod, 2018). These lacustrine sediments may contain significant fossil vertebrates (McLeod, 2018).

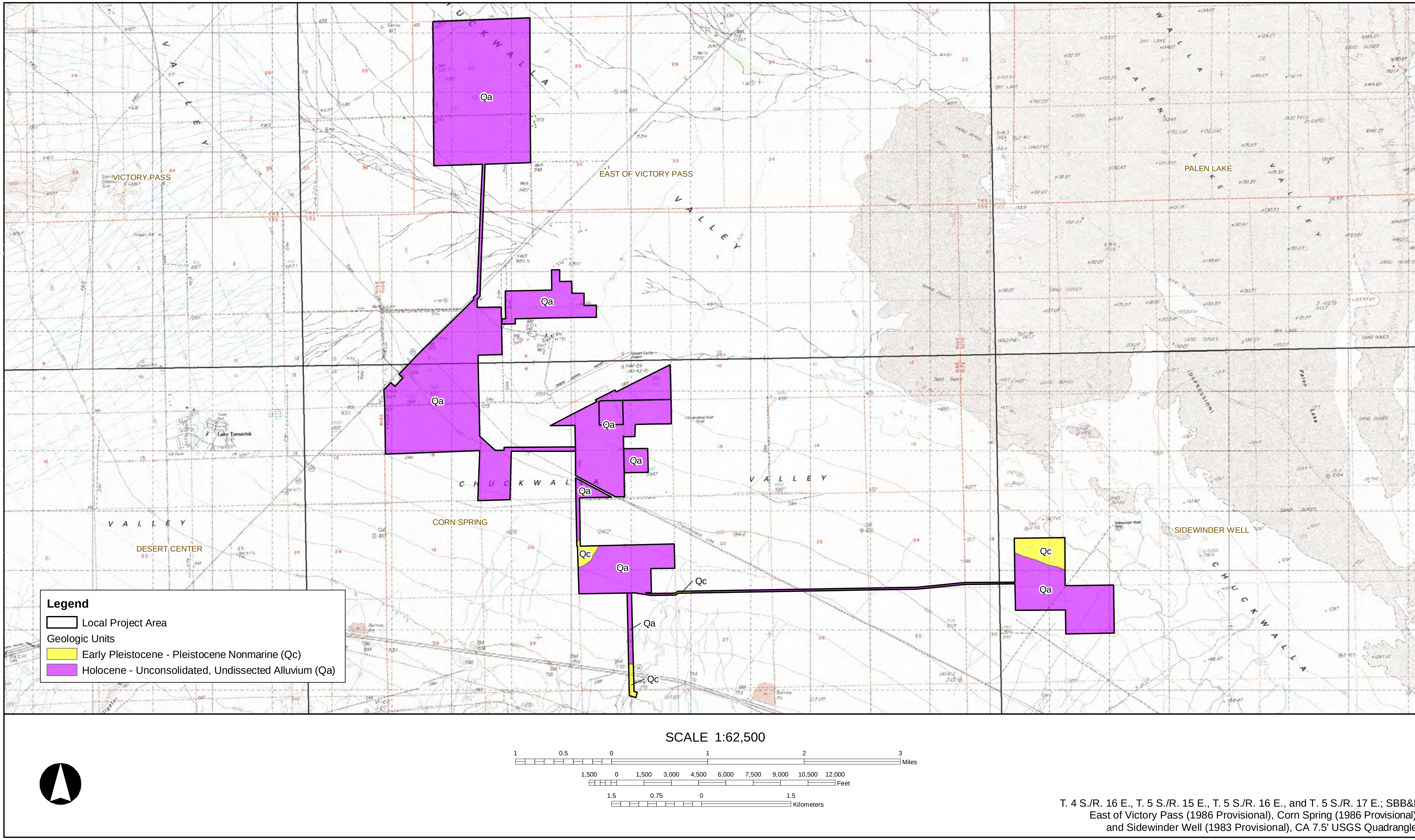

Figure 5-1 **Geologic units in the Project area.**

6
RESULTS AND ANALYSIS

6.1 MUSEUM RECORDS SEARCH AND ONLINE DATABASE RESULTS

The NHMLAC and UCMPDB searches yielded no records for previously identified vertebrate localities within the Project Area. However, the NHMLAC reports at least three localities recorded near the Project Area from the same or similar sedimentary deposits (Table 6-1). The closest fossil locality, LACM 5977, contains specimens of kangaroo rat and pocket mouse from Pleistocene-age older Quaternary deposits. This locality is east-southeast of the proposed Project Area, north of I-10 on the southwest side of Ford Dry Lake. The NHMLAC also reported two additional Pleistocene-age localities from the Pinto Formation, northwest of the Project Area between the Eagle and Coxcomb mountains: LACM (CIT) 208 and LACM 3414. These produced tortoise, horse, camel, and llama (McLeod, 2018). Depth for each vertebrate locality is unreported. Several fossil localities within Quaternary deposits in Riverside County are recorded in the UCMPDB. However, the majority of these fossils are from the Bautista Beds, which are not mapped near the Project Area or the records have unspecified localities.

Table 6-1
Vertebrate Localities Reported near the Project Area

Locality No.	Geologic Unit	Age	Taxa
LACM 5977	Fine-grained lacustrine deposits	Pleistocene	*Dipodomys* (kangaroo rat) *Perognathus* (pocket mouse)
LACM (CIT) 208 and LACM 3414	Pinto Formation	Pleistocene	*Gopherus* (tortoise) *Equus* (horse) *Camelops* (camel) *Tanupolama stevensi* (llama)

Source: McLeod, 2018

6.2 LITERATURE REVIEW

In addition to the museum and online database search results, technical reports from field surveys conducted in the vicinity of the Project Area also provided information pertinent to the Athos Project Area. For instance, five nonsignificant fossil occurrences were reported for the adjacent Palen Solar Power Project. Of these, four were specimens of petrified wood and one was of nondiagnostic vertebrate material. All specimens were discovered ex situ, having been transported an unknown distance from their original geologic context (DeBusk and Corsetti, 2009).

Another five fossil occurrences of indeterminate significance were encountered at the Desert Harvest Solar Project. The report describes bones from relict deposits scattered within sand dunes, which have been variously attributed to rodent, rabbit, bird, and tortoise remains, as well as an isolated tortoise shell fragment. These localities are interpreted to have been either the surface of the ancient Palen Dry Lake during high stand or reworked pond deposits (Roeder, 2012a, 2012b). In the latter, such deposits may have been deposited initially prior to ca. 5,000 years ago and subsequently eroded and redeposited into dunes of relatively modern age (Nials, 2013).

6.3 DETERMINATION OF PALEONTOLOGICAL RESOURCE POTENTIAL FOR GEOLOGIC UNITS WITHIN THE PROJECT AREA

Æ overlaid the GIS shapefile for the Project Area onto the Paleontological Sensitivity Map as published by the County of Riverside (Figure 6-1). According to the County's map, the Project Area consists of locations with high A (Ha), low, and undetermined paleontological sensitivities. The majority of the Project Area is characterized by Ha paleontological sensitivity, followed in acreage by low and undetermined paleontological sensitivities (Table 6-2). No locations of High B (Hb) paleontological potential are mapped in the Project Area.

Table 6-2
Distribution of Paleontological Sensitivity throughout the Project Area

High A (acres)	Low (acres)	Undetermined (acres)
2,256.65	1,087.55	50.94

6.4 FIELD RESULTS

Preconstruction investigations were conducted to confirm the presence/absence of surface fossils as well as to ascertain the subsurface paleontological potential throughout the Project Area.

6.4.1 Reconnaissance Field Survey

The ground surface and shallow to moderate depths over the majority of the Project Area are disturbed as a result of previous agricultural activities associated with past jojoba farming (Figure 6-2). The overall topography is low relief, characterized by agricultural fields and alluvial wash plains incised by ephemeral stream channels with coarse-grained berms (Figure 6-3). The surface geology is predominantly coarse-grained alluvial sands with abundant angular to subangular cobbles and boulders of igneous and metamorphic origin. In the North Development Block there are occasional finer-grained eolian sands, whereas the South and Southeastern development blocks are characterized by abundant cobbles and boulders. Observations of subsurface geology were restricted to shallow ephemeral stream channels or past trenching (Figure 6-4). Exposures varied between 2 and 4 feet thick and offered little to no additional information in comparison to the observed surface geology.

Only one fossil specimen was observed during the two-day reconnaissance field survey (UTM Zone 11 653446 Easting, 3736590 Northing). This specimen was an indeterminate vertebrate bone fragment with evidence of mineralogical replacement; it was approximately 2.5–3.0 centimeters long (Figure 6-5) and was found ex situ in unconsolidated alluvium in the Northeast Development Block.

