PALEONTOLOGICAL IDENTIFICATION REPORT/ PALEONTOLOGICAL EVALUATION REPORT

STATE ROUTE 133 AUXILIARY LANE PROJECT

CITY OF IRVINE, ORANGE COUNTY, CALIFORNIA

DISTRICT 12

E.A. 0N8900
12-ORA-133-PM 8.5-M9.3
Project ID# 1214000130

Submitted to:

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1750 East 4th Street, Suite 100
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September 2019

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Approved by: _____ Date: 9/24/19

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September 2019

EXECUTIVE SUMMARY

The California Department of Transportation (Caltrans) proposes the State Route 133 Auxiliary Lane Project (project), in Irvine, Orange County, California. This operational improvement project is on State Route 133 (SR-133) from the southbound (SB) Interstate 5 (I-5)/SB SR-133 connector (SB I-5 connector) to the SB SR-133/northbound (NB) Interstate 405 (I-405) connector (NB I-405 connector). There are two alternatives under consideration for this project: a No Build Alternative and a Build Alternative. The No Build Alternative proposes no improvements to SR-133. The Build Alternative proposes to construct a new auxiliary lane on SB SR-133 from the SB I-5 connector (Post Mile [PM] M9.3) to the NB I-405 connector (PM 8.5). This auxiliary lane will become the second lane on the NB I-405 connector. The Build Alternative also proposes to extend the number three lane on SB SR-133 approximately 300 feet (ft) south of San Diego Creek to match the existing roadway pavement. This project is a non-capacity increasing project.

Following Caltrans guidelines and the recommendations from the Society of Vertebrate Paleontology (SVP), this report identifies and evaluates any potential paleontological resources that may be encountered during development of this project and makes recommendations on how to mitigate impacts to those resources. The findings in this study are based on the anticipated excavation and construction methods for the project, the definitions of paleontological significance and sensitivity, reviews of geological and paleontological literature, the results of fossil locality searches through the Natural History Museum of Los Angeles County and the San Diego Natural History Museum, and the results of a field survey of accessible portions of the project area.

Geologic mapping shows that the project area contains Holocene to late Pleistocene Young Alluvial Fan Deposits and the Miocene to late Eocene Vaqueros Formation. Artificial Fill is also likely present as the project area is currently developed with existing SR-133 and adjacent streets. Artificial Fill has no paleontological sensitivity. The Young Alluvial Fan Deposits are assigned low paleontological sensitivity from the surface to a depth of 10 ft and high sensitivity below that mark. The Vaqueros Formation is considered to have high paleontological sensitivity.

Based on the results of this study and consideration of the development methods of the project, no special paleontological situations that would require project redesign to avoid critical fossil localities or deposits are anticipated. However, the majority of the project area contains geologic units that have high paleontological sensitivity (e.g., the Young Alluvial Fan Deposits below a depth of 10 ft and the Vaqueros Formation). These geologic units would be impacted by excavation activities associated with the Build Alternative. As such, development of the Build Alternative has the potential to impact scientifically significant, nonrenewable paleontological resources, and preparation of a Paleontological Mitigation Plan (PMP) is recommended if the Build Alternative is selected. The PMP should follow the guidelines contained in the Caltrans *Standard Environmental Reference, Environmental Handbook, Volume 1, Chapter 8 – Paleontology*, as well as those from the SVP. Because the No Build Alternative does not involve construction, it does not have the potential to impact paleontologically sensitive geologic units or any paleontological resources they may contain. Therefore, no paleontological resource impact mitigation measures are recommended for the No Build Alternative.

This document includes information used to determine the potential to encounter scientifically significant fossil remains in the geologic units found in the project area. It is not, and should not be used as, a geological assessment.

TABLE OF CONTENTS

APPENDICES

FIGURES AND TABLES

FIGURES

TABLE

LIST OF ABBREVIATIONS AND ACRONYMS

Caltrans	California Department of Transportation
CCO	Construction Change Order
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
DOE	United States Department of Energy
ft	foot/feet
GP	general purpose
HOV	high-occupancy vehicle
I-405	Interstate 405
I-5	Interstate 5
LACM	Natural History Museum of Los Angeles County
Ma	million years ago
MGS	Midwest Guardrail System
mi	mile(s)
NALMA	North American Land Mammal Age
NASA	National Aeronautics and Space Administration
NB	northbound
OC	Overcrossing
PEAR	Preliminary Environmental Analysis Report
PGRSP	Partially Grouted Rock Slope Protection
PIR/PER	Paleontological Identification Report/Paleontological Evaluation Report
PM	Post Mile
PMP	Paleontological Mitigation Plan
PRC	Public Resources Code
PRIMP	Paleontological Resources Impact Mitigation Plan
project	State Route 133 Auxiliary Lane Project
RSP	rock slope protection
SB	southbound

SDNHM	San Diego Natural History Museum
SER	Standard Environmental Reference
sf	square feet
SR-133	State Route 133
SVP	Society of Vertebrate Paleontology
TCE	temporary construction easement
USGS	United States Geological Survey

1.0 INTRODUCTION

The California Department of Transportation (Caltrans) proposes the State Route 133 Auxiliary Lane Project (project) in Irvine, Orange County, California. This operational improvement project is on State Route 133 (SR-133) from the southbound (SB) Interstate 5 (I-5)/SB SR-133 connector (SB I-5 connector) to the SB SR-133/northbound (NB) Interstate 405 (I-405) connector (NB I-405 connector). The location and regional vicinity of the project are illustrated on Figure 1, as depicted on the United States Geological Survey (USGS) *Tustin, California* 7.5-minute topographic quadrangle map in Irvine Ranch Sections 138 and 139, San Bernardino Baseline and Meridian (USGS, 1981). The project area depicted on Figure 1 includes the horizontal and vertical extent of temporary and permanent impacts associated with this project.

Caltrans is the Lead Agency under the California Environmental Quality Act (CEQA). This project is a non-capacity increasing project. There are two alternatives under consideration for this project: a No Build Alternative and a Build Alternative. These alternatives are described in further detail below.

1.1 NO BUILD ALTERNATIVE

The No Build Alternative does not include improvements to the existing SR-133. Therefore, SR-133 would be maintained in its existing condition and would continue to be used by commuters, recreation traffic, and commercial trucks. The No Build Alternative serves as the baseline against which to evaluate the effects of the Build Alternative.

1.2 BUILD ALTERNATIVE

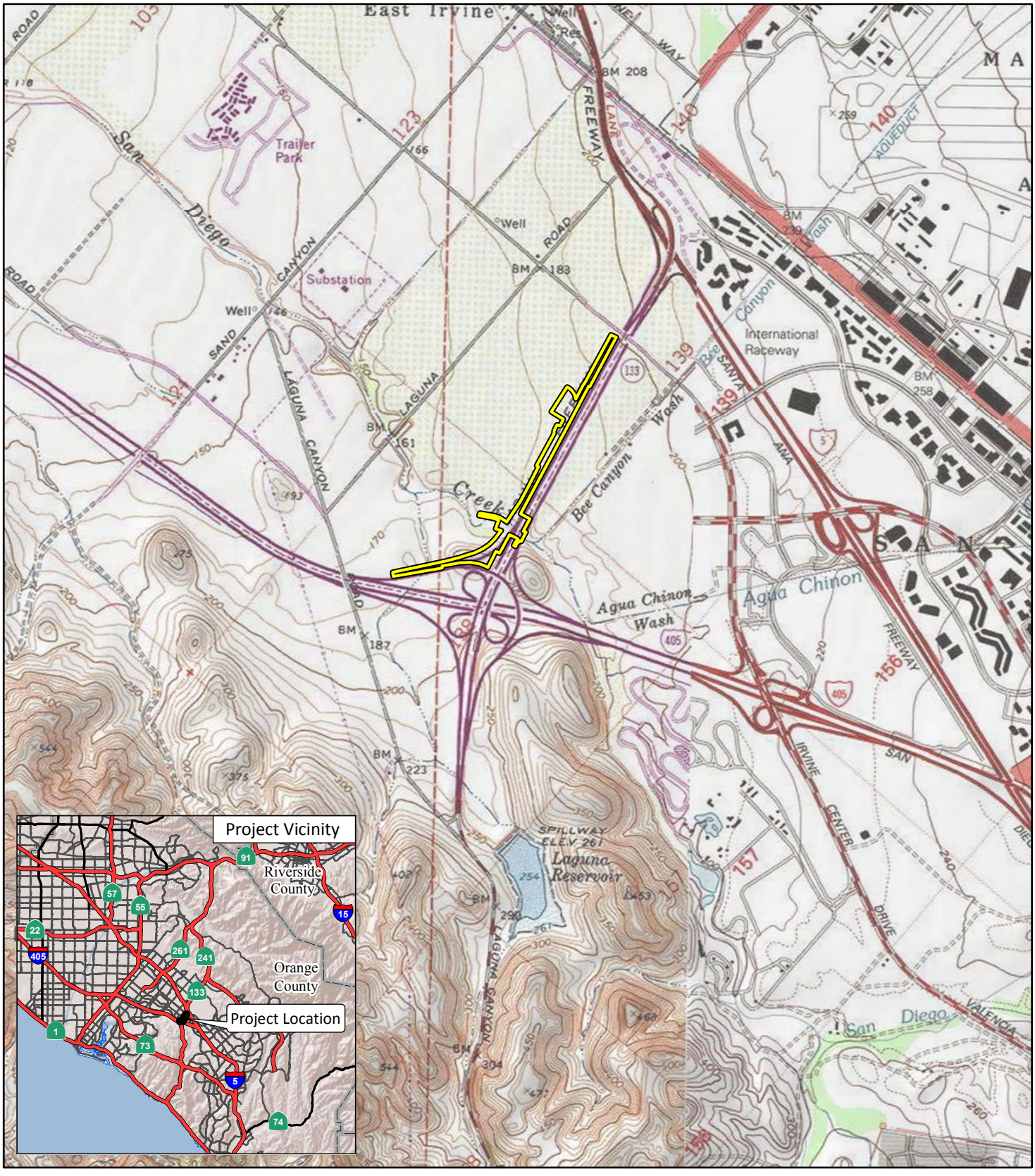
The Build Alternative proposes to construct a new auxiliary lane on SB SR-133 from the SB I-5 connector (Post Mile [PM] M9.3) to the NB I-405 connector (PM 8.5). This auxiliary lane will become the second lane on the NB I-405 connector. The Build Alternative also proposes to extend the number three lane on SB SR-133 approximately 300 feet (ft) south of San Diego Creek to match the existing roadway pavement. Improvements associated with the Build Alternative include the following construction activities:

- Construct additional asphalt concrete pavement to provide a 12-ft auxiliary lane from the SB I-5/ SB SR-133 connector to the SB SR-133/NB I-405 connector and a 12-ft lane from the gore area to 300 ft south of San Diego Creek.

- Construct additional asphalt concrete pavement to provide a second 12-ft lane on the SB SR-133/NB I-405 connector.

- Realign the Barranca Parkway loop on-ramp and reconstruct the ramp entrance. Convert the high-occupancy vehicle (HOV) lane to a general-purpose (GP) lane, install a connector ramp meter system, reconstruct loop detectors, and modify the Midwest Guardrail System (MGS) along the on-ramp left shoulder, if needed.

- Reconstruct maintenance vehicle pullouts.



LEGEND

Project Area

FIGURE 1

N

0 1000 2000

FEET

SR-133 Auxiliary Lane Project

Project Location

12-ORA-133 PM 8.5/M9.3

EA 0N8900

SOURCE: Caltrans (9/16/2019); USGS 7.5' Quad - El Toro (1982) and Tustin (1981), CA

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- Construct tieback walls at the Barranca Parkway Overcrossing (OC) and Alton Parkway OC.
- Construct an approximately 500-ft-long retaining wall along and between the SB shoulder and concrete channel. This retaining wall will be located between Barranca Parkway and Alton Parkway.
- Construct an approximately 200-ft-long retaining wall along the SB SR-133/NB I-405 connector shoulder and north of San Diego Creek.
- Construct an approximately 650-ft-long retaining wall along the SB SR-133/NB I-405 connector shoulder and south of San Diego Creek.
- Relocate and modify two existing overhead signs to accommodate pavement widening.
- Remove and replace light poles along the shoulder of SB SR-133 and the Barranca Parkway on-ramp.
- Install ramp metering at the SB SR-133/NB I-405 connector.
- Remove and replace signage as needed.
- Construct an approximately 500-ft-long MGS between Wall # 29 and the tieback wall at the Alton Parkway OC.
- Remove the existing metal beam guard railing and end treatment at the gore area of SB SR-133 and the SB SR-133/NB I-405 connector.
- Construct approximately 1,200 square feet (sf) of additional bridge pavement, construct a bridge rail with a 20:1 taper and install REACT 350 to shield the end of the bridge railings beyond the gore area of SB SR-133 and the SB SR-133/NB I-405 connector.
- Relocate three drainage inlets along the right shoulder of SB SR-133 and two drainage inlets along the right shoulder of the SB SR-133/NB I-405 connector.
- Refresh all the striping and markers.
- Widen the San Diego Creek Left Bridge (55-0290L) and the San Diego Creek Off-Ramp Bridge at the SB SR-133/I-405 north connector (55-0290F). Scour mitigation will be performed at the San Diego Creek bridges to prevent the existing bridge foundations from being undermined and may include installation of Rock Slope Protection (RSP) and/or installation of Partially Grouted Rock Slope Protection (PGRSP). The RSP/PGRSP should extend approximately 10 ft upstream of the San Diego Creek Bridge (55-0290R) (i.e., SR-133 NB bridge) and 10 ft downstream of the Off-Ramp Bridge (55-0290F). The RSP/PGRSP should be placed at Abutments 1 and 6, and at Piers 2 through 5. The RSP should be placed in a 6-ft-deep excavated trench where the top of the RSP is flush with the tops of the footings. The PGRSP should be flush with the tops of the footings, and the excavation will be up to the bottom of the footing (approximately 2 ft). A 5-ft-deep cut wall

should be constructed at the upstream and downstream ends of the RSP/PGRSP for the entire length (i.e., from Abutment 1 to Abutment 6).

- Aquire a permanent right-of-way fee acquisition and temporary construction easements (TCEs).
- Clear and grub the project area.
- Plant/landscape along the highway.
- Remove the existing curb and gutter, and construct 5-ft right shoulder along the NB I-405 Connector.

1.2.1 Excavation Parameters

Based on personal communication with Caltrans,[1] the maximum depths of excavation for the various components of the Build Alternative are detailed below in Table A.

Table A: Anticipated Maximum Excavation Depths for Components of the SR-133 Auxiliary Lane Project

Project Component	Depth
Construct additional asphalt concrete pavement	3 – 4 ft
Realign/reconstruct Barranca Parkway loop on-ramp and ramp entrance	3.10 ft
Reconstruct loop detectors at Barranca Parkway loop on-ramp	2 inches
Reconstruct maintenance vehicle pullouts	3.10 ft
Construct tieback walls at Barranca Parkway OC and Alton Parkway OC	3.5 ft
Construct retaining walls	5.5 ft
Replace/install sign structures	25 ft
Replace light poles	5 ft
Install ramp metering system	6 ft
Install Midwest Guardrail System	7 ft
Relocate draining inlets	10 ft
Install Rock Slope Protection/Partially Grouted Rock Slope Protection (RSP/PGRSP)	6 ft
Clear and grub	<1 ft
Plant/landscape	1.5 ft

Source: Personal communication, California Department of Transportation (July 2019).
ft = foot/feet
OC = overcrossing
SR-133 = State Route 133

[1] Personal communication (e-mail) with Cheryl Sinopoli, District 12 Archaeologist, on July 23, 2019.

2.0 REGULATORY ENVIRONMENT

This project is subject to State regulations regarding paleontological resources. The following discussion of applicable regulations has been excerpted from the Caltrans *Standard Environmental Reference (SER), Environmental Handbook, Volume 1, Chapter 8 – Paleontology* (Caltrans, 2017) and supplemented through additional research on the language of the individual regulations.

2.1 STATE REGULATIONS

Under State law, paleontological resources are protected by both CEQA and Public Resources Code (PRC) Section 5097.5, both of which are discussed in more detail below.

2.1.1 California Environmental Quality Act (California PRC 21000 et seq.)

The purpose of CEQA is to provide a Statewide policy of environmental protection. As part of this protection, State and local agencies are required to analyze, disclose, and, when feasible, mitigate the environmental impacts of, or find alternatives to, proposed projects.

The *State CEQA Guidelines* (California Code of Regulations [CCR] 15000 et seq.) provide regulations for the implementation of CEQA and include more specific direction on the process of documenting, analyzing, disclosing, and mitigating the environmental impacts of a project. To assist in this process, Appendix G of the *State CEQA Guidelines* provides a sample checklist form that may be used to identify and explain the degree of impact a project would have on a variety of environmental aspects, including paleontological resources (Section VII[f]).

