

# **Paleontological Resource Assessment for the Madison Avenue Improvements Project, City of Murrieta, Riverside County, California**

Prepared By



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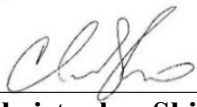
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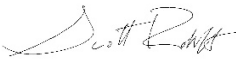
September 2018

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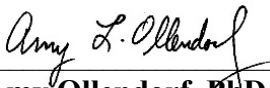
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## MANAGEMENT SUMMARY

The City of Murrieta (City) is proposing to improve Madison Avenue between Guava Street and Golden Gate Circle in the City of Murrieta, Riverside County, California. Under contract to Kleinfelder, Inc., Applied EarthWorks, Inc. (Æ) completed a paleontological resource assessment of the Madison Avenue Improvements Project (Project) in accordance with the California Environmental Quality Act (CEQA). The City is the lead CEQA agency for the Project. This report summarizes the methods and results of Æ's paleontological resource assessment and provides Project-specific management recommendations following the criteria set forth by the County of Riverside (2015a, 2015b).

Æ reviewed relevant literature and geologic maps, as well as collections records maintained by the Natural History Museum of Los Angeles County and the University of California Museum of Paleontology's online database. The purpose of the review was to identify the geologic units in and beneath the Project area, and to determine whether previously recorded significant fossil localities occur either within the Project boundaries or within the same geologic units nearby. Following this review, Æ conducted a field survey, during which the ground surface of the Project area was inspected visually for exposed fossils and any geologic exposures were evaluated for their potential to contain preserved fossils at the subsurface. Using the results of the records searches and field survey, Æ determined the paleontological resource potential of the Project area in accordance with County of Riverside (2015a, 2015b) guidelines.

Published geologic maps indicate much of the Project area is characterized by surface deposits of the middle to late Pleistocene Pauba Formation with two small subareas consisting of younger Quaternary alluvial channel deposits. Museum records indicate no previously recorded significant fossil localities directly within Project boundaries; however, four vertebrate fossil localities from the Pauba Formation and two vertebrate fossil localities from Quaternary alluvial channel deposits similar to those in the Project area are recorded nearby, to the east-southeast of the Project area. For these reasons, the County of Riverside has assigned a High A (Ha) level of paleontological sensitivity to the entire Project area. Æ found no paleontological resources during the field survey, although less than 10 percent of the ground surface was visible.

As a result of the study, Æ suggests much of the Project area may have been previously disturbed to unknown depths by residential development, utility installations, and road maintenance. Areas where the surface geology is visible show sediments that may belong to the Pauba Formation or Quaternary alluvial deposits. Because subsurface testing was outside Æ's scope of work, the paleontological sensitivity of the Project area cannot be refined at this time. Therefore, until proven otherwise, the likelihood of impacting scientifically significant fossils as a result of Project development remains high with regard to ground-disturbing activities.

Per County of Riverside (2015a) guidelines for High A sensitivity, Æ recommends that a qualified paleontologist be retained to develop and implement a Paleontological Resource Impact Mitigation Program during construction, which entails on-site monitoring during ground-disturbing activities. At the conclusion of all Project-related ground disturbances, all significant paleontological resources found during the course of monitoring should be permanently curated at an approved repository and a final technical report describing the findings should be submitted

to the City. By implementing these mitigation measures during Project development, adverse impacts to paleontological resources can be reduced to a less than significant level pursuant to the requirements of CEQA.

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# 1

## INTRODUCTION

Under contract to Kleinfelder Inc., Applied EarthWorks, Inc. (Æ) completed a paleontological resource assessment of the Madison Avenue Improvements Project (Project) located in the City of Murrieta, Riverside County, California (Figure 1-1). The study consisted of a literature and geologic map review, museum records searches, and a field reconnaissance survey. This report summarizes the methods and results of Æ's assessment and provides Project-specific management recommendations. The City of Murrieta (City) is the lead agency for compliance with the California Environmental Quality Act (CEQA). Æ conducted this assessment in accordance with the professional standards and guidelines set forth by the County of Riverside (2015a, 2015b).

### 1.1 PROJECT BACKGROUND AND DESCRIPTION

The Project area is within the Peninsular Ranges with elevations ranging from approximately 1,075 feet to 1,110 feet above mean sea level (amsl) (Figure 1-1). Specifically, the Project is within an unsectioned portion of the Temecula Land Grant, Township 7 South, Range 3 West, San Bernardino Baseline and Meridian, as shown on the 1973 Murrieta, California 7.5' U.S. Geological Survey (USGS) topographic quadrangle (Figure 1-2).

