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Paleontological Report

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PALEOSERVICES
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Paleontological Resource Assessment

Glamis Specific Plan
Imperial County, California

June 21, 2019

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Executive Summary

This technical report provides an assessment of paleontological resources at the Glamis Specific Plan Area (study area) in Imperial County, California. The purpose of this report is to aid the preparation of a Specific Plan for the Glamis area by identifying and summarizing paleontological resources that may occur in the vicinity of the study area, identifying elements of future development (if any) that may negatively impact such resources, and providing recommendations to reduce any potential negative impacts to less than significant levels (if necessary). The report includes the results of an institutional records search conducted at the San Diego Natural History Museum (SDNHM) and a paleontological field survey of the site.

The approximately 141 acre study area is located approximately 27 miles east of the City of Brawley in the eastern portion of Imperial County, and lies at the intersection of State Highway 78 (SR 78) and the Union Pacific Railroad (UPR). Possible future development at the site includes retail and service commercial facilities, motels, recreational vehicle and mobile home parks, and community facilities in support of existing recreational land uses. Specific details on planned earthwork at the site are currently undefined, but shallow remedial over-excavation earthwork and trenching for subgrade utilities is anticipated.

Published geologic mapping for the study area reports that the site is underlain by Pleistocene nonmarine deposits, which are generally described as consisting of alluvial sediments derived from the Chocolate Mountains located to the northeast. During the paleontological field survey, however, the surface of the study area was observed to be mostly level, undissected ground, suggesting the presence of younger alluvium of Holocene age. In addition, localized deposits of previously placed gravel fill up to 4 feet thick were present in previously graded/developed portions of the study area. No exposures of older Pleistocene-age alluvial fan deposits were observed. There are no SDNHM fossil collection localities known from within a 5-mile radius of the study area. While Pleistocene-age alluvial deposits have produced fossils of large vertebrates in Imperial County (e.g., remains of the horse *Equus* sp., camel *Camelops* sp., and ground sloth *Nothrotheriops* sp.), sedimentary deposits of Holocene age are generally considered too young to contain fossil remains.

Based on the observation of Holocene-age alluvial deposits at the study area and lack of documented fossil localities nearby, the sediments underlying the study area are assigned a low paleontological resource potential. In addition, the undocumented gravel fill present within previously developed portions of the study area is assigned no paleontological potential.

Although precise grading plans were not available at the time this report was prepared, future suggested development at the study area will likely involve only minor grading and trenching. Based on this assumption, it is likely that earthwork will be confined to the Holocene-age alluvial deposits (low paleontological resource potential) and overlying deposits of artificial fill (no paleontological resource potential) observed during the field survey

Consequently, construction is not likely to create negative impacts to paleontological resources, and thus paleontological mitigation is not recommended for future development within the study area. In the unlikely event that fossils are unearthed during construction (i.e., an inadvertent discovery), mitigation measures are provided to ensure proper collection and treatment of the fossils.