As stated in Section 15002(b)(1-3) of the *State CEQA Guidelines*, CEQA applies to governmental action, including activities that are undertaken by, financed by, or require approval from a governmental agency. Because this project is undertaken by governmental agencies, CEQA regulations apply.

2.1.2 California PRC Section 5097.5

This law protects historic, archaeological, and paleontological resources on public lands in California and establishes criminal and civil penalties for violations.

Specifically, PRC Section 5097.5 states:

> (a) No person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor.

(b) As used in this section, "public lands" means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

Because this project involves public lands as defined in Section 5097.5(b), project proponents are required to comply with this regulation.

3.0 SIGNIFICANCE

3.1 DEFINITION OF SIGNIFICANCE

The scientific significance or importance of a paleontological resource is based on various attributes of that resource. In the interest of thoroughness, definitions of significance from Caltrans, the Society of Vertebrate Paleontology (SVP), and one additional source are included below.

3.1.1 California Department of Transportation

According to Caltrans (2017), there are two generally recognized types of paleontological significance:

- **National:** A National Natural Landmark-eligible paleontological resource is an area of national significance (as defined under 36 Code of Federal Regulations [CFR] 62) that contains an outstanding example of fossil evidence of the development of life on earth. This is the only codified definition of paleontological significance.

- **Scientific:** Definitions of a scientifically significant paleontological resource can vary by jurisdictional agency and paleontological practitioner.

Generally, scientifically significant paleontological resources are identified sites or geological deposits containing individual fossils or assemblages of fossils that are unique or unusual, are diagnostically or stratigraphically important, and add to the existing body of knowledge in specific areas stratigraphically, taxonomically, or regionally. Particularly important are fossils found in situ (undisturbed) in primary context (e.g., fossils that have not been subjected to disturbance subsequent to their burial and fossilization). As such, they aid in stratigraphic correlation, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, paleoclimatology, the relationships between aquatic and terrestrial species, and evolution in general. Discovery of in situ fossil-bearing deposits is rare for many species, especially vertebrates. Terrestrial vertebrate fossils are often assigned greater significance than other fossils because they are rarer than other types of fossils. This is primarily due to the fact that the best conditions for fossil preservation include little or no disturbance after death and quick burial in oxygen-depleted, fine-grained sediments. While these conditions often exist in marine settings, they are relatively rare in terrestrial settings. This has ramifications with regard to the amount of scientific study needed to characterize an individual species adequately and therefore affects how relative sensitivities are assigned to formations and rock units.

3.1.2 Society of Vertebrate Paleontology

The SVP provides the following definitions of significance (SVP, 2010):

- **Significant Paleontological Resources** are fossils and fossiliferous deposits, here defined as consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plans, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be

older than recorded human history and/or older than middle Holocene (i.e., older than about 4,200 years ago; Cohen et al., 2019).

3.1.3 Other

Eisentraut and Cooper (2002) developed a useful set of criteria for judging whether fossils are scientifically significant. Using their method, fossils can be judged scientifically significant if they meet any of the criteria within the following categories:

- **Taxonomy:** Assemblages that contain rare or unknown taxa, such as defining new (previously unknown to science) species, or representing a species that is the first or has very limited occurrence within the area or formation.

- **Evolution:** Fossils that represent important stages or links in evolutionary relationships or that fill gaps or enhance underrepresented intervals in the stratigraphic record.

- **Biostratigraphy:** Fossils that are important for determining or confining relative geologic (stratigraphic) ages or for use in defining regional to interregional stratigraphic associations. These fossils are often known as biostratigraphic markers and represent plants or animals that existed for only a short and restricted period in the geologic past.

- **Paleoecology:** Fossils that are important for reconstructing ancient organism community structure and interpretation of ancient sedimentary environments. Depending on which fossils are found, much can be learned about the ancient environment, from water depth, temperature, and salinity to what the substrate was like (muddy, sandy, or rocky), and even whether the area was in a high-energy location (e.g., a beach) or a low-energy location (e.g., a bay). Even terrestrial animals can contain information about the ancient environment. For example, an abundance of grazing animals such as horse, bison, and mammoth suggest more of a grassland environment, while an abundance of browsing animals such as deer, mastodon, and camel suggest more of a brushy environment. Preserved parts of plants can also lend insight into what was growing in the area at a particular time. In addition, by studying the ratios of different species to each other's population densities, relationships between predator and prey can be determined.

  There is a complex but vital interrelationship among evolution, biostratigraphy, and paleoecology: biostratigraphy (the record of fossil succession and progression) is the expression of evolution (change in populations of organisms through time), which in turn is driven by natural selection pressures exerted by changing environments (paleoecology).

- **Taphonomy:** Fossils that are exceptionally well or unusually/uniquely preserved or that are relatively rare in the fossil record. This could include preservation of soft tissues such as hair, skin, or feathers from animals or the leaves/stems of plants that are not commonly fossilized.

3.2 SUMMARY OF SIGNIFICANCE

All vertebrate fossils that can be related to a stratigraphic context are considered scientifically significant, nonrenewable paleontological resources. Invertebrate and plant fossils as well as other

environmental indicators associated with vertebrate fossils are considered scientifically significant. Certain invertebrate and plant fossils that are regionally rare or uncommon, or that help to define stratigraphy, age, or taxonomic relationships, are considered scientifically significant.

4.0 SENSITIVITY

4.1 DEFINITION OF SENSITIVITY

Sensitivity is often stated as "potential" because decisions about how to manage paleontological resources must be based on "potential." The actual situation cannot be known until grading and excavation for the project is underway. Caltrans and the SVP each have a ranking system to describe paleontological sensitivity, as described in the following sections.

4.1.1 California Department of Transportation

In accordance with the Caltrans SER guidelines for paleontology (Caltrans, 2017), the sensitivity of rock units and formations that may contain paleontological resources is assessed on the basis of high, low, or no potential for paleontological resources as follows:

- **High Potential:** Rock units which, based on previous studies, contain or are likely to contain significant vertebrate, significant invertebrate, or significant plant fossils. These units include, but are not limited to, sedimentary formations that contain significant nonrenewable paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. These units may also include some volcanic and low-grade metamorphic rock units. Fossiliferous deposits with very limited geographic extent or an uncommon origin (e.g., tar pits and caves) are given special consideration and ranked as highly sensitive. High sensitivity includes the potential for containing: (1) abundant vertebrate fossils; (2) a few significant fossils (large or small vertebrate, invertebrate, or plant fossils) that may provide new and significant taxonomic, phylogenetic, ecologic, and/or stratigraphic data; (3) areas that may contain datable organic remains older than Recent, including *Neotoma* middens; and/or (4) areas that may contain unique new vertebrate deposits, traces, and/or trackways. Areas with a high potential for containing significant paleontological resources require monitoring and mitigation during grading and excavation.

- **Low Potential:** This category includes sedimentary rock units that: (1) are potentially fossiliferous, but have not yielded significant fossils in the past; (2) have not yet yielded fossils but possess a potential to contain fossil remains; or (3) contain common and/or widespread invertebrate fossils if the taxonomy, phylogeny, and ecology of the species contained in the rock are well understood. Sedimentary rocks expected to contain vertebrate fossils are not placed in this category because vertebrates are generally rare and found in more localized stratum. Rock units designated as low potential generally do not require monitoring and mitigation during grading and excavation. However, as excavation for construction gets underway, it is possible that new and unanticipated paleontological resources might be encountered. If this occurs, a Construction Change Order (CCO) must be prepared to have a qualified Principal Paleontologist evaluate the resource. If the resource is determined to be significant, monitoring and mitigation are required during grading and excavation from that time on.

- **No Potential:** Rock units of intrusive igneous origin, most extrusive igneous rocks, and moderately to highly metamorphosed rocks are classified as having no potential to contain

significant paleontological resources. For projects encountering only these types of rock units, paleontological resources can generally be eliminated as a concern when the Preliminary Environmental Analysis Report (PEAR) is prepared and no further action taken.

4.1.2 Society of Vertebrate Paleontology

According to the SVP (2010), paleontological potential is the potential for the presence of significant nonrenewable paleontological resources. All sedimentary rocks, some volcanic rocks, and some metamorphic rocks have potential to contain significant nonrenewable paleontological resources, and review of available literature may further refine the potential of each rock unit, formation, or facies. The SVP has four categories of potential or sensitivity: high, low, none, and undetermined. If a geographic area or geological unit is classified as having undetermined potential for paleontological resources, studies must be undertaken to determine whether that rock unit has a sensitivity of either high, low, or none. These categories are described in more detail below.