The proposed Project involves the widening of Madison Avenue from the intersection at Guava Street to Golden Gate Circle. The Project will be constructed within a 100-foot right-of-way (ROW). Grading will be necessary for construction of the roadway and will extend beyond the ROW, incorporating 2:1 cut and fill slopes and retaining walls as necessary to comply with standard engineering practices, and design criteria in accordance with the City of Murrieta's Grading Ordinance. The proposed Project will consist of a 100-foot ROW major roadway (76 feet curb-to-curb) along an alignment length of approximately 1.3 miles (6,990 linear feet). Additional ROW may be required for temporary construction access and easements. A construction staging area is proposed to be located either within the future ROW, or at an adjacent disturbed vacant lot in the immediate alignment vicinity. The unimproved area west of Madison Avenue and north of Fig Street has been identified as a potential laydown area. A second potential laydown area has been identified along Madison and south of Golden Gate Circle. A temporary access road may be constructed between Madison and Monroe Avenue to the south of Guava Street to allow for parcel access throughout construction. This access road will be a minimum width, an all-weather surface (dirt/gravel), and will avoid sensitive resources to the extent possible. The proposed Project will include street lights exclusively at cross street intersections where warranted for safety. Sidewalks will be provided only along developed properties that currently exist along Madison Avenue. As part of road construction, road improvements may include installation of various wet/dry utilities within the road bed (water, sewer, gas, electrical, storm drain). The Project will also include appropriate storm water drainage facilities and storm drain crossings for off-site conveyance. Existing Overhead dry utilities will be relocated overhead and not in the roadway.