Contents

1.0 Introduction

1.1 Glamis Specific Plan Area Description and Scope of Work

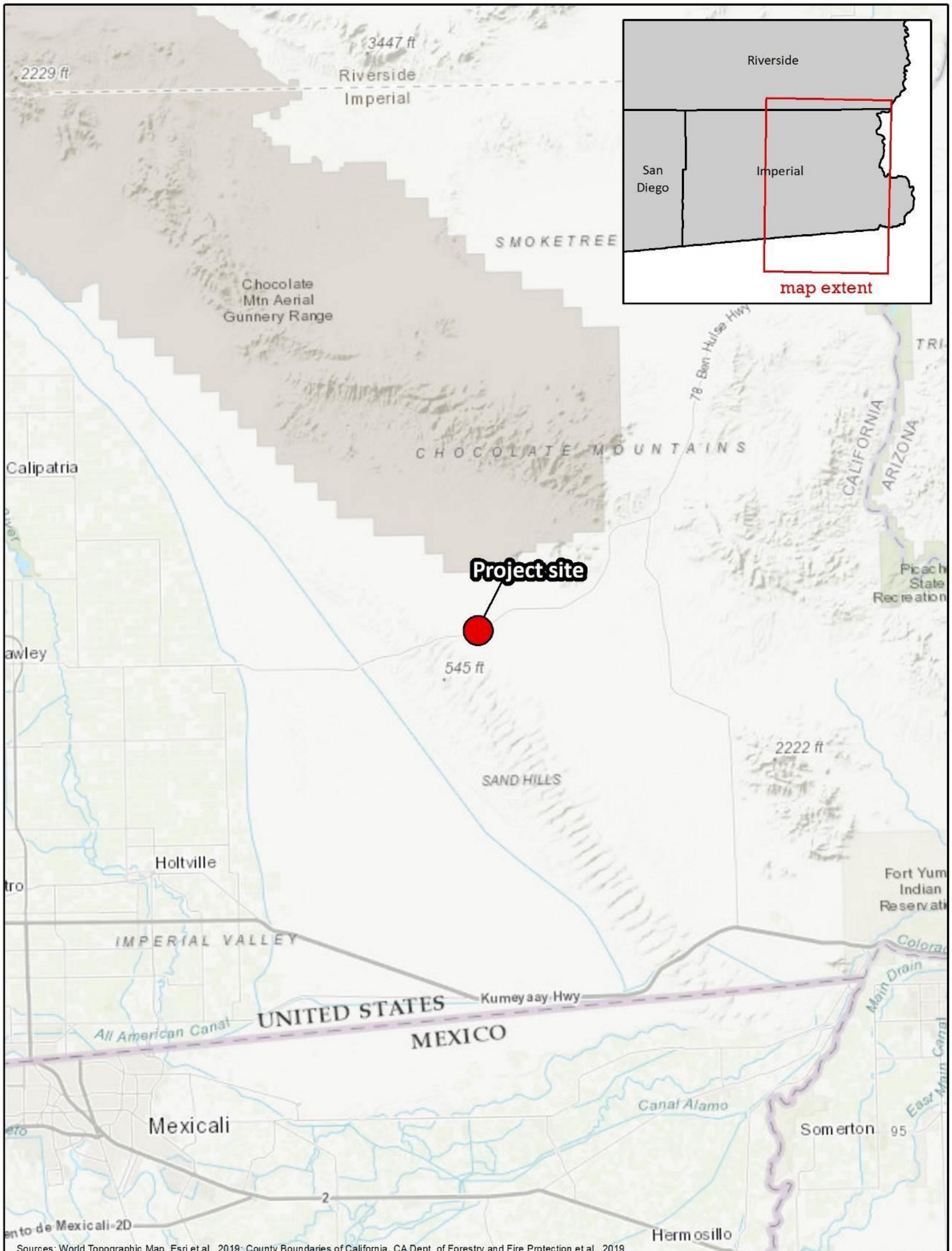
This technical report provides an assessment of paleontological resources at the Glamis Specific Plan Area (study area) in Imperial County, California (Figure 1). The approximately 141 acre study area is located approximately 27 miles east of the City of Brawley in the eastern portion of Imperial County, and lies at the intersection of State Highway 78 (SR 78) and the Union Pacific Railroad (UPR). Possible future development at the site includes retail and service commercial facilities, motels, recreational vehicle and mobile home parks, and community facilities in support of existing recreational land uses. Specific details on planned earthwork at the site are currently undefined.

Because the study area occurs in an area underlain by native sedimentary deposits, a paleontological resource assessment was conducted in order to evaluate whether future development within the study area has the potential to negatively impact paleontological resources. This assessment report is intended to identify and summarize paleontological resources that occur in the vicinity of the study area, identify elements of future development (if any) that may negatively impact paleontological resources, and provide recommendations to reduce any potential negative impacts to less than significant levels (if necessary) to aid the preparation of a Specific Plan for the Glamis area. The report includes the results of an institutional records search conducted at the San Diego Natural History Museum (SDNHM) and a paleontological field survey of the site. This report was prepared by Katie M. McComas and Thomas A. Deméré of the Department of PaleoServices, SDNHM.

