

Appendix G

Paleontological Resources Assessment

Paleontological Resource Assessment for the Proposed Thousand Palms Flood Control Project, Riverside County, California

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SUMMARY OF FINDINGS

At the request of Aspen Environmental Group, on behalf of the Coachella Valley Water District and the U.S. Army Corps of Engineers, Los Angeles District, Applied EarthWorks, Inc. (Æ) performed a paleontological resource assessment in support of the proposed Thousand Palms Flood Control Project (Proposed Project), Riverside County, California. This study consisted of a search of museum collections records maintained by the Natural History Museum of Los Angeles County, the University of California Museum of Paleontology online database, and the Paleobiology Database as well as a comprehensive literature and geologic map review and preparation of this technical report. This report summarizes the methods and results of a paleontological resource assessment and provides Project-specific management recommendations. This study is intended to illustrate compliance with the California Environmental Quality Act (CEQA).

The purpose of the literature review and museum records search was to identify the geologic unit(s) underlying the Proposed Project area and to determine whether previously recorded paleontological localities occur either within the Proposed Project boundaries or within the same geologic unit elsewhere. Using the results of the literature review and museum records search, the paleontological resource potential of the Proposed Project area was determined in accordance with Society of Vertebrate Paleontology guidelines.

As a result of this study, the Proposed Project area is found to be immediately underlain by Quaternary surficial deposits, which have been determined to have a low paleontological resource potential (i.e., sensitivity). A review of available museum records indicated that no paleontological resources have been previously recorded in the Quaternary surficial deposits within the Proposed Project area or vicinity; however, older geologic units (i.e., Quaternary older alluvium and Ocotillo Conglomerate), which have proven to yield significant fossil resources in Riverside County and the Coachella Valley, may underlie the Proposed Project area at moderate depth. Consequently, the likelihood of impacts to scientifically significant vertebrate fossils as a result of Proposed Project development is low unless excavations disturb older underlying sensitive units. Therefore, it is recommended that a qualified paleontologist be retained on an on-call basis in the event that a paleontological resource is encountered during the course of Proposed Project development. In addition, a worker environmental awareness training should be conducted, which would provide a description of the fossil resources that may be encountered in the Proposed Project area and outline steps to follow in the event that a fossil discovery is made. These measures have proven to be effective in reducing or eliminating adverse impacts to paleontological resources and would satisfy the requirements of CEQA.

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1 INTRODUCTION

At the request of Aspen Environmental Group, on behalf of the Coachella Valley Water District (CVWD) and the U.S. Army Corps of Engineers, Los Angeles District (USACE), Applied EarthWorks, Inc. (Æ) performed a paleontological resource assessment in support of the proposed Thousand Palms Flood Control Project (Proposed Project), Riverside County, California (Figure 1-1). The assessment consisted of a review of museum records; a comprehensive literature and geologic map review; and preparation of this report, which includes Proposed Project-specific management recommendations.

1.1 PROJECT LOCATION AND DESCRIPTION

The Proposed Project is located in the Thousand Palms area of the Coachella Valley in Riverside County, California, north of Interstate 10 (I-10). Specifically, the Proposed Project encompasses approximately 6 miles within portions of Township 4 South, Range 6 East, Sections 7, 35 and 36; Township 5 South, Range 7 East, Sections 1, 2, and 6; and Township 10 North, Range 33 West, Sections 33-35 on the Myoma 7.5' U.S. Geological Survey (USGS) Quadrangle map. Flood control improvements associated with the Proposed Project would reduce flooding hazards from coalescing alluvial fans in the area between the Indio Hills and I-10. This area includes unincorporated territory of Riverside County as well as portions of the cities of Cathedral City and Indio. The unincorporated community of Thousand Palms, located near the central portion of the Proposed Project area, is located about 10 miles east of the city of Palm Springs and immediately north of the city of Palm Desert.

The Proposed Project consists of four reaches (Reaches 1–4), which would be constructed in order to protect the growing community of Thousand Palms from flooding hazards. Reaches 1–4 within the Proposed Project area would include levees, channels, and energy-dissipating structures. The levees and channels would be constructed of soil cement, which is typically a compacted, high-density mix of pulverized rocks and soils with cement and water. The upslope sides of each levee would also be armored with soil cement to stabilize these areas. Construction of the Proposed Project would include trenching and excavation to install the levees and channel facilities. The height of the levees would range from approximately 11.5 to 18 feet, while the height of channel embankments would be approximately 5 feet. All levees would have an underground toe extending to depths of 15 feet, which would be the maximum depth of disturbance for the Proposed Project.

1.2 PURPOSE OF INVESTIGATION

The purpose of this investigation is to: (1) identify the geologic units within the Proposed Project area and assess their paleontological resource potential, (2) determine whether the Proposed Project has the potential to adversely impact known scientifically significant paleontological resources, and (3) provide project-specific management recommendations for paleontological resource mitigation, as necessary. The study was conducted in accordance with professional