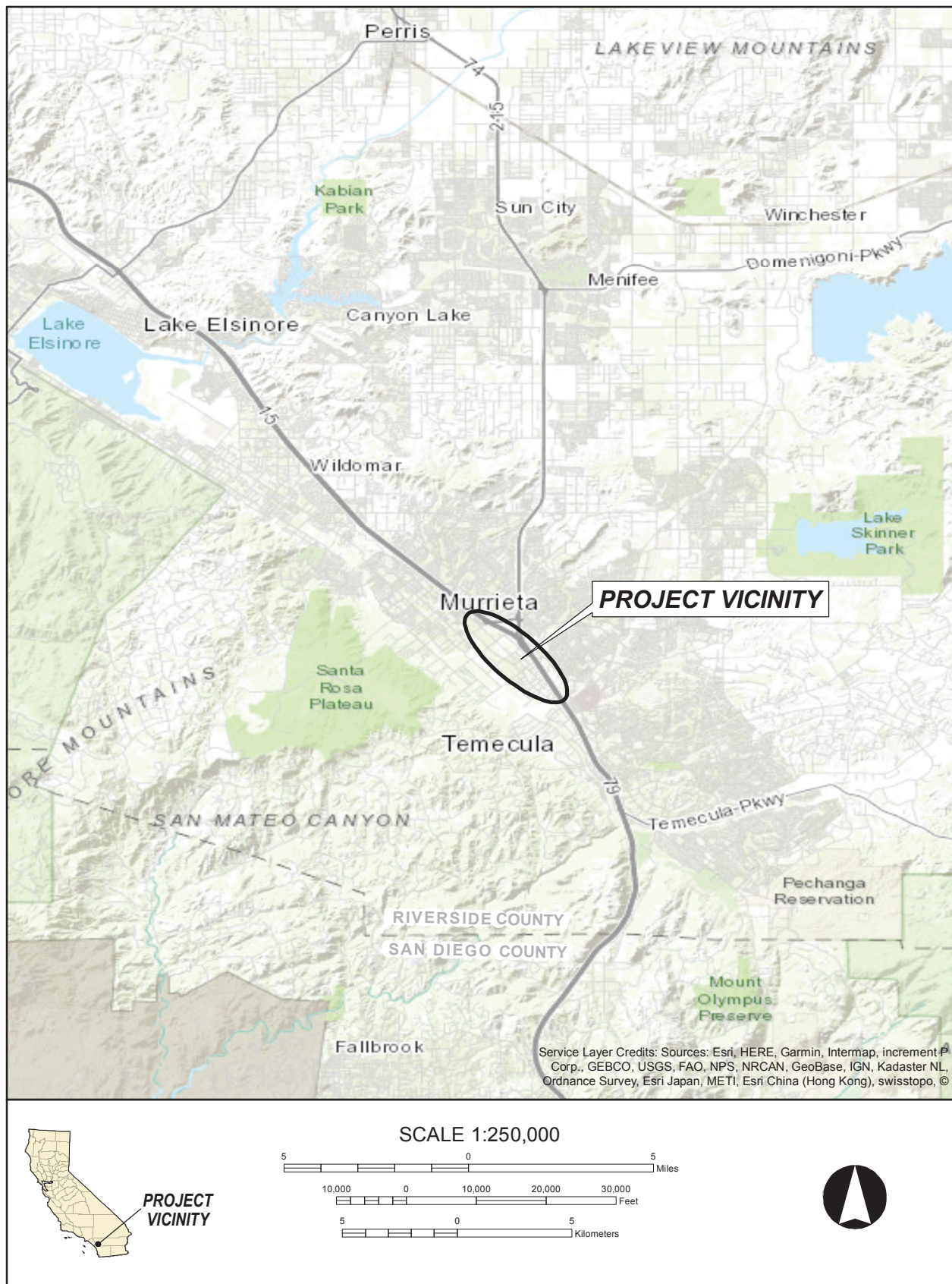


**Figure 1-1** Project vicinity map.

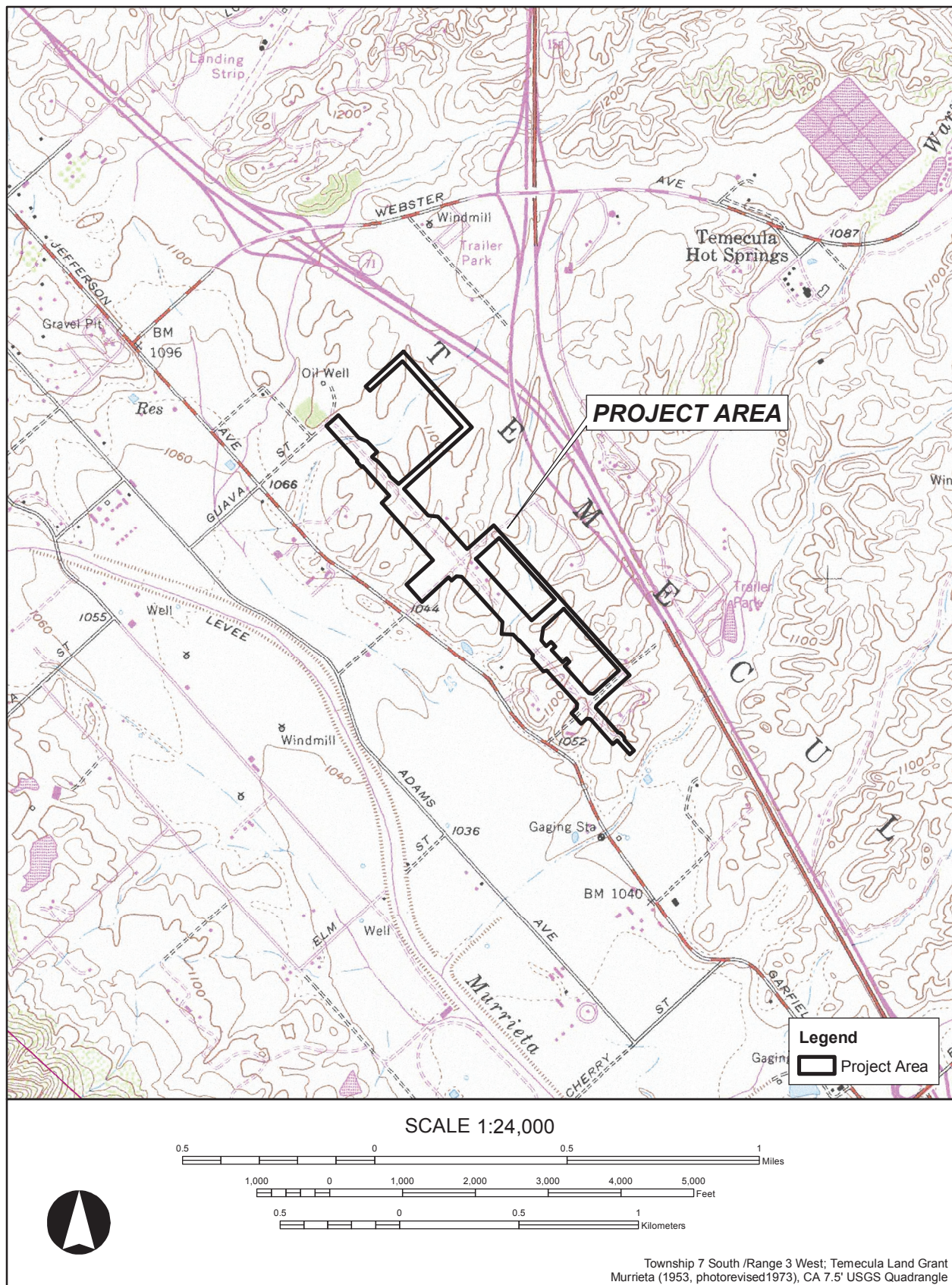


**Figure 1-2 Project location map.**

## **1.2 PURPOSE OF INVESTIGATION**

The purpose of this paleontological resource assessment is to (1) identify the geologic units within the Project area, (2) assess their paleontological sensitivity, (3) evaluate whether the Project has the potential to adversely impact scientifically significant paleontological resources, and (4) provide Project-specific mitigation measures to be implemented during Project construction.

## **1.3 REPORT ORGANIZATION**

This report documents the results of Æ's paleontological resource assessment efforts in the Project area. Chapter 1 has introduced the scope of work, identified the Project location, described the Project, and defined the purpose of the investigation. Chapter 2 outlines the regulatory framework governing the Project. Chapter 3 presents the paleontological sensitivity criteria and resource sensitivity guidelines used for this assessment. Chapter 4 describes the methods employed, and Chapter 5 provides details about the geology and paleontology of the Project area. The results of the museum records searches, field survey, and paleontological sensitivity assessment are discussed in Chapter 6. Management recommendations are presented in Chapter 7 and references cited are listed in Chapter 8.