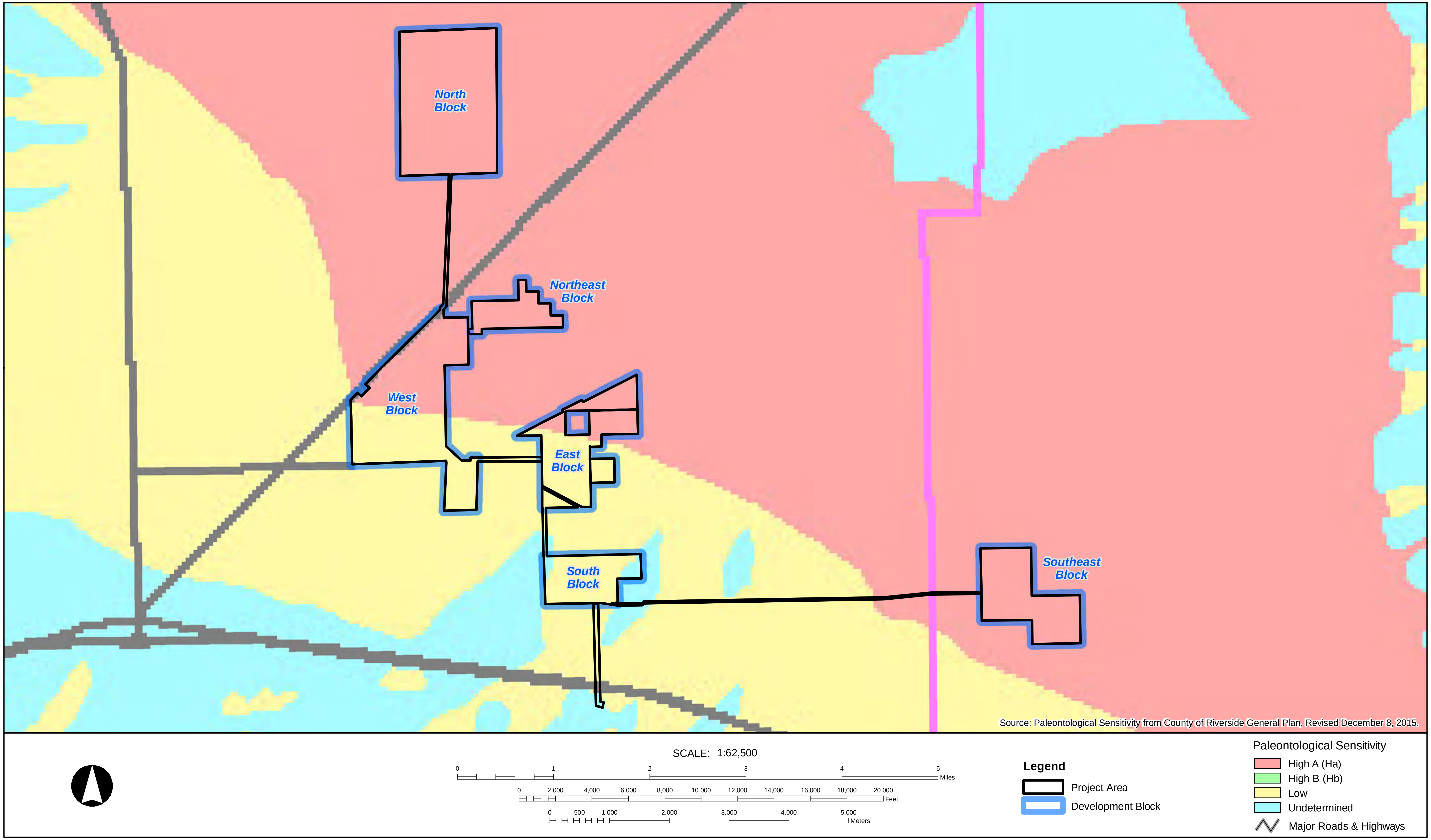

Figure 6-1 Paleontological sensitivity in the Project area and vicinity.

Figure 6-2 Alluvial wash, West Development Block, southeast subarea, facing north.

Figure 6-3 Disturbed surface from agricultural tilling, North Development Block, southern subarea, facing east

Figure 6-4 Stratigraphic profile of exposure in previously abandoned trench.

Figure 6-5 Indeterminate vertebrate fossil—top (left), obverse (right)

Examination of surface exposures verified the ubiquity of Quaternary alluvium as mapped by Dibblee (2010). The sedimentary deposits across the ground surface and in near-surface contexts across the Project Area are characterized by poorly sorted, angular to subangular, poorly consolidated coarse-grained sands to boulders, which are indicative of high-energy and relatively recent deposition. Both factors are generally incompatible with good fossil preservation. Published literature and museum records searches indicate there may be older fossiliferous alluvium beneath the younger alluvium (McLeod 2018); however, the thickness of the younger alluvium is unknown at this time.

6.4.2 Geotechnical Trenching—Observations

Of the 40 geotechnical trenches excavated by Terracon (Figure 6-6), 33 were observed by Æ during paleontological monitoring. It should be noted that Terracon's lexicon refers to each trench location as a "test pit" or "TP," and all trenches are numbered sequentially from north to south to southeast. For each group of trenches in proximity displaying similar strata, one trench was selected as a representative stratigraphic profile to illustrate. Additionally, certain trenches were selected for their presence of unique layers. Æ illustrated stratigraphic profiles for a total of 14 observed trenches (Figure 6-7). Sedimentological descriptions as well as presence/absence of fossils for each observed trench are recorded in Table 6-3.

The approximate dimensions of each excavated trench were 10 feet long by 2 feet wide by 10 feet deep (Figure 6-8). The near-surface sedimentary deposits throughout the Project Area consist of alternating layers of tan fine- to coarse-grained sand with varying proportions of gravel and boulder fractions, interspersed with dark brown or reddish silt to silty sand layers (e.g., TP 16 in Figure 6-9). No fossils were encountered in any of the geotechnical trenches. The results are discussed below on a development block by development block basis from north to south to southeast.

6.4.2.1 North Development Block

In the North Development Block (North), sediments were observed to be increasingly fine-grained with depth in TPs 1, 2 and 5, whereas TPs 3 and 6 exhibited increasingly coarse-grained sediments with depth. TP 6 also exposed a unique whitish layer of calcium-rich sand at a depth of 8–10 feet. This unique layer also was observed in TP 13 (Northeast Development Block, see below). TPs 4 and 9 had identical stratigraphic successions of fine-grained sand with low gravel content from 0 to 4 feet, a reddish silty sand layer from 4 to 6 feet, followed by more fine-grained sand with low gravel content from 6 to 10 feet.

6.4.2.2 Northeast Development Block

In the Northeast Development Block (Northeast), TP 13 contained a unique layer of calcium-rich sand similar to that observed in TP 6 (North, see above). However, TP 13 also included caliche fragments first encountered at 8 feet, which continued to an unknown total depth (Figure 6-10).

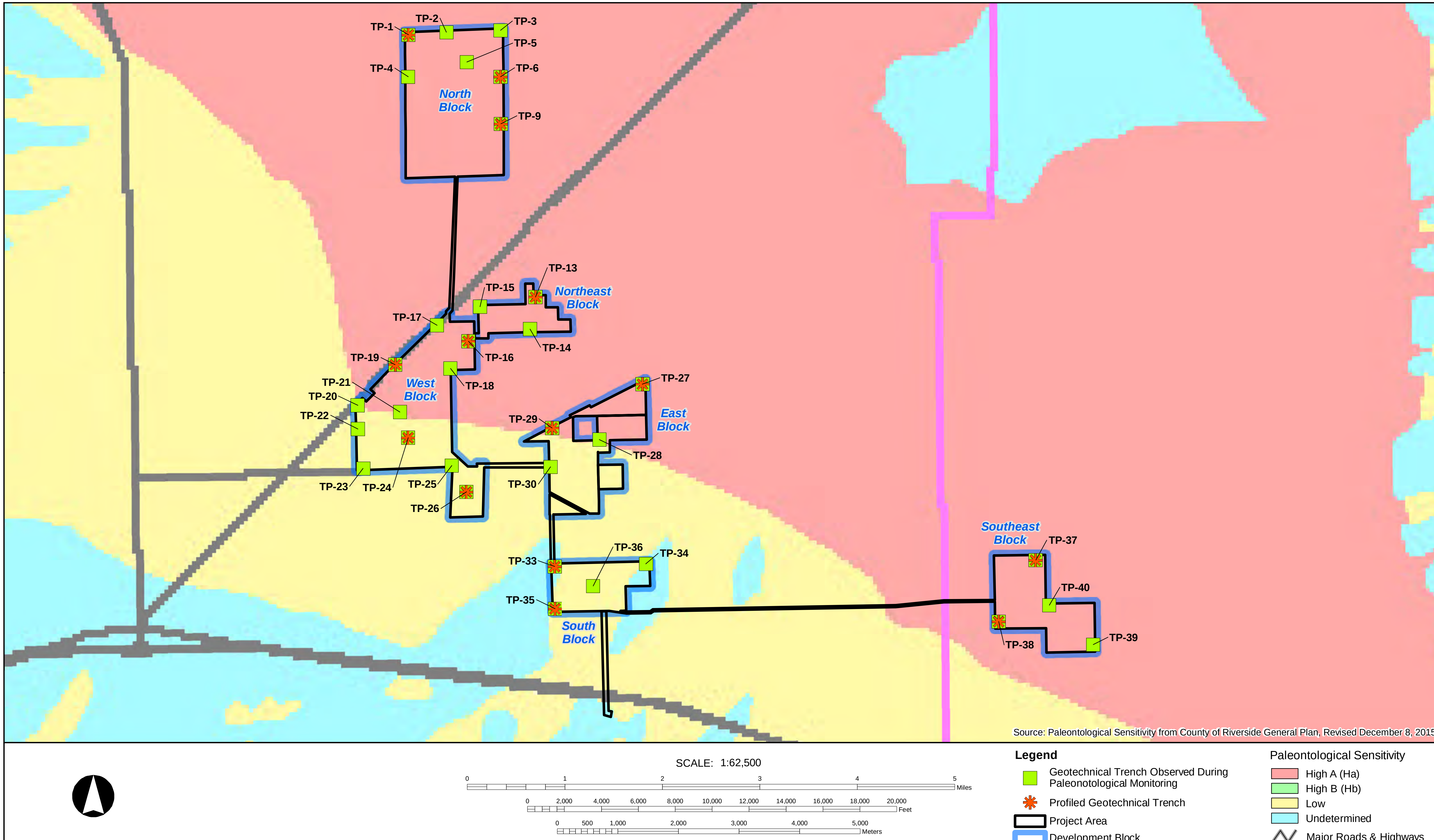

Figure 6-6 **Locations of observed geotechnical trenches and illustrated stratigraphic profiles.**