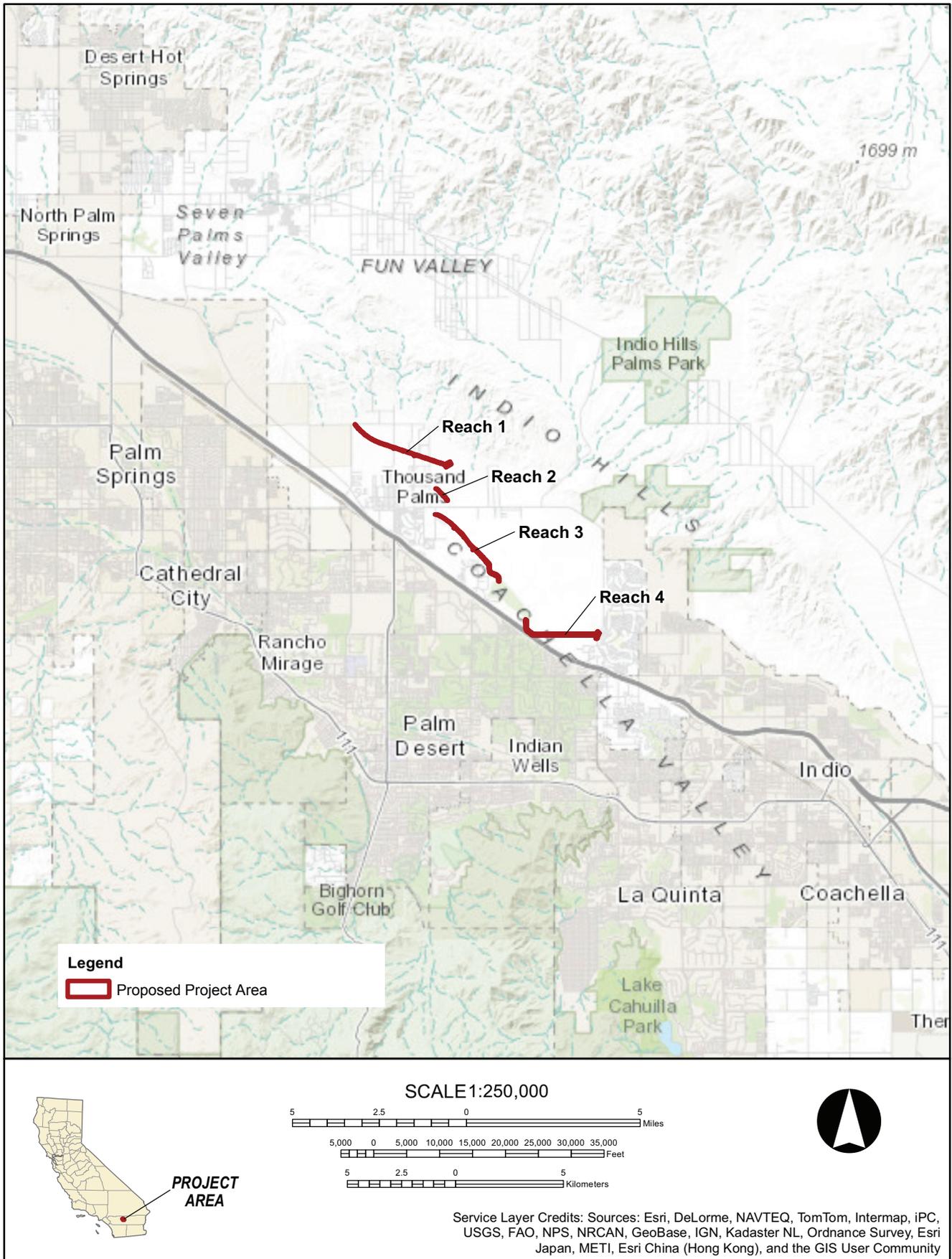


Figure 1-1 Proposed Project Vicinity Map.

standards and guidelines set forth by the Society of Vertebrate Paleontology (SVP, 2010) and meets the requirements of the laws and regulations described in Chapter 2.

1.3 KEY PERSONNEL

This paleontological assessment was prepared under the direction of Æ's Paleontology Program Manager, Jessica DeBusk, who served as Senior Paleontologist and provided a quality assurance review of this report. Associate Paleontologist Heather Clifford served as the primary author of this report and produced all graphics. Ms. DeBusk has more than 12 years of professional experience as a consulting paleontologist and meets the SVP's definition of a qualified professional paleontologist.

1.4 REPORT ORGANIZATION

This report documents the results of Æ's paleontological resource assessment of the Proposed Project area. Chapter 1 has introduced the scope of work, identified the Proposed Project location, described the Proposed Project, defined the purpose of the investigation, and presented key personnel. Chapter 2 outlines the regulatory framework governing the Proposed Project. Chapter 3 defines the paleontological significance and sensitivity of the Proposed Project. Chapter 4 describes methods, and Chapter 5 provides an overview of the geology and paleontology of the Proposed Project area. Chapter 6 presents an analysis and the results of the study. Chapter 7 provides management recommendations, while conclusions are presented in Chapter 8. Lastly, Chapter 9 lists references cited.

2 REGULATORY FRAMEWORK

Paleontological resources (i.e., fossils) are considered to be nonrenewable scientific resources because once destroyed, they cannot be replaced. As such, paleontological resources are afforded protection under the various state and local laws and regulations briefly discussed in this chapter.

2.1 STATE

Paleontological resources cannot be replaced once they are destroyed. Therefore, paleontological resources are considered nonrenewable scientific resources and are protected under the CEQA. Specifically, in Section V(c) of Appendix G of the CEQA Guidelines, the “Environmental Checklist Form,” the question is posed: “Will the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?” In order to determine the uniqueness of a given paleontological resource, it must first be identified or recovered (i.e., salvaged). Therefore, mitigation of adverse impacts to paleontological resources is mandated by CEQA.