## 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 CALIFORNIA ENVIRONMENTAL QUALITY ACT

The Project requires discretionary approval from the City of Murrieta and is therefore subject to the requirements of CEQA; thus, the Project is subject to the Guidelines for Implementation of CEQA (California Code of Regulations, Title 14, Chapter 3) Section 15002(a)(3), which states among 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.” CEQA Guidelines Section 15366(3)(b) further states, “a city or county will have jurisdiction by law with respect to a project when the city or county having primary jurisdiction over the area involved is (1) the site of the project; (2) the area in which the major environmental effects will occur; and/or (3) the area in which reside those citizens most directly concerned by any such environmental effects.” Under this provision, the City is the Lead Agency for CEQA.

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

### 2.2 RIVERSIDE COUNTY

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

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

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

The paleontologist shall document the extent and potential significance of the paleontological resources on the site and establish appropriate mitigation measures for further site development.

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

**OS 19.9:** Whenever paleontological resources are found, the County Geologist shall direct them to a facility within Riverside County for their curation, including the Western Science Center in the City of Hemet.

These policies discuss appropriate measures to be taken depending on sensitivity category, as well as the treatment of paleontological resources that are found during mitigation.

## **2.3 CITY OF MURRIETA GENERAL PLAN**

The City of Murrieta is among a fairly unique group of California municipalities with their own policies that address the preservation of paleontological resources. Section 5.9: Cultural Resources of the City of Murrieta General Plan 2035 states the “San Bernardino County Museum Earth Sciences Division has classified the majority of the City and the Sphere of Influence as having a high potential for containing significant, nonrenewable paleontological resources” (City of Murrieta, 2011:5.9-19). Thus, the plan adopts Conservation Element Goal CSV-7, “Paleontological resources are conserved as a record of the region’s natural history” (City of Murrieta, 2011:5.9-27). All future improvements and development within the City would therefore be subject to compliance with Goal CSV-7 and the associated policies:

- **CSV-7.1** Continue development review procedures that protect paleontological resources.
- **CSV-7.2** Encourage local display and educational use of paleontological resources (City of Murrieta, 2011:5.9-27).

Appropriate mitigation measures are detailed in the General Plan as well:

- **CR-1** ...If, following review by the EIC and/or tribal consultation, it is determined that there is a potential for impacts to cultural resources [including paleontological resources], further...analysis by a qualified professional(s), as defined in Mitigation Measure CR-2, may be required by the City.
- **CR-2** In the event that cultural resources (archaeological, historical, paleontological) resources are inadvertently unearthed during excavation and grading activities of any future development project, the contractor shall cease all earth-disturbing activities within a 100-foot radius of the area of discovery. If not already retained due to conditions present pursuant to Mitigation Measure CR-1, the project proponent shall retain a qualified professional (i.e., archaeologist, historian, architect, paleontologist,

Native American Tribal monitor), subject to approval by the City of Murrieta to evaluate the significance of the find and appropriate course of action (refer to Mitigation Measures CR-1...). If avoidance of the resources is not feasible, salvage operation requirements pursuant to Section 15064.5 of the CEQA Guidelines shall be followed. After the find has been appropriately avoided or mitigated, work in the area may resume (City of Murrieta, 2011:5.9-24-25).

## PALEONTOLOGICAL RESOURCE ASSESSMENT GUIDELINES

Protection of paleontological resources requires assessment of the potential for rocks to contain significant paleontological resources that could be directly or indirectly impacted or destroyed during Project development, and the formulation and implementation of management measures to mitigate these impacts.

### 3.1 DEFINITION OF PALEONTOLOGICAL RESOURCES AND SIGNIFICANCE CRITERIA

Paleontological resources are defined by the Society of Vertebrate Paleontologists (SVP, 2010) 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, fossils are considered to be greater than 5,000 years old (older than middle Holocene) and are typically preserved in sedimentary rocks. Although uncommon, certain volcanic rocks and low grade metamorphic rocks may be fossiliferous if formed under certain conditions (SVP, 2010).

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 PALEONTOLOGICAL RESOURCE SENSITIVITY AND GUIDELINES

Most professional paleontologists in California adhere to guidelines set forth by the SVP in “Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources” (SVP, 2010), unless others are available (e.g., Riverside County, US Bureau of Land Management). Riverside County has developed its own guidelines that establish detailed protocols for the assessment of the paleontological sensitivity of a project area and outline measures to follow in order to mitigate adverse impacts to known or unknown fossil resources during project development (County of Riverside 2015a, 2015b).

Following the County’s established process, 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 underlying 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. Also, an area mapped as granite 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.

According to the County's classification system, paleontological sensitivity is assigned to one of four categories—low, undetermined, and high (A and B) potential (County of Riverside, 2015a). The criteria for each sensitivity classification, and the corresponding mitigation recommendations, are summarized in Table 3-1.