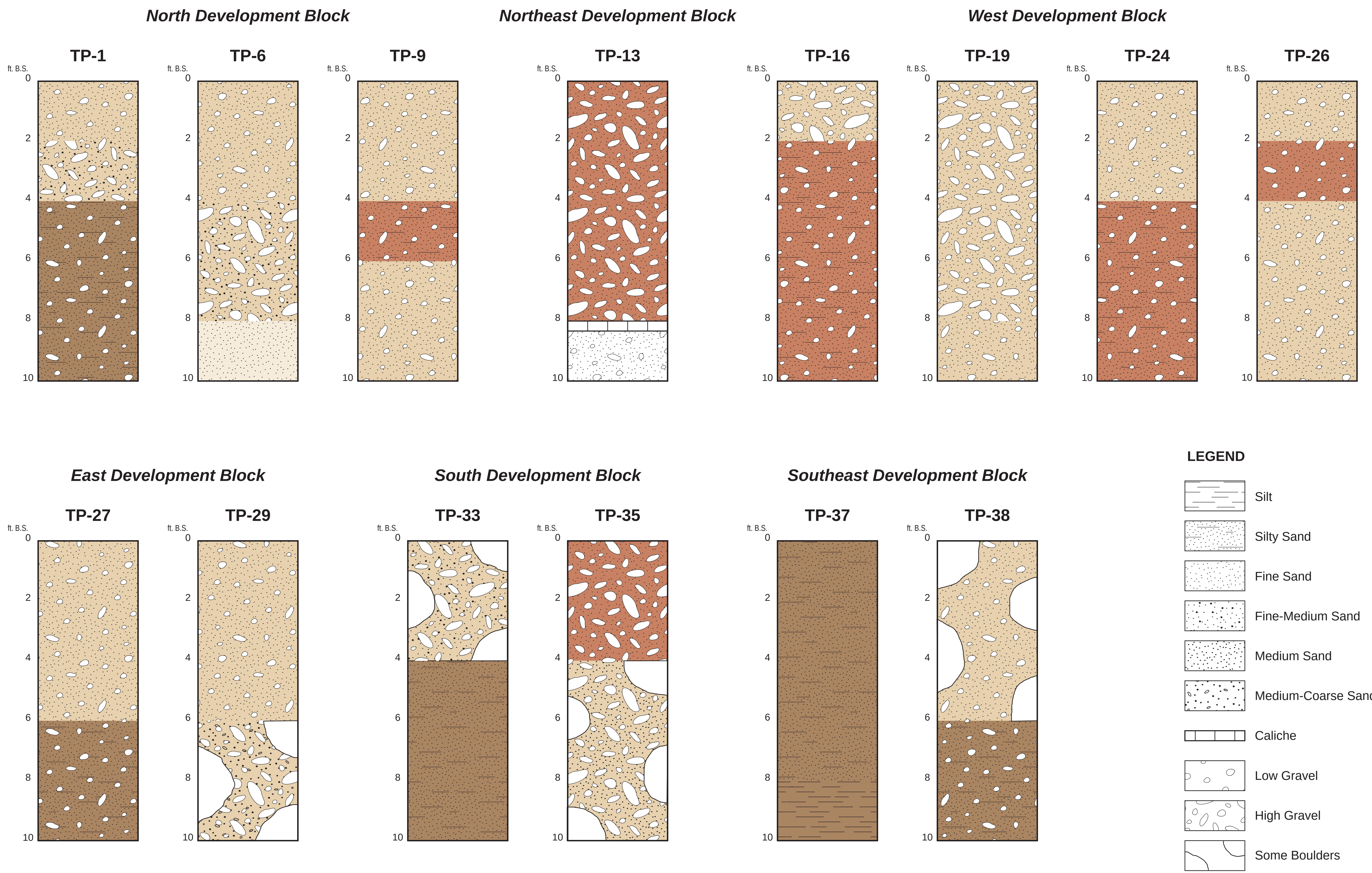

Figure 6-7 **Representative stratigraphic profiles of observed geotechnical trenches.**

Table 6-3
Results of Geotechnical Trenching

Trench (Test Pit, TP)	Description	Paleontology
1(*)	**0-2 ft:** tan fine-grained sand, low gravel **2-4 ft:** tan fine to medium-grained sand, high gravel **4-10 ft:** dark brown silty sand, low gravel	None throughout
2	**0-6 ft:** tan fine-grained sand, low gravel **6-10 ft:** dark brown silty sand, low gravel	None throughout
3	**0-4 ft:** red Fe-rich fine-grained sand, low gravel **4-10 ft:** tan fine to medium-grained sand, high gravel	None throughout
4	**0-4 ft:** tan fine-grained sand, low gravel **4-6 ft:** red Fe-rich silty sand **6-10 ft:** tan fine-grained sand, low gravel	None throughout
5	**0-10 ft:** dark brown silty sand, low gravel	None throughout
6(*)	**0-4 ft:** tan fine-grained sand, low gravel **4-8 ft:** tan fine to medium-grained sand, high gravel **8-10 ft:** white to tan Ca-rich fine-grained sand	None throughout
7	Not observed	
8	Not observed	
9(*)	**0-4 ft:** tan fine-grained sand, low gravel **4-6 ft:** red Fe-rich silty sand, low gravel **6-10 ft:** tan fine-grained sand, low gravel	None throughout
10	Not observed	
11	Not observed	
12	Not observed	
13(*)	**0-8 ft:** red Fe-rich fine-grained sand, high gravel **8-10 ft:** white Ca-rich fine-grained sand and caliche fragments, low gravel	None throughout
14	**0-4 ft:** tan fine-grained sand, low gravel **4-10 ft:** red Fe-rich silty sand, low gravel	None throughout
15	**0-2 ft:** tan fine-grained sand, low gravel **2-4 ft:** red Fe-rich fine-grained sand, low gravel **4-10 ft:** dark brown silty sand, low gravel	None throughout
16(*)	**0-2 ft:** tan fine-grained sand, high gravel **2-10 ft:** red Fe-rich silty sand, low gravel	None throughout
17	**0-4 ft:** tan fine-grained sand, high gravel **4-10 ft:** red Fe-rich silty sand, low gravel	None throughout
18	**0-2 ft:** tan fine to medium-grained sand, high gravel **2-4 ft:** red Fe-rich fine to medium-grained sand, high gravel **4-6 ft:** tan fine to medium-grained sand, high gravel **6-10 ft:** red Fe-rich fine to medium-grained sand, high gravel	None throughout
19(*)	**0-8 ft:** tan fine-grained sand, high gravel **8-10 ft:** tan fine-grained sand, low gravel	None throughout
20	**0-2 ft:** tan fine-grained sand, low gravel **2-10 ft:** red Fe-rich silty sand, low gravel	None throughout
21	**0-6 ft:** tan fine-grained sand, low gravel **6-10 ft:** tan fine-grained sand, high gravel	None throughout

Table 6-3
Results of Geotechnical Trenching

Trench (Test Pit, TP)	Description	Paleontology
22	**0-2 ft:** tan fine-grained sand, low gravel **2-6 ft:** red Fe-rich fine-grained sand, high gravel **6-10 ft:** red Fe-rich silty sand	None throughout
23	**0-2 ft:** tan fine-grained sand, high gravel **2-10 ft:** red Fe-rich silty sand, low gravel	None throughout
24(*)	**0-4 ft:** tan fine-grained sand, low gravel **4-10 ft:** red Fe-rich silty sand, low gravel	None throughout
25	**0-2 ft:** tan fine-grained sand, high gravel **2-8 ft:** tan fine-grained sand, low gravel **8-10 ft:** tan fine to medium-grained sand, high gravel	None throughout
26(*)	**0-2 ft:** tan fine-grained sand, low gravel **2-4 ft:** red Fe-rich fine-grained sand, low gravel **4-10 ft:** tan fine-grained sand, low gravel	None throughout
27(*)	**0-6 ft:** tan fine-grained sand, low gravel **6-10 ft:** dark brown silty sand, low gravel	None throughout
28	**0-2 ft:** tan fine to medium-grained sand, high gravel **2-10 ft:** dark brown silty sand, high gravel	None throughout
29(*)	**0-6 ft:** tan fine-grained sand, low gravel **6-10 ft:** tan medium to coarse-grained sand, high gravel, some boulders	None throughout
30	**0-2 ft:** tan fine to medium-grained sand, high gravel **2-10 ft:** red Fe-rich silty to fine-grained sand, low gravel	None throughout
31	Not observed	
32	Not observed	
33(*)	**0-4 ft:** tan fine to medium-grained sand, high gravel, some boulders **4-10 ft:** dark brown silty sand	None throughout
34	**0-4 ft:** red Fe-rich fine-grained sand, high gravel, some boulders **4-8 ft:** tan fine-grained sand, high gravel, some boulders **8-10 ft:** red Fe-rich fine-grained sand, high gravel, some boulders	None throughout
35(*)	**0-4 ft:** red Fe-rich fine-grained sand, high gravel **4-10 ft:** medium-grained sand, high gravel, some boulders	None throughout
36	**0-10 ft:** tan fine-grained sand, high gravel, some boulders	None throughout
37(*)	**0-8 ft:** dark brown silty sand **8-10 ft:** dark brown silt	None throughout
38(*)	**0-6 ft:** tan fine-grained sand, low gravel, some boulders **6-10 ft:** dark brown silty sand, low gravel	None throughout
39	**0-10 ft:** dark brown silty sand, low gravel	None throughout
40	**0-8 ft:** dark brown silty sand, low gravel **8-10 ft:** tan fine-grained sand, high gravel	None throughout

(*) – profiled geotechnical trench

Figure 6-8 Example of excavated geotechnical trench (TP 17, facing west).

Figure 6-9 Tan fine-grained sand (top) and red silty sand (bottom) in TP 16.

Figure 6-10 Caliche layer (bottom) in TP 13

6.4.2.3 West Development Block

In the West Development Block (West), fine-grained sand with high gravel content was exposed near the surface of TP 16 grading downward into reddish silty sand, beginning around 2 feet deep. This stratigraphy was similar to that of TP 17, also in the West, but also was similar to TPs 14 and 15 in the Northeast (see above). TP 19 had high gravel content throughout much of the top 10 feet, similar to TPs 18 and 21. TP 24 showed a familiar trend with fine-grained sand with high gravel content near the surface, transitioning downward to reddish silty sand at approximately 4 feet depth, similar to TPs 20, 22, and 23. The top 2 feet in TP 26 was similar to the upper layer of TP 24. From 2 to 8 feet, the entire profile of TP 26 was identical to TP 25, although it differed slightly by remaining consistently fine-grained with low gravel content from 0 to 2 feet and from 8 to 10 feet.

6.4.2.4 East Development Block

In the East Development Block (East), TP 29 is unique in that it contained coarse-grained sand with high gravel content and boulders near the base. TP 27 showed a fining downward trend similar to TPs 28 and 30, although the silty sand in TP 30 was distinctly reddish.

6.4.2.5 South Development Block

In the South Development Block (South), TP 33 was selected for observation and illustration because it was placed in an area of undetermined sensitivity. TP 35, similar to TPs 34 and 36, contained a high gravel and boulder content throughout.

6.4.2.6 Southeast Development Block

In the Southeast Development Block (Southeast), TP 38 contained boulders from 0 to 6 feet depth, but from 6 to 10 feet it was nearly identical to the entirety of TPs 39 and 40 (i.e., silty sand with low gravel content). TP 37 is unique in comparison to TPs 38–40 because it was primarily finer sediment devoid of any gravel.

6.4.3 Geotechnical Trenching—Interpretations

The lack of fossils along with the overall ubiquity of poorly sorted layers and the inconsistencies in the thicknesses of similar layers, even between neighboring trenches, made discernment of individual geologic units (i.e., younger alluvium vs. older alluvium), if present, impossible by Æ's purely observational methods across the Project Area. Nevertheless, there appear to be at least a few notable trends among the observed trenches. For instance, fine-grained probable eolian sands were more abundantly obvious in the upper few feet of trenches in the north and central portions of the Project (Northeast, West, and East) than in the southern portion of the Project (South and Southeast). Conversely, coarse gravels and boulders were observed in much more abundance in the southern portions of the Project. Fine-grained deposits are usually best for fossil preservation, and eolian sands generally are not known for fossil preservation outside of highly unusual conditions. Coarse-grained sediments, such as gravels and boulders, generally are unlikely to preserve fragile fossil material because of the high energy of the depositional environment.