2.2 COUNTY OF RIVERSIDE

Paleontological resources are addressed under the Multipurpose Open Space Element of the Riverside County General Plan (County of Riverside, 2008), policies OS 19.8 and 19.9, which state the following:

OS 19.8: Whenever existing information indicates that a site proposed for development may contain biological, paleontological, or other scientific resources, a report shall be filed stating the extent and potential significance of the resources that may exist within the proposed development and appropriate measures through which the impacts of development may be mitigated;

OS 19.9: When existing information indicates that a site proposed for development may contain paleontological resources, a paleontologist shall monitor site grading activities, with the authority to halt grading to collect uncovered paleontological resources, curate any resources collected with an appropriate repository, and file a report with the Planning Department documenting any paleontological [p. OS-37].

The SABER Policy (**S**afeguard **A**rtifacts **B**eing **E**xcavated in **R**iverside **C**ounty) enacted in October 2011 by the Riverside County Board of Supervisors mandates that any paleontological resources found or unearthed in the County of Riverside be curated at the Western Science Center in the city of Hemet. This new policy will be included as an amendment to the Multipurpose Element of the General Plan Update.

3

PALEONTOLOGICAL RESOURCE ASSESSMENT GUIDELINES AND SIGNIFICANCE CRITERIA

3.1 DEFINITION OF PALEONTOLOGICAL RESOURCES AND SIGNIFICANCE CRITERIA

Paleontological resources are the evidence of once-living organisms as preserved in the rock record. They include both the fossilized remains of ancient plants and animals and the traces thereof (trackways, imprints, burrows, etc.). In general, fossils are considered to be greater than 5,000 years old (older than Middle Holocene) and are typically preserved in sedimentary rocks. Although rare, fossils can also be preserved in volcanic rocks and low-grade metamorphic rocks formed under certain conditions (SVP, 2010).

Significant paleontological resources are defined as “identifiable” vertebrate fossils, uncommon invertebrate, plant, and trace fossils that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, or biochronological data (SVP, 2010). These data are important because they are used to examine evolutionary relationships, provide insight on the development of and interaction between biological communities, and establish time scales for geologic studies, and for many other scientific purposes (Scott and Springer, 2003; SVP, 2010).

3.2 PROFESSIONAL STANDARDS AND PALEONTOLOGICAL RESOURCE SENSITIVITY

Absent specific agency guidelines, most professional paleontologists in California adhere to guidelines set forth by SVP in *Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources* (SVP, 2010). These guidelines establish detailed protocols for the assessment of the paleontological resource potential (i.e., “sensitivity”) of a project area and outline measures to follow in order to mitigate adverse impacts to known or unknown fossil resources during project development. In order to prevent project delays, SVP highly recommends that the owner or developer retain a qualified professional paleontologist in the advance planning phases of a project to conduct an assessment and to implement paleontological mitigation during construction, as necessary.

Using baseline information gathered during a paleontological resource assessment, the paleontological resource potential of the geologic unit(s) (or members thereof) underlying a project area can be assigned to one of four categories defined by SVP (2010). These categories include high, undetermined, low, and no potential. The criteria for each sensitivity classification and the corresponding mitigation recommendations are summarized in Table 3-1 below.

If a project area is determined to have high or undetermined potential for paleontological resources following the initial assessment, then SVP recommends that a Paleontological Resource Mitigation Plan (PRMP) be developed and implemented during the construction phase of a project. The mitigation plan describes, in detail, when and where paleontological monitoring will take place and establishes communication protocols to be followed in the event that an

unanticipated fossil discovery is made during project development. If significant fossil resources are known to occur within the boundary of the project and have not been collected, then the plan will outline the procedures to be followed prior to any ground-disturbing activities (i.e., preconstruction salvage efforts or avoidance measures, including fencing off a locality). Should microfossils be known to occur in the geologic unit(s) underlying the project area or suspected to occur, then the plan will describe the methodology for matrix sampling and screening.

**Table 3-1
Paleontological Sensitivity Categories**

Resource Potential*	Criteria	Mitigation Recommendations
No Potential	Rock units that are formed under or exposed to immense heat and pressure, such as high-grade metamorphic rocks and plutonic igneous rocks.	No mitigation required.
Low Potential	Rock units that have yielded few fossils in the past, based upon review of available literature and museum collections records. Geologic units of low potential also include those that yield fossils only on rare occasion and under unusual circumstances.	Mitigation is not typically required.
Undetermined Potential	In some cases, available literature on a particular geologic 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 (i.e., field survey).	A field survey is required to further assess the unit's paleontological potential.
High Potential	Geologic units with high potential for paleontological resources are those that have proven to yield vertebrate or significant invertebrate, plant or trace fossils in the past or are likely to contain new vertebrate materials, traces, or trackways. Rock units with high potential also may include those that contain datable organic remains older than late Holocene (e.g., animal nests or middens).	Typically, a field survey as well as on-site construction monitoring will be required. Any significant specimens discovered will need to be prepared, identified, and curated into a museum. A final report documenting the significance of the finds will also be required.

* - Adapted from SVP (2010).

The PRMP should be prepared by a qualified professional paleontologist and developed using the results of the initial paleontological assessment and survey. Elements of the plan can be adjusted throughout the course of a project as new information is gathered and conditions change, so long as the lead agency is consulted and all parties are in agreement. For example, if after 50 percent of earth-disturbing activities have occurred in a particular unit or area and no fossils whatsoever have been discovered, then the project paleontologist can reduce or eliminate monitoring efforts in that unit or area.