- **High Potential:** Rock units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources. Rocks units classified as having high potential for producing paleontological resources include, but are not limited to: sedimentary formations and some volcaniclastic formations (e.g., ashes or tephras), some low-grade metamorphic rocks that contain significant paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils (e.g., middle Holocene and older, fine-grained fluvial sandstones, argillaceous and carbonate-rich paleosols, cross-bedded point bar sandstones, and fine-grained marine sandstones). Paleontological potential consists of both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, plant, or trace fossils; and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data. Rock units that contain potentially datable organic remains older than the late Holocene, including deposits associated with animal nests or middens, and rock units that may contain new vertebrate deposits, traces, or trackways are also classified as having high potential.
- **Low Potential:** Reports in the paleontological literature or field surveys by a qualified professional paleontologist may allow determination that some rock units have a low potential for yielding significant fossils. Such rock units will be poorly represented by fossil specimens in institutional collections, or based on general scientific consensus, fossils will only be preserved in rare circumstances; the presence of fossils is the exception, not the rule (e.g., basalt flows or Recent colluvium). Rock units with low potential typically will not require measures to protect fossils.
- **No Potential:** Some rock units have no potential to contain significant paleontological resources (e.g., high-grade metamorphic rocks [such as gneisses and schists] and plutonic igneous rocks [such as granites and diorites]). Rock units with no potential require no protection measures relative to paleontological resources.

- **Undetermined Potential:** Rock units for which little information is available concerning their paleontological content, geologic age, and depositional environment are considered to have undetermined potential. Further study is necessary to determine whether these rock units have high, low, or no potential to contain significant paleontological resources. A field survey by a qualified professional to specifically determine the paleontological resource potential of these rock units is required before a Paleontological Resources Impact Mitigation Program (PRIMP) can be developed. In cases where no subsurface data are available, paleontological potential can sometimes be determined by strategically located excavations into subsurface stratigraphy.

4.2 SUMMARY OF SENSITIVITY

A formation or rock unit has paleontological sensitivity or the potential to contain significant paleontological resources if it previously has produced, or has lithologies conducive to the preservation of, vertebrate fossils and associated or regionally uncommon invertebrate or plant fossils. All sedimentary rocks, certain extrusive volcanic rocks, and mildly metamorphosed rocks are considered to have potential for paleontological resources.

5.0 METHODS

5.1 LITERATURE REVIEW

LSA examined geologic maps of the area and reviewed relevant geological and paleontological literature to determine which geologic units are present in the project area and whether fossils have been recovered from those or similar geologic units elsewhere in the region. Because geologic formations and units may extend over large geographic areas and contain similar lithologies and fossils, the literature review includes areas well beyond the project area. The results of this literature review include an overview of the geology of the project area and a discussion of the paleontological sensitivity (or potential) of the geologic units within the project area.

5.2 FOSSIL LOCALITY SEARCHES

In July 2019, fossil locality searches were conducted through the Natural History Museum of Los Angeles County (LACM) and the San Diego Natural History Museum (SDNHM). The locality searches included a 1-mile (mi) buffer around the current project area. The purpose of a locality search is to establish the status and extent of previously recorded paleontological resources in and adjacent to the study area. The locality search results from Dr. Samuel McLeod, Curator of Vertebrate Paleontology at the LACM, and Katie McComas, Paleontology Collections Assistant from the SDNHM, are summarized in Section 6.2, and copies of the letters from the LACM and SDNHM are provided in Appendices A and B, respectively.

5.3 FIELD SURVEY

The purpose of a field survey is to note the sediments and to identify any unrecorded paleontological resources exposed on the surface of a project area. In this way, impacts to existing, unrecorded paleontological material may be mitigated prior to the beginning of ground-disturbing activities, and portions of the project area that are more likely to contain paleontological resources may be identified.

On July 24, 2019, LSA paleontologist Kelly Vreeland, M.Sc., conducted a field survey of the project area. Safe access along the entire length of the project area was not possible due to active traffic and a lack of safe turnouts along SR-133. Where safe access was possible, special attention was given to areas that had exposed ground surfaces. Inaccessible areas were visually inspected from a distance. The results of the field survey are summarized in Section 6.3.

5.4 PERSONNEL

5.4.1 Sarah Rieboldt, Ph.D.

Dr. Sarah Rieboldt, Associate and Senior Paleontologist at LSA, prepared this Paleontological Identification Report/Paleontological Evaluation Report (PIR/PER). Dr. Rieboldt received her Ph.D. in Paleontology from the University of California, Berkeley, and has extensive experience surveying for and collecting paleontological resources; salvaging large fossil specimens; collecting bulk sediment samples; identifying, preparing, and curating fossil material; and writing paleontological assessment reports and final mitigation monitoring reports at the conclusion of construction projects. She has

conducted paleontological and geological fieldwork in California, Nevada, Utah, Wyoming, Colorado, Texas, and Alabama and has 8 years of experience working with natural history collections in several museums (the Field Museum of Natural History, the University of California Museum of Paleontology, and the University of Colorado Museum of Natural History). She has worked as a geologist and paleontological consultant on many different projects, including carbon sequestration and astrobiology research programs funded by the United States Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA), respectively, as well as on projects for the State of California Department of Parks and Recreation, Caltrans, and various private developers in California, Nevada, and Utah. Her résumé is included in Appendix C.

5.4.2 Kelly Vreeland, M.Sc.

Mrs. Vreeland is a paleontologist at LSA whose field and laboratory experience includes fieldwork and research projects throughout California and Nevada, as well as conducting fieldwork and surficial geologic mapping in Montana. She received her Master of Science in Geology from California State University, Fullerton, in 2014, where she focused her research on invertebrate paleontology and paleoecology. Her fieldwork and research at California State University, Fullerton, and LSA has provided her with a strong knowledge of the geology and paleontology of Southern California. In addition to paleontological monitoring and surveying, she is responsible for the collection, identification, preparation, and curation of fossils from various projects within Southern California. Mrs. Vreeland assisted with the preparation of this PIR/PER and conducted the paleontological field survey. Her résumé is included in Appendix C.

6.0 RESULTS

6.1 LITERATURE REVIEW

The project area is located in the northern Peninsular Ranges Geomorphic Province, a 900-mi-long northwest-southeast trending structural block that extends from the Transverse Ranges in the north to the tip of Baja California in the south and includes the Los Angeles Basin (California Geological Survey, 2002; Norris and Webb, 1976). The total width of this province is 225 mi, extending from the Colorado Desert in the east, across the continental shelf to the southern Channel Islands (i.e., Santa Barbara, San Nicolas, Santa Catalina, and San Clemente) in the west (Sharp, 1976). This province is characterized by a series of mountain ranges and valleys that trend in a northwest-southeast direction roughly parallel to the San Andreas Fault Zone (Norris and Webb, 1976; Sharp, 1976). It contains extensive pre-Cenozoic (more than 66 million years ago [Ma]) igneous and metamorphic rock covered by limited exposures of Cenozoic (less than 66 Ma) sedimentary deposits (Norris and Webb, 1976).

Geologic mapping by Morton and Miller (2006) shows that the project area contains Holocene to late Pleistocene Young Alluvial Fan Deposits, as well as the Miocene to late Eocene Vaqueros Formation (Figure 2). Artificial Fill is also likely present from the surface to varying depths throughout much of the project area where it was placed during construction of SR-133. These geologic units and their paleontological sensitivities are described in more detail below. Dates for the geologic time intervals used in this report are derived from the *International Chronostratigraphic Chart* prepared by the International Commission on Stratigraphy (Cohen et al., 2019).