With a few exceptions, the thicker reddish silt and silty sand layers were concentrated within the central portion of the Project Area (Northeast and West). Similar fine reddish layers were rarer in the North and South in comparison to the central portion of the Project and were absent altogether in the Southeast and north half of the East. Comparatively fine-grained sediments observed in TP 33 (South) and TP 37 (Southeast) may be associated with fossiliferous deposits at depth from ancient Palen Dry Lake.

7
RECOMMENDATIONS

The literature review and museum records search along with Riverside County's paleontological sensitivity mapping informed the field reconnaissance survey and interpretations from 33 observed geotechnical trenches in the Project Area. The following section provides a discussion of paleontological sensitivity and mitigation recommendations.

Highly sensitive (Ha) geologic units and units with undetermined paleontological sensitivity are mapped from surface exposures in and near the Project Area (County of Riverside, 2015b). Æ's discovery of a single fossil ex situ in the Northeast Development Block during the surface reconnaissance field survey supports the sensitivity rankings. Museum record searches and the literature review results suggest the presence of the Pinto Formation and older Quaternary alluvium in the Project Area, both of which have previously yielded significant paleontological material elsewhere. Æ's observations of reddish sediments in some of the geotechnical trenches may confirm the presence of the Pinto Formation at depth in the Project Area. Furthermore, the presence of fine-grained sediments in some of the trenches also is compatible with depositional environments conducive to fossil preservation.

The present study indicates Project-related activities may impact potentially significant paleontological resource; therefore, several management recommendations are provided herein to mitigate adverse impacts to paleontological resources, if present. The following measures have been used by professional paleontologists for many years and have proven to be effective in reducing or eliminating adverse impacts to paleontological resources from development projects.

7.1 WORKER'S ENVIRONMENTAL AWARENESS TRAINING

Prior to the start of construction, all field personnel should be briefed regarding the types of fossils that could be found in the Project Area and the procedures to follow should paleontological resources be encountered. This training should be accomplished at the pregrade kick-off meeting or morning tailboard meeting and should be conducted by the Project paleontologist or his/her representative. Specifically, the training should provide a description of the fossil resources that may be encountered in the Project Area, outline steps to follow in the event that a fossil discovery is made, and provide contact information for the Project paleontologist and on-site monitor(s). The training should be developed by the Project paleontologist and may be conducted concurrent with other environmental training (e.g., cultural and natural resources awareness training, safety training, etc.).

7.2 PALEONTOLOGICAL MITIGATION MONITORING

Monitoring recommendations are presented on the basis of proposed depth of disturbance by grading and excavation during construction. Prior to the commencement of ground-disturbing activities, a qualified professional paleontologist should be retained to prepare and implement a Paleontological Resources Mitigation Plan (PRMP) for the Project.

7.2.1 Disturbance Less than 10 Feet

In general, disturbance of the top 10 feet by construction activities warrants only spot-check monitoring across the entire Project Area. The major exceptions to this general rule are locations in which sediments from the fossiliferous Pinto Formation may be present. Full-time monitoring is warranted in those development areas where Æ documented reddish sediments that may be derived from the Pinto Formation (Figure 7-1):

- Northeast Development Block,
- West Development Block, and
- Southern portion of the East Development Block.

If no paleontological finds are made during full-time monitoring in those locations, then the paleontological monitor may switch to spot-check monitoring at the direction of the Project paleontologist.

7.2.2 Disturbance Greater than 10 Feet

For depths below 10 feet, Æ recommends full-time monitoring initially since the subsurface geology is yet undocumented. If no paleontological finds are made during full-time monitoring at depths greater than 10 feet, then the paleontological monitor may switch to spot-check monitoring at the direction of the Project paleontologist.

7.3 FOSSIL PREPARATION, CURATION, AND REPORTING

Any significant fossils collected during fieldwork will be prepared in a properly equipped paleontology laboratory to a point ready for curation. Preparation will include the careful removal of excess matrix from fossil materials and stabilization and repair of specimens, as necessary. Following laboratory work, all fossils specimens will be identified to the lowest taxonomic level, cataloged, analyzed, and prepared for curation. Fossil specimens will be submitted for permanent curation in a museum repository approved by the County. The cost of curation is assessed by the repository and is the responsibility of IP Athos, LLC.

At the conclusion of laboratory work and curation, a final report will be prepared to describe the results of the paleontological inventory and evaluation. The report will include an overview of the Project Area geology and paleontology, a description of the field and laboratory methods, a list of taxa recovered (if any), an analysis of fossils recovered (if any) and their scientific significance, and recommendations. If fossils are collected and prepared for curation, a copy of the report will be submitted to the curation institution along with the fossil assemblage.

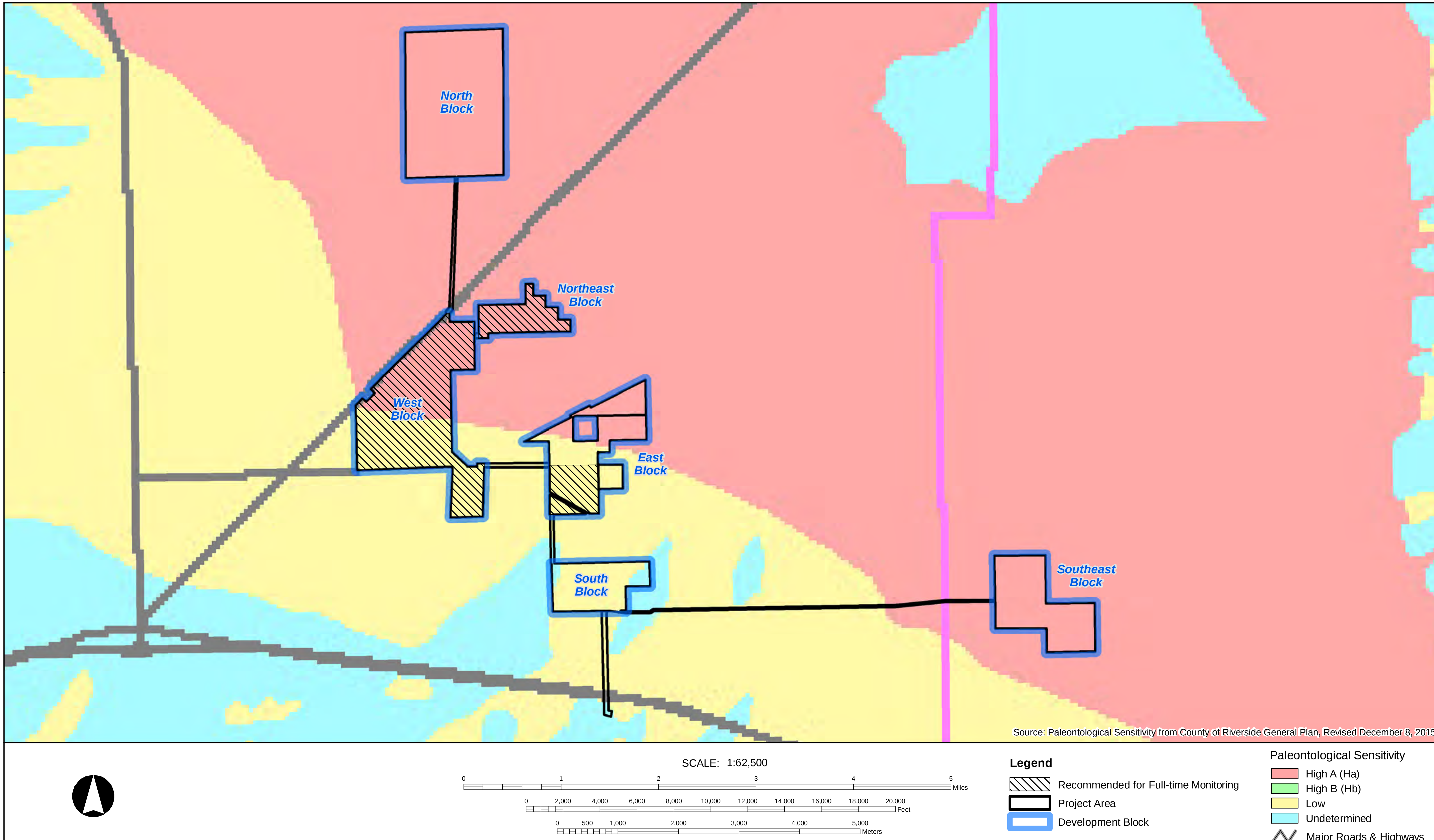

Figure 7-1 Areas recommended for full-time monitoring.

8
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APPENDIX A

Qualifications of Key Personnel

Applied EARTHWORKS Inc.

AMY L. OLLENDORF

Managing Principal/Paleontology Program Manager

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

- Licensed Professional Geologist, Minnesota #30084
- Registered Professional Archaeologist #12588

Professional Experience

- 2018–present, Managing Principal/ Paleontology Program Manager, Applied EarthWorks, Inc.
- 2015–2017, 2005–2008, President and Senior Cultural Heritage Specialist, ALO Environmental Associates LLC
- 2006–2015, Program Manager, Cultural Heritage Planning and Management, AECOM
- 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.
- 1994–1996, Statewide Inventory Coordinator, Minnesota State Historic Preservation Office

Summary of Qualifications

Dr. Ollendorf is a licensed professional geologist (Minnesota) with more than 30 years of experience in environmental compliance at the global, national, tribal, state, and local levels. She has supervised and/or participated in paleontology, paleoecology, and geoarchaeological services, tribal negotiations, and agency coordination throughout her career. She also has been a team member or project manager for projects involving an Environmental Impact Statement (EIS) or Environmental Assessment (EA) and has project experience in the renewable energy and utilities sectors. Dr. Ollendorf's project experience includes work in 35 states (including Arizona, California, Nevada, New Mexico, and Washington), and abroad.

Selected Project Experience

Proposed Development of 55 Acres On the Northwest Corner of Alabama Street & Palmetto Avenue, City of Redlands, San Bernardino County, California. Paleontology Program Manager (2018). Overseeing records search request to Natural History Museum of Los Angeles (NHMLA) and will provide quality control/quality assurance on the paleontological technical memorandum. Client: Albert A. Webb Associates for City of Redlands.