4 METHODS

4.1 LITERATURE REVIEW AND RECORDS SEARCH

Paleontological resources are not found in “soil” but are contained within the geologic deposits or bedrock that underlies the soil layer. Therefore, in order to ascertain whether a particular project area has the potential to contain significant fossil resources at the subsurface, it is necessary to review relevant scientific literature and geologic mapping to determine the underlying geology and stratigraphy of the area. Further, in order to delineate the boundaries of an area of paleontological sensitivity, it is necessary to determine the extent of the entire geologic unit because paleontological sensitivity is not limited to surface exposures of fossil material.

To determine whether fossil localities have been previously discovered within a project area or a particular rock unit, a search of pertinent local and regional museum repositories for paleontological localities within and nearby the project area should be performed. For the Proposed Project, a museum records search was conducted using the University of California Museum of Paleontology’s (UCMP’s) online database and PaleoBiology Database, which contain paleontological records for Riverside County. In addition, a review of Natural History Museum of Los Angeles County (LACM) locality records for the Coachella Valley was also performed.

5 GEOLOGY AND PALEONTOLOGY

5.1 REGIONAL GEOLOGY

The Proposed Project area is located in the Coachella Valley within the Colorado Desert geomorphic province in California. The Colorado Desert extends from the Mojave Desert to the north, the Colorado River on the east, the Peninsular Ranges on the west, and south into Mexico. Dominant features within the Colorado Desert include the Salton Trough; the Colorado River; and the Orocopia, Chocolate, Palo Verde, and Chuckwalla mountains (Norris and Webb, 1976). The Coachella Valley is located within the Salton Trough, a large structural depression that extends from the San Geronio Pass in the north to the Gulf of Mexico in the south. The Salton Trough is a graben structure, bounded by roughly parallel north-west-trending faults, including the San Andreas Fault zone, which is directly north of the Proposed Project area, and the San Jacinto and Elsinore faults to the southeast (Alles, 2011; Norris and Webb, 1976). During the Pliocene, the Salton Trough formed due to spreading and subsidence associated with the rift system that opened the Gulf of California, which still continues to undergo approximately 48 millimeters per year of spreading. The Salton Trough would currently be under water as part of the Gulf of California if not for millions of years of sedimentation from the Colorado River (Alles, 2011). During the Pliocene to Early Pleistocene, sedimentation along the Colorado River resulted in the build-up of a substantial delta, which eventually separated the marine waters of the Gulf of California from the brackish and fresh waters of the Salton Trough (Ingwall, 2008). Since the Late Pleistocene, the Salton Trough was periodically occupied by the freshwater Lake Cahuilla. The lake formed, drained, and reformed between approximately 37,000 to 300 years before present as a result of fluctuations in the course of the Colorado River and the subsequent diversion of the river's mouth from the Gulf of California to the Salton Trough (Deméré, 2002; Norris, 1979).

5.2 GEOLOGY AND PALEONTOLOGY OF THE PROPOSED PROJECT AREA

The Proposed Project area is mapped at a scale of 1:100,000 by Lancaster et al. (2012) and 1:62,500 by Dibblee and Minch (2008) and is immediately underlain by Quaternary surficial deposits of Holocene age. These Holocene deposits may be underlain at an unknown depth by older Pleistocene alluvium and/or the late Pliocene to early Pleistocene Ocotillo Conglomerate, which are exposed nearby. The geology and paleontology of these units is described below and the geologic units are depicted in Figure 5-1.

The Proposed Project area is immediately underlain by Quaternary alluvial fan (Qyf) and valley (Qya) deposits, ephemeral wash (Qw) deposits, and significant eolian (Qe) accumulation. The Quaternary alluvial fan deposits exposed near Reaches 1 and 2 consist of unconsolidated to moderately consolidated, boulder, cobble, gravel, sand, and silt deposits derived from the erosion of rock units in the Indio Hills. The alluvial fan unit is moderately dissected by recent alluvial wash deposits composed of unconsolidated sand and gravel deposited in ephemeral channels. Quaternary alluvial valley sediments are exposed along Reaches 3 and 4, further south from the

