Paleontological Resource Assessment for the 15719 and 15755 Arrow Route Warehouse Project, Unincorporated San Bernardino County, California

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draft

MANAGEMENT SUMMARY

At the request of Albert A. Webb Associates, Applied EarthWorks, Inc. (Æ) completed a Paleontological Resource Assessment (PRA) for the 15719 and 15755 Arrow Route Warehouse Project west of the City of Fontana (City) in unincorporated San Bernardino County, California (Project). This PRA is written in partial satisfaction of the California Environmental Quality Act (CEQA) since a Conditional Use Permit is required from the County of San Bernardino. The County of San Bernardino is the lead agency for CEQA compliance. The approximately 9.23-acre Project area is on the south side of Arrow Route at the southwest corner of the intersection with Almeria Avenue.

Æ completed this PRA from desktop studies. The desktop studies included a review of published literature and maps as well as museum records searches. The purpose of these studies was to identify the geologic units in the Project area and to determine whether previously recorded paleontological localities occur either within the Project area or within the same geologic units elsewhere nearby. Æ applied paleontological sensitivity criteria of the Society of Vertebrate Paleontology (SVP) to the results of the desktop studies, and assigned the entire Project area to Low Potential because there is a low likelihood for significant paleontological resources to be preserved both near the ground surface and at depth during ground disturbance.

The present study indicates Project-related ground-disturbing activities likely will not impact significant paleontological resources. Æ does not recommend mitigation unless a fossil is encountered during Project construction. If an unanticipated fossil is discovered during construction, all ground-disturbing activities within the area of the find will cease immediately and the Project proponent will retain a qualified paleontologist to oversee the documentation of the extent and potential significance of the find as well as recovery efforts. If the fossil is significant per SVP criteria, then paleontological monitoring will be conducted on an as-needed basis for further ground-disturbing activities in the Project area. Construction can resume in the fossil findspot upon authorization by the qualified paleontologist.

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INTRODUCTION

At the request of Albert A. Webb Associates, Applied EarthWorks, Inc. (Æ) completed a Paleontological Resource Assessment (PRA) for the 15719 and 15755 Arrow Route Warehouse Project west of the City of Fontana in unincorporated San Bernardino County (County), California (Project) (Figure 1-1). This PRA is written in partial satisfaction of the California Environmental Quality Act (CEQA), because the Project requires a Conditional Use Permit from the County of San Bernardino. The County is the lead agency for CEQA compliance.

1.1 PROJECT DESCRIPTION

The proposed Project involves the redevelopment of 9.23 acres of land currently utilized as an automobile junkyard at 15719 and 15755 Arrow Route (Project area). The Project requires the demolition of the junkyard followed by the construction and operation of an industrial non-refrigerated warehouse building.

The Project is on the south side of Arrow Route at the southwest corner of the intersection with Almeria Avenue, which is west of Tokay Avenue and east of Lime Avenue in an unincorporated area of San Bernardino County, immediately adjacent to the west side of the City of Fontana. The Project is in Assessor's Parcel Numbers (APNs) 232-161-18 and -19 and is mapped in the center of the south half of Section 12 in Township 1 South, Range 6 West as shown on the Fontana, California 7.5-minute U.S. Geological Survey topographic quadrangle map (Figure 1-2).

The proposed warehouse will be approximately 196,654 square feet (4.5 acres) including 4,000 square feet of potential office space (one 2,000-square foot office area in the northwestern portion of the building and the other 2,000-square foot office area in the northeastern portion of the building) with paved circulation and parking areas, water-quality basins, septic system, and loading docks. The applicant is proposing a speculative building as there is no tenant identified at this time. The potable water pipeline will connect to the existing distribution line along Arrow Route. Wastewater will be treated by a septic system. The existing power poles along the Project's frontage along Arrow Route will be relocated or installed underground. An additional approximately 60,957 square feet (1.4 acres) will be landscaped with two water-quality basins on the southwestern and southeastern corners of the Project area. Control features will include curbs, gutters, and u-channels to convey water runoff to the basins. A steel-tube fence will be constructed on the north, east, and south sides of the Project area. Truck loading docks and truck parking will be located on the south side of the Project area and will be accessed through two metal gates at the east and west sides of the truck yard. Other parking for a total of 118 vehicles, 30 trailers, and numerous bicycles will be located on the north side of the warehouse. Arrow Route, which is adjacent to the Project site, is a major highway. The proposed Project will expand the existing 36-foot roadway to 40 feet, add new curb and gutter, reconfigure driveways, and add landscaping on the southerly portion of Arrow Route along the Project site frontage. The maximum depth of proposed disturbance associated with the Project is expected to be 8 feet below ground surface (bgs).

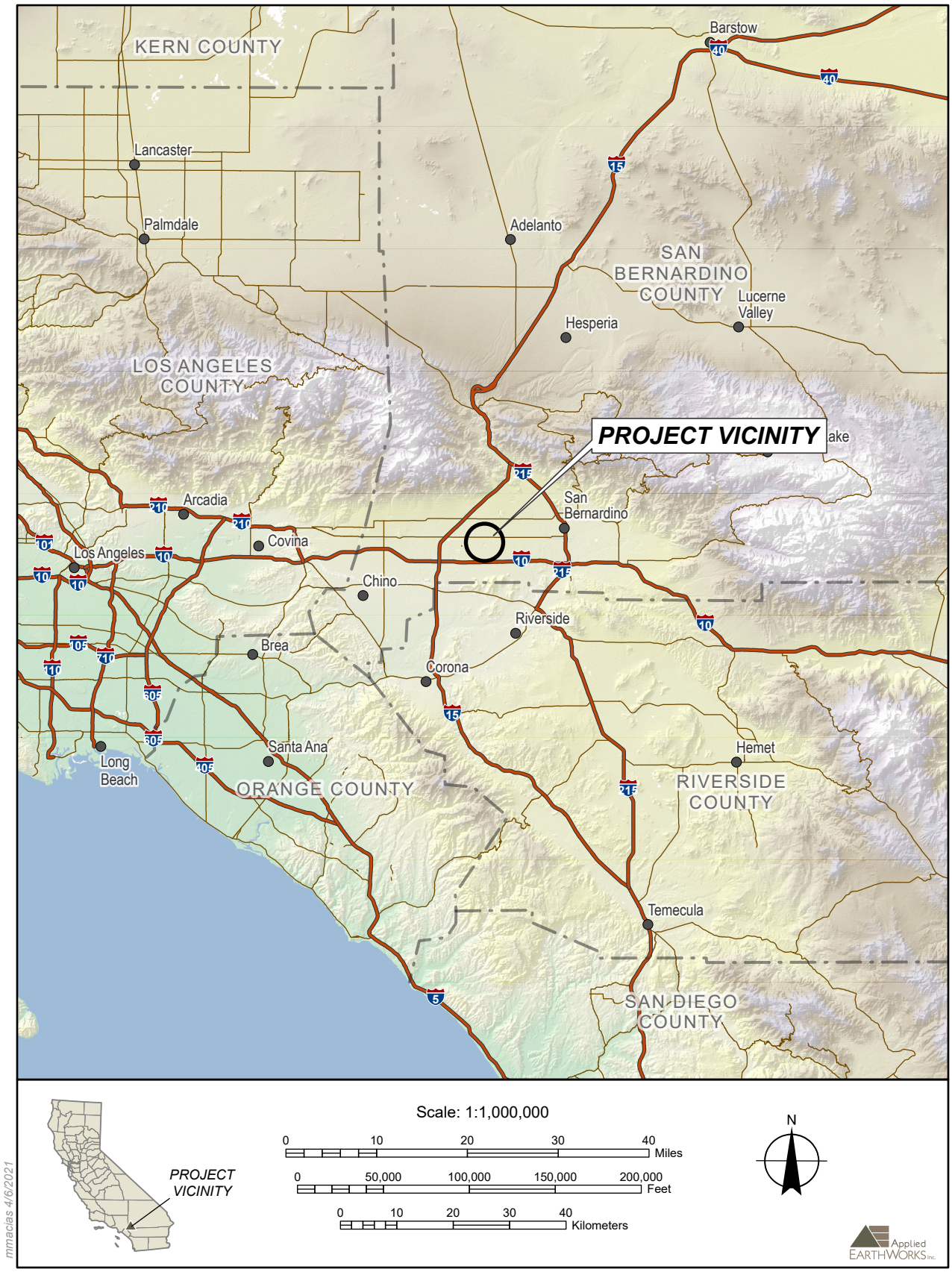

Figure 1-1 Project vicinity in San Bernardino County, California.