**Table 3-1**  
**Paleontological Sensitivity Classifications**

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

Source: County of Riverside, 2015a

## 4 METHODS

The following section summarizes the desktop and field methods that AEC used to assess paleontological sensitivity of the Project area.

### 4.1 LITERATURE REVIEW AND RECORDS SEARCH

Chemical and physical weathering processes often cause the breakdown of bedrock to generate a layer of soil at the ground surface (Boggs Jr., 2012). Although many factors govern the thickness of the soil, it typically obscures the geologic deposits that underlie it. Intact and in situ paleontological resources are not found in the soil layer, but in the deposits beneath it. Therefore, in order to ascertain whether a particular project area has the potential to contain significant paleontological resources at the subsurface, it is necessary to review relevant scientific literature and geologic maps to determine the underlying geology and stratigraphy of the area. Furthermore, in order to delineate the boundaries of paleontological sensitivity, it is necessary to determine the extent of the entire geologic unit because paleontological sensitivity is not limited to surface exposures of fossil material.

In order to determine whether fossil localities have been discovered previously within a project area or a particular rock unit, a desktop study is completed. AEC's study involved examination of readily available geologic maps (Kennedy et al., 2003) and professional publications (Norris and Webb, 1976; Reynolds and Reynolds, 1990a, 1990b) as well as searches of pertinent museum repositories for fossil localities within and near the Project area. As this Project occurs in geologic deposits for which vertebrate fossil discoveries hold significance, a museum records search for vertebrate fossil localities was conducted at the Natural History Museum of Los Angeles County (NHMLAC). The Records Search Area consisted of a 1-mile buffer around the Project area located within the Temecula Land Grant Murrieta, CA USGS 7.5-minute topographic quadrangle map. The records search was supplemented by a search for any significant fossil localities from the online database maintained by the University of California Museum of Paleontology (UCMPDB).

### 4.2 FIELDWORK

AEC's Paleontology Supervisor, Chris Shi conducted a field survey of the Project area on June 27, 2018. The purpose of the field survey was to visually inspect Madison Avenue's right-of-way for exposed fossils and to evaluate geologic exposures for their potential to contain preserved fossil material at the subsurface. The survey involved walking the shoulders of Madison Avenue between Guava Street and Elm Street from the southeast end of the Project area to the northwest end of the Project area. Many areas, particularly the southwest side of Madison Avenue, were covered by dense vegetation that obscured the ground surface; these areas were not comprehensively examined due to poor visibility. However, areas where the ground surface was visible were examined for surface geology during the pedestrian survey. In addition, a windshield survey was conducted within the portions of the Project area where traffic control is proposed (Guava Street, Monroe Avenue, and Hoover Avenue between Fig Street and Elm Street).

### **4.3 KEY PERSONNEL**

Æ's Paleontology Program Manager Dr. Amy Ollendorf, oversaw this paleontological resource assessment report and ensured its quality. Æ's Project Paleontologist, Scott Rohlf, was responsible for the identification of paleontological resources in the Project area and assessing the potential impacts to paleontological resources. Under Ollendorf's and Rohlf's supervision, Christopher Shi conducted the field reconnaissance survey and wrote the report, and Cari Inoway provided GIS mapping.

Ollendorf has 30 years of environmental compliance and earth science experience across the United States and abroad. Rohlf meets the SVP (2010) qualifications standards. Shi has a graduate degree in geology and possesses familiarity and proficiency with paleontology, sedimentology, and stratigraphy. He also has almost 2 years of paleontological monitoring experience in California.

## 5 GEOLOGY AND PALEONTOLOGY

The Project area and vicinity are composed of geologically young sediments that are well known for their preservation of Pleistocene-age vertebrate fossils. This section describes the known geology and paleontology of the region.

### 5.1 REGIONAL GEOLOGY

The Project area is located within the northern part of the geologically complex Peninsular Ranges geomorphic province. The Peninsular Ranges are a northwest-southeast oriented complex of blocks that extend 125 miles from the Transverse Ranges and Los Angeles Basin to the tip of Baja California. The Peninsular Ranges are bounded to the east by the Colorado Desert and range in width from 30 to 100 miles (Norris and Webb, 1976). The Project area is situated approximately 5 miles southeast of the Santa Ana Mountains and 10 miles northwest of Palomar Mountain, within the southern part of the Perris Block, a relatively stable rectangular structural unit positioned between the Elsinore and San Jacinto fault zones (Kennedy et al., 2003). The geology in the vicinity of the Project area consists largely of young Cenozoic deposits that nonconformably overlie older Cenozoic basalts and Mesozoic plutonic and metasedimentary bedrock (Kennedy et al., 2003).

### 5.2 GEOLOGY AND PALEONTOLOGY OF THE PROJECT AREA

The Project area is mapped at a scale of 1:24,000 by Kennedy et al. (2003). According to this published map, surface exposures of Pleistocene- to Holocene-age sedimentary rocks are distributed across the Project area (Figure 5-1). The geology and paleontology of these deposits are described in the following sections.