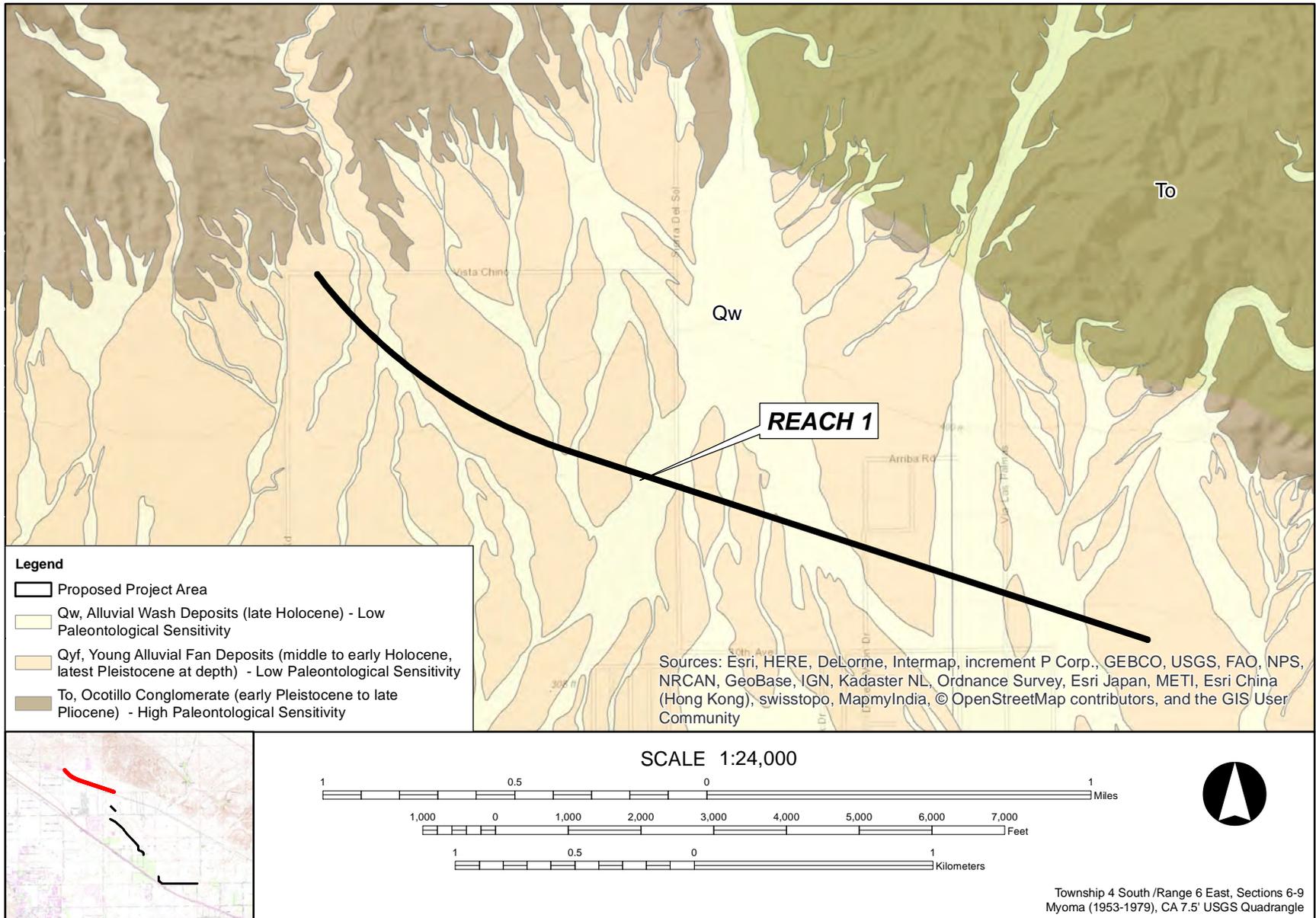


Figure 5-1a Geologic Units and Paleontological Sensitivity in the Proposed Project Area - Reach 1.