1.2 Definition of Paleontological Resources

As defined here, paleontological resources (i.e., fossils) are the buried remains and/or traces of prehistoric organisms (i.e., animals, plants, and microbes). Body fossils such as bones, teeth, shells, leaves, and wood, as well as trace fossils such as tracks, trails, burrows, and footprints, are found in the geologic deposits within which they were originally buried. The primary factor determining whether an object is a fossil or not isn't how the organic remain or trace is preserved (e.g., "petrified"), but rather the age of the organic remain or trace. Although typically it is assumed that fossils must be older than ~11,700 years (i.e., the generally accepted end of the last glacial period of the Pleistocene Epoch), organic remains of early Holocene age can also be considered to represent fossils because they are part of the record of past life.

Fossils are considered important scientific and educational resources because they serve as direct and indirect evidence of prehistoric life and are used to understand the history of life on Earth, the nature of past environments and climates, the membership and structure of ancient ecosystems, and the pattern and process of organic evolution and extinction. In addition, fossils are considered to be non-renewable resources because typically the organisms they represent no longer exist. Thus, once destroyed, a particular fossil can never be replaced. And finally, for the purposes of this report, paleontological resources can be thought of as including not only the actual fossil remains and traces, but also the fossil collecting localities and the geologic units containing those localities.



PALEOSERVICES

FIGURE 1

Index Map
Glamis Specific Plan
Imperial County, California

0 7.5
scale in miles

1.3 Regulatory Framework

Paleontological resources are considered scientifically and educationally significant nonrenewable resources, and as such they are protected under a variety of federal (e.g., Antiquities Act of 1906; National Environmental Policy Act of 1969; Federal Land Policy Management Act of 1976; Paleontological Resources Preservation Act of 1009), state (e.g., California Environmental Quality Act; Public Resources Code), and local (e.g., General Plan for the County of Imperial) laws, regulations, and ordinances.

The study area is located within Imperial County; therefore, local laws, ordinances, and regulations are applicable, as outlined below.

1.3.1 Local

The General Plan for the County of Imperial does not specify any requirements for paleontological resources. Paleontological resources, however, are often considered a sub-category of cultural resources. The Conservation and Open Space Element of the General Plan contains requirements for cultural resources that involve the identification and documentation of significant historic and prehistoric resources and the preservation of representative and worthy examples. The Conservation and Open Space Element also recognizes the value of historic and prehistoric resources and the need to assess current and proposed land uses for impacts upon these resources.

2.0 Methods

2.1 Paleontological Records Search and Literature Review

A paleontological records search was conducted at the SDNHM in order to determine if any documented fossil collection localities occur within the study area or immediate surrounding area. This involved examination of the SDNHM paleontological database for any records of known fossil collection localities within a 5-mile radius of the study area.

Additionally, a review was conducted of relevant published geologic maps (e.g., Strand, 1962; Jennings, 1967), published geological and paleontological reports (e.g., Jefferson, 1991a,b), and other relevant literature (e.g., field trip guidebooks, theses and dissertations, unpublished paleontological mitigation reports). This approach was followed in recognition of the direct relationship between paleontological resources and the geologic units within which they are entombed. Knowing the geologic history of a particular area and the fossil productivity of geologic units that occur in that area, it is possible to predict where fossils may, or may not, be encountered.

2.2 Paleontological Field Survey

A paleontological field survey of the study area was conducted on June 17, 2019, by Bradford O. Riney of the Department of PaleoServices, SDNHM. The purpose of the field survey was to confirm the published geologic mapping, to field check the results of the literature and record searches, and to determine the paleontological potential of the strata present within the study area. The field survey included inspection of all available outcrops (e.g., graded pads and roads, and natural surfaces) within the study area, in order to collect stratigraphic data (e.g., bedding type, thickness, geologic contacts), detailed lithologic descriptions of strata (e.g., color, sorting of grains, texture, sedimentary structures, and grain size of sedimentary rocks), and prospect for any fossilized remains present at the surface.