#### 5.2.1 Pauba Formation, Sandstone Member (Qpfs)

Much of the Project area is underlain by the informal sandstone member of the middle to late Pleistocene (mid-Quaternary Period) Pauba Formation (Qpfs). The unit consists of brown, moderately well-indurated, cross-bedded sandstone with sparse cobble- to boulder-conglomerate beds and is known to contain fossils of vertebrate fauna of late Irvingtonian and early Rancholabrean ages (Reynolds and Reynolds, 1990a, 1990b). The Pauba Formation overlies older unnamed sandstone and conglomerate units of Pliocene to early Pleistocene age.

#### 5.2.2 Young Alluvial Channel Deposits (Qya)

Young alluvial channel deposits (Qya) cover only a small region of the Project area and range from latest Pleistocene to Holocene age. The unit consists of unconsolidated sand, silt, and clay-bearing alluvium. Significant and in situ fossils are rare in the younger Holocene deposits, but may be present in the older deposits of Pleistocene age.

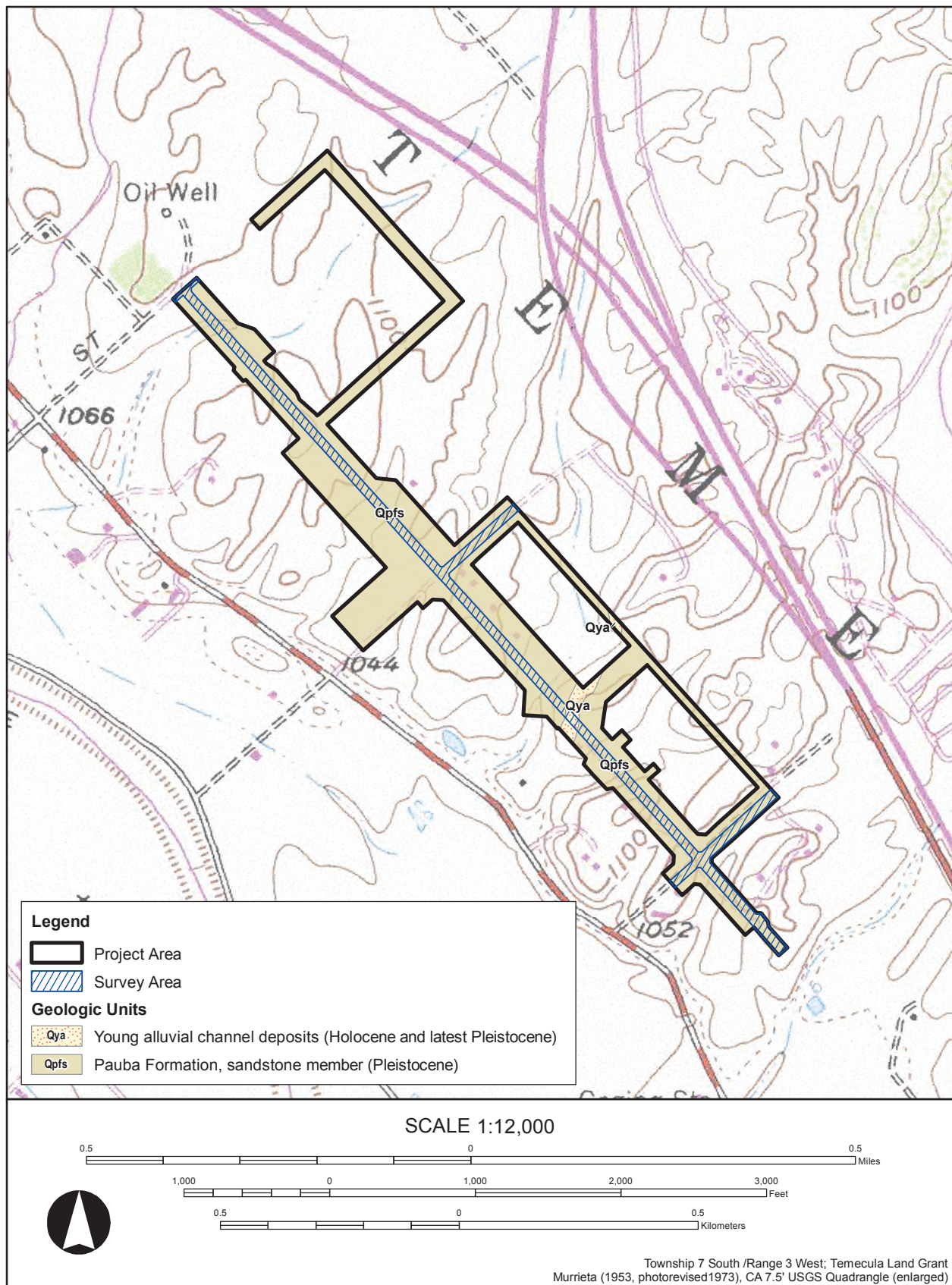


**Figure 5-1 Geologic units in the Project area.**

## 6 RESULTS AND ANALYSIS

The following section summarizes the results and analyses from Æ's desktop and field efforts.