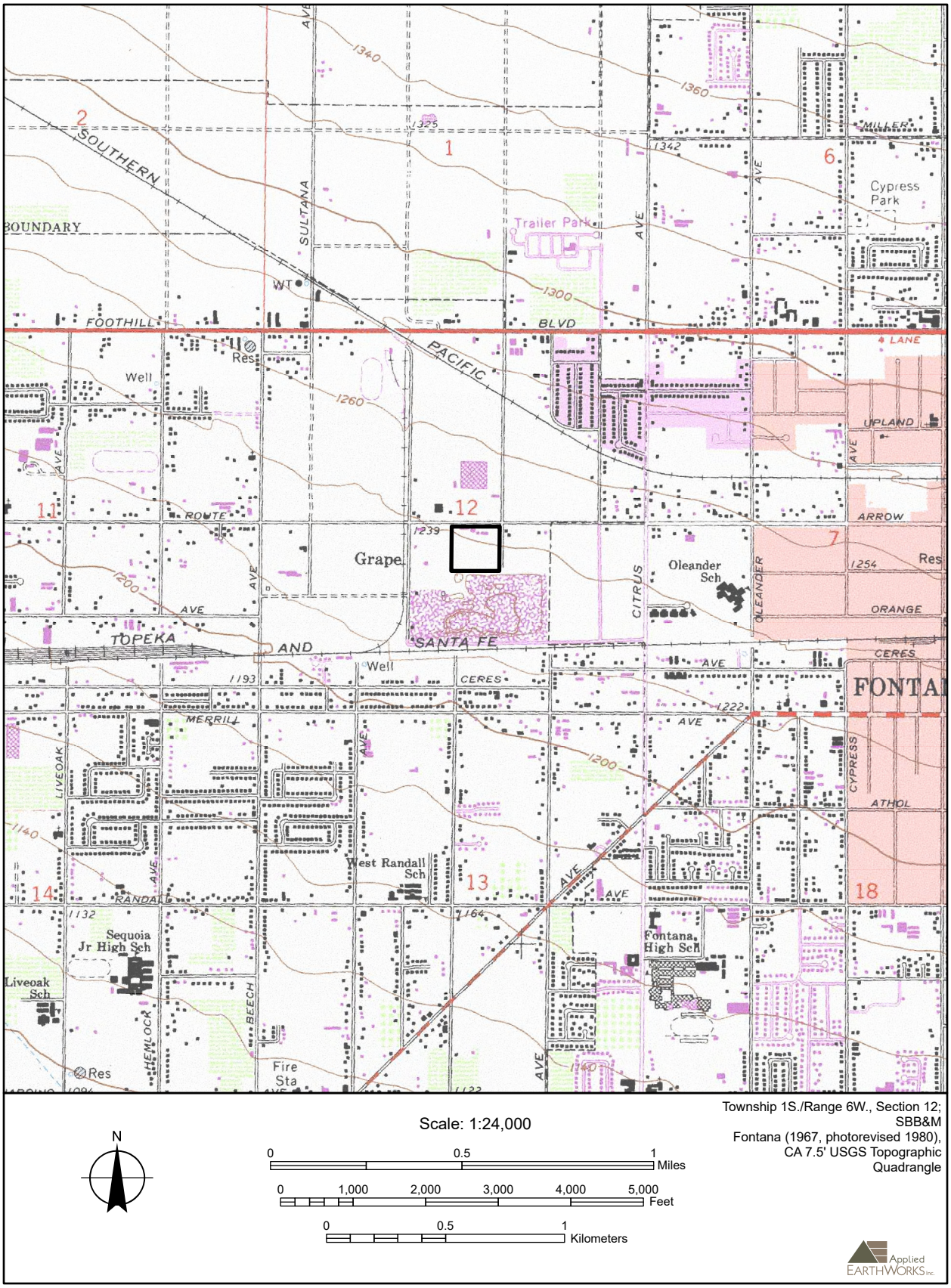

Figure 1-2 Project location map.

1.2 PURPOSE OF INVESTIGATION

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

1.3 KEY PERSONNEL

Qualifications for Æ's key paleontology personnel can be found in Appendix A. Æ Paleontology Program Manager, Dr. Amy Ollendorf, served as the Principal Investigator for the paleontological investigation. She oversaw each task required for this PRA, including quality control. Ollendorf qualifies as a principal investigator for paleontology per industry standards (Murphey et al., 2019). Ollendorf has interdisciplinary doctoral and master's degrees involving geology and micropaleontology and an undergraduate degree in geology and anthropology (double major), both of which also focused on paleontological subject matter. Ollendorf has extensive field and laboratory experience in invertebrate paleontology and paleobotany. Ollendorf also is the principal investigator for paleontology on Æ's 2018–2021 California Statewide Paleontological Resource Use Permit (CA-18-05P). She also is a Registered Professional Archaeologist (RPA 12588) with over 37 years of experience.

Æ Senior Paleontologist Melissa Macias completed the desktop research, wrote the PRA, and created the figures. Macias meets Society of Vertebrate Paleontology (SVP, 2010) and industry standards for qualified professional paleontologist (principal investigator, project paleontologist). Macias has master's and undergraduate degrees in geology; her master's degree research focused on mammalian paleontology and biogeography. She has over 10 years of experience in geology and paleontology, including the past 5 years in paleontological monitoring, recovery and preparation of fossil remains, laboratory analysis, and report preparation.

1.4 REPORT ORGANIZATION

Chapter 1 has described the Project, defined the purpose of the investigation, and provided a description of Æ's key personnel for this PRA. Chapter 2 discusses the regulatory framework governing the Project. Chapter 3 presents the paleontological sensitivity criteria and resource guidelines used for this assessment. Chapter 4 provides the methods employed, and Chapter 5 describes the geology and paleontology of the Project area. The results of the desktop studies and paleontological sensitivity assessment are presented in Chapter 6. Management recommendations can be found in Chapter 7, and references cited are listed in Chapter 8. Appendix A contains qualifications 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. This Project is not subject to federal laws. However, all resources are protected under state and local laws.

2.1 STATE

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

2.1.1 California Environmental Quality Act

The Project requires a Conditional Use Permit (CUP) since the proposed warehouse will exceed 80,000 square feet in size and a lot merger is needed to combine the two APNs into one parcel. Therefore, this Project is subject to Section 15002(a)(3) of the Guidelines for Implementation of CEQA (California Code of Regulations, Title 14, Chapter 3), which states one of the basic purposes of CEQA is the intention to "prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible." Therefore, CEQA requires detailed studies that analyze the environmental effects of a proposed project.

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

2.1.2 CEQA Implementation

Guidelines for implementation of CEQA are codified in the California Code of Regulations (CCR), Title 4, Chapter 3, Sections 15000 et seq., which requires state and local public agencies to identify the environmental impacts of proposed discretionary activities or projects, determine if the impacts will be significant, and identify alternatives and mitigation measures that will substantially reduce or eliminate significant impacts to the environment. The various agencies within state government all have their own guidance documents to assist with CEQA compliance. The County is the government agency responsible for compliance with the CEQA for the Project.

2.2 LOCAL

The County provides guidance for the identification, protection, and preservation of significant paleontological resources. The following sections describe all relevant objectives, policies, and required actions and mitigation measures.

2.2.1 San Bernardino County

Cultural and paleontological resources within the county also are addressed. In the *County of San Bernardino Countywide Plan, Cultural Resources Element*, the following objective and policies are set forth, including programs therein:

> **POLICY CR-2.1** National and state historic resources. We encourage the preservation of archaeological sites and structures of state or national significance in accordance with the Secretary of Interior's standards.
>
> **CR-2.2** Local historic resources. We encourage property owners to maintain the historic integrity of resources on their property by (listed in order of preference): preservation, adaptive reuse, or memorialization.
>
> **CR-2.3** Paleontological and archaeological resources. We strive to protect paleontological and archaeological resources from loss or destruction by requiring that new development include appropriate mitigation to preserve the quality and integrity of these resources. We require new development to avoid paleontological and archeological resources whenever possible. If avoidance is not possible, we require the salvage and preservation of paleontological and archeological resources.
>
> **CR-2.4** Partnerships. We encourage partnerships to champion and financially support the preservation and restoration of historic sites, structures, and districts.
>
> **CR-2.5** Public awareness and education. We increase public awareness and conduct education efforts about the unique historic, natural, tribal, and cultural resources in San Bernardino County through the County Museum and in collaboration with other entities.

Paleontological resources are addressed specifically under Mitigation Measure (MM) 5.5 Cultural Resources for this policy (PlaceWorks, 2020:12–14):

> **MM CR 5-5** In areas of documented or inferred paleontological resource presence, development projects proposed on previously undisturbed soils shall require consultation with a qualified paleontologist meeting the standards of SVP (2010). The initial consultation may be provided by a qualified paleontologist on staff at the County Museum. The qualified paleontologist will determine the degree of paleontological resource sensitivity, as outlined below, and will recommend a project-specific paleontological resources monitoring and mitigation plan (PRMMP). This plan will address specifics of monitoring and mitigation for the development project, and will take into account updated geologic mapping, geotechnical data, updated paleontological records searches, and any changes to the regulatory framework. This PRMMP should usually meet the standards of the SVP (2010), unless the project is on BLM land or subject to federal jurisdiction, in which case the BLM standards (2009) should be used. The following provisions would be typical for units mapped with the different levels of paleontological sensitivity:

- High (SVP)/Class 4–5 (BLM)—All projects involving ground disturbances in previously undisturbed areas sediments mapped as having high paleontological sensitivity will be monitored by a qualified paleontological monitor (BLM, 2009; SVP, 2010) on a full-time basis under the supervision of the Qualified Paleontologist. Undisturbed sediments may be present at the surface, or present in the subsurface, beneath earlier developments. This monitoring will include inspection of exposed sedimentary units during active excavations within sensitive geologic sediments. The monitor will have authority to temporarily divert activity away from exposed fossils to evaluate the significance of the find and, should the fossils be determined to be significant, professionally and efficiently recover the fossil specimens and collect associated data. Paleontological monitors will use field data forms to record pertinent location and geologic data, will measure stratigraphic sections (if applicable), and collect appropriate sediment samples from any fossil localities.

- Low to High (SVP)/Class 2 to Class 4–5 (BLM)—All projects involving ground disturbance in previously undisturbed areas mapped with low-to-high paleontological sensitivity will only require monitoring if construction activity will exceed the depth of the low sensitivity surficial sediments. The underlying sediments may have high paleontological sensitivity, and therefore work in those units might require paleontological monitoring, as designated by the Qualified Paleontologist in the PRMMP. When determining the depth at which the transition to high sensitivity occurs and monitoring becomes necessary, the Qualified Paleontologist should take into account: a) the most recent local geologic mapping, b) depths at which fossils have been found in the vicinity of the project area, as revealed by the museum records search, and c) geotechnical studies of the project area, if available.

  Low (SVP)/Class 2–3 (BLM)—All projects involving ground disturbance in previously undisturbed areas mapped as having low paleontological sensitivity should incorporate worker training to make construction workers aware that while paleontological sensitivity is low, fossils might still be encountered. The Qualified Paleontologist should oversee this training as well as remain on-call in the event fossils are found. Paleontological monitoring is usually not required for sediments with low (Low / Class 2–3) paleontological sensitivity.

- None (SVP)/Class 1 (BLM)—Projects determined by the Qualified Paleontologist to involve ground-disturbing activities in areas mapped as having no paleontological sensitivity (i.e., plutonic igneous or high-grade metamorphic rocks) will not require further paleontological mitigation measures.

- Unknown (SVP)/Class U (BLM): All projects involving ground disturbance in previously undisturbed areas mapped as having unknown paleontological sensitivity should retain a Qualified Paleontologist to conduct a field survey of the proposed Project area to determine the sensitivity of the geologic units, after which the relevant mitigation measures can be applied.