Athos Renewable Energy Project, Riverside County, California. Paleontology Program Manager and Project Manager (2018). Oversaw museum and online records searches for the 3,237-acre solar facility, a 11.1-mile-long by 150-foot-wide transmission line corridor (158 acres), and a surrounding 5-mile-wide buffer. Also oversaw completion of a Paleontology Survey Plan, ground-reconnaissance field survey, observations of geotechnical trenches on private lands, and Paleontological Identification Report (PIR) to the County. Wrote Scope of Work and will oversee completion of paleontological observation of geotechnical test trenching for presence/absence of subsurface fossils and/or fossiliferous geologic units on private lands. If necessary, also will oversee BLM Paleontology Work Plan and Fieldwork Authorization for fossil identification surveys of proposed generation tie-in lines ("gen-ties") and access roads on BLM lands as well as a Report of Findings to BLM. Completing for NEPA and CEQA compliance. Client: IP Athos, LLC and Aspen Environmental Group.

Ten West Link 500 kV Transmission Connection, Maricopa County, Arizona to Riverside County, California. Paleontology Program Manager and Project Manager (2018). Oversaw museum and online records searches and Paleontology Identification Report (PIR) for the entire 114-mile-long preferred alignment and alternatives. Completed for U.S. BLM compliance with the NEPA and California Public Utilities Commission (PUC) compliance with the CEQA. Client: DCR Transmission LLC.

Professional Experience (continued)

- 1993–1994, Staff Archaeologist, Institute for Minnesota Archaeology
- 1991–1993, Independent Contractor—Paleoecology
- 1990, Co-Director, Geoarchaeological Field School & Geoarchaeologist, Southern Illinois University-Edwardsville
- 1987–1990, Graduate Research Assistant, Limnological Research Center, University of Minnesota, Minneapolis
- 1984–1987, Graduate Research Assistant, Archaeometry Laboratory, University of Minnesota, Duluth
- 1983–1984, University of Maryland Research Assistant, Crustal Dynamics Project, Geology & Geophysics Branch, NASA Goddard Space Flight Center, Greenbelt, Maryland
- 1987, 1984, Assistant Geoarchaeologist, Tel Miqne Excavations, ASOR-Albright Institute, Jerusalem, Israel
- 1983, Summer Intern, US Bureau of Land Management, Phoenix District, Arizona
- 1983, Teaching Assistant – Evolution of the Earth and Research Assistant—Palynomorph (Acritarchs) Research, Beloit College

Selected Project Experience (continued)

Madera Travel Center at Avenue 17 and Highway 99, Madera County, California. Paleontology Program Manager (2018). Co-authored draft Paleontological Resource Mitigation Plan for CEQA compliance. Client: Love’s Travel Stops Corporate Office.

Talavera Pipeline Replacement, City of Indio, Riverside County, California. Paleontology Program Manager (2018). Completed quality control/quality assurance on draft paleontological technical memorandum for CEQA compliance. Client: Albert A. Webb Associates for Coachella Valley Water District.

Blythe Airport Perimeter Fence Project, Riverside County, California. Paleontology Program Manager (2018). Will complete quality control/quality assurance on draft paleontological technical memorandum for federal (NEPA) and CEQA compliance. Client: Mead & Hunt for Caltrans

Madison Street Improvements Project, City of Murrieta, Riverside County, California. Paleontology Program Manager (2018). Completed quality control/quality assurance on draft paleontological technical memorandum for the Warm Springs Creek Bridge. Will oversee fossil identification survey and draft paleontological resources technical report for CEQA compliance. Client: Kleinfelder for City of Murrieta Public Works & Engineering.

I-215 University Parkway Interchange Improvement Project, San Bernardino County, California. Paleontology Program Manager (2018). Will complete quality control/quality assurance on updated PIR following design changes for CEQA compliance. Client: HDR for Caltrans.

I-10 Monroe Interchange Project, Riverside County, California. Paleontology Program Manager (2018). Will complete quality control/quality assurance on draft PIR for CEQA compliance. Also oversaw fossil identification field. Client: Michael Baker for Caltrans.

Water-Main Replacement Project in the San Gorgonio River, City of Banning, Riverside County, California. Paleontology Program Manager (2018). Overseeing paleontological spot-check monitoring for CEQA compliance. Client: Aspen Environmental Group for City of Banning Public Works Department.

De Anza Sewer Force Main Project, City of San Jacinto, Riverside County, California. Paleontology Program Manager (2018). Oversaw creation of informational brochure for construction-worker sensitivity training for Worker Environmental Awareness Program (WEAP) compliance. Also overseeing coordination and completion of spot-check monitoring. If fossils are found, then also will oversee development and implementation of a paleontological treatment plan and completion of a paleontological letter report for CEQA compliance. Client: HELIX for Eastern Municipal Water District.

Other Paleontological Research

Ph.D. Dissertation.
Changing Landscapes in the American Bottom (USA): An Interdisciplinary Investigation with an Emphasis on the Late-Prehistoric and Early-Historic Periods. Advisor: Herbert E. Wright, Jr.

M.S. Thesis.
A Study of Phytoliths from Philistine Levels at Tel Miqne (Ekron), Israel. Advisor: George R. Rapp, Jr.

B.S. Theses.
The High Diversity of the Mazon Creek Biota: The Result of Excellent Preservation in a Deltaic Environment. Advisor (Geology): Carl Mendelson.

The Role of Man in the Pleistocene Extinction of Large Mammals. Advisor (Anthropology): Daniel Shea.

Selected Project Experience (continued)

Sixth Street Park, Arts, River & Connectivity (PARC) Improvements, City of Los Angeles, Los Angeles County, California. Paleontology Program Manager (2018). Completed quality control/quality assurance of draft paleontological technical memorandum for CEQA compliance. Client: GPA Consulting for City of Los Angeles Bureau of Engineering.

Multiple Projects as Independent Contractor. Paleoecologist (1991–1993). Distinguished the post-contact cultural horizon using pollen analysis for Dr. Daniel Engstrom (University of Minnesota) and Minnesota Pollution Control Agency (MPCA) for projects in Lake St. Croix (MN-WI border) and Duluth-Superior Harbor (MN-WI border). Collected modern pollen samples and made reference slides of Upper Midwest pollen taxa for Dr. Greg McDonald (Cincinnati Museum of Natural History & Science, Ohio). Processed sediment samples from the Island of Madeira and analyzed phytoliths for Dr. Glenn Goodfriend (Carnegie Institution, Washington, D.C.).

Geoarchaeological Field School at Cahokia Mounds State Historic Site (UNESCO World Heritage Site), Collinsville, Illinois. Co-Director (1990). Lectured on paleoecological research and geoarchaeology, led wetland-coring & laboratory activities, participated in remote sensing field and laboratory activities. Co-Director: Dr. Rinita Dalan.

Limnological Research Center, University of Minnesota, Minneapolis. Graduate Research Assistant (1987–1990). Conducted analyses of pollen and other appropriate material from lake-sediment and peat cores. Supervisors: Dr. Herbert Wright, Jr. and Dr. Linda Shane.

Archaeometry Laboratory, University of Minnesota, Duluth. Graduate Research Assistant (1984–1987). Conducted sediment grain-size analyses, processed and identified phytoltihs and pollen, assisted in publication, obtained literature about sediment studies, performed various office duties. Supervisor: Dr. George (Rip) Rapp, Jr.

Crustal Dynamics Project, Geology & Geophysics Branch, NASA Goddard Space Flight Center, Greenbelt, Maryland. University of Maryland Research Assistant (1983–1984). Correlated geologic features with satellite magnetic anomalies (MAGSAT) and researched the crustal structure and composition of each feature for Principal Investigator (Dr. Herbert Frey).

Tel Miqne (Ekron) Excavations, American Schools of Oriental Research, Israel. Assistant Geoarchaeologist and Project Archaeologist (1984, 1987). Assisted the Project Geoarchaeologist (Dr. Arlene Rosen) in all phases of field and laboratory studies during spring-summer excavations. **1987 season** involved all phases of grain-size studies, including collection, processing, microscopic analysis, and data analysis; also assisted with on-site geological problems and flotation procedures. **1984 season** involved assistance with wadi stratigraphy studies, on-site geological problems, flotation procedures, and grain-size analyses.

Selected Project Experience (continued)

Collaborative Research: Deltaic Resilience and the Genesis of Mesopotamian Cities (Iraq) Project. Phytolith Analyst (2014). Oversaw chemical processing of mudbrick samples from the archaeological site of Ur for the. Completed phytolith analysis and reporting. Client: Dr. Jennifer Pournelle, Principal Investigator, University South Carolina Research Foundation.

Geological Background Research for the Naval Industrial Reserve Ordnance Plant (NIROP) Superfund Cleanup Project, City of Fridley, Hennepin County, Minnesota. Staff Geologist (2014). Compiled and examined boring logs and identified stratigraphic contacts for 3D modeling at the 83-acre site located about 700 feet east of the Mississippi River. Research completed for compliance with the US Clean Water Act (CWA). Client: US Navy.

Geoarchaeological Investigation for the Elford-Fullerton Relief Line Installation, City of Rochester, Olmsted County, Minnesota. Project Manager/Principal Investigator (2006). Oversaw backhoe trenching to identify presence/absence of well-developed, deeply buried archaeological soils and assessed archaeological potential of paleosols. Also completed final report for compliance with Section 106. Client: Earth Tech, Inc.

Geoarchaeological Investigation for the Bear Creek Sewer Installation in Rochester, Olmsted County, Minnesota. Principal Investigator (2006). Monitored geotechnical backhoe trenching to identify presence and absence of well developed, deeply buried archaeological soils for proposed. Also completed draft and final reports. Client: Earth Tech, Inc.

Geoarchaeological Sensitivity Study for a West Field Wetland Mitigation Site in Savage, Scott County, Minnesota. Principal Investigator (2003). Completed soil probing (one-inch diameter) to assess archaeological sensitivity. Also completed final report regarding buried soils in the four survey areas (with Charles Diesen). Client: Waste Management.

Multi-Disciplinary High-Density Testing/Evaluation of Archaeological Site 32CS0046 near Enderlin, North Dakota. Project Director (2003). Oversaw high-resolution (one-meter interval) topographic mapping (half-inch elevations), remote sensing (magnetic field gradiometry and ground-penetrating radar), and soils field investigations. Submitted final report with subconsultants (Peterson Environmental Consulting, Inc. and Archaeo-Physics LLC). Client: Cass County Joint Water Resource District.