### 6.1 MUSEUM RECORDS SEARCH RESULTS

The NHMLAC and UCMPCDB searches yielded no records for previously identified vertebrate localities within the Project area. However, the NHMLAC report (McLeod, 2018) discusses six nearby localities recorded from sedimentary deposits similar to those in the Project area (Table 6-1). Two of the fossil localities, LACM 6967 and 7456, are recorded from Quaternary alluvium similar to the channel deposits (Qya) and are located east-southeast of the Project area, near Temecula Creek. These contain specimens of tree frog, garter snake, pocket gopher, and pocket mouse. The other four fossil localities are from the Pauba Formation, although the records do not specify whether the fossils were observed from the sandstone member. Of these four localities, the closest is LACM 7941, which occurs southeast of the Project area and west of I-15. This locality contains a specimen of a horse and an undetermined elephant. Slightly farther away and east of I-15, LACM 5447, 5891, and 5892 contain various horse specimens.

**Table 6-1  
Vertebrate Localities Reported near the Project area**

| Locality No.              | Geologic Unit       | Age                          | Taxa                                                                                                                                                           |
|---------------------------|---------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LACM 6967 and 7456        | Quaternary alluvium | late Pleistocene to Holocene | <i>Hyla</i> (tree frog)<br><i>Anniella</i> (lizard)<br><i>Thamnophis</i> (garter snake)<br><i>Thomomys</i> (pocket gopher)<br><i>Peromyscus</i> (pocket mouse) |
| LACM 7941                 | Pauba Formation     | middle to late Pleistocene   | Undetermined Proboscidea (elephant)<br><i>Equus</i> (horse)                                                                                                    |
| LACM 5447, 5891, and 5892 | Pauba Formation     | middle to late Pleistocene   | <i>Equus</i> (horse)                                                                                                                                           |

Source: McLeod, 2018

### 6.2 FIELD RESULTS

Ground visibility throughout the Project area was poor (less than 10 percent) due to residential development, utility installations, and road maintenance. The southwest side of Madison Street appeared undisturbed with high vegetation noted in the area. Low to medium vegetation was observed on the northeast side of Madison Avenue and these areas appeared to be moderately disturbed. Modern refuse was also noted within the shoulders of Madison Avenue.

Surface topography is characterized by broad alluvial wash plains with a maximum relief of ~80 feet. Much of the ground surface is obscured by vegetation consisting of grasses and shrubs, approximately 1–3 feet in height (Figure 6-1).



**Figure 6-1 Southwest side of Madison Avenue, facing northwest.**

In areas where the surface geology is visible, it consists predominantly of fine-grained sand with occasional gravel and cobbles of igneous and metamorphic origin. Within the survey area, there were no visible incisions or exposures that offered information of the subsurface geology. No paleontological resources were discovered.

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

Based on the County of Riverside's (2015b) sensitivity map and Æ's literature review and museum records search results, the Project area consists of geologic units determined to have High A (Ha) paleontological resource potential (Figure 6-2). Both the young alluvial channel deposits and sandstone member of the Pauba Formation have High A resource potential because the same or similar deposits in the vicinity of the Project area previously yielded significant vertebrate fossils.