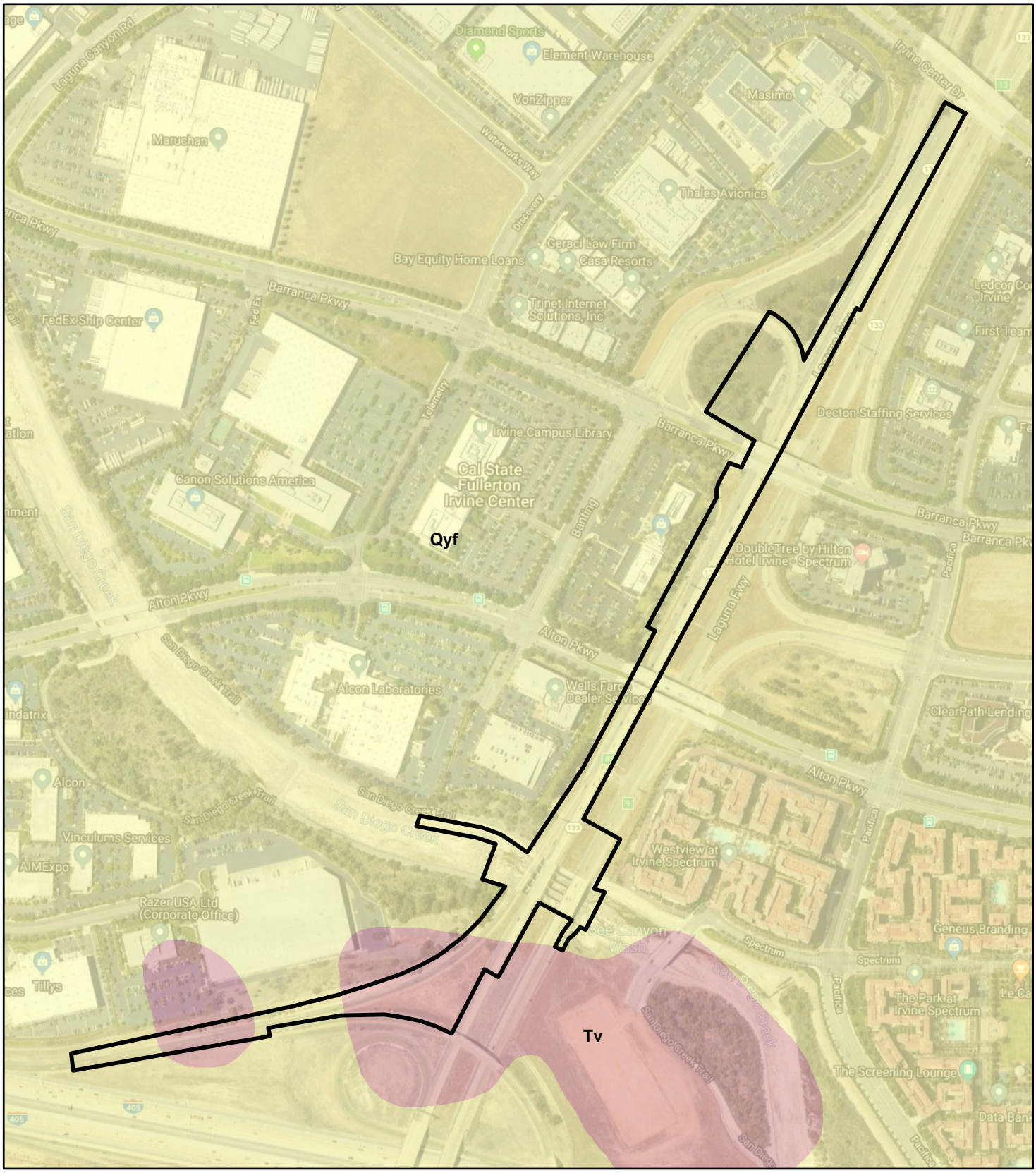
6.1.1 Artificial Fill

Artificial Fill consists of sediments that have been removed from one location and transported to another location by human activity, rather than by natural means. The transportation distance can vary from a few feet to many miles, and composition is dependent on the source and purpose. Artificial Fill will sometimes contain modern debris such as asphalt, wood, bricks, concrete, metal, glass, plastic, and even plant material.

While Artificial Fill may contain fossils, these fossils have been removed from their original location and are thus out of stratigraphic context. Therefore, they are not considered important for scientific study. As such, Artificial Fill has no paleontological sensitivity.

6.1.2 Young Alluvial Fan Deposits

The Young Alluvial Fan Deposits are Holocene to late Pleistocene in age (less than 126,000 years ago) and consist of unconsolidated silt, sand, and gravel (Morton and Miller, 2006). Cobble- and boulder-size clasts are also present and become more abundant closer to the hills and mountains (Morton and Miller, 2006). These sediments were eroded from higher elevations, carried by flooding streams and debris flows, and deposited in a fan or lobe shape at the base of the hills. They show slight to moderate dissection by erosional gullies (Morton and Miller, 2006).



LEGEND

Project Area

Geology

Qyf - Young Alluvial Fan Deposits

Tv - Vaqueros Formation

N

0 250 500

FEET

FIGURE 2

SR-133 Auxiliary Lane Project

Geology

12-ORA-133 PM 8.5/M9.3

EA 0N8900

SOURCE: Google Maps (2018); Caltrans (9/16/2019); Morton and Miller (2006)

I:\CDT1901\GIS\MXD\Task01_SR133_Cultural\Geology.mxd (9/18/2019)

Although Holocene (less than 11,700 years ago) deposits can contain remains of plants and animals, only those from the middle to early Holocene (4,200 to 11,700 years ago) are considered scientifically important (SVP, 2010), and fossils from this time interval are not very common. These Holocene deposits overlie older, Pleistocene deposits that have produced scientifically important fossils elsewhere in the region (Jefferson 1991a, 1991b; Miller, 1971; Reynolds and Reynolds, 1991; Springer et al., 2009). These older, Pleistocene deposits span the end of the Rancholabrean North American Land Mammal Age (NALMA), which dates from 11,000 to 240,000 years ago (Sanders et al., 2009) and was named for the Rancho La Brea fossil site in central Los Angeles. The presence of *Bison* defines the beginning of the Rancholabrean NALMA (Bell et al., 2004), but fossils from this time also include other large and small mammals, reptiles, fish, invertebrates, and plants (Jefferson 1991a, 1991b; Miller, 1971; Reynolds and Reynolds, 1991; Springer et al., 2009). There is a potential to find these types of fossils in the older sediments of this geologic unit, which may be encountered below a depth of approximately 10 ft. Therefore, these deposits are assigned low paleontological sensitivity above a depth of 10 ft and high sensitivity below that mark.

6.1.3 Vaqueros Formation

In Orange County, the predominantly marine Vaqueros Formation is early Miocene to late Eocene in age and dates to the Arikareean NALMA (20.8–30.6 Ma) (Morton and Miller, 2006; Morton et al., 1976; Prothero and Donohoo, 2001; Schoellhamer et al., 1981; Whistler and Lander, 2003). It is composed of white, pale yellow brown, yellowish green, reddish, and greenish-gray interbedded sandstone, sandy siltstone, siltstone, mudstone, and shale, with minor conglomerates and local coquina beds (Daniel-Lyle, 1995; Morton et al., 1976; Schoellhamer et al., 1981). The wide range of lithologies in this formation represents deposition in a variety of subenvironments, including river-dominated (delta front through delta plain), wave-dominated (lower shoreface through backshore), tide-dominated (interdistributary bay), and shallow to deep marine environments (Daniel-Lyle, 1995).

Exposures of the Vaqueros Formation across Orange County have produced a variety of scientifically important fossils of marine invertebrates, marine and terrestrial vertebrates, and plants. Between 2003 and 2006, LSA conducted paleontological mitigation monitoring in the Vaqueros Formation along Laguna Canyon Road/SR-133 to the south of the project area and recovered a substantial assemblage of vertebrate, invertebrate, and plant fossils (Smith et al., 2008). Specifically, 1,352 marine vertebrate, 582 invertebrate, and 19 plant specimens were recovered from 67 localities during the course of this project (Smith et al., 2008). These specimens included a wide variety of sharks, bat rays, a sea cow, whales, dolphins, barnacles, crabs, echinoids, bivalves, and gastropods (Smith et al., 2008). The marine vertebrate collection was particularly significant because several of the whale and dolphin specimens were new to science or showed better preservation than previously discovered examples (Smith et al., 2008). In addition, north of the project area in the foothills of the Santa Ana Mountains, paleontological mitigation monitoring at the Frank R. Bowerman Landfill by RMW Paleo Associates, Inc. between 1991 and 1996 also yielded a significant collection of marine invertebrates and vertebrates, including polychaete worms, crabs, barnacles, bivalves, gastropods, cephalopods, sand dollars, sharks, rays, bony fish, a bird, camels, three kinds of dolphin, and a baleen whale (Raschke, 1997). Some of these finds represent first occurrences in Orange County (e.g., the baleen whale [*Pachycetus*] and one of the dolphins) (Raschke, 1997). Based

on the diversity, abundance, and scientific significance of fossils recovered from the Vaqueros Formation, this geologic unit is considered to have high paleontological sensivity.

6.2 FOSSIL LOCALITY SEARCHES

According to the fossil locality searches conducted by the LACM and SDNHM, there are no known fossil localities within the boundaries of the project area. Only the LACM has a record of a fossil locality from deposits similar to the older sediments in the Young Alluvial Fan Deposits, but both museums have records of fossil localities from the Vaqueros Formation.

The LACM has one fossil locality from what it calls older Quaternary deposits (i.e., the older sediments of the Young Alluvial Fan Deposits). Locality LACM 7713, located south of the project area on the western side of SR-133 at the southern end of the interchange with I-405, produced a fossil specimen of ground sloth (Mylodontidae) from what the museum calls a relatively shallow depth.