Southwest Arterial Highway Project in Dubuque County, Iowa. Project Director (2002). Oversaw completion of continuous borings, trenching, soil sampling, laboratory analyses (lead-content analyses). Also submitted final report with geological (Dr. Rolfe Mandel) and environmental laboratory (Braun Intertec Corporation) subconsultants. Client: Iowa DOT.

Selected Project Experience (continued)

Phase III Archaeological Data Recovery for Reconstruction of the 7th Street Interchange, U.S. Highway 14/61, LaCrosse, LaCrosse County, Wisconsin. Phytolith Analyst (2000). Completed laboratory procedures, microscopic phytolith analysis, and final report for archaeological sediments. Client: Mississippi Valley Archaeology Center and Wisconsin DOT.

Loucks & Associates, Lake Onamia/T.H. 169 Phase III Archaeological Data Recovery, Mille Lacs County, Minnesota. Paleoecologist (2000). Completed paleoecological literature search, overview, and final report in support of archaeological mitigation for FHWA compliance with Section 106.

Geoarchaeological Investigation for the Proposed Redesign and Realignment of CSAH 1/5 and the Proposed Replacement of Bridge No. 4184, Scott and Sibley Counties, Minnesota. Principal Investigator (1999). Completed continuous borings and final report in support of the EA/EAW. Client: TKDA & Associates and Scott & Sibley County Highway Departments.

Archaeological Salvage Excavations of a Mid-Nineteenth Century Cemetery (21SN0136) at the James W. Miller Learning Resources Center, St. Cloud State University, Minnesota. Project Manager (1999). Oversaw continuous borings at active construction site (Dr. Richard Rothaus, Principal Investigator).

Phase III Archaeological Data Recovery Project (Sites 13JK118 and 13JK121), Fulton, Iowa. Pollen Analyst (1997). Completed laboratory procedures, microscopic pollen analyses, and final report of archaeological sediments. Client: Louis Berger & Associates and Iowa DOT.

Washington Street Residential District Phase III Archaeological Data Recovery Project in Downtown St. Paul, Ramsey County, Minnesota. Pollen Analyst (1997). Completed laboratory procedures, microscopic pollen analyses, and final report of archaeological sediments. Client: The 106 Group, Ltd. and the Science Museum of Minnesota.

Keystone Gulf Coast Expansion (Keystone XL), Cushing, Oklahoma, to Texas City, Texas. Cultural Resources Task Manager and Paleontologist. Selected and managed subcontractors for proposed 478-mile-long crude-oil pipeline; helped plan right-of-way alignments, re-reroutes; researched existing cultural resources; wrote cultural resources management section and paleontology sections of Environmental Report for permit application. Coordinated with client, subcontractors, engineers, right- of-way agents, federal agencies, Texas Historical Commission, Texas Archaeological Research Laboratory, Oklahoma SHPO, Oklahoma Archeological Survey, and federally recognized American Indian tribes. Client: Trow Engineering.

Selected Project Experience (continued)

PolyMet Mining, Land Exchange (Hay Lake and McFarland parcels) with the U.S. Forest Service, Cook and St. Louis counties, Minnesota. Principal Investigator. Researched and summarized existing conditions of cultural resources and paleontological resources for an Environmental Impact Statement for USFS compliance with NEPA.

Geoarchaeological Investigation in the Proposed Holman Airfield Approach Lights Corridor, St. Paul, Ramsey County, Minnesota. Geoarchaeologist (1996). Completed continuous borings and final geoarchaeological report in support of Phase I archaeological investigation for Federal Aviation Administration compliance with Section 106. Client: Archaeological Research Services and the Metropolitan Airports Commission.

Geoarchaeological Investigation for the Replacement of Railroad Bridge No. 235.66 over the Wisconsin River, Prairie du Chien, Crawford County, Wisconsin. Project Director (2002). Oversaw completion of vibra-cores, geotechnical borings, and push-probes for deeply buried archaeological sites. Also submitted final report with geological subconsultant (Dr. Michael Kolb, StrataMorph Geoexploration) in support of EA with subcontractor (StrataMorph Geoexploration), wrote cultural resources report for submittal to the client and Wisconsin SHPO, and wrote management sections of the EA for compliance with NEPA. Client: BNSF Railroad Corporation.

Geoarchaeological Investigation for the 250MW Ridgecrest Solar Power Project, City of Ridgecrest, Kern County. Quality Assurance/Senior Reviewer (2009). Reviewed draft geoarchaeological monitoring report of geotechnical investigations. Jointly regulated by the Bureau of Land Management (BLM) and the California Energy Commission (CEC). Geoarchaeological Subcontractor: SWCA Environmental Consultants. Client: Solar Millennium, LLC and Chevron Energy Solutions.

Geoarchaeological Investigation for the 500MW Palen Solar Power Project, near Desert Center, Riverside County. Quality Assurance/ Senior Reviewer (2009). Reviewed draft geoarchaeological monitoring report of geotechnical investigations. Jointly regulated by the BLM and the CEC. Geoarchaeological Subcontractor: SWCA Environmental Consultants. Client: Solar Millennium, LLC and Chevron Energy Solutions.

Geoarchaeological Investigation for the 1,000MW Blythe Solar Power Project, near Blythe, Riverside County. Quality Assurance/ Senior Reviewer (2009). Reviewed draft geoarchaeological monitoring report of geotechnical investigations. Jointly regulated by the BLM and the CEC. Geoarchaeological Subcontractor: SWCA Environmental Consultants. Client: Solar Millennium, LLC and Chevron Energy Solutions.

Selected Project Experience (continued)

Geoarchaeological Investigation for the City of Palmdale, 570 MW Palmdale Hybrid Power Project, Palmdale, Los Angeles County, California. Quality Assurance/Senior Reviewer (2009). Oversaw geoarchaeological scope of work and reporting of desktop study results in response to data requests by the CEC for the 377-acre project area in the Antelope Valley. Project included solar thermal. Geoarchaeological Subcontractor: William Self Associates, Inc. (Dr. James Allen and Mr. David De Vries). Client: Solar Millennium, LLC and Chevron Energy Solutions.

Geoarchaeological Investigation for the Nextera Energy Resources, 250 MW Beacon Solar Energy Project, Kern County, California. Quality Assurance/Senior Reviewer (2009). Oversaw geoarchaeological trenching plan and post-field reporting, including preliminary report, and comprehensive draft and final reports in response to data requests by the CEC for the 2,012-acre project area in the Fremont Valley. Geoarchaeological Subcontractor: Far Western Anthropological Research Group, Inc. (Dr. Craig Young). Client: Solar Millennium, LLC and Chevron Energy Solutions.

Selected Publications

Ollendorf, Amy L., 1994, New Paleoecological Data Pertaining to the Late Holocene in the American Bottom, USA. *Program and Abstracts of the 13th Biennial Meeting of the American Quaternary Association,* University of Minnesota, Minneapolis, p. 236.

Ollendorf, Amy L., 1993, Toward a Classification Scheme of Sedge (Cyperaceae) Phytoliths, In G. Rapp, Jr. and S.C. Mulholland, eds., *Phytolith Systematics: Emerging Issues*. Plenum Press, p. 91-111.

Mulholland, Susan C., Rapp, George Jr., Ollendorf, Amy L., and Regal, R., 1990, Variation in Phytolith Assemblages within a Population of Corn (cv. Mandan Yellow Flour), *Canadian Journal of Botany* 68:1638-1645.

Ollendorf, Amy L., Mulholland, Susan C., and Rapp, George Jr., 1988, Phytolith Analysis as a Means of Plant Identification: *Arundo donax* and *Phragmites communis*. *Annals of Botany* 61:209-214.

Mulholland, Susan C., Rapp, George Jr., and Ollendorf, Amy L., 1988, Variation in Corn Phytolith Assemblages. *Canadian Journal of Botany* 66:2001-2008.

Ollendorf, Amy L., 1987, Archaeological Implications of a Phytolith Study at Tel Miqne (Ekron), Israel. *Journal of Field Archaeology* 14:453-463.

Ollendorf, Amy L., Mulholland, Susan C., and Rapp, George Jr., 1987, Phytoliths from Some Israeli Sedges. *Israel Journal of Botany* 36:125-132.

Ollendorf, Amy L., Mulholland, Susan C., and Rapp, George Jr., 1987, A New Apparatus for the Digestion of Plants in Phytolith Analysis. *Phytolitharien Newsletter* 5(1):13-16.

Selected Publications (continued)

Ollendorf, Amy L., 1986, Tel Miqne, Israel - Phytoliths from Philistine Levels. *Old World Archaeology Newsletter* 10(2):16.

Selected Presentations

Ollendorf, Amy L., 2000, "Pollen Analysis." Assisted Dr. Edward Cushing (Univ. of MN) by helping train health professionals during weekend seminar sponsored by Multidata Corporation. **Invited.**

Ollendorf, Amy L., 1999, "Pollen Analysis." Assisted Dr. Edward Cushing (Univ. of MN) by helping train health professionals during weekend seminar sponsored by Multidata Corporation. **Invited.**

Ollendorf, Amy L., 1997, "Sneezing, Wheezing, and the Study of Fossil Pollen: What this Allergenic Material Can Tell Us About the Past." Guest lecture at the *Annual Meeting of the Materials Information Society - Minnesota Chapter of the American Society of Metallurgists International*, Minneapolis, Minnesota. **Invited.**

Ollendorf, Amy L., 1997, "Paleoecological Research at Cahokia." Guest lecture for *Minnesota Archaeology Week and Hamline University Anthropology Club*, St. Paul, Minnesota. **Invited.**

Ollendorf, Amy L., 1994, "New Paleoecological Data Pertaining to the Late Holocene in the American Bottom, USA." *Program and Abstracts of the 13th Biennial Meeting of the American Quaternary Association*, University of Minnesota, Minneapolis, p. 236.

Ollendorf, Amy L., 1993, "Paleoecology and Culture Change in the American Bottom, USA." *58th Annual Meeting of the Society for American Archaeology*, St. Louis, Missouri.

Ollendorf, Amy L., 1993, "Recent Paleoecological Doctoral Research in the American Bottom." Guest lecture in the *Illinois State Museum Lunchtime Lecture Series*, Springfield, Illinois. **Invited.**

Ollendorf, Amy L., 1991, "The Decline of the Mississippian Occupation of Cahokia: An Interdisciplinary Investigation of Landscape Changes in the American Bottom (USA)." *24th Annual Chacmool Conference*, University of Calgary, Alberta, Canada.