During the survey, the field paleontologist was equipped with standard field equipment (e.g., rock hammer, camera, hand lens, tape measure), a Garmin Handheld GPS unit, and an iPhone loaded with

Esri's Collector app that was used to view relevant maps and collect field data. Collected field data included waypoints that were keyed to field notes and photographs.

2.3 Paleontological Resource Assessment Criteria

The Society of Vertebrate Paleontology (SVP, 2010) has developed standards for assessing the paleontological potential of a given geologic unit using a four-part scale: High Potential, Undetermined Potential, Low Potential, and No Potential. The specific criteria for each scale of Paleontological Potential is outlined below.

2.2.1 High Potential

High potential is assigned to geologic units known to contain paleontological localities with rare, well-preserved, critical fossil materials for stratigraphic or paleoenvironmental interpretation, and fossils providing important information about the paleobiology and evolutionary history (phylogeny) of animal and plant groups. Generally speaking, highly sensitive formations produce vertebrate fossil remains or are considered to have the potential to produce such remains.

2.2.2 Undetermined Potential

Undetermined potential is assigned to geologic units that exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the geology and/or paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may be useful for more precisely determining the paleontological potential.

2.2.3 Low Potential

Low potential is assigned to geologic units that, based on their relatively youthful age and/or high-energy depositional history, are judged unlikely to produce important fossil remains.

2.2.4 No Potential

No paleontological potential is assigned to geologic formations that are entirely igneous in origin or have undergone high-grade metamorphism, and therefore have no potential for producing fossil remains, or to artificial fill materials which lack stratigraphic/geologic context for any contained fossil remains.

2.4 Paleontological Impact Analysis

Direct impacts to paleontological resources occur when earthwork activities (e.g., mass grading, utility trenching, or miscellaneous excavations) cut into the geologic units within which fossils are buried, and physically destroy the fossil remains. As such, only earthwork activities that will disturb potentially fossil-bearing sedimentary deposits (i.e., those rated with a high or undetermined paleontological potential) have the potential to significantly impact paleontological resources. Paleontological mitigation typically is recommended to reduce any negative impacts to paleontological resources to less than significant levels.

The purpose of the impact analysis is to determine which (if any) earthwork activities associated with future development of the study area may disturb potentially fossil-bearing geologic units, and where and at what depths this earthwork will occur. The paleontological impact analysis involved analysis of available project documents, and comparison with geological and paleontological data gathered during the records search, literature review, and field survey.

3.0 Existing Conditions: Geologic Setting

The study area is located along the eastern side of the Salton Trough, a geologic region that straddles the complex tectonic junction between the continental North American Plate to the east and the largely oceanic Pacific Plate to the west. The deeply buried spreading center of the East Pacific Rise has its northern terminus beneath the eastern valley floor and is the source of the extensive geothermal resources in this region. In terms of its geologic history, the Salton Trough can be thought of as the northern, landward extension of the Gulf of California. It has been filling with tremendous volumes of sediment for the last approximately 8 million years, first with locally derived terrestrial sediments, then with marine sediments from a northward extension of the Gulf, and finally with terrestrial sediments derived from the Colorado River and its extensive delta. In total, these sediments are thought to be over 5 miles thick. The Salton Trough continues to undergo active tectonic deformation related to transform faulting associated with the San Andreas Fault Zone and associated faults (e.g., Imperial Fault). These competing forces of fault deformation and river delta deposition have combined to create the varied geomorphic features of the Salton Trough with its uplifted local mountains and hills (e.g., Yuha Buttes, Coyote Mountains, Fish Creek Mountains, Superstition Hills, Vallecito Mountains, Borrego Mountain, and San Felipe Hills), its deeply eroded landscapes (e.g., Carrizo Badlands, Borrego Badlands, and Vallecito Badlands), and its broad alluvial and lacustrine lowlands (e.g., the Imperial Valley floor).

In the immediate vicinity of the study area the geology is dominated by two contrasting geomorphic features. To the northeast is a coalescing series of alluvial fans derived from uplift and erosion of the Chocolate Mountains, while to the southwest lies the 45 mile long Algondones Dunes, the largest tract of desert dunes in North America (Norris and Webb, 1990). The dunes are migrating to the southeast being driven by prevailing northwesterly winds, which have deposited a veneer of Holocene-age dune sands over portions of the study area. However, the majority of the study area is underlain by sediments representing the distal portions of the Chocolate Mountains alluvial fan "apron."