From the Vaqueros Formation, the closest LACM fossil localities are LACM 7505, LACM 7548–7553, LACM 7675–7678, and LACM 7712, from west-southwest to south of the project area between the Sand Canyon Reservoir and the Laguna Reservoir. These localities produced a suite of marine vertebrate fossils, including eagle ray (*Myliobatis*), requiem shark (*Carcharhinus*), extinct quadrupedal marine mammals (Desmostylia), sea cow (Dugongidae), toothed whales (Squalodontidae, Platanistidae, and *Argurocetus*), and baleen whales (Eomysticetidae and Cetotheriidae). The SDNHM has one locality from the Vaqueros Formation, from a canyon on the southwest side of French Hill, approximately 3 mi to the west of the project area in the Turtle Rock neighborhood. This locality produced a fossil specimen of oyster (*Ostrea eldridgei*).

Copies of the LACM and SDNHM fossil locality search results letters are included in Appendices A and B, respectively.

6.3 FIELD SURVEY

Visibility along the length of the project area varied from 0 to 70 percent, with pavement and dead grasses covering much of the ground surface. Artificial Fill was present along the edges of the highway and in some areas of the median between NB and SB SR-133. Native sediments within the central median along the southern project boundary were light brown, medium to coarse sand, with rounded to sub-rounded grains and some pebble-sized clasts, consistent with the Young Alluvial Fan Deposits mapped by Morton and Miller (2006). In the southwestern portion of the project area, red, coarse sand and very fine, beige silty sand with some bedding was present, consistent with the Vaqueros Formation mapped by Morton and Miller (2006). No paleontological resources were observed during the field survey.

7.0 RECOMMENDATIONS

Based on the results of this study and consideration of the development methods of the project, no special paleontological situations that would require project redesign to avoid critical fossil localities or deposits are anticipated for this project. However, the majority of the project area contains geologic units that have high paleontological sensitivity (e.g., the Young Alluvial Fan Deposits below a depth of 10 ft and the Vaqueros Formation). These geologic units would be impacted by excavation activities for the project. As such, development of the project has the potential to impact scientifically significant, nonrenewable paleontological resources, and preparation of a Paleontological Mitigation Plan (PMP) is recommended. The PMP shall be developed concurrently with the final design plans and shall follow the Caltrans guidelines in the *SER, Environmental Handbook, Volume 1, Chapter 8 – Paleontology* (Caltrans, 2017), as well as guidelines from the SVP. Following these guidelines, the PMP shall include sections describing project activities, the geologic units within the project area and their paleontological sensitivities, the work plan for mitigating project impacts to paleontological resources, estimates of monitoring schedules and costs, decision thresholds for monitoring levels and fossil collections, a recommended repository for recovered fossils, any necessary permits, and the appropriate documentation at the end of the monitoring program.

Once the PMP has been prepared, the paleontological resource protocols and procedures within it shall be incorporated into the project plans, specifications, and estimates. Implementation of these protocols and procedures will reduce project impacts to scientifically important paleontological resources.

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APPENDIX A

FOSSIL LOCALITY SEARCH RESULTS FROM THE NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY

Natural History Museum
of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
www.nhm.org

NATURAL HISTORY MUSEUM
LOS ANGELES COUNTY

Vertebrate Paleontology Section
Telephone: (213) 763-3325

e-mail: smcleod@nhm.org

8 July 2019

LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, California 92614

Attn: Kelly Vreeland, Paleontologist

re: Paleontological Resources Records Check for the proposed SR-133 Auxiliary Lane Project, LSA Project # CDT1901.01, in the City of Irvine, Orange County, project area

Dear Kelly:

I have thoroughly searched our paleontology collection records for the locality and specimen data for the proposed SR-133 Auxiliary Lane Project, LSA Project # CDT1901.01, in the City of Irvine, Orange County, project area as outlined on the portion of the Tustin USGS topographic quadrangle map that you sent to me via e-mail on 24 June 2019. We do not have any vertebrate fossil localities that lie within the project boundaries, but we do have localities nearby from the same sedimentary deposits that occur in the proposed project area, either at the surface or at depth.

In most of the proposed project area, the less elevated terrain, the surficial deposits consist of younger Quaternary Alluvium, derived as alluvial fan deposits from the Los Alisos Hills to the east, via Brea Canyon Wash that drains into San Diego Creek that crosses the proposed project area. These deposits typically do not contain significant vertebrate fossils in the uppermost layers, but they may be underlain by older Quaternary deposits that may contain significant fossil vertebrate remains. Our closest vertebrate fossil locality from these older Quaternary deposits is LACM 7713, due south of the southwestern portion of the proposed project area on the western side of the Laguna Freeway (Highway 133) at the southern end of the interchange with the San Diego Freeway (I-405), that produced a fossil specimen of ground sloth, Mylodontidae, from unstated but shallow depth.

In the elevated terrain in the southwestern portion of the proposed project area there area exposures of the marine early Miocene Vaqueros Formation and the Vaqueros Formation may occur at relatively shallow depth beneath the Quaternary deposits in the rest of the proposed project area. Our closest vertebrate fossil localities in the Vaqueros Formation are LACM 7505, 7548-7553, 7675-7678, and 7712, west-southwest to south of the proposed project area between the Sand Canyon Reservoir and the Laguna Reservoir, that produced a suite of marine vertebrate fossils including eagle ray, *Myliobatis*, requiem shark, *Carcharhinus*, extinct quadrupedal marine mammals, Desmostylia, sea cow, Dugongidae, toothed whales, Squalodontidae, Platanistidae and *Argyrocetus*, and baleen whales, Eomysticetidae and Cetotheriidae.

Shallow excavations in the younger Quaternary Alluvium exposed in most of the proposed project area are unlikely to uncover significant fossil vertebrate remains. Deeper excavations there that extend down to older sedimentary deposits, as well as any excavations in the exposures of the Vaqueros Formation in the southwestern portion of the proposed project area, however, may well encounter significant vertebrate fossils. Any substantial excavations in the proposed project area, therefore, should be closely monitored to quickly and professionally collect any specimens without impeding development. Sediment samples should also be collected and processed to determine the small fossil potential in the proposed project area. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,

Samuel A. McLeod

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: invoice

APPENDIX B

FOSSIL LOCALITY SEARCH RESULTS FROM THE SAN DIEGO NATURAL HISTORY MUSEUM

17 July 2019

Ms. Kelly Vreeland
LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, CA 92614

RE: Paleontological Records Search – SR-133 Auxiliary Lane (LSA Project Number **CDT1901.01**)

Dear Ms. Vreeland:

This letter presents the results of a paleontological records search conducted for the State Route 133 (SR-133) Auxiliary Lane project (Project), located in the southeastern portion of the City of Irvine, Orange County, California. The Project site is located along SR-133 south of Interstate 5 and north of Interstate 405 (I-405), and along the SR-133 onramp to northbound I-405 (Figure 1).

A review of published geological maps covering the Project site and surrounding area was conducted to determine the specific geologic units underlying the Project site. Each geologic unit was subsequently assigned a paleontological resource potential following guidelines developed by the Society of Vertebrate Paleontology (SVP, 2010). In addition, a search of the paleontological collection records housed at the San Diego Natural History Museum (SDNHM) was conducted in order to determine if any documented fossil collection localities occur at the Project site or within the immediate surrounding area.

Geologic Units Underlying the Project Area

Published geological reports (e.g., Morton and Miller, 2006) covering the Project area indicate that the proposed Project has the potential to impact late Pleistocene- to Holocene-age alluvial-fan deposits and the late Oligocene- to early Miocene-age Vaqueros Formation. These geologic units and their paleontological potential are summarized below. The SDNHM does not have any recorded fossil localities within one mile of the Project site; the nearest fossil locality from the Vaqueros Formation is located approximately 3.3 miles west of the Project site, and is described in further detail below.

Late Quaternary alluvial-fan deposits – Late Pleistocene- to Holocene-age (less than approximately 126,000 years old) alluvial-fan deposits (mapped by Morton and Miller, 2006, as young alluvial-fan deposits) underlie the majority of the Project site, and may have been partially or totally removed during construction of the roadways in this area. These deposits are specifically described as ranging from unconsolidated to moderately consolidated silty sand to arenaceous clay with slightly to moderately dissected surface topography. The SDNHM does not have any fossil localities from these deposits within a 1-mile radius of the Project. Young alluvial deposits are generally assigned a low paleontological potential based on their relatively young geologic age and lack of recorded fossil collection localities. However, these deposits may grade downward into older, Pleistocene-age deposits that could contain fossils, and also commonly overlie geologic units of high paleontological potential that could be impacted by construction where the contact is relatively shallow.