Ollendorf, Amy L. and Wright, H.E. Jr., 1989, "Landscape Changes Associated with Urbanization in Temperate Europe." *1st Joint Archaeological Congress*, Baltimore, Maryland. **Invited.**

Ollendorf, Amy L., 1988, "Comparison of Sedge Phytoliths from Widely Separated Geographic Areas, With an Emphasis on Israel." *3rd Annual Phytolith Workshop*, University of Missouri-Columbia.

Ollendorf, Amy L., 1986, "Phytoliths from Philistine Occupation Surfaces at Tel Miqne (Ekron), Israel." *51st Annual Meeting of the Society for American Archaeology*, New Orleans, Louisiana.

SCOTT ROHLF
Associate Paleontologist

Areas of Expertise

- Geology
- Paleontology
- Paleontological fieldwork/supervision
- Fossil preparation
- Small-fraction fossil sampling
- Environmental Science

Years of Experience

- 10

Education

M.S., Earth Science, University of California, Santa Cruz, 2011

B.S., Environmental Geology, University of California, Santa Cruz, 2009

Other Paleontological Research

M.A. thesis: *Using Earth System Model GEOCLIM-LPJ to Establish Past Temperatures at Vertebrate Localities in the Paleobiology Database* Advisor: Paul Koch.

Registrations/Certifications

- Type II Wildland Firefighter
  - L-180, S-130, S-190 Certificates

Professional Experience

2017–	Associate Paleontologist, Applied EarthWorks, Inc., San Luis Obispo, California.
2014–	Adjunct Faculty, Santa Barbara City College, California.
2016	Environmental Services Intern, California State Parks, Santa Cruz District, California.
2012–2014	Staff Paleontologist, Applied EarthWorks, Inc., San Luis Obispo, California.
2009–2011	Teaching Assistant, University of California, Santa Cruz.
2009	Paleontologist, Bryce Canyon National Park, Utah.
2007	Paleontologist, John Day Fossil Beds National Monument, Oregon.

Technical Qualifications

Mr. Rohlf has over 10 years of experience as a paleontologist. He has successfully completed numerous paleontological inventory and monitoring projects in California, Oregon, and Utah. His paleontological experience was gained through graduate studies, positions with the National Park Service, and as Applied EarthWorks, Inc. staff. Mr. Rohlf is experienced in conducting fossil prospecting and collection, including specimen identification and preparation for curation, site erosional surveys, background and literature research, paleontological monitoring, and field-worker supervision. His report writing experience, includes paleontological identification reports, paleontological technical memoranda, and monitoring plans. His field and lab experience are supplemented by his instruction and mentorship of undergraduate students as an adjunct faculty member in the Earth and Planetary Sciences Department at Santa Barbara City College. Mr. Rohlf's skills are applicable to a wide range of paleontological work assignments, including those around construction equipment.

Paleontological Teaching Experience

Santa Barbara City College. Adjunct Faculty (2014–present). Provide instruction and mentorship to undergraduate students. Responsible for the following courses: Environmental Geology, Dynamic Earth, and Physical Geography. Develop lecture and laboratory course material and examinations following campus approved outlines. Lead field trips to areas of local geologic and geographic interest relevant to course material.

Selected Project Experience

Athos Renewable Energy Project, Riverside County, California. Staff Paleontologist (2018). Completed Paleontological Survey Plan and fossil identification surface survey of private lands. Also completed quality control/assurance on the Paleontological Identification Report submitted to the County (CEQA compliance). Client: IP Athos, LLC and Aspen Environmental Group.

Blythe Airport Fence, Blythe, Riverside County, California. Staff Paleontologist (2018). Completed quality control/assurance on paleontological technical memorandum. Client: Mead & Hunt for Caltrans.

Talavera Pipeline Replacement, City of Indio, Riverside County, California. Staff Paleontologist (2018). Completed letter request for records search and prepared draft paleontological technical memorandum. Client: Albert A. Webb Associates for Coachella Valley Water District.

Prologis Trailer Park Expansion Project near the City of Redlands, San Bernardino County, California. Staff Paleontologist (2018). Prepared draft paleontological technical memorandum. Client: Albert A. Webb Associates.

Crossroads North Storm Drain Facilities Improvement Project, Riverside County, California. Staff Paleontologist (2018). Prepared draft paleontological technical memorandum. Client: Albert A. Webb Associates.

Bloomington Commerce Center Project, Bloomington, San Bernardino County, California. Staff Paleontologist (2018). Completed letter request for records search and preparation of draft paleontological technical memorandum. Client: Howard Industrial Partners.

Ten West Link Transmission Line Project, Riverside County, California, to Maricopa County, Arizona. Staff Paleontologist (2017–present). Completed letter requests for records searches and prepared draft and final paleontological identification report for 114-mile-long preferred alignment corridor and alternatives. Client: DCR Transmission, LLC.

Madera Travel Center at Avenue 17 and Highway 99, Madera County, California. Staff Paleontologist (2017–present). Completed letter request for records search and wrote draft Paleontology Monitoring Plan. Client: Love’s Travel Stops Corporate Office.

Sixth Street Park, Arts, River & Connectivity Improvements, Los Angeles, California. Staff Paleontologist (2017–present). Completed letter request for records search and writing draft paleontological technical memorandum. Client: GPA Consulting for City of Los Angeles.

Selected Project Experience (continued)

Ethanac and Nichols Road Corridor Project, Riverside County, California. Staff Paleontologist (2017). Prepared paleontology section for Preliminary Environmental Analysis Report (PEAR). Client: Michael Baker International for Caltrans.

Topaz Solar Farm, San Luis Obispo County, California. Staff Paleontologist (2012–2014). Directed and supervised on-site monitoring for paleontological resources. Conducted fossil specimen salvages. Developed and implemented matrix sampling, washing, and picking procedures for small-fraction fossils. Conducted specimen preparation, identification, and cataloging. Represented Applied EarthWorks, Inc. during site-wide coordination meetings. Authored daily, site-wide paleontological monitoring reports. Client: First Solar, Inc.

Bryce Canyon National Park. Paleontologist (2009). Conducted fossil prospecting surveys and collections for vertebrate and invertebrate macrofossils. Collected and conducted matrix sampling, washing, and picking for vertebrate, invertebrate, and botanical small-fraction fossils. Assessed and composed reports on erosional and possible poaching effects on known fossil localities.

John Day Fossil Beds National Monument. Paleontologist (2007). Conducted fossil prospecting surveys and collections for macrofossils, with an emphasis on vertebrates and botanical fossils. Created plaster jackets for removal of large vertebrate specimens. Prepared specimens in laboratory with manual and mechanical, power assisted tools (air-scribes and sand-blasters).

CHRISTOPHER J. SHEA

Staff Paleontologist

Years of Experience

4

Education

M.S., Geology—Quaternary Stratigraphy, University of Minnesota, Duluth, 2017

B.S., Geology, Northern Illinois University, DeKalb, 2015

Coursework: Paleontology, Paleogeography, Paleoecology, Paleoclimatology

Other Paleontological Research

M.S. thesis: *A multiple proxy lake sediment record of Middle to Late Holocene climate change in southwestern British Columbia, Canada.* Advisor: Byron Steinman.

B.S. thesis: *Late Holocene oxygen isotope record of solar variability from Lake Mirabel, Guatemala.* Advisor: Nathan Stansell.

Northern Illinois Geological Field School, 2014 (6 weeks). Surveyed and mapped fossiliferous geologic units and collected fossil specimens in the Big Horn Mountains in Wyoming and the Black Hills in South Dakota.

Registrations/Certifications

- OSHA 40-hour HAZWOPER (2017)
- Worker Environmental Awareness Program (2018)
- Valley Fever Awareness and Prevention Training (2018)
- Incidental Take Permit (2018)
- Emergency Response Training (2018)

Professional Experience

2018–	Staff Paleontologist, Applied EarthWorks, Inc., Pasadena, California
2015–2017	Research Assistant, University of Minnesota, Duluth, Minnesota
2014–2015	Lab Manager Assistant and Manager of Department of Geology Fossil Collection, Northern Illinois University, DeKalb, Illinois

Technical Qualifications

Mr. Shea is a Staff Paleontologist with a background in geology, paleontology, stratigraphy, and paleolimnology. He received his bachelor's degree in geology from Northern Illinois University, DeKalb, taking multiple paleontology-related courses. His master's research at the University of Minnesota-Duluth involved field work in the fossiliferous Cache Creek Limestone with a focus on sedimentology and Quaternary paleoenvironmental reconstruction. As a Staff Paleontologist at Applied EarthWorks, he provides fossil identification, bulk-sediment sampling, stratigraphic analysis and other geological data collection, and prepares reports and proposals. As a Geologist and Paleontologist, Mr. Shea has cataloged and characterized specimens from the large collections of invertebrate and vertebrate fossils curated at Northern Illinois University. Additionally, he has extensive background in lab management and analyses including Scanning Electron Microscopy (SEM), X-Ray Fluorescence (XRF), X-Ray diffraction (XRD), and more. Mr. Shea has also conducted field surveys, taught geology lab courses, and collected lake sediment from fossiliferous units in multiple countries, including the Coban Formation in Guatemala and the Cache Creek Formation in Canada.

Selected California Experience

California Flats Solar Project, Monterey County, California. Staff Paleontologist (2018). Completing full-time paleontological monitoring on-site during construction in the paleontologically sensitive Pismo Formation as well as the paleontologically sensitive Temblor, Monterey, and Etchegoin formations. Completed as part of CEQA compliance. Client: First Solar.

Ten West Link Transmission Line Project, Riverside County, California, Maricopa and Yuma Counties, Arizona. Staff Paleontologist (2018) Worked as a team member under the guidance of the Project Paleontologist to prepare a Paleontological Identification Report (PIR) for the 114-mile-long study area, which included the Preferred Route and alternatives. Completed for BLM approval for NEPA compliance. Client: DCR Transmission LLC.

Professional Affiliations

- Geological Society of America

Other Paleontological Experience

Research Assistant, University of Minnesota, Duluth, Minnesota (2015–2017). Conducted field work in the fossiliferous Cache Creek Limestone and lab research funded by the National Science Foundation to understand drought variability in the Pacific Northwest while managing the Sedimentology Laboratory and teaching introductory geology laboratory courses.

Lab Manager Assistant and Manger of Department of Geology Fossil Collection, Northern Illinois University, DeKalb (2014–2015). Inventoried and updated laboratories and fossil collections.