4.0 Results

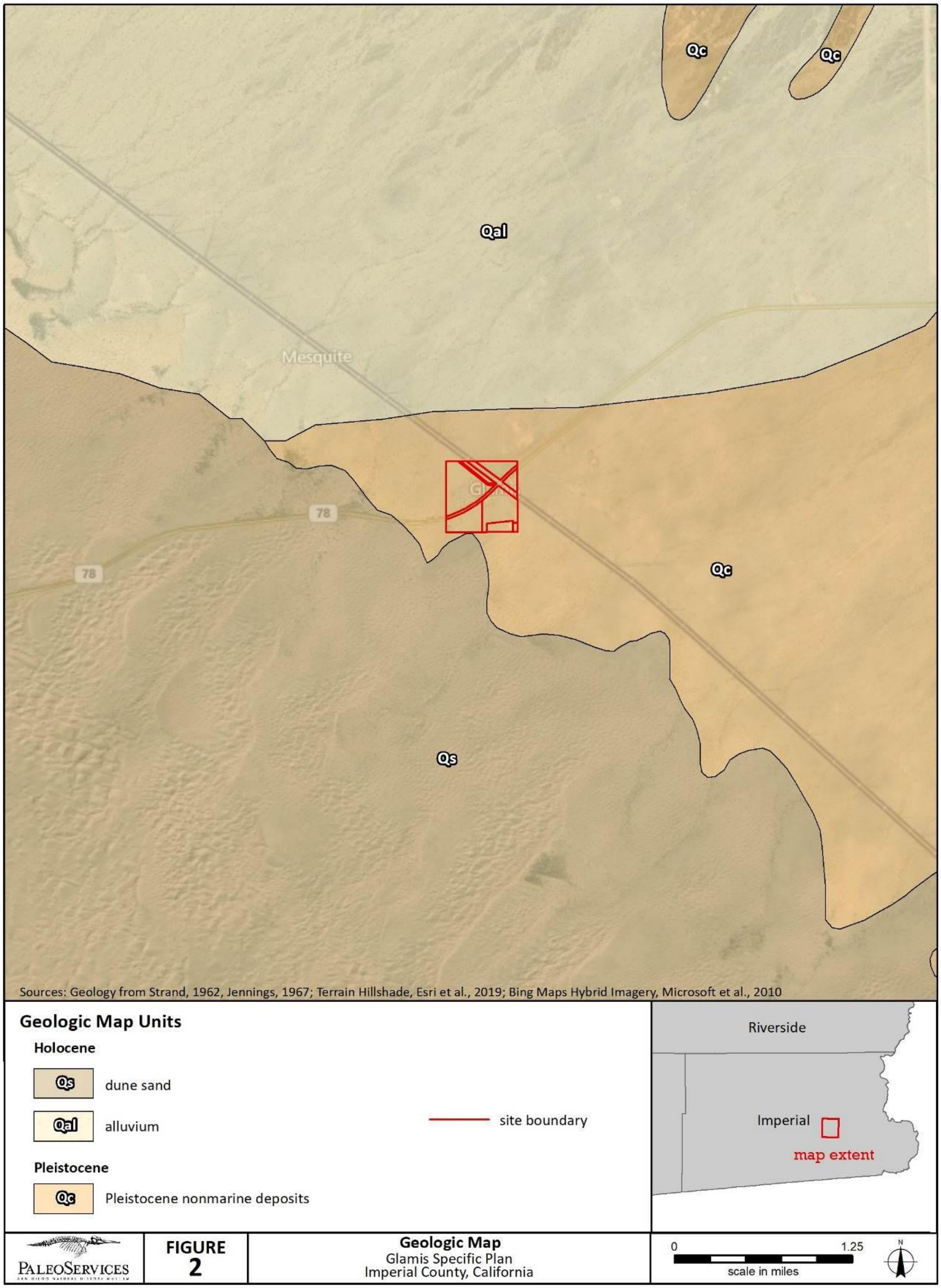
4.1 Results of the Records Search and Literature Review