Vaqueros Formation – The marine deposits of the late Oligocene- to early Miocene-age (approximately 24 to 22 million years old) Vaqueros Formation underlie the southern and western portions of the Project site near the SR-133/I-405 interchange, and likely underlie the young alluvial-fan deposits elsewhere in the Project site. While there are no SDNHM fossil collection localities recorded within a 1-mile radius of the Project site, there is one locality recorded from a canyon on the southwest side of French Hill, approximately 3 miles to the west of the Project site in the Turtle Rock neighborhood of Irvine (Figure 1). A single specimen of the oyster *Ostrea eldridgei*, consisting of an articulated pair of valves, was collected from this "oyster reef" horizon. Elsewhere in southern California, the Vaqueros Formation is known for its diverse assemblages of early Miocene marine invertebrates. Important discoveries of marine mammals (pinnipeds, dolphins, baleen whales, sirenians, and desmostylians) have also been reported from this rock unit (Barnes, 1977). The Vaqueros Formation is assigned a high paleontological potential on the basis of the locally abundant fossil remains of marine mollusks recovered from these deposits, coupled with the occasional discovery of significant fossil marine vertebrates.

Summary and Recommendations

The high paleontological potential of the Vaqueros Formation (SVP, 2010) and the discovery of fossil remains at a locality in the area suggest the potential for construction of the proposed project to result in impacts to paleontological resources. Any proposed excavation activities that extend deep enough to encounter previously undisturbed deposits of this geologic unit have the potential to impact the paleontological resources preserved therein. For these reasons, implementation of a complete paleontological resource mitigation program during ground-disturbing activities is recommended.

The fossil collection locality information contained within this paleontological record search should be considered private and is the sole property of the San Diego Natural History Museum. Any use or reprocessing of information contained within this document beyond the scope of the SR-133 Auxiliary Lane project is prohibited.

If you have any questions concerning these findings please feel free to contact me at 619-255-0321 or kmccomas@sdnhm.org.

Sincerely,

Katie McComas, M.S.
Paleontological Report Writer & GIS Specialist
San Diego Natural History Museum

Enc: Figure 1: Project map

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APPENDIX C

RÉSUMÉS

SARAH RIEBOLDT, PH.D.

ASSOCIATE / SENIOR PALEONTOLOGIST

EXPERTISE

Paleontological Mitigation Reports

Paleontological Resource Monitoring

Fossil Collection, Salvage, Identification, and Curation

Federal, State, and Local Laws, Ordinances, Regulations, and Standards (LORS) Regarding Paleontological Resources

EDUCATION

University of California, Berkeley, Ph.D., Paleontology, 2005.

University of Colorado, Boulder, Magna cum Laude B.A., Biology, Minor in Geology, 1999.

PROFESSIONAL EXPERIENCE

Paleontologist, LSA, Irvine, California, April 2013–Present.

Project Manager, Department of Geological Sciences, California State University, Fullerton, and John D. Cooper Archaeological and Paleontological Center, Santa Ana, California, April 2012–April 2013.

Geologist, Geological Survey of Alabama, Tuscaloosa, Alabama, April 2010–February 2012.

Collections Assistant, Field Museum of Natural History, Chicago, Illinois, February 2009–February 2010.

PROFESSIONAL RESPONSIBILITIES

Dr. Rieboldt is an Associate and Senior Paleontologist at LSA with 18 years of experience in the paleontology and geology fields. She has conducted paleontological and geological fieldwork in California, Nevada, Utah, Wyoming, Colorado, Texas, and Alabama and has 8 years of experience working with natural history collections in several museums (the Field Museum of Natural History, the University of California Museum of Paleontology, and the University of Colorado Museum of Natural History). She has worked as a geologist and paleontological consultant on many different projects, including carbon sequestration and astrobiology research programs funded by the United States Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA), respectively, as well as on projects for the State of California Department of Parks and Recreation, Caltrans, and various private developers in California, Nevada, and Utah. She also has experience in monitoring the excavation and construction process on residential developments and a natural gas pipeline, as well as monitoring drilling and coring operations.

Dr. Rieboldt oversees the paleontological resources program at LSA and prepares and reviews paleontological assessment reports, mitigation plans, and monitoring reports. She provides guidance on the various federal, State, and local regulations and guidelines regarding paleontological resources as they apply to projects throughout the state. She also is responsible for scheduling paleontological monitors on both large- and small-scale projects.

PROJECT EXPERIENCE

State Route 120 at Union Road Interchange Project
Manteca, California

LSA conducted environmental technical studies for the State Route 120 (SR 120) at Union Road Interchange Project in Manteca in San Joaquin County. The California Department of Transportation (Caltrans) proposed this project to improve the functionality of the interchange by modifying the existing overcrossings and ramps, constructing auxiliary lanes, and installing signals for the interchange. Dr. Rieboldt analyzed the potential for the No Build Alternative and two Build Alternatives to impact paleontological resources in the Paleontological Identification Report (PIR) for this project.

Tegner Road Bridge Replacement at Turlock Irrigation District Lateral #5 Canal BRLO-5938(196) Project
Stanislaus County, California

LSA prepared an Initial Study and Mitigated Negative Declaration for the Tegner Road Bridge Replacement at Turlock Irrigation District Lateral #5 Canal BRLO-5938(196) Project in Stanislaus County. The proposed project involves the replacement of the bridge and improvements to the road approaches on Tegner Road and Harding Road. Dr. Rieboldt analyzed the potential for the project to impact paleontological resources and summarized the results of the analysis in a paleontological resources technical memorandum, as well as in the appropriate section of the environmental document.

PROFESSIONAL EXPERIENCE (CONTINUED)

Science Writer, University of California Museum of Paleontology, Berkeley, California, April 2009–November 2009.

Collections Assistant, Chicago Academy of Sciences, Chicago, Illinois, October 2008–February 2009.

Postdoctoral Research Associate, Center for Integrative Planetary Science, University of California, Berkeley, May 2005–December 2005.

Paleontological Consultant, Ric Windmiller Consulting, Auburn, California, June 2000–June 2005.

Graduate Student Researcher, Department of Integrative Biology, University of California, Berkeley, January 2004–December 2004.

Science Writer, University of California Museum of Paleontology, Berkeley, California, June 2003–December 2003.

Paleontological Consultant, California Department of Parks and Recreation, San Francisco, California, and University of California Museum of Paleontology, Berkeley, California, June 2001–December 2002.

Graduate Student Researcher, University of California Museum of Paleontology, Berkeley, California, August 2002–December 2002.

Paleontological Consultant, ECORP Consulting, Inc., Roseville, California, June 2002.

Paleontological Consultant, Jones & Stokes Associates, Sacramento, California, August 2001–January 2002.

PROJECT EXPERIENCE (CONTINUED)

North County Corridor New State Route 108 Project
Stanislaus County, California

LSA conducted environmental technical studies for the North County Corridor New State Route 108 (SR-108) Project in Stanislaus County. The proposed project involves relocating the current alignment of SR-108 in order to reduce congestion, improve traffic flow, and accommodate forecasted traffic demands in the northern part of Stanislaus County. LSA prepared the Paleontological Identification Report/Paleontological Evaluation Report and at the request of Caltrans, Dr. Rieboldt prepared a preliminary Paleontological Mitigation Plan (PMP) for this project.

SR-120/McKinley Avenue Interchange Project
Manteca, California

LSA is conducting environmental technical studies for the State Route 120 (SR-120)/McKinley Avenue Interchange Project in Manteca in San Joaquin County. The project involves the construction of a new interchange at SR-120 and McKinley Avenue in order to reduce congestion, improve traffic flow, and accommodate forecasted traffic demands in and around the City of Manteca. Dr. Rieboldt assisted in the preparation of the Paleontological Identification Report/Paleontological Evaluation Report and prepared the PMP for this project.

Digital 395 Project
San Bernardino, Kern, Inyo, and Mono Counties, California; Douglas and Washoe Counties and Carson City, Nevada

Dr. Rieboldt prepared the Paleontological Resources Monitoring and Mitigation Plan for the Digital 395 Project, which involved the installation of over 590 miles of fiber-optic line along United States Highway 395 on the east side of the Sierra Nevada. Running from Barstow, California, to Reno, Nevada, the project route passed through lands managed by the United States Department of the Interior, Bureau of Land Management; the United States Department of Agriculture, Forest Service; the United States Department of Defense; the States of California and Nevada; and the lands of several Native American tribes. As such, this project was subject to multiple federal, State, and local regulations and policies regarding paleontological resources.