Undergraduate Researcher, Northern Illinois University, DeKalb (2014–2015). Under an Undergraduate Research Assistantship, learned basic research techniques, lab work, and apply them to complete a senior thesis project.

Selected California Experience (continued)

Athos Renewable Energy Project, Riverside County, California. Staff Paleontologist (2018). Worked as a team member under the guidance of the Project Paleontologist to request and review museum fossil records searches, and to prepare a Survey Work Plan for 700 acres of land. Completed for California Environmental Quality Act (CEQA) compliance. Client: Aspen Environmental Group.

Ponte Vista, Los Angeles County, California. Staff Paleontologist **(**2018). Under supervision of the Project Paleontologist, completed on-site monitoring during ground-disturbing construction activities within paleontologically sensitive units (Palos Verdes Sands and San Pedro Formation), took pictures, and maintained a daily activity log. Completed for CEQA compliance. Client: iStar Financial.

Madera Travel Center, Riverside County, California. Staff Paleontologist **(**2018). Worked as a team member under the guidance of the Project Paleontologist to prepare a Paleontological Resource Mitigation Plan (PRMP), which included the mapping of paleontologically sensitive geologic units underlying the project area and the development of monitoring plans. Completed for CEQA compliance. Client: Alphabiota Environmental Consulting.

Fieldwork

California Flats, Monterey County, California (2018)

- Monitored on site during ground-disturbing construction activities with the paleontologically sensitive Monterey Formation.
- Received worker environmental and valley fever awareness safety training.

Ponte Vista, Los Angeles County, California (2018)

- Monitored on site during ground-disturbing construction activities within paleontologically sensitive units (Palos Verdes Sands, San Pedro Formation), took pictures, and maintained a daily activity log.

Northern Illinois University Field School (2014, 6 weeks)

- Mapped several square kilometers in the Big Horn Mountains, WY and the Black Hills, SD using topographic maps, a Brunton compass, and GPS.
- Surveyed and measured outcrops to develop detailed stratigraphic columns, marking important features such as crossbedding, fossils, and distinct depositional and erosional features.
- Recovered and described fossils in the field.
- Identified geological formations by index fossils, such as belemnites of the Sundance Formation and fish scales in the Mowry Shale.

Fieldwork (continued)

British Columbia, Alberta, and Washington (2015 and 2016, summers—each 2–3 weeks)

- Collected over 80m of sediment from the fossiliferous Cache Creek Formation using hand-driven piston equipment deployed from inflatable rafts.
- Hiked up to several kilometers with 50lbs+ packed bags using GPS and topographic maps as a guide.
- Conducted field surveys using well level loggers, gathered water samples, and took detailed notes.

Guatemala (July 2015, February 2016, January 2017—each 2 weeks)

- Cored four lakes in lesser-studied rural countryside within the fossiliferous Coban Formation, organized outreach with locals, and collaborated with the University of San Carlos.
- Organized and packed field equipment in order to be shipped on a plane and through customs.
- Built and installed a weather station to monitor on site parameters including temperature, humidity, and rain.

CHRISTOPHER SHI

Associate Paleontologist

Education

Ph.D., Geology (studies), 2012–2016

M.S., Geology, University of California, Los Angeles, 2011

B.S., Biology, University of Minnesota, Minneapolis, 2006

Professional Experience

2018–present, Associate Paleontologist, Applied EarthWorks, Inc., Pasadena, California

2016–2018, Paleontological Field Technician, Applied EarthWorks, Inc., Pasadena, California

2017–2018, Paleontology Field Technician, Rincon Consultants, Los Angeles, California

2008–2009, Instructor, Mad Science of Minnesota, St. Paul

Other Paleontological Research

Ph.D., Geology Studies. Proposed dissertation topic: *Establishing a link between the trend in changing seawater chemistry and the evolution of the first animals that built shells and skeletons from calcium carbonate during the Cambrian explosion*. Advisor: Bruce N. Runnegar.

M.S. Thesis. *Demonstrating the application of confocal laser scanning microscopy in the characterization of a fossil fern from the Eocene*. Advisor: J. William Schopf.

Summary of Qualifications

Mr. Shi is a paleontologist and geologist with more than 10 years of experience in paleontology, evolutionary biology, mineralogy, and sedimentary geology. He has a background in plant and invertebrate taphonomy, and his master's thesis focused on the characterization of fossilized Eocene ferns using a novel three-dimensional imaging technique. Additionally, Mr. Shi spent several years working toward a Ph.D. in geology with research focused on the link between the trend in changing seawater chemistry and the evolution of the first animals to develop shells from calcium carbonate during the Cambrian explosion. As an Associate Paleontologist with Applied EarthWorks, Mr. Shi conducts records searches and background research, and authors paleontology monitoring plans as well as paleontological inventory and evaluation reports. He has served as lead monitor on a number of construction monitoring projects for transportation, land development, water, and power generation projects. In the field, Mr. Shi's responsibilities include fossil identification, bulk sediment sampling, stratigraphic analysis, and geological data collection.

Selected Project Experience

Blythe Airport Perimeter Fence Project, Riverside County, California. Associate Paleontologist (2018). Will complete paleontological technical memorandum for federal (NEPA) and CEQA compliance. Client: Mead & Hunt for Caltrans.

Madison Street Improvements Project, City of Murrieta, Riverside County, California. Associate Paleontologist (2018). Will supervise fossil identification survey. Also will complete paleontological technical memorandum for the Warm Springs Creek Bridge and paleontological resources technical report for CEQA compliance. Client: Kleinfelder for City of Murrieta.

De Anza Sewer Force Main Project, City of San Jacinto, Riverside County, California. Associate Paleontologist (2018). Created informational brochure for construction-worker sensitivity training for Worker Environmental Awareness Program (WEAP). Also will coordinate or complete spot-check monitoring. If fossils are found, then also will develop and implement a paleontological treatment plan and will complete a paleontological letter report. Completing for CEQA compliance. Client: HELIX for Eastern Municipal Water District.

Ten West Link Transmission Project, Riverside County, California, Yuma and Maricopa Counties, Arizona. Associate Paleontologist (2018). Responsible for research and co-authorship of paleontological identification report for the 114-mile-long preferred alignment corridor and alternatives. Completed for the BLM for NEPA compliance. Client: DCR Transmission, LLC.

Selected Project Experience (continued)

Athos Renewable Energy Project, Riverside County, California. Associate Paleontologist (2018). Coordinated fossil identification surface survey of private lands (CEQA compliance). Will coordinate or complete fossil identification surface survey of proposed generation tie-in lines ("gen-ties") on BLM lands (federal compliance). Also will observe geotechnical test trenching for presence/absence of subsurface paleontological resources and will co-author Paleontological Resources Investigation Report to the County and Report of Findings to BLM. Client: IP Athos, LLC and Aspen Environmental Group.

I-215 University Parkway Interchange Improvement Project, San Bernardino County, California. Associate Paleontologist (2018). Updated PIR following design changes for CEQA compliance. Client: HDR for Caltrans.

I-10 Monroe Interchange Project, Riverside County, California. Associate Paleontologist (2018). Completing museum records and online research and coordinated fossil identification field survey. Will complete draft PIR for CEQA compliance. Also Client: Michael Baker for Caltrans.

Talavera Pipeline Replacement Project, City of Indio, Riverside County, California. Associate Paleontologist (2018). Responsible for review of technical memorandum for the 5.7-mile-long pipeline replacement. Client: Albert A. Webb Associates for Coachella Valley Water District.

Sixth Street Park, Arts, River & Connectivity Improvements Project, City of Los Angeles, Los Angeles County, California. Associate Paleontologist (2018). Responsible for review of technical memorandum for the construction of public spaces spanning 12 acres. Client: GPA Consulting for City of Los Angeles.

Vista Pointe Project, Los Angeles County, California. Lead Paleontology Monitor (2018). Responsible for construction monitoring, fossil identification, sample collection, stratigraphic analysis, and geologic data collection for a 1.5-acre-lot cleared for the construction of residential units. Also completing preparation of fossils for museum curation. Completed for CEQA compliance. Client: iStar Financial and Harridge Development Group.

Sampson Road Improvements Project, San Pedro, California. Lead Paleontology Monitor (2017). Managed Worker's Awareness Training for all construction crews on site. Responsible for construction monitoring, fossil identification, sample collection, stratigraphic analysis, and geologic data collection for an urban and infrastructure development project spanning 400 acres. Client: Jones & Stokes.

The Grove Project, Scotts Valley, California. Lead Paleontology Monitor (2017). Responsible for construction monitoring, fossil identification, stratigraphic analysis, and geologic data collection for a 4.32-acre-lot cleared for the construction of residential units. Client: City Ventures.

Selected Project Experience (continued)

Crowder Canyon (SR 138) Paleontological Mitigation Project, San Bernardino County, California. Paleontological Field Technician (2017). Responsible for construction monitoring, fossil identification, stratigraphic analysis, and geologic data collection for the 1.7-mile-long state route realignment. Client: Caltrans, District 8.

Malibu Wastewater Treatment Facility, City of Malibu, Los Angeles County, California. Paleontological Field Technician (2017). Responsible for construction monitoring, fossil identification, stratigraphic analysis, and geologic data collection for a 4.8-acre-lot cleared for the installation of the facility. Client: Myers-Banicki for City of Malibu.

Highpark (Ponte Vista) Residential Development, San Pedro, California. Paleontological Field Technician (2017). Responsible for construction monitoring, fossil identification, bulk sediment sampling, stratigraphic analysis, and geological data collection for a 61.5-acre-lot cleared for the construction of residential units. Client: iStar Financial.

Relevant Publications

Shi, C. S. 2013. Use of Confocal Laser Scanning Microscopy for Studies in Paleobotany: Documentation of Stem Anatomy of the Eocene Fern *Dennstaedtiopsis aerenchymata* (Dennstaedtiaceae). LAP LAMBERT Academic Publishing: 88 p.

Shi, C. S., J. W. Schopf, A. B. Kudryavtsev. 2013. Characterization of the stem anatomy of the Eocene fern *Dennstaedtiopsis aerenchymata* (Dennstaedtiaceae) by use of confocal laser scanning microscopy. American Journal of Botany, vol. 100, no. 8: p. 1626–1640.

Zheng, J., W. Zhuang, N. Yian, G. Kou, H. Peng, C. McNally, D. Erichsen, A. Cheloha, S. Herek, C. Shi, and Y. Shi. 2004. Classification of HIV-1 mediated neuronal dendritic and synaptic damage using Multiple Criteria Linear Programming. Neuroinformatics, vol. 2, no. 3: p. 303–326.