4.1.1 Study Area Geology

Published geologic mapping reports that the study area is entirely underlain by "Pleistocene nonmarine sedimentary deposits" (Qc) (Figure 2; Strand, 1962; Jennings, 1967). As described above, these sediments appear to be derived from alluvial fans being shed off of the elevated peaks of the Chocolate Mountains to the northeast of the study area. As described in the literature, these deposits consist of well to poorly bedded, unconsolidated or poorly consolidated deposits of light gray, very poorly sorted, pebbly sandstones and cobble to boulder conglomerates that occur as moderately dissected terraces in stream valleys on the higher parts of alluvial fans in the Imperial Valley.

4.1.2 Study Area Paleontology

There are no SDNHM fossil collection localities known from within a 5-mile radius of the study area. However, there is one SDNHM locality recorded from Pleistocene-age gravel deposits located approximately 22 miles southeast of the study area from another portion of the Algodones Dunes, where a partial lower jaw with two cheek teeth identified as horse, *Equus* sp., were found in excavation spoils along the south side of the All American Canal.


Qc
Qc
Qal
Mesquite
78
78
Qc
Qs
Sources: Geology from Strand, 1962, Jennings, 1967; Terrain Hillshade, Esri et al., 2019; Bing Maps Hybrid Imagery, Microsoft et al., 2010
Geologic Map Units
Holocene
Qs dune sand
Qal alluvium
Pleistocene
Qc Pleistocene nonmarine deposits
site boundary
Riverside
Imperial
map extent
PaleoServices
FIGURE 2
Geologic Map
Glamis Specific Plan
Imperial County, California
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Fossil remains of other large mammals have been found in Pleistocene alluvial deposits in other parts of eastern Imperial County, including near Niland (e.g., camel, *Camelops* sp.) and Salton City (e.g., ground sloth, *Nothrotheriops* sp.) (Jefferson, 1991b). Sparse fossil remains of freshwater fish and small terrestrial mammals were recovered from Pleistocene older alluvium during paleontological monitoring of trenching activities associated with the construction of the North Baja Pipeline Project between Ehrenberg, Arizona and the United States-Mexico international border (Orr and Linder, 2004). Scattered remains of terrestrial mammals also have been reported from deposits of older alluvium near Plaster City. Similar deposits in other areas of southern California have produced significant, but often fragmentary, fossil remains, including bones and teeth of large and small terrestrial "Ice Age" mammals.

4.2 Results of the Paleontological Field Survey

As observed during the field survey, the study area consists of several graded pads supporting various existing facilities (e.g., a large RV storage area, general store, radio tower, and small graveyard). The study area is bisected from southwest to northeast by SR 78, and is crossed in the northeast by the UPR. A dirt road (Ted Kipf Road) parallels the UPR northwest from its intersection with SR 78. Man-made outcrops consisting of disturbed sediments and/or imported gravel fill are present around the margins of the graded pad. Because natural or man-made exposures of undisturbed native sediments were unavailable for inspection, the wind-deflated surface topography of the study area was used to characterize the underlying deposits.

Portions of the study area that have been previously developed consisted of graded pads that were raised above original grade, supported by what appears to be imported gravel fill (Figure 3). The fill was present to varying degrees throughout much of the study area, and measured up to four feet thick.

Figure 3. Previously graded pad built of undocumented gravel fill. Photo taken just south of the intersection of SR 78 and the UPR, looking south at the radio tower located in the southeastern corner of the study area.

The underlying sedimentary deposits were undissected by the action of modern ephemeral streams, and therefore appeared to be younger than the mapped Pleistocene-age alluvial fan deposits. Based on the distribution and character of these deposits, they likely represent Holocene-age or modern distal-fan deposits derived from the Chocolate Mountains to the northeast of the study area.

No fossils were encountered during the field survey.