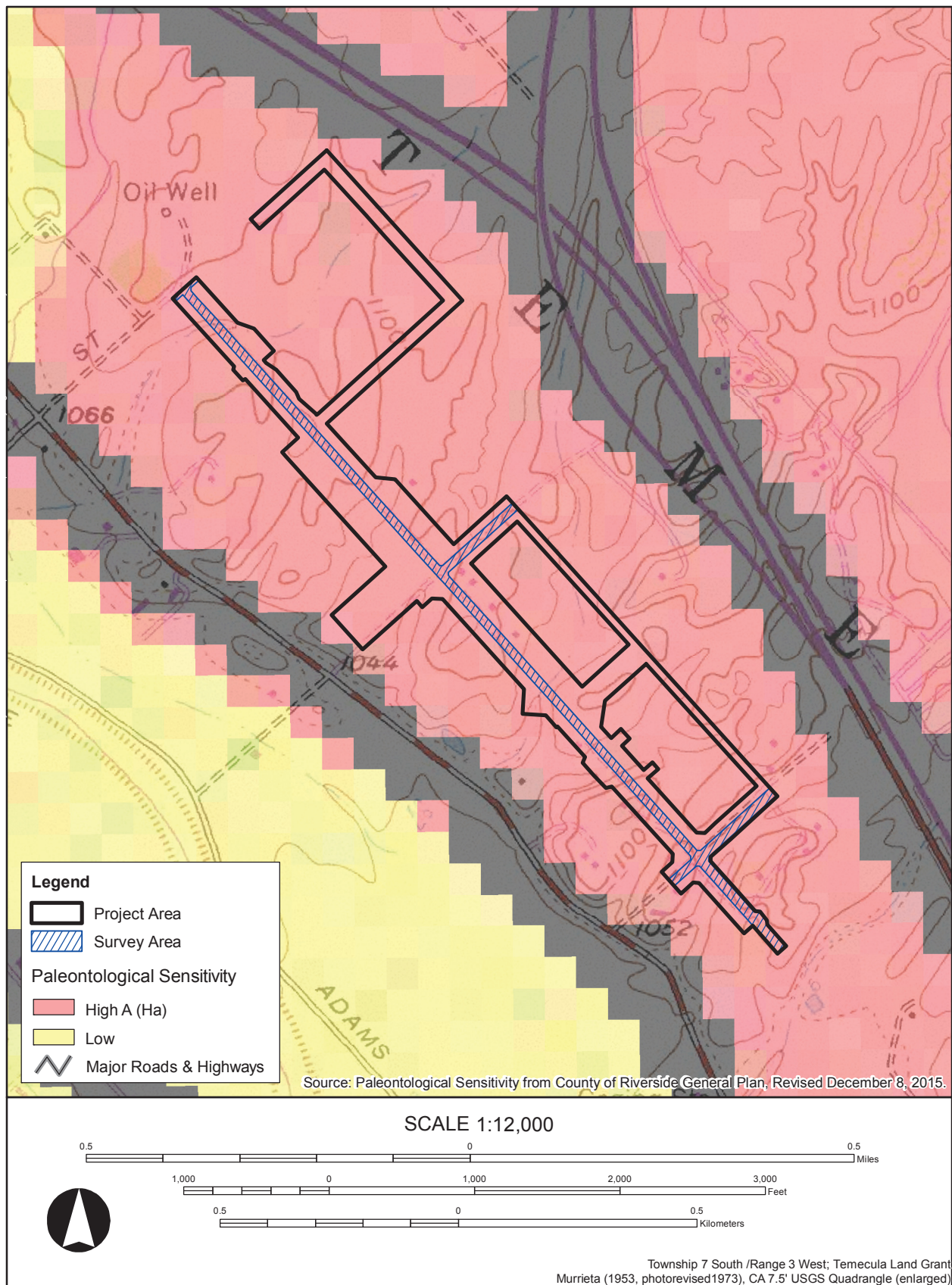


**Figure 6-2 Paleontological sensitivity in the Project area and vicinity.**

However, much, if not all of the Project area has been disturbed previously to unknown depths by residential development, utility installations, and road maintenance (Figure 6-3), which largely obscures these deposits. Because subsurface testing was outside Æ's scope of work, the paleontological sensitivity of the Project area cannot be refined at this time. Therefore, until proven otherwise, the likelihood of impacting scientifically significant vertebrate fossils as a result of Project development remains high with regard to ground-disturbing activities.



**Figure 6-3** Northeast side of Elm Street, facing southeast.

## RECOMMENDATIONS

Highly sensitive (High A) geologic units are mapped from surface exposures in and near the Project area (County of Riverside, 2015b). Literature review and museum records searches suggest the presence of the Pauba Formation and potentially fossiliferous Quaternary alluvial deposits in the Project area. Same or similar deposits have previously yielded significant paleontological resources elsewhere. Despite the amount of previous ground disturbance in most portions of the Project area, the presence of fine-grained sediments in areas that are not obscured or disturbed suggest depositional environments in the immediate subsurface that are conducive to fossil preservation; these may represent sediments from the Pauba Formation or Quaternary alluvial deposits.

The present study indicates Project-related activities may impact potentially significant paleontological resources at an unknown, yet shallow depth below ground surface (bgs); therefore, several management recommendations are provided herein to mitigate adverse impacts to paleontological resources, if present.

Per County of Riverside (2015a) guidelines, Æ recommends that a qualified paleontologist approved by the County (“Project Paleontologist”) be retained to create and implement a Paleontological Resource Impact Mitigation Program (PRIMP) prior to the issuance of a grading permit. Components of the PRIMP will include Worker’s Environmental Awareness Program (WEAP) training and mitigation monitoring. These measures, along with information about the treatment of discovered paleontological resources, are described in the following sections.

### 7.1 WORKER’S ENVIRONMENTAL AWARENESS TRAINING

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

### 7.2 PALEONTOLOGICAL MITIGATION MONITORING

Æ recommends initial full-time monitoring for any ground disturbance exceeding 2 feet bgs in the Project area. Monitoring will not be required in areas where ground disturbance is less than 2 feet bgs.

Monitoring will entail the visual inspection of excavated or graded areas and trench sidewalls. In the event that a paleontological resource is discovered, the monitor will have the authority to

divert temporarily the construction equipment within a 100-foot radius of the discovery (City of Murrieta, 2011) until it is assessed for scientific significance and collected. Monitoring efforts can be reduced or eliminated at the discretion of the Project Paleontologist if no fossil resources are encountered after 50 percent of the excavations are completed, or if buried crystalline bedrock, which has no paleontological resource potential, is encountered at depth within the area of excavation.

### **7.3 FOSSIL PREPARATION, CURATION, AND REPORTING**

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

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

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