  MM CR 5-6 In the event of any fossil discovery, regardless of depth or geologic formation, construction work will halt within a 50-ft. radius of the find until its significance can be determined by a Qualified Paleontologist. Significant fossils will be recovered, prepared to the point of curation, identified by qualified experts, listed in a database to facilitate analysis, and deposited in a designated paleontological curation facility in accordance with the standards of the SVP (2010) and BLM (2009). A repository will be identified and a curatorial arrangement will be signed prior to

collection of the fossils. Although the San Bernardino County Museum is specified as the repository for fossils found in the county in the current General Plan (San Bernardino County, 2007), the museum may not always be available as a repository. Therefore, any accredited institution may serve as a repository.

3
PALEONTOLOGICAL RESOURCE ASSESSMENT GUIDELINES

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

3.1 DEFINITION OF PALEONTOLOGICAL RESOURCES AND SIGNIFICANCE CRITERIA

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

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

3.2 PROFESSIONAL STANDARDS AND CLASSIFICATION OF PALEONTOLOGICAL RESOURCE SENSITIVITY

Most professional paleontologists in California adhere to the SVP (2010) guidelines, unless others are available. The County does not have its own guidelines for paleontological sensitivity; therefore, this PRA utilizes the SVP's. These guidelines establish detailed protocols for the assessment of the paleontological sensitivity of a project area and outline measures to follow in

[1] Middle Holocene: extends from 8,200 to 4,200 years ago in the Holocene Epoch of the Quaternary Period, covering approximately the past 11,700 years (Cohen et al., 2020); the Quaternary Period also includes the older Pleistocene Epoch, which lasted from approximately 2.6 million years ago to approximately 11,700 years ago (Cohen et al., 2020).

order to mitigate adverse impacts to known or unknown fossil resources during project development (SVP, 2010).

Baseline information gathered during a paleontological resource assessment is used to assign the paleontological sensitivity of the geologic unit(s) (or members thereof) exposed at or distributed across the ground surface of a project area, in addition to those thought to be beneath a project area at depth. It should be noted that surface geology is not always indicative of subsurface geology or the potential for paleontological resources. For instance, an area whose surface geology is mapped as non-fossiliferous sediments may cover fossil-rich Pleistocene sediments at depth. Also, an area mapped as granite, devoid of fossils, may be covered by fossil-rich Pleistocene sediments. Thus, actual paleontological sensitivity across a project area ultimately can be determined only through a combination of desktop and field efforts.

The SVP provides a classification system to rank a geologic unit's sensitivity or potential for significant paleontological resources. The SVP scale includes High, Undetermined, Low, and No Potential. Geologic units are considered to have a High Potential if vertebrates or significant specimens of other fossil types have been recovered anywhere in their extent; or if the units are sedimentary rocks that are temporally or lithologically suitable for the preservation of significant fossils. The criteria for the categories are shown in Table 3-1.

Table 3-1
Paleontological Sensitivity Classifications

SVP Sensitivity/ Potential	Criteria[1]	Mitigation Recommendations[2]
High	Rock units from which vertebrate or significant specimens of other fossil types have been recovered are considered to have a high potential. Rock units with high potential also may include rock units that are temporally or lithologically suitable for the preservation of fossils (e.g., Middle Holocene and older, argillaceous and carbonate-rich paleosols, fine-grained marine sandstones, etc.).	Typically, a field survey, Paleontological Resource Impact Mitigation Program (PRIMP), and onsite construction monitoring will be required. Any significant specimens discovered during monitoring will need to be prepared, identified, and curated into a museum. A final report documenting the significance of the finds will also be required.
Undetermined	In some cases, available literature on a particular rock unit will be scarce and a determination of whether or not it is fossiliferous or potentially fossiliferous will be difficult to make. Under these circumstances, further study is needed to determine the unit's paleontological resource potential.	A field survey is required to further assess the unit's paleontological potential. The survey may provide data for development of a PRIMP prior to construction.
Low	Rocks units from which few fossils have been recovered or are generally unsuitable for preservation of fossils are considered to have a low potential. These units typically yield fossils only on rare occasions and under unusual circumstances (e.g., basalt flows, recent colluvium, etc.).	Mitigation is not typically required; however, if an unanticipated paleontological resource is encountered, a qualified professional paleontologist (Principal Investigator, Project Paleontologist) may need to evaluate the resource to consider mitigation.
No Potential	Rock units that have no potential for paleontological resources are those that are formed under or exposed to immense heat and pressure, such as high-grade metamorphic rocks and plutonic igneous rocks.	No mitigation required.

Source: SVP (2010)
[1] Criteria based on SVP (2010)
[2] Recommendations based on SVP (2010)

4
METHODS

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

4.1 LITERATURE REVIEW AND MUSEUM RECORDS SEARCHES

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

To supplement the map and literature reviews, Æ requested a search of records of the invertebrate and vertebrate collections maintained by the Natural History Museum of Los Angeles County (NHMLAC) and the San Bernardino County Museum (SBCM). Æ also completed online searches of two databases readily available to the public—the Paleobiology Database (PBDB) and the database maintained by the University of California Museum of Paleontology (UCMP). All the records searches were completed to identify known fossil localities within or nearby the Project area.

5
GEOLOGY AND PALEONTOLOGY

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

5.1 REGIONAL GEOLOGY

The Project area is in the eastern portion of the San Bernardino Valley south of the San Bernardino Mountains, which comprise the easternmost portion of the Transverse Ranges geomorphic province (California Geological Survey, 2002). A geomorphic province is a region of unique topography and geology that is distinguished from other regions based on its landforms and tectonic history (American Geological Institute, 1976). North of the San Bernardino Valley, the Transverse Ranges are an east–west-trending series of mountain ranges and valleys, which extend from offshore portions in the west, including the San Miguel, Santa Rosa, and Santa Cruz islands, to the San Bernardino Mountains in the east (California Geological Survey, 2002). South of the San Bernardino Valley, the Peninsular Ranges consist of several northwest-trending mountain ranges separated by valleys, extending from offshore portions in the west, including the Santa Catalina, Santa Barbara, San Clemente, and San Nicolas islands, to the Salton Trough in the east (California Geological Survey, 2002).

The regional geology of the San Bernardino Valley consists of Neogene alluvial deposits and Quaternary alluvial, eolian, and landslide deposits above Cretaceous plutonic rocks of the Peninsular Ranges batholith and metasedimentary rocks and batholith remnants from the Paleozoic Era (Morton et al., 2006a).

5.2 GEOLOGY AND PALEONTOLOGY OF THE PROJECT AREA

The Project area has been mapped at various scales:

- **1:250,000** – Geologic Map of California, San Bernardino Sheet (Rogers, 1967); Geologic Map of the San Bernardino Quadrangle, California (Bortugno et al., 1986; and references therein)
- **1:100,000**–Geologic map of the San Bernardino and Santa Ana 30′ x 60′ quadrangles, California (Morton and Miller, 2006; and references therein) with extensive geologic descriptions provided in Morton et al. (2006a); Preliminary geologic map of the San Bernardino 30′ x 60′ quadrangle, California (Morton et al., 2006b; and references therein)
- **1:24,000** – Geologic map of the Riverside West/south 1/2 of Fontana quadrangles, San Bernardino and Riverside Counties (Dibblee and Minch, 2004; and references therein); Preliminary geologic map of the Fontana 7.5′ quadrangle, San Bernardino and Riverside Counties (Morton, 2003; and references therein)

Rogers (1967) is part of the *Geologic Atlas of California* series published between 1958 and 1969, which provides the first complete consistent view of the geology of the state (California Department of Conservation, 2019). These compilations adopt a single set of map symbols to correlate potentially equivalent geologic units by defining the units only by geologic time rather than by both time and lithology. Bortugno et al. (1986) covers the same area as Rogers (1967), but is more detailed and defines geologic units by both time and lithology. (Morton and Miller, 2006) utilizes information provided by Bortugno et al. (1986) or sources referenced within, as well as information from more recent studies and original field data to further refine the geology within their specific regions. Consequently, this PRA is based largely on the interpretations of (Morton and Miller, 2006) as the most recent published and most comprehensive map. Other geologic maps that include the Project area are from Dibblee and Minch (2004) and Morton (2003).

According to Morton and Miller (2006), the surficial geology of the Project area consists of Holocene-age alluvial sediments originating from the San Gabriel Mountains to the north (Morton et al., 2006a).

5.2.1 Artificial Fill (Qaf)

Modern and historic deposits of artificial fill dating to the late Holocene cover an area at the Auto Club Speedway southwest of the Project area (Figure 5-1). This area has been modified by construction and quarrying, with sand and gravel derived from local sources. Paleontological sensitivity of artificial fill is low, as any fossils present are out of context.

5.2.2 Young Alluvial Deposits (Qf, Qyf_5, and Qyf_1)

Young alluvial-fan deposits are mapped across the ground surface of the entire Project area and immediate vicinity (Figure 5-1). Holocene Epoch and late Pleistocene-age deposits mapped in the Project area and its surroundings include very young alluvial-fan deposits (Qf), late Holocene young alluvial-fan deposits, unit 5 (Qyf_5), and early Holocene to late Pleistocene young alluvial-fan deposits, unit 1 (Qyf_1). Holocene sediments of the Lytle Creek alluvial fan (Qyf_5) comprise the mapped surficial geology of the entire Project area (Clarke, 1989; Morton et al., 2006a).

Recent and modern Qf deposits are present in the active and recently active alluvial fans to the west and northwest of the Project area. The sediments are composed of undissected sand- to boulder-sized clasts. Qyf_5 sediments are unconsolidated sand- to boulder-sized clasts of modern braided river deposits deposited throughout the valley floor (Morton et al., 2006a). Qyf_1 sediments are moderately consolidated silt, sand, and boulders deposited throughout the San Bernardino Valley and are exposed approximately 2 miles south of the Project area (Morton and Miller, 2006). According to the geotechnical report for the Project, younger alluvium sediments (consistent with Qyf_5) are present within the Project area to a depth of approximately 28 feet bgs and are underlain by older fan alluvium sediments (consistent with Qyf_1) to an unknown depth (Doerschlag and Aragon, 2020).

Holocene-age deposits, particularly those less than 5,000 years old, are unlikely to yield significant fossils, as they generally are too young for the fossilization process to occur (SVP, 2010). Older, early Holocene and late Pleistocene sediments, such as the underlying Qyf1, are more conducive to fossil preservation than the younger units described above.