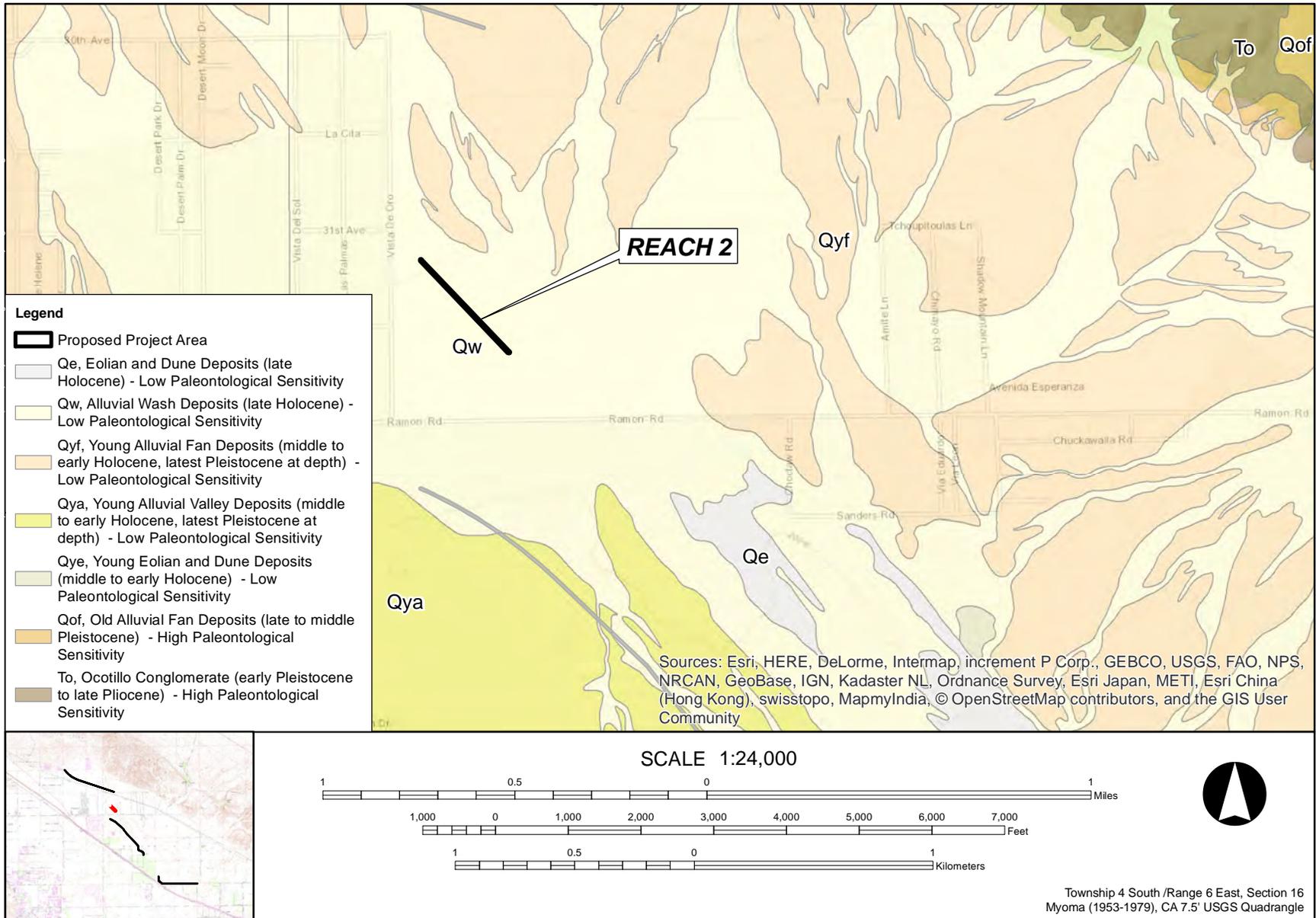


Figure 5-1b Geologic Units and Paleontological Sensitivity in the Proposed Project Area - Reach 2.

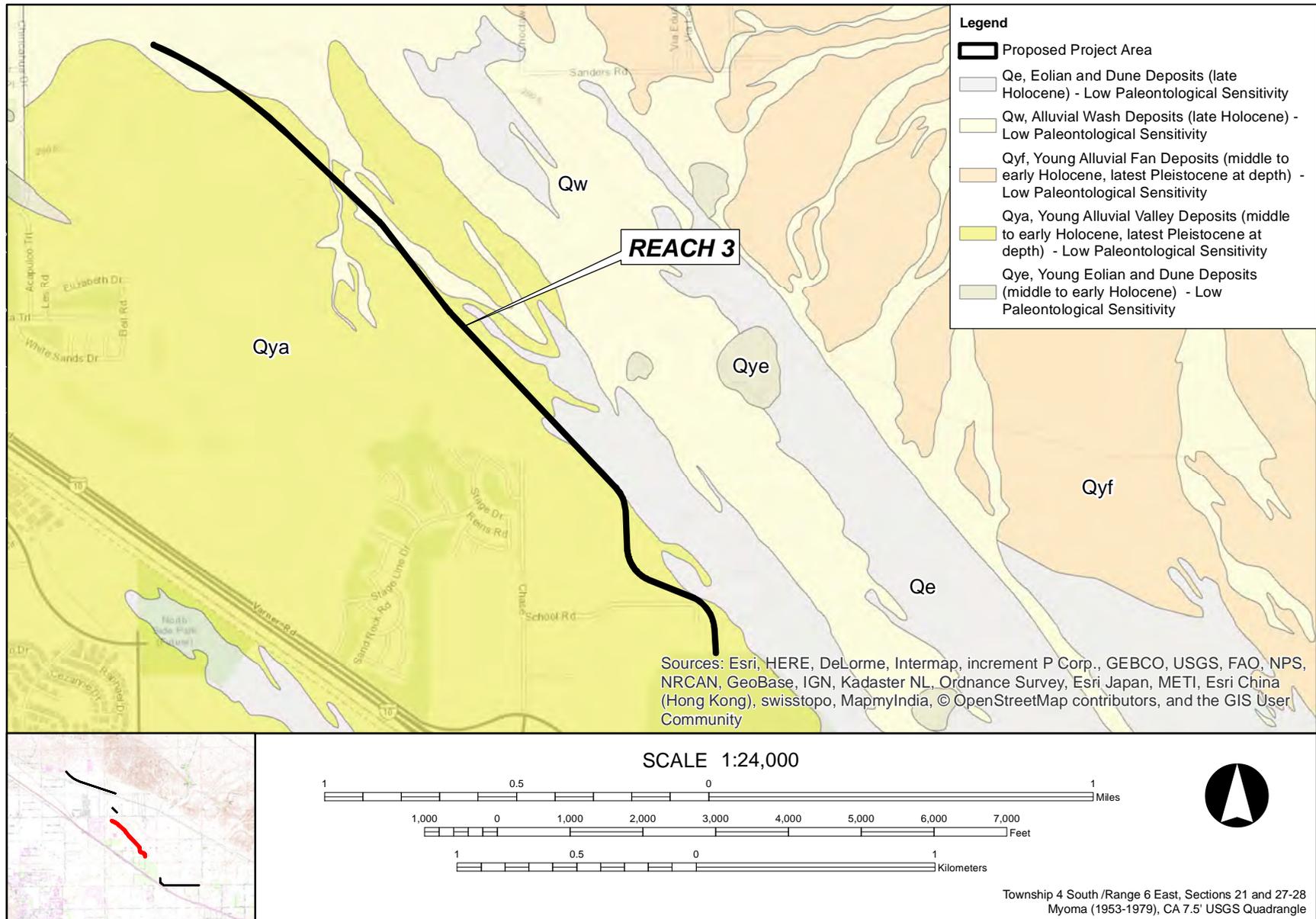


Figure 5-1c Geologic Units and Paleontological Sensitivity in the Proposed Project Area - Reach 3.