Figure 4. Typical appearance of alluvial fan deposits within the study area. The sediments are undissected, and therefore likely Holocene or modern in age. Photo taken from the northwestern portion of the study area, facing south towards the RV storage area.

4.3 Results of Paleontological Potential Analysis

Alluvial fan deposits of Pleistocene age are generally assigned an undetermined paleontological potential due to variation in the concentration of fossil resources, typically linked to the grain size of individual alluvial deposits (i.e., fine-grained sediments reflective of low energy conditions more likely to preserve fossil remains vs. coarse-grained and gravelly sediments reflective of high-energy conditions less likely to preserve fossil remains). In addition, paleontological potential typically varies with geologic age (i.e., Pleistocene and older sediments more likely to contain fossil remains than younger, Recent or modern sediments). Among the various methods for determining the age of surficial sedimentary deposits is the degree of surface erosion/dissection evident at a given location (i.e., heavily dissected ground surfaces reflect prolonged time period vs. undissected ground surfaces reflect short time period).

Given these criteria, the sedimentary deposits observed during the paleontological field survey appeared to be Holocene in age (undissected ground surface indicating that these deposits have not been subjected to significant erosion by the action of streams and are, therefore, likely Holocene in age). Holocene-age alluvial fan deposits are assigned a low paleontological potential because of their relatively young geologic age (i.e., less than 11,700 years old). These deposits appear to be present throughout the study area, except in previously graded portions of the study area, where they appear to be overlain by imported gravel fill materials, which are assigned no paleontological potential.

4.4 Results of Paleontological Impact Analysis

As discussed above, published geologic mapping reports that the study area is immediately underlain by "Pleistocene nonmarine sedimentary deposits." Although in most cases Pleistocene sedimentary deposits are typically assigned an undetermined paleontological potential, the observation of probable Holocene-age undissected alluvial deposits on-site during the paleontological field survey supports a low paleontological potential rating for the sedimentary deposits underlying the study area. In addition, the artificial fill present in previously graded portions of the study area has no paleontological potential. Given the no-to-low paleontological potential of the deposits present on site (Figure 5), it is unlikely that their disturbance by earthwork related to future development within the study area will result in negative impacts to paleontological resources.


Ted Kipf Rd
78
78
Glamis Flats Rd
Sources: Terrain Hillshade, Esri et al., 2019; Bing Maps Hybrid Imagery, Microsoft et al., 2010
Paleontological Potential Rating
low potential, overlain by no potential
site boundary
Riverside
Imperial
map extent
PaleoServices
FIGURE
5
Paleontological Potential Map
Glamis Specific Plan
Imperial County, California
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0.2
scale in miles
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5.0 Recommendations & Conclusions

Implementation of a paleontological mitigation program is not recommended for future development within the Glamis Specific Plan Area, as construction-related earthwork is not anticipated to negatively impact paleontological resources. However, in the unlikely event that fossils are unearthed during earthwork activities (i.e., an inadvertent discovery), the following measures should be followed:

1. Upon discovery of an unearthed fossil, earthwork within the vicinity of the discovery shall immediately halt, and a qualified paleontologist should evaluate the discovery. Earthwork shall be diverted until the significance of the fossil discovery can be assessed by the qualified paleontologist.
2. If the fossil discovery is deemed significant, the fossil shall be recovered using appropriate recovery techniques based on the type, size, and mode of preservation of the unearthed fossil.
3. Earthwork may resume in the area of the fossil discovery once the fossil has been recovered, and the qualified paleontologist deems the site has been mitigated to the extent necessary. Additional earthwork following the fossil discovery may be monitored for paleontological resources on an as-needed basis, at the discretion of the qualified paleontologist.
4. Recovered fossils shall be prepared, identified, catalogued, and stored in a recognized professional repository (e.g., the San Diego Natural History Museum) along with associated field notes, photographs, and compiled fossil locality data. Donation of the fossils should be accompanied by financial support for initial specimen curation and storage.
5. A final summary report should be completed that outlines the results of the mitigation program. This report should include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and significance of recovered fossils. This report shall be submitted to appropriate agencies, as well as to the designated repository.

6.0 References

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