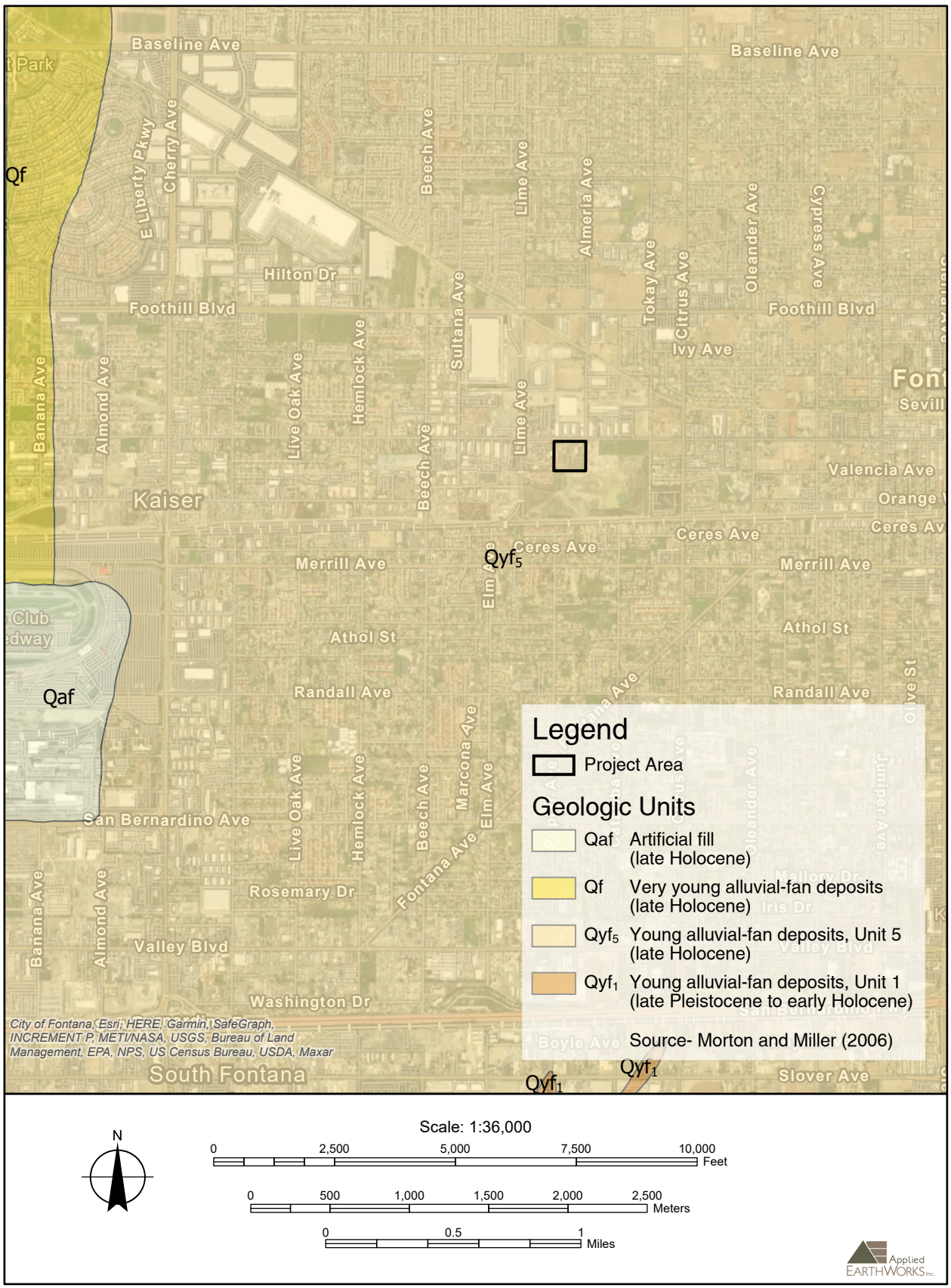

Figure 5-1 Geologic map in the Project area and vicinity.

6
RESULTS AND ANALYSIS

This chapter reports on the results of the desktop studies and field survey completed for this Project. Paleontological sensitivity rankings also are assigned to the geologic units mapped at the ground surface and likely present at depths within the Project area.

6.1 LITERATURE REVIEW

In the absence of extensive subsurface testing and observational data from a qualified paleontologist, Æ analyzed the results of nonpaleontological investigative drilling of the Project area (Doerschlag and Aragon, 2020). Findings in the geotechnical report support the characterization of geologic units by Morton and Miller (2006) and are consistent with the potential for the presence of Quaternary young alluvial-fan deposits within the Project area. The report identifies silty eolian sand and gravelly sand deposits associated with younger alluvium (consistent with Qyf_5) beginning at the present ground surface and extending to a depth of approximately 28 feet bgs. Dense brown gravelly sand associated with older alluvium (consistent with Qyf_1) were encountered in boring B-3 in the center of the project area at 28 feet bgs and extend to boring termination at 50 feet bgs.

6.2 MUSEUM RECORDS SEARCHES

No fossil localities are recorded within the Project area, although several vertebrate and invertebrate fossil localities have been reported from the same sedimentary units as those mapped close to the Project area, namely the Qyf_1 deposits (Bell, 2021; Cortez, 2021). Table 6-1 summarizes the records search results from the NHMLAC (LACM and CIT collection acronyms) and SBCM along with Æ's literature review and the online database searches.

Table 6-1
Fossil Localities Reported Near the Project Area

Locality No.	Geologic Unit (Age)	Taxon	Depth	Approximate Distance from Project Area
LACM VP 7811	Quaternary eolian silt (Pleistocene)	*Masticophis* (whip snake)	9-11 feet bgs	14.5 miles
LACM VP 1207	Unknown (Pleistocene)	*Odocoileus* sp. (deer)	Unknown	16 miles
LACM CIT 7268, 7271	Unknown (Pleistocene)	Unspecified vertebrates	Unknown	16.5 miles
LACM VP 1728	Quaternary shale with very coarse sand interbeds (Pleistocene)	*Equus* sp. (horse) *Camelops* sp. (camel)	15-20 feet bgs	13 miles

Table 6-1
Fossil Localities Reported Near the Project Area

Locality No.	Geologic Unit (Age)	Taxon	Depth	Approximate Distance from Project Area
LACM VP 7508	Unknown (Pleistocene)	Proboscidea (elephant) *Nothrotheriops* sp. (giant ground sloth) *Equus* (horse)	Unknown	19 miles
SBCM 5.1.11	Unknown (Pleistocene)	*Smilodon* sp. (saber tooth cat)	5 feet bgs	4.5 miles
SBCM 5.1.14	Quaternary very fine silty clayey sand with occasional pebbles (Pleistocene)	*Gyraulus* sp. (freshwater gastropod) *Stagnicola* sp. (freshwater gastropod) Gastropoda Bivalvia *Sylvilagus* sp. (cottontail rabbit) *Thomomys* sp. (pocket gopher) *Neotoma* sp. (pack rat) *Microtus californicus* (meadow vole) *Mammut pacificus* (mastodon)	Unknown	4.5 miles
SBCM 5.1.15	Quaternary cemented clayey silty moderately sorted sand with small caliche rootlets (Pleistocene)	*Bison* sp. (bison)	Unknown	4.5 miles
SBCM 5.1.16	Quaternary clayey silty fine sand with occasional larger subangular grains (Pleistocene)	*Camelops hesternus* (camel)	Unknown	4.5 miles
SBCM 5.1.17, 5.1.19	Unknown (Pleistocene)	*Mammut pacificus* (mastodon) Mammal, unidentified	Unknown	4.5 miles
SBCM 5.1.20	Unknown-light olive gray subangular sand (Pleistocene)	*Camelops hesternus* (camel) Artiodactyla (artiodactyl) Mammal, unidentified	Unknown	4.5 miles
5.1.21	Unknown (Pleistocene)	*Equus* sp. (horse)	21 feet bgs	4.5 miles

Source: (Bell, 2021; Cortez, 2021)

The nearest previously recorded localities to the Project area, SBCM 5.1.11 through 5.1.21, are all approximately 4.5 miles to the southwest. These localities yielded a variety of vertebrate and

invertebrate taxa, one from a depth of 5 feet bgs (SBCM 5.1.11) and one from 21 feet bgs (5.1.21). The collection depths of the other six samples are unknown.

Among the NHMLAC collections, the five localities are farther to the southwest, with LACM VP 1728 the closest to the Project area. This locality yielded specimens of *Equus* sp. (horse) and *Camelops* sp. (camel) at 15 to 20 feet bgs. The next closest locality is LACM VP 7811, farther southwest from the Project area. This locality yielded a fossil specimen of a coachwhip snake (*Masticophis flagellum)* at 9 to 11 feet bgs. LACM VP 1207, still farther to the southwest between the cities of Corona and Norco, yielded a specimen of fossil deer (*Odocoileus*) at an unstated depth. Even farther southwestward, at the Sundance Condominiums in Chino Hills, LACM VP 7268 and 7271 yielded vertebrate specimens, but their taxonomic identities are unknown. Lastly, LACM VP 7508, at the Oakcrest Development in Chino Hills, yielded specimens of *Nothrotheriops* sp. (giant ground sloth), Proboscidea (elephant), and *Equus* sp. (horse) from an unknown depth. Because of these results, Bell (2020) suggests deeper excavations through younger Quaternary deposits within the Project area may well encounter significant fossil remains in underlying older Quaternary deposits.

The UCMP and PBDB online databases list numerous vertebrate, invertebrate, and plant fossil localities from San Bernardino County. However, no localities are specified from the Pleistocene deposits within a 10-mile radius of the Project area.

6.3 DETERMINATION OF PALEONTOLOGICAL RESOURCE POTENTIAL WITHIN THE PROJECT AREA

Using information obtained from the desktop studies and field survey, Æ determined the paleontological resource potential of the geologic units exposed at the ground surface in the Project area. Æ's paleontological sensitivity rankings follow the SVP's (2010) classification system.

The sediments documented within the Project area during the separate geotechnical investigation support the interpretation of an alluvial depositional environment (Doerschlag and Aragon, 2020). Æ notes late Holocene-age alluvial-fan deposits (Qyf_5) are mapped at the surface of the Project area (Morton and Miller, 2006) and likely extend to at least 28 feet bgs (Doerschlag and Aragon, 2020). Because of their young age, Qyf_5 sediments have a low likelihood of preserving significant paleontological resources. Therefore, Æ assigns a ranking of Low Potential to the Project area (Figure 6-1). The uppermost Holocene-age surficial sediments may be too young to preserve fossils, but the paleontological sensitivity of the Project area increases with depth because of the high likelihood of encountering fossiliferous, late Pleistocene-age Qyf_1 deposits.