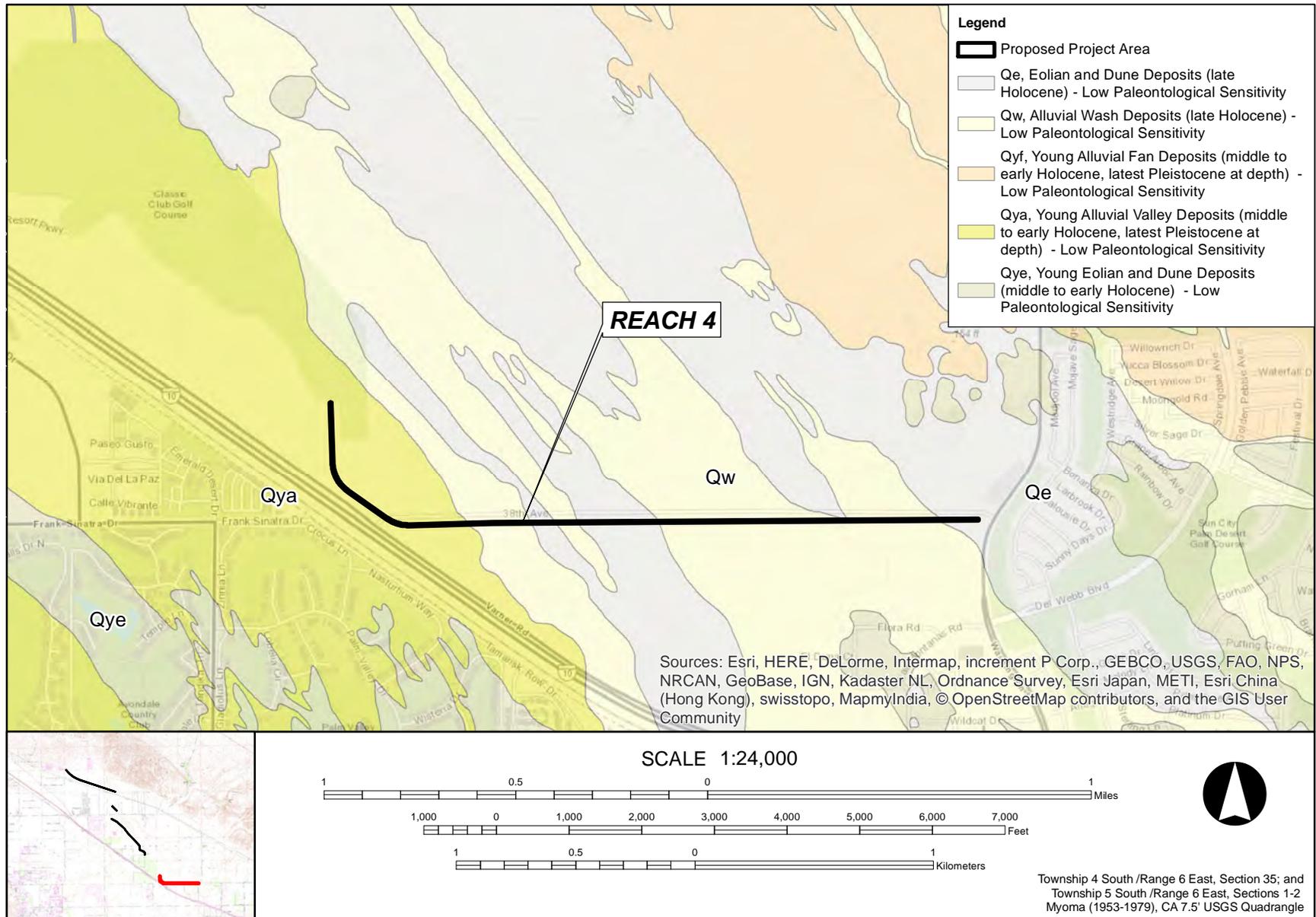


Figure 5-1d Geologic Units and Paleontological Sensitivity in the Proposed Project Area - Reach 4.

Indio Hills, toward the center of the Coachella Valley. These sediments are characterized by unconsolidated to moderately consolidated, undissected, clay, silt, sand, and gravel. Eolian deposits composed of unconsolidated, well-sorted, wind-blown sand are widespread along Reaches 3 and 4 (Bedrossian, et al., 2012).

According to Dibblee and Minch (2008), the Proposed Project area is located approximately 2 miles northwest of the northernmost shoreline of ancient Lake Cahuilla; therefore, fine-grained Quaternary lacustrine Lake Cahuilla sediments, though common throughout the central Salton Trough, are not expected to be present within the Proposed Project area. However, the Holocene age surficial deposits mapped in the Proposed Project area may be underlain at moderate depth by older Pleistocene alluvial deposits, which have proven to yield scientifically significant Ice Age vertebrate fossils throughout Southern California and Riverside County (Springer et al., 2009). Furthermore, the Ocotillo Conglomerate is exposed less than 500 feet northwest of Reach 1 and may underlie a portion the Quaternary surficial deposits in the Proposed Project area at moderate depth. Several localities have been previously identified within the Ocotillo Conglomerate, which have yielded numerous fossil specimens belonging to the Borrego Local Fauna (LF) (Jefferson and Remeika, 1994; Remeika and Jefferson, 1993). Recovered fossil specimens include horse, camel, pronghorn, elk, deer, zebra, oxen, ground sloth, badger, bear, dire, wolf, coyote, mountain lion, sabertooth cat, rabbit, gopher, squirrel, rat, sucker fish, hawk, eagle, duck, vulture, owl, flamingo, tortoise, and pond turtle.