Figure 6-1 Paleontological Sensitivity of the Project area.

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RECOMMENDATIONS

Holocene-aged alluvial sediments (Qyf_5) are mapped at the surface throughout the Project area. Borings from the Project geotechnical report indicate young alluvial sediments (consistent with Qyf_5) are present to a depth of 28 feet bgs (Doerschlag and Aragon, 2020). Excavation depths for the Project are anticipated to not exceed 8 feet bgs. Æ concludes that Project-related construction activities are unlikely to impact significant paleontological resources across the entire Project area. Æ's desktop studies indicate the paleontological resource potential near the ground surface and to approximately 28 feet bgs is Low throughout the Project area.

The present study indicates Project-related ground-disturbing activities likely will not impact significant and intact paleontological resources. Æ does not recommend mitigation unless a fossil is encountered during Project construction. If an unanticipated fossil is discovered during construction, all ground-disturbing activities within the area of the find will cease and the Project proponent should retain a qualified paleontologist to oversee the documentation of the extent and potential significance of the find as well as recovery efforts. If the fossil is significant per SVP (2010) criteria, then paleontological monitoring will be conducted on an as-needed basis for further ground-disturbing activities in the Project area.

8
REFERENCES CITED

American Geological Institute. 1976. Dictionary of Geological Terms. Anchor Press, Garden City, New York, 472 pp.

Bell, A. 2020. Paleontological Resources for the Pacific Opal Active Adult Community. Research and Collections, Natural History Museum of Los Angeles County, Los Angeles, California.

Bell, A. 2021. Paleontological resources for the Webb-Arrow Route Warehouse Project. Research and Collections, Natural History Museum of Los Angeles County, Los Angeles, California.

Boggs, S., Jr. 2012. Principles of Sedimentology and Stratigraphy. 5th Edition. Prentice Hall, Upper Saddle River, New Jersey, 585 pp.

Bortugno, E. J., T. E. Spittler, compilers, E. Taylor, and R. R. Moar, graphics. 1986. Geologic Map of the San Bernardino Quadrangle, California. 1:250,000. Division of Mines and Geology, Sacramento, California, Division of Mines and Geology Regional Geologic Maps Series Map No. 3A, Sheet 1 of 5.

California Department of Conservation. 2019. CGS Regional Geologic Maps. Available at https://www.conservation.ca.gov/cgs/maps-data/rgm. Accessed June 15, 2020.

California Geological Survey. 2002. California Geomorphic Provinces. California Department of Conservation, California Geological Survey Note 36.

Clarke, A. O. 1989. Neotectonics and Stream Piracy on the Lytle Creek Alluvial Fan, Southern California. California Geographical Society XXIX:21–42.

Cohen, K. M., D. A. T. Harper, and P. L. Gibbard. 2020. The ICS international chronostratigraphic chart 2020/01. Episodes 36:199–204. Available at https://stratigraphy.org/icschart/ChronostratChart2020-01.pdf.

Cortez, C. 2021. Paleontological Records Review for the Webb - Arrow Route Warehouse Project, Fontana, San Bernardino, California. Division of Earth Sciences, San Bernardino County Museum, Redlands, California.

Dibblee, T. W., Jr., and J. A. Minch. 2004. Geological map of The Riverside West/South 1/2 of Fontana Quadrangle, San Bernardino and Riverside Counties, California. 1:24,000. Dibblee Foundation Map DF-128. Dibblee Geological Foundation, Santa Barbara, California.

Doerschlag, M. G., and C. F. Aragon. 2020. Preliminary Geotechnical Investigation Proposed Light Industrial Project 15719 & 15755 Arrow Route, Fontana, San Bernardino County, California. Aragon Geotechnical, Inc.

Morton, D. M. 2003. Preliminary geologic map of the Fontana 7.5' Quadrangle, San Bernardino and Riverside Counties, California, Version 1.0. U.S. Geological Survey Open File Report 03-418.

Morton, D. M., and F. K. Miller. 2006. Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California. 1:100,000. U.S. Geological Survey Open-File Report 2006-1217.

Morton, D. M., F. K. Miller, P. M. Cossette, and K. R. Bovard. 2006a. Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles. 1:100,000. U.S. Geological Survey Open File Report OF-2006-1217, Geology and description of map units, version 1.0.

Morton, D. M., F. K. Miller, P. M. Cossette, and K. R. Bovard. 2006b. Preliminary geologic map of the San Bernardino 7.5′ quadrangle, Riverside County, California. U.S. Geological Survey Open-File Report OF-2003-293.

Murphey, P. C., G. E. Knauss, L. H. Fisk, T. A. Deméré, and R. E. Reynolds. 2019. Best practices in mitigation paleontology. Proceedings of the San Diego Society of Natural History No. 47, 43 pp.

PlaceWorks. 2020. San Bernardino Countywide Plan Mitigation Monitoring and Reporting Program. PlaceWorks. Prepared for County of San Bernardino, San Bernardino, California.

Rogers, T. H., (compiler). 1967. Geologic Map of California, Olaf P. Jenkins Edition, San Bernardino Sheet. California Division of Mines and Geology, Sacramento, California.

Scott, E., and K. Springer. 2003. CEQA and Fossil Preservation in California. The Environmental Monitor Fall 2003.

SVP. 2010. Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources.11. Available at https://vertpaleo.org/wp-content/uploads/2021/01/SVP_Impact_Mitigation_Guidelines.pdf. Accessed April 1, 2021.

APPENDIX A

Qualifications of Key Personnel

Applied EARTHWORKS Inc.

MELISSA K. MACIAS

Senior Paleontologist/Project Manager

Areas of Expertise

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

Years of Experience

- 12

Education

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

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

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

Professional Experience

- 2020–present, Senior Paleontologist / Project Manager, Applied EarthWorks, Inc.
- 2015–2020, Paleontologist, Psomas
- 2015, Paleontological Monitor, Duke CRM
- 2013–2015, Graduate Teaching Assistant, Fort Hays State University
- 2015, Graduate Curatorial Assistant, Sternberg Museum of Natural History
- 2008–2013, Undergraduate Teaching Assistant, Santa Barbara City College

Summary of Qualifications

Melissa Macias has five years of experience with CEQA and NEPA compliance as well as conducting and managing paleontological resource impact assessments. Melissa has worked on paleontological resources impact mitigation programs that have required monitoring of earth-moving activities, recovery and preparation of fossil remains for collections, field personnel supervision, laboratory analysis of paleontological specimens, and final report preparation. In addition to experience in Southern California, Melissa also has paleontology and geology experience in Utah, Montana, and Colorado.

Selected Project Experience

Paleontological Sensitivity GIS Mapping Project. Senior Paleontologist (2020-present). Creating a statewide paleontological sensitivity GIS database using existing geologic maps and Society of Vertebrate Paleontology guidelines. The database will be used for preliminary assessments of baseline sensitivity for current and upcoming projects.

McKay Point Reservoir Project, Tulare County, California. Senior Paleontologist (2020-present). Completing a Paleontological Resource Assessment (PRA) for the 194-acre Project on vacant land for CEQA compliance (County). Client: Sespe Consulting, Inc.

Hinkley Remediation Project, City of Hinkley, San Bernardino County, California. Paleontology GIS Technician (2020-present). Preparing GIS survey maps for various Release to Construction project areas for CEQA (State) and NEPA (USFWS) compliance. Paleontologically sensitive geologic units: Intermediate-age lacustrine, eolian, sand, and gravel deposits; Quaternary older alluvium; and Pleistocene-age lacustrine deposits. Client: Arcadis for Pacific Gas and Electric.

Pacific Opal Active Adult Community Project, City of Lancaster, Los Angeles County, California. Senior Paleontologist (2020-present). Completing a Paleontological Resource Assessment (PRA) for the 82.12-acre Project on vacant land for CEQA compliance (City). Client: Pacific Communities Builder, Inc.

Registrations/Certifications

- Certified Paleontologist, Orange County (2016-present)
- Qualified Paleontologist, Riverside County (2019-present)

Other Paleontological Research

M.S. Research.
Paleobiogeography of North American Giant Ground Sloths. Advisor: Dr. Laura Wilson

B.S. Thesis.
Late Pleistocene megafauna localities at Vandenberg Air Force Base. Advisor: Dr. Andre Wyss

Selected Project Experience (continued)

Crossroads North Storm Drain Facilities Improvement Project, Community of Winchester, Riverside County, California. Senior Paleontologist (2020). Completed paleontological resource impact mitigation program for the project. Paleontologically sensitive geologic units: Quaternary older alluvium. Completed for CEQA compliance (County). Working closely with paleontology staff (Chris Shi and Amy Ollendorf). Client: Webb and Associates.

Interstate 15/State Route 74 Interchange Improvement Project, City of Lake Elsinore, Riverside County, California. Senior Paleontologist (2020). Completed Paleontological Identification Report (PIR) for the project. Paleontologically sensitive geologic units: Quaternary older alluvium, Silverado Formation. Completed for CEQA compliance (County). Working closely with paleontology staff (Chris Shi and Amy Ollendorf). Client: HDR Engineering.

Interstate 10/Cherry Valley Boulevard Interchange Project, City of Calimesa, Riverside County, California. Senior Paleontologist (2020). Created geologic map and paleontological sensitivity figures for report. Paleontologically sensitive geologic units: Quaternary older alluvium, San Timoteo Formation. Completed for CEQA compliance (County). Working closely with paleontology staff (Chris Shi and Amy Ollendorf). Client: Michael Baker International.

Menifee Town Center Plot Plan No. 2018-023, Menifee Plaza Development, Precise Grading Plan GP19-060 Project, City of Menifee, Riverside County, California. Senior Paleontologist (2020). Completed Cultural and Paleontological Resource Monitoring Report for the project. Paleontologically sensitive geologic units: Quaternary older alluvium. Completed for CEQA compliance (City). Working closely with paleontology staff (Chris Shi and Amy Ollendorf). Client: Golden Star Investment Properties, LLC.

Bloomington Business Park Project, Community of Bloomington, San Bernardino County, California. Senior Paleontologist (2020). Completed paleontological technical memorandum for Sites 3 and 4. Paleontologically sensitive geologic units: Quaternary older alluvium. Completed for CEQA compliance (County). Working closely with paleontology staff (Chris Shi and Amy Ollendorf). Client: Howard Industrial Partners.

AMY L. OLLENDORF

Managing Principal/Paleontology Program Manager

Areas of Expertise

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

Years of Experience

- 37

Education

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

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

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

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

Registrations/Certifications

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

Professional Experience

- 2018–present, Managing Principal/Paleontology Program Manager, Applied EarthWorks, Inc.
- 2015–2018 and 2005–2008, President and Senior Project Manager, ALO Environmental Associates LLC
- 2006–2015, Program Manager, Cultural Heritage Planning and Management, AECOM
- 2003–2005, Director, Cultural Resources Management, Peterson Environmental Consulting, Inc.

Summary of Qualifications

Dr. Ollendorf has more than 37 years of experience in cultural heritage, geoarchaeology, paleoecology, paleontology, and environmental compliance at the global, national, tribal, state, and local levels. She meets industry standards for principal investigator in paleontology and she is also Æ's principal investigator on Æ's California and Nevada statewide Paleontological Resource Use Permits for paleontology from the US Bureau of Land Management (BLM).

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

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

Selected Project Experience

Creekside Tentative Tract Map 20274, City of Victorville, San Bernardino County, California. Paleontology Program Manager (2020-present). Overseeing completion of Worker Environmental Awareness Program (WEAP) training and construction monitoring for paleontological resources for CEQA compliance (City). Will oversee preparation and will provide QA/QC of construction monitoring report. Paleontologically sensitive geologic units: Crowder Formation, Pleistocene alluvium. Working closely with paleontology staff (Chris Shi). Client: KB Home.

Professional Experience (continued)

- 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
- 1993–1994, Staff Archaeologist, Institute for Minnesota Archaeology
- 1991–1993, Independent Contractor—Paleoecology
- 1990, Co-Director, Geoarchaeological Field School, Southern Illinois University, Edwardsville
- 1987–1990, Graduate Research Assistant, Limnological Research Center, University of Minnesota
- 1984–1987, Graduate Research Assistant, Archaeometry Laboratory, University of Minnesota
- 1983–1984, Research Assistant, Crustal Dynamics Project, Geology & Geophysics Branch, NASA Goddard Space Flight Center
- 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, Beloit College Geology Department
- 1983, Research Assistant – Palynomorphs (Acritarchs), Beloit College Geology Department

Selected Project Experience (continued)

Recurrent Energy Crimson Solar Project, Riverside County, California. Paleontology Program Manager (2020-present). Overseeing completion and will provide QA/QC of Paleontological Resource Mitigation and Monitoring Plan (PRMMP) for a 2,800+-acre solar farm for federal compliance (BLM). Paleontologically sensitive geologic units: Alluvial deposits of the Mule Mountains, Pleistocene to Holocene alluvium. Working closely with paleontology staff (Chris Shi). Client: Recurrent Energy, LLC.

Pacific Opal Active Adult Community Project, City of Lancaster, Los Angeles County, California. Paleontology Program Manager (2020-present). Oversaw completion and provided QA/QC of a Paleontological Resource Assessment (PRA) for the 82.12-acre Project on vacant land for CEQA compliance (City). Paleontologically sensitive geologic units: Pleistocene to Holocene alluvium, possibly also lacustrine deposits at depth. Worked closely with paleontology staff (Melissa Macias). Client: Pacific Communities Builder, Inc.

Coachella Valley Association of Governments (CVAG) Art and Music Multi-Purpose Trail Project, Riverside County, California. Paleontology Program Manager (2020-present). Oversaw completion of museum records search for CEQA compliance (CVAG). Will oversee completion and provide QA/QC of a PRA. Paleontologically sensitive geologic units: Pleistocene alluvium, Lake Cahuilla beds. Working closely with paleontology staff (Chris Shi). Client: Albert A. Webb Associates.

First Street Village Development, Burbank, Los Angeles County, California. Paleontology Program Manager (2019-present). Oversaw pre-construction WEAP training and paleontological resource construction monitoring of Phase 1 development for CEQA compliance (City). Presently overseeing completion of negative findings construction monitoring report for paleontological resources. Paleontologically sensitive geologic units: Quaternary alluvium. Working closely with paleontology staff (Chris Shi). Client: First Street Village LLC.

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)

Fairmead Landfill Expansion, City of Chowchilla, Madera County, California. Paleontology Program Manager (2019-present). Oversaw pre-construction WEAP training and construction monitoring over the 23-acre Project area immediately adjacent to the paleontologically diverse Fairmead Locality (Pleistocene, Irvingtonian). Will oversee additional phases of preconstruction WEAP training and construction monitoring; recovered fossil inventory, condition assessment, treatment, and curation; and post-construction monitoring reports. Paleontologically sensitive geologic units: Modesto, Riverbank, and Turlock Lake Formations. Completing for CEQA compliance (County). Working closely with paleontology staff (Chris Shi and Michael George). Client: County of Madera.

Pacific Gas & Electric (PG&E) Groundwater Remediation, Hinkley, San Bernardino County, California. Paleontology Program Manager and Project Manager (2018-present). Over a multi-year period, completing Release-To-Construction (RTC) project-by-project reviews for cultural and paleontological resource management. Tasks include assessing project areas for sensitivity for cultural and paleontological resources, previously surveyed areas, and recorded locations of cultural resources. Also overseeing cultural and paleontological construction monitoring on a project-by-project basis. Requires project-specific reporting, annual reporting, regular client communication, and coordination with cultural and paleontological staff. Paleontologically sensitive geologic units: Pleistocene alluvium and Middle to Late Pleistocene lacustrine deposits associated with Pluvial Harper Lake. Reports to date include individual cultural and paleontological reports of field findings as a result of preconstruction surveys and monitoring, and 2018 and 2019 Annual Reports co-authored with Chris Shi. Completing for CEQA compliance (State of California's Lahontan Regional Water Quality Control Board) and NEPA compliance (U.S. Fish & Wildlife Service). Client: Arcadis for PG&E.

Selected Project Experience (continued)

California High-Speed Rail Construction Package 1, Madera and Fresno Counties, California. Paleontology Program Manager and Project Manager (2018-present). *Æ* is providing multi-year paleontological monitoring during construction of the 32-mile segment from Avenue 19 in Madera County to East American Avenue in Fresno County. The segment includes 12 grade separations, two viaducts, one tunnel, and a major crossing over the San Joaquin River. Overseeing daily construction monitoring and reporting; onsite and offsite screening of sediments and rock matrix; and offsite fossil analyses. Will complete treatment and preparation of significant fossils for permanent curation. Paleontologically sensitive geologic units: undifferentiated Modesto and post-Modesto Holocene-age sediment; Modesto, Riverbank, Turlock Lake, Tulare, Laguna, and Mehrten Formations; North Merced Gravel; and Pleistocene non-marine sediment. Completing for CEQA compliance (California High-Speed Rail Authority) and NEPA compliance (Federal Railroad Administration). Working closely with paleontology staff (Melissa Macias, Erik Pino, and Michael George). Client: Parsons.

Highpark Development Project (formerly Ponte Vista) in San Pedro, City of Los Angeles, Los Angeles County, California. Paleontology Program Manager and Project Manager (2018-present). *Æ* provided multi-year paleontological monitoring during construction of 676 homes on 61.5 acres. Paleontologically sensitive geologic units: San Pedro Formation and Palos Verde Sand. By winter 2018, *Æ* paleontological monitors had documented 26 paleontological localities and recovered 27 large vertebrate specimens along with over 4,000 pounds of additional bulk matrix which yielded thousands of scientifically significant invertebrate fossils and more than 25 small-fraction vertebrate specimens. *Æ* has processed the fossil specimens for permanent curation at the Natural History Museum of Los Angeles County and is preparing a final paleontological monitoring report for compliance with the CEQA (City). Final deliverables will be produced and submitted after *Æ* has received a fully executed Deed of Gift Form from the land developer. Oversaw final fossil preparation and providing QA/QC of monitoring report. Working closely with paleontology staff (Chris Shi). Client: Harridge Development Group (formerly iStar Financial).

Phase 1 and 2 Developments near the City of Lake Elsinore, Riverside County, California. Paleontology Program Manager (2020). Oversaw completion of a PRA, including ground reconnaissance field survey, for the 17-acre Project on vacant land for CEQA compliance (County). Worked closely with paleontology staff (Chris Shi). Client: Pacific Hydrotech Corporation.

Indio Behavioral Health Hospital Project, City of Indio, Riverside County, California. Paleontology Program Manager (2020). Oversaw WEAP training for CEQA compliance (City). Paleontologically sensitive geologic units: Pleistocene alluvium. Client: ALPA Construction.

Santa Margarita Ranch Agricultural Subdivision Project, San Luis Obispo County, California. Paleontology Program Manager (2019-2020). Oversaw preparation and completed QA/QC of paleontological resource impact mitigation program (PRIMP). Paleontologically sensitive geologic units: Monterey, Santa Margarita, and Paso Robles Formations and older Quaternary alluvium. Completing for CEQA compliance (County). Worked closely with paleontology staff (Chris Shi). Client: Kirk Consulting for Santa Margarita Ranch, LLC.

Bellota-Warnerville 230 kV Reconductoring Project, San Joaquin and Stanislaus Counties, California. Paleontology Program Manager (2019-2020). Completed paleontology sections of draft Proponent's Environmental Assessment (PEA); also oversaw preparation and completed QA/QC of field survey and Paleontological Field Survey Report (PFSR) for CEQA compliance (California Public Utilities Commission [CPUC]) for the 23-mile-long project. Paleontologically sensitive geologic units: Modesto, Riverbank, Turlock Lake, Mehrten Formations and possibly also the Laguna Formation. Worked closely with paleontology staff (Chris Shi). Client: Stantec.

Selected Project Experience (continued)

Replacement of Two Timber Railroad Avenue Bridges near the Community of Whitewater, Riverside County, California. Paleontology Program Manager and Project Manager (2019-2020). Oversaw preparation and completed QA/QC of paleontological technical memorandum for replacement of the Railroad Avenue Bridge over Fornat Wash (Bridge Number 56C0099) and the Railroad Avenue Bridge over East Channel Stubbe Wash (Bridge Number 56C0101) within a 4.5-acre Project area. Paleontologically sensitive geologic units: Older Alluvial Deposits, Palm Spring Formation, and Imperial Formation. Completed for NEPA (Caltrans, District 8) and CEQA (County) compliance. Worked closely with paleontology staff (Chris Shi). Client: WSP.