No previously recorded fossils have been documented from within Quaternary surficial deposits in the Proposed Project area or vicinity. Holocene age alluvial deposits, particularly those younger than 5,000 years old, are generally too young to contain fossilized material (SVP, 2010), but they may overlie sensitive older deposits (e.g., Pleistocene age alluvium or the Ocotillo Conglomerate) at an unknown depth.

6 ANALYSIS AND RESULTS

6.1 MUSEUM RECORDS SEARCH RESULTS

A search of Æ’s in-house paleontological locality database, which contains locality records data from the LACM for Riverside County, including the Coachella Valley and Indio Hills, returned no previously recorded vertebrate fossil localities from Quaternary surficial deposits in the Proposed Project area or immediate vicinity. However, at least one vertebrate locality (LACM 5832) was previously recorded within the Ocotillo Conglomerate, east of the Proposed Project area within the Indio Hills, which yielded a fossil specimen of camel (McLeod, 2015). A supplemental review was conducted of online museum collections records maintained by the UCMP (2016) and PaleoBiology Database (2016), which identified no previously recorded fossil localities within Quaternary surficial deposits in the vicinity of the Proposed Project area.

6.2 PALEONTOLOGICAL RESOURCE POTENTIAL FOR GEOLOGIC UNITS WITHIN THE PROPOSED PROJECT AREA

Based on the literature review and museum records search results, the geologic deposits underlying the Proposed Project area have been determined to have a low paleontological sensitivity in accordance with criteria set forth by SVP (2010) because they are generally too young to preserve fossil material. However, these deposits may be underlain at moderate depth by older Pleistocene alluvium or the Pliocene-Pleistocene Ocotillo Conglomerate, which have proven to yield an abundant and diverse vertebrate fauna from exposures within the Riverside County and the Coachella Valley. Consequently, the likelihood of impacts to scientifically significant vertebrate fossils as a result of Proposed Project development is low, unless excavations disturb older underlying sensitive units. Therefore, further paleontological resource management is recommended for the Proposed Project, including retaining a qualified paleontologist on call in the event that a fossil resource is encountered during the course of ground-disturbing activities. The paleontological resource management recommendations for the Proposed Project are further discussed in Chapter 7 and the paleontological sensitivity ratings of the geologic units in the Proposed Project area are shown below in Table 6-1 and depicted in Figure 5-1.

**Table 6-1
Geologic Units in the Proposed Project Area and Their Recommended Paleontological Sensitivity**

Geologic Unit*	Map Abbreviation	Age	Typical Fossils	Paleontological Resource Potential
Quaternary surficial deposits	Qya, Qyf, Qw, Qe	Holocene	None	Low (but may overlie older sensitive units at moderate depth).

* - Geology taken from Lancaster et al., 2012.

MANAGEMENT RECOMMENDATIONS

The following management recommendations have been developed in accordance with SVP (2010) guidelines and, if implemented, will satisfy the requirements of CEQA. These measures have been used by professional paleontologists for many years and have proven to be effective in reducing or eliminating adverse impacts to paleontological resources as a result of private and public development projects throughout California and elsewhere.

It is recommended that a qualified and permitted paleontologist be retained on an on-call basis in the event that a paleontological resource is encountered during construction of the Proposed Project. In addition, all construction workers and other on-site personnel shall receive environmental awareness training on paleontological resources. The training will provide a description of the fossil resources that may be encountered in the Proposed Project area, outline steps to follow in the event that a fossil discovery is made, and provide contact information for the Project Paleontologist. The training will be developed by the Project Paleontologist and may be conducted concurrent with other environmental training (e.g., cultural and natural resources awareness training, safety training, etc.). The training may also be videotaped or presented in an informational brochure for future use by field personnel not present at the start of the Proposed Project.

In the event paleontological resources are discovered by on-site personnel during construction activities, work in the immediate vicinity of the find should be halted and a temporary construction exclusion zone of at least 50 feet, consisting at a minimum of lath and flagging tape, should be erected around the discovery. The exclusion zone acts as a buffer around the discovery until the Project Paleontologist can assess the resource and make the appropriate notifications to CVWD. If the discovery is considered scientifically significant or potentially significant, the paleontological resource should be recovered, documented, prepared, identified, and curated in accordance with SVP (2010) guidelines. Immediately following fossil collection, the temporary construction exclusion zone will be removed and the Project Paleontologist will notify the Project Supervisor that grading activities may resume in the area of the find. If paleontological resources are inadvertently discovered during construction of the Proposed Project, a final report describing the results of the paleontological mitigation efforts associated with the Proposed Project should be submitted to CVWD within 30 days following completion of field and laboratory work.

8 CONCLUSIONS

This assessment is based on the results of a museum records search and review of available geologic and paleontologic literature. Therefore, only fossils that have already been previously inventoried or collected are available for this analysis. In addition to unrecorded surface fossils, there is the potential for an unknown number of paleontological resources buried within older sensitive deposits that may underlie the Proposed Project area at depth. These nonrenewable scientific resources may be at risk of being adversely impacted by ground-disturbing activities during construction of the Proposed Project. By implementing the management recommendations presented in Chapter 7, adverse impacts to paleontological resources can be reduced to a less than significant level pursuant to the requirements of CEQA.

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