Port San Luis Harbor Terrace Project, San Luis Obispo County, California. Paleontology Program Manager (2020). Oversaw preparation and completed QA/QC of WEAP training brochure for CEQA compliance (County). Paleontologically sensitive geologic units: Atascadero and Pismo Formations. Working closely with paleontology staff (Chris Shi). Client: RTA Harbor Terrace, LLC.

Interstate 15/State Route 74 (I-15/SR 74) Interchange Improvement Project, City of Lake Elsinore, Riverside County, California. Paleontology Program Manager (2020). Oversaw preparation and completed QA/QC of paleontological identification report (PIR) along approximately 2 miles of I-15 and 0.5-mile along SR 74 for NEPA and CEQA compliance (Caltrans, District 8). Paleontologically sensitive geologic units: Pleistocene alluvium and Paleocene-age Silverado Formation. Worked closely with paleontology staff (Chris Shi and Melissa Macias). Client: HDR.

Interstate 10/Cherry Valley Boulevard Interchange Project, City of Calimesa, Riverside County, California. Paleontology Program Manager (2020). Oversaw preparation and provided QA/QC of paleontological identification report/paleontological evaluation report (PIR/PER) along approximately 1.7 miles of I-10 and 0.30-mile along Cherry Valley Boulevard for NEPA and CEQA compliance (Caltrans, District 8). Paleontologically sensitive geologic units: Middle to Early Pleistocene alluvial-fan deposits, Late to Middle Pleistocene alluvial-fan deposits, Pleistocene-age Live Oak Canyon fluvial braidplain deposits, including paleosols, Pliocene- to Pleistocene-age San Timoteo Formation. Worked closely with paleontology staff (Chris Shi and Melissa Macias). Client: Michael Baker International.

Double Trouble Telecommunication Site near City of Indio, Riverside County, California. Paleontology Program Manager (2020). Oversaw preparation and completed QA/QC of Potential Fossil Yield Classification (PFYC) Assessment for development of 0.35-acre lease area and access road. Completed for NEPA compliance (BLM). Paleontologically sensitive geologic units: Late Pleistocene to Holocene (younger) alluvial fan deposits, Late to Middle Pleistocene (older) alluvial fan deposits, and Pliocene- to Pleistocene-age Ocotillo and Palm Spring Formations. Worked closely with paleontology staff (Chris Shi). Client: InterConnect Towers, LLC.

Crossroads North-TPM 36545 Project near the Community of Winchester, Riverside County, California. Senior Paleontology Program Manager (2020). Oversaw preparation and completed QA/QC of PRIMP for the drainage facilities improvements within the 50-acre Project area. Paleontologically sensitive geologic units: Quaternary older alluvium. Completed for CEQA compliance (County). Worked closely with paleontology staff (Melissa Macias). Client: Webb and Associates.

Universal Pipeline Construction Storage Yard Project (PPT180027) near City of Perris, Riverside County, California. Paleontology Program Manager (2020). Oversaw preparation and completed QA/QC of the PRA, including field survey, for development of 3-acre storage yard for construction. Completed for CEQA compliance (County). Paleontologically sensitive geologic units: Pleistocene-age alluvial deposits. Worked closely with paleontology staff (Chris Shi and Melissa Macias). Client: Universal Pipeline, Inc.

Selected Project Experience (continued)

Sites 3 and 4 of the Bloomington Business Park Project, Community of Bloomington, San Bernardino County, California. Paleontology Program Manager (2020). Oversaw preparation and completed QA/QC of paleontological technical memorandum for the development of 74.6 acres within the Bloomington Business Park Specific Plan area. Completed for CEQA compliance (County). Paleontologically sensitive geologic units: Pleistocene-age alluvial deposits. Worked closely with paleontology staff (Melissa Macias and Chris Shi). Client: Howard Industrial Partners.

Rosewood Village Residential Project, City of Commerce, Los Angeles County, California. Paleontology Program Manager (2020). Oversaw preparation and completed QA/QC of paleontological technical memorandum for the development of multiple housing complexes on 5.74 acres. Paleontologically sensitive geologic units: Pleistocene-age alluvial deposits, Pliocene-age Fernando Formation, and Miocene-age Monterey Formation. Completed for CEQA compliance (City). Worked closely with paleontology staff (Win McLaughlin and Chris Shi). Client: City Ventures.

Menifee Town Center Plot Plan No. 2018-023, Menifee Plaza Development, Precise Grading Plan GP19-060 Project, City of Menifee, Riverside County, California. Paleontology Program Manager (2020). Oversaw completion of ground-surface reconnaissance field survey, and provided QA/QC of the PRIMP and joint paleontological and cultural negative findings construction monitoring report covering commercial development of 1.95 acres. Completed for CEQA compliance (City). Paleontologically sensitive geologic units: Pleistocene valley deposits and very old alluvial fan deposits. Worked closely with paleontology staff (Chris Shi). Client: Golden Star Investment Properties, LLC.

VENTANA Tentative Tract Map No. 37884 Project, City of Indio, Riverside County, California. Paleontology Program Manager (2020). Oversaw completion of ground-surface reconnaissance field survey and provided QA/QC of PRA for CEQA compliance. Paleontologically sensitive geologic units: Lake Cahuilla beds; Pliocene- to Pleistocene-age alluvial deposits, including Bautista Beds. Client: Ave. 50 Indio, LLC.

Improvements to the Avenue 50 and Jackson Street Intersection, City of Indio, Riverside County, California. Paleontology Program Manager (2019-2020). Oversaw completion of ground-surface reconnaissance field survey and provided QA/QC of paleontological technical memorandum for CEQA compliance. Paleontologically sensitive geologic units: Lake Cahuilla beds. Worked closely with paleontology staff (Chris Shi). Completed for CEQA compliance (County). Client: Albert A. Webb Associates, Inc.

Menifee Town Center – Parcels 13, 14, and 15 Development Project, Riverside County, California. Paleontology Program Manager (2018-2020). Oversaw preparation and completed QA/QC of negative findings construction monitoring report for cultural and paleontological resources as well as PRIMP covering 13-acre project area. Paleontologically sensitive geologic units: Middle to Late Pleistocene alluvial fan deposits. Worked closely with paleontology staff (Scott Rohlf, Chris Shi, and Aimee Montenegro). Completed for CEQA compliance (City). Client: Kristoff Commercial Real Estate.

Western San Bernardino County Distribution System Infrastructure Protection Program (DSIPP), San Bernardino County, California. Paleontology Program Manager (2019). Oversaw completion of paleontological resource assessment for O&M activities throughout the Programmatic Footprint (74 miles of pipeline, 392 pipeline structures, and approximately 50 miles of patrol roads through 10 cities) as well as within work areas for 13 individual Capital Investment Plan (CIP) projects. Paleontologically sensitive geologic units: Early Holocene or older axial-channel deposits, alluvial fan deposits; Undetermined sensitivity: Miocene-age unnamed fault-bounded conglomerate and sandstone unit. Completed for CEQA compliance (Metropolitan Water District of Southern California). Worked closely with paleontology staff (Chris Shi). Client: Dudek.

Selected Project Experience (continued)

Fresno Meat-Rendering Plant, City of Fresno, Fresno County, California. Paleontology Program Manager (2019). Oversaw completion of preconstruction paleontological survey of 10 acres and letter report. Paleontologically sensitive geologic units: Pleistocene nonmarine and Quaternary non-marine alluvial fan deposits. Completed for CEQA compliance (City). Worked closely with paleontology staff (Chris Shi). Client: Darling Ingredients, Inc.

Santa Ana River Trail – Phase 6 Through Green River Golf Course, Orange-San Bernardino County Line to City of Corona, Riverside County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of combined paleontological identification report/paleontological evaluation report (PIR/PER) for two possible Santa Ana River Trail (SART) alignments, a short segment linking SART – Phase 5 to SART – Phase 3, and a small staging area. Project included field surveys for paleontological resources. Completed for CEQA compliance (Riverside County Transportation Commission). Worked closely with paleontology staff (Chris Shi). Client: Michael Baker International.

Wastewater Collection and Treatment Improvements, Community of Franklin-Beachwood, Merced County, California. Paleontology Program Manager (2019). Overs**aw** preparation and complet**ed** QA/QC of paleontological resource identification letter report for the approximately 67-acre project area for CEQA compliance (Franklin County Water District). Paleontologically sensitive geologic units: Riverbank and Modesto Formations. Work**ed** closely with paleontology staff (Chris Shi). Client: Quad Knopf, Inc.

Port of Long Beach Master Plan Update, City of Long Beach, Los Angeles County, California. Paleontology Program Manager (2019). Oversaw preparation and provided QA/QC of paleontological resource sections of the Program Environmental Impact Report (PEIR) for the Port Master Plan Update (PMPU) for CEQA compliance (Port of Long Beach). Paleontologically sensitive geologic units: Pleistocene-age sedimentary deposits of the continental shelf and possibly also Late Pleistocene- to Holocene-age young alluvium. Worked closely with paleontology staff (Chris Shi). Client: Leidos.

CEMEX Rockfield Modification Project, City of Fresno, Fresno County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of paleontological technical memorandum for expansion of current aggregate mining and processing operations at quarry and plant sites within a 490.5-acre Project area. Paleontologically sensitive geologic units: Modesto, Riverbank, Turlock Lake, and Tulare Formations. Completed for NEPA (U.S. Army Corps of Engineers) and CEQA compliance (California Public Utilities Commission). Worked closely with paleontology staff (Chris Shi). Client: Buada Associates, Inc.

City of Fresno Cannabis Ordinance Environmental Impact Report, Fresno County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of paleontological technical memorandum to assist with evaluation of the proposed regulation and permitting of commercial cannabis activities with a focus on land-use areas within the City capable of supporting cultivation, distribution, manufacturing, testing, and retail facilities with an 800-foot buffer from other cannabis retailers, schools, daycare centers, and other youth facilities. Paleontologically sensitive geologic units: Modesto, Riverbank, Tulare, and Turlock Lake Formations. Completed for CEQA compliance (City). Worked closely with paleontology staff (Scott Rohlf). Client: Quad Knopf, Inc.

Interstate 10 Eastbound Truck Climbing Lane Improvement Project, City of Yucaipa, San Bernardino County and City of Calimesa, Riverside County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of paleontological technical memorandum for improvements to a total of 3 miles of existing 6-lane eastbound I-10 by adding a truck-climbing lane (TCL) from the 16th Street Overcrossing Bridge to 0.2 mile east of the County Line Road Undercrossing Bridge by paving the existing median. Paleontologically sensitive geologic units: San Timoteo Formation and Pleistocene-age alluvial deposits, and possibly also pre-Pliocene Mill Creek Formation/Potato Sandstone. Completed for NEPA and CEQA compliance (Caltrans and San Bernardino County Transportation Authority). Worked closely with paleontology staff (Chris Shi). Client: HDR.

Selected Project Experience (continued)

Sun Lakes Boulevard Realignment, City of Banning, Riverside County, California. Paleontology Program Manager (2019). Edited and approved Constraints Analysis for paleontological resources within the approximately 14-acre project area. Paleontologically sensitive geologic units: Mt. Eden and San Timoteo Formations, and Quaternary alluvial deposits. Worked closely with paleontology staff (Win McLaughlin, Chris Shi). Client: Albert A. Webb Associates, Inc.

Banning Electric Utility – Ivy Distribution Substation Project, City of Banning, Riverside County, California. Paleontology Program Manager (2019). Oversaw completion and provided QA/QC of paleontological resource constraints memorandum for CEQA compliance (City). Paleontologically sensitive geologic units: Pleistocene alluvium. Worked closely with paleontology staff (Win McLaughlin and Chris Shi). Client: Albert A. Webb Associates, Inc.

Biola University North Dorm Project: Tennis Courts and Wastewater Treatment Area Expansion, City of La Mirada, Los Angeles County, California. Paleontology Program Manager (2019). Oversaw preparation and providing QA/QC of paleontological resource monitoring for construction for CEQA compliance (City). Paleontologically sensitive geologic units: older Quaternary alluvium. Worked closely with paleontology staff (Chris Shi, Aimee Montenegro). Client: Biola University.

Rowland Heights Hotel and Plaza Project, Los Angeles County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of PRIMP for CEQA compliance (County). Paleontologically sensitive geologic units: Pleistocene alluvium, Puente/Monterey Formation. Worked closely with paleontology staff (Chris Shi). Client: Envicom.

Rados Heacock Environmental Project, City of Moreno Valley, Riverside County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of paleontological technical memorandum for construction of two new industrial buildings on 37.12 acres of vacant land. Paleontologically sensitive Pleistocene-age alluvial deposits are located in the Project area. Completed for CEQA compliance (County). Worked closely with paleontology staff (Scott Rohlf). Client: Albert A. Webb Associates, Inc.

Southern California Logistics Center Project, Victorville, San Bernardino County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of PRA and review of the paleontological resource section of the PEIR for the Victorville Airport for CEQA compliance (City). Paleontologically sensitive geologic units: Pleistocene-age or older alluvial deposits. Worked closely with paleontology staff (Chris Shi). Client: Michael Baker.

5401 Telegraph Road Parking Structure, City of Commerce, Los Angeles County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of WEAP training, and paleontological resource monitoring, and oversaw reporting for CEQA compliance. Paleontologically sensitive geologic units: older Quaternary alluvial deposits, but no paleontological resources were observed during construction monitoring. Worked closely with paleontology staff (Chris Shi, Jorge Mendieta). Client: Parkco Building Company.

Duke Perry Street & Barrett Avenue Project in the City of Perris, Riverside County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of paleontological technical memorandum for construct an industrial warehouse and paved parking lot on approximately 7.25 acres. Recommended the creation of a PRIMP since the project area was ranked High B for paleontological sensitivity with nearby Pleistocene vertebrate fossil localities recorded in alluvial deposits similar to those in the Project area. Worked closely with paleontology staff (Chris Shi). Completed for CEQA compliance. Lead agency: City of Perris. Albert A. Webb Associates, Inc. for Duke Realty.

Selected Project Experience (continued)

Cannabis Cultivation Warehouse on Assessor's Parcel 314-160-004, City of Perris, Riverside County, California. Paleontology Program Manager (2019). Oversaw preparation and completed QA/QC of paleontological technical memorandum for development of 0.93 acres of vacant land. Recommended the creation of a PRIMP since the older Quaternary alluvial deposits in the project area are ranked High B for paleontological sensitivity with nearby Pleistocene vertebrate fossil localities recorded in alluvial deposits similar to those in the Project area. Worked closely with paleontology staff (Chris Shi). Completed for CEQA compliance. Client: Richard Park.

Athos Renewable Energy Project, Riverside County, California. Paleontology Program Manager (2018-2019). Supervised completion of paleontological desktop and field investigations and completed QA/QC of all deliverables -- PIR to the County, and Fieldwork Authorization Request and PRA to the BLM (utilized BLM's PFYC system for the PRA) – for the Project covering 3,662-acres, including a 11.1-mile-long by 200-foot-wide generation-tie transmission line corridor and access roads. Paleontologically sensitive geologic units: Early Pleistocene nonmarine sediments, including Ocotillo Conglomerate, older Pleistocene Pinto Formation and paleosols. Worked closely with paleontology staff (Scott Rohlf, Chris Shi, and Christopher Shea). Completed for NEPA (BLM) and CEQA (County) compliance. Client: Aspen Environmental Group for IP Athos, LLC.

Central Coast Oil and Gas Leasing and Development in Alameda, Contra Costa, Fresno, Merced, Monterey, San Benito, San Joaquin, San Mateo, Santa Clara, Santa Cruz, and Stanislaus Counties, California. Principal Investigator (2018). Updated paleontology sections of Affected Environment, Environmental Consequences, and References Cited chapters for 7 alternatives covered in the *Resource Management Plan Amendment/Final Environmental Impact Statement* on public lands and split mineral estate lands administered by the BLM Central Coast Field Office. Utilized BLM's Potential Fossil Yield Classification (PFYC) system. In addition to FEIS chapters, responsible for updating Administrative Record and providing copies of primary sources cited. Completed for NEPA and CEQA compliance. Lead agencies: BLM for NEPA and California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) for CEQA. Client: Aspen Environmental Group.

Duke Development on the Northwest Corner of Alabama Street & Palmetto Avenue, City of Redlands, San Bernardino County, California. Paleontology Program Manager (2018). Oversaw preparation and completed QA/QC of paleontological resource technical memorandum on approximately 55 acres. Paleontologically sensitive geologic units: Late to Middle Pleistocene alluvial deposits (e.g., Very Old Axial-Channel deposits). Worked closely with paleontology staff (Scott Rohlf and Christopher Shea). Completed for CEQA compliance (County). Client: Albert A. Webb Associates, Inc. for Duke Realty.

I-10 Monroe Interchange Project, Riverside County, California. Paleontology Program Manager (2018). Oversaw preparation and completed QA/QC of PIR for CEQA compliance (Caltrans, District 8). Included paleontological field surveys of two design alternatives over a total of approximately 73 acres. Paleontologically sensitive geologic units: Quaternary, especially pre-Holocene, fluvial deposits and possibly also Lake Cahuilla lacustrine deposits at depth. Worked closely with paleontology staff (Scott Rohlf and Christopher Shea). Client: Michael Baker.

Water-Main Replacement Project along the San Gorgonio River, City of Banning, Riverside County, California. Paleontology Program Manager (2018). Total project length: 6.5 miles. Oversaw paleontological spot-check monitoring and reporting for water mainline replacement on private lands for CEQA compliance (City). Paleontologically sensitive geologic units: San Timoteo Formation and Quaternary older alluvium, but no paleontological resources were observed during construction monitoring. Worked closely with paleontology staff (Scott Rohlf and Christopher Shea). Will also oversee full-time monitoring and reporting in high-sensitivity areas on US Forest Service (USFS) lands for compliance with the Omnibus Public Land Management Act. Client: Aspen Environmental Group.

Selected Project Experience (continued)

De Anza Sewer Force Main Project, City of San Jacinto, Riverside County, California. Paleontology Program Manager (2018). Total project length: 7,500 linear feet. Oversaw creation of informational brochure for construction-worker sensitivity training for WEAP compliance. Also oversaw coordination and completion of spot-check monitoring. Completed senior review and QA/QC for paleontology mitigation monitoring letter report. Paleontologically sensitive geologic units: older Quaternary deposits, but no paleontological resources were observed during construction monitoring. Worked closely with paleontology staff (Christopher Shea). All completed for CEQA compliance (Eastern Municipal Water District). Client: HELIX.

Sixth Street Park, Arts, River & Connectivity (PARC) Improvements, City of Los Angeles, Los Angeles County, California. Paleontology Program Manager (2018). Completed QA/QC of paleontological resource technical memorandum for CEQA compliance (City). Paleontologically sensitive geologic units: Middle to Late Pleistocene alluvial deposits, Late Miocene- to Early Pliocene-age Puente Formation, and Early Pliocene- to Early Pleistocene-age Fernando Formation. Worked closely with paleontology staff (Scott Rohlf). Client: GPA Consulting.

Collaborative Research: Deltaic Resilience and the Genesis of Mesopotamian Cities (Iraq) Project. Phytolith Analyst (2014). Completed phytolith analysis and reporting about mudbrick samples from the archaeological site of Ur after overseeing chemical processing. 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.

Hay Lake and McFarland Parcels Land Exchange, Cook and St. Louis Counties, Minnesota. Principal Investigator (2010). Researched and summarized Existing Conditions of paleontological resources for DEIS. Completed for NEPA compliance (USFS, Superior National Forest). Client: PolyMet Mining.

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 phytoliths 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).

Selected Project Experience (continued)

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 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, Review of R.R. Brooks and D. Johannes, *Phytoarchaeology,* Portland, OR: Dioscorides Press. *American Antiquity* 58(4):763-764.

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., 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.

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

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.**

Selected Presentations

Applied EarthWorks, Inc. Paleontology Program, 2020, "National Fossil Day" video. Oversaw completion of original 5-minute-long video by paleontology staff (Aimee Montenegro, Chris Shi, and Melissa Macias). Posted to Facebook and LinkedIn; available for distribution.

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.**

Selected Presentations (continued)

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.