State Route 99/120 Interchange Connector Project
Manteca, California

LSA prepared the environmental document and conducted environmental technical studies for the State Route 99/120 Interchange Connector Project in Manteca in San Joaquin County. Caltrans District 10, in cooperation with the San Joaquin Council of Governments proposed reconstructing the existing interchange in order to reduce congestion, improve operations, and accommodate forecasted traffic demands in and around the City of Manteca. Dr. Rieboldt prepared the Paleontological Identification Report/Paleontological Evaluation Report (PIR/PER) for this project.

PROFESSIONAL EXPERIENCE (CONTINUED)

Collections Assistant, University of California Museum of Paleontology, Berkeley, California, August 1999–December 1999.

Collections Assistant, University of Colorado Museum of Natural History, Boulder, Colorado, September 1997–May 1999.

TEACHING

Science Specialist, San Roque School, Santa Barbara, California, January 2006–June 2008.

Graduate Student Instructor, Department of Integrative Biology, University of California, Berkeley, August 2000–December 2000, January 2001–May 2001, and January 2003–May 2003.

AFFILIATIONS

Society of Vertebrate Paleontology

Geological Society of America

PROJECT EXPERIENCE (CONTINUED)

Interstate 5/Sperry Road Interchange Project
Patterson, California

LSA prepared the environmental document and conducted environmental technical studies for the Interstate 5/Sperry Road Interchange Project in Patterson, Stanislaus County. Caltrans, in conjunction with Stanislaus County and the City of Patterson proposed this project to improve operations, enhance safety, and increase capacity of the interchange. For this project, a No Build Alternative and two Build Alternatives, each with a variant, were evaluated. Dr. Rieboldt prepared the PIR/PER to determine the potential for this project to impact paleontological resources and make recommendations regarding mitigation of those impacts.

Mitsubishi Plant Expansion Project
Sacramento, California

Dr. Rieboldt prepared the Paleontological Resources Assessment for Mitsubishi Plant Expansion Project in Sacramento. This project included expanding the existing plant and constructing a new office building, all of which involved excavation into the late to middle Pleistocene Riverbank Formation, which is sensitive for paleontological resources. The paleontological assessment evaluated impacts to resources and made mitigation recommendations.

Rock Island and Hyla Pipe Vaults Project
San Luis Obispo County, California

LSA conducted paleontological resources monitoring for the Rock Island and Hyla Pipe Vaults Project in unincorporated San Luis Obispo County. This project involved installation of two buried concrete pipe vault crossings on the Arroyo Grande Oil Field operated by Freeport McMoran Oil and Gas. Dr. Rieboldt oversaw this project from beginning to end, preparing the Paleontological Resources Impact Mitigation Program, scheduling and supervising the paleontological monitoring, and preparing the final Paleontological Resources Mitigation Monitoring Report.

Newhall Ranch Road Bridge Widening Project
Santa Clarita, Los Angeles County, California

Dr. Rieboldt prepared the Paleontological Resources Assessment for the Newhall Ranch Road Bridge Widening Project, located in Santa Clarita, California. This project addressed existing and projected mobility and circulation deficiencies within the City and included widening the existing Newhall Ranch Road Bridge over Francisquito Creek and conducting associated transportation improvements. Through background research, a literature review, and fossil locality search, this assessment evaluated the potential for the project to impact paleontological resources and developed mitigation measures to minimize those impacts.

PROJECT EXPERIENCE (CONTINUED)

Railroad Avenue Multi-Use Trail Project
Santa Clarita, Los Angeles County, California

Dr. Rieboldt prepared the paleontological analysis for the Railroad Avenue Multi-Use Trail Project in Santa Clarita in Los Angeles County. This project proposed the construction of a 1.5-mile mixed-use pathway for pedestrians and bicycles along the east side of Railroad Avenue from Oak Ridge Drive to Lyons Avenue. Based on the results of a fossil locality search through the Natural History Museum of Los Angeles County and a review of geologic maps and relevant geological and paleontological literature, this analysis recommended the appropriate level of assessment that would be necessary for environmental compliance.

Weddington Street Project
Los Angeles, California

Dr. Rieboldt prepared the Paleontological Analysis Memorandum for the 15353–15385 Weddington Street Project, which involved the demolition of the existing three-story apartment building and construction of a new five-story condominium complex with subterranean parking. The paleontological analysis documented the location and nature of paleontologically sensitive sediments and made recommendations to ensure project development did not adversely affect those resources.

Haven and Fourth Street Hotels and Restaurant Project
Rancho Cucamonga, California

LSA is currently in the process of preparing technical analyses for the Haven and Fourth Street Hotels and Restaurant Project in the City of Rancho Cucamonga. The proposed project includes the development of two five-story 115-room hotels and an approximately 6,000 square foot restaurant on a 7.18-acre site. Dr. Rieboldt prepared the Paleontological Resources Report.

La Pata Avenue 1.8-Mile Gap Closure and Camino del Rio Extension Project
San Juan Capistrano, California

This project was a massive undertaking to extend La Pata Avenue and Camino del Rio in the City of San Juan Capistrano, Orange County, and involved the removal of 14.8 million cubic yards of earth material. Dr. Rieboldt oversaw the paleontological monitoring program conducted by LSA for this project. She also made preliminary identifications of fossils recovered from the project and will prepare the final paleontological monitoring report at the conclusion of the monitoring program.

SR-710 North Study
Los Angeles County, California

LSA is leading an environmental team to prepare an EIR/EIS for the State Route 710 North Study, which spans 23 cities and communities in Los Angeles County. This project, under the direction of Caltrans in cooperation with the Los Angeles Metropolitan Transportation Authority, proposes to improve mobility and relieve congestion between State Route 2 and Interstates 5, 10, 210, and 605 in east/northeast Los Angeles and the San Gabriel Valley. Development of this project involves four alternatives: Freeway Tunnel, Light Rail, Bus Rapid Transit, and Transportation System Management/Transportation Demand Management for which Dr. Rieboldt wrote the Paleontological Identification Report/Paleontological Evaluation Report and addressed public comments on the EIR/EIS.

NBCUniversal Studios G Lot Project
Universal City, Los Angeles County, California

Dr. Rieboldt prepared the Paleontological Resources Monitoring Plan (PRMP) and the Final Mitigation Monitoring Report for the NBCUniversal G Lot Project. For the PRMP, Dr. Rieboldt reviewed the area geology, the applicable City and County mitigation requirements, and the project development plans in order to create an appropriate plan for monitoring excavation activities. This project involved substantial excavation into the middle Miocene

PROJECT EXPERIENCE (CONTINUED)

(15.97 to 11.62 million years ago) Topanga Group and produced dozens of specimens of fossil leaves and bony fish, as well as a few whale specimens. As part of the mitigation monitoring report, Dr. Rieboldt documented project compliance with the applicable requirements and identified and described the fossils recovered. She also coordinated the curation of the recovered fossils into the Natural History Museum of Los Angeles County.

NBCUniversal Studios Universal Hollywood Drive Project
Universal City and Los Angeles, Los Angeles County, California

Dr. Rieboldt prepared the Paleontological Resources Monitoring Plan (PRMP) for the NBCUniversal Studios Universal Hollywood Drive Project, located in the City of Los Angeles and Universal City, which is in unincorporated Los Angeles County. This project involved improving and widening of Universal Hollywood Drive and included excavation into Holocene to Late Pleistocene (less than 126,000 years ago) Young Alluvial Deposits and Middle Miocene (15.97 to 11.62 million years ago) Topanga Group. The PRMP outlined the best practices for paleontological monitoring.

Foothill Parkway Westerly Extension Project
City of Corona and Unincorporated Riverside County, California

The Foothill Parkway Westerly Extension Project, located in the City of Corona and unincorporated Riverside County, involved construction of approximately 2 miles of roadway with associated structures and connector road improvements to accommodate existing and future traffic demands in that area. The project included excavation into paleontologically sensitive deposits of Holocene to Pleistocene Alluvial Deposits, the Paleocene Silverado Formation, and the Late Cretaceous Williams and Ladd Formations. Dr. Rieboldt prepared the Paleontological Resources Impact Mitigation Plan for this project, which outlined best practices for paleontological monitoring during project excavation, as well as procedures for preparing, curating, and documenting any recovered fossils.

Pio Pico Energy Center Project
San Diego County, California

Dr. Rieboldt prepared the Paleontological Resources Monitoring and Mitigation Plan for the Pio Pico Energy Center Project. This project involved the construction of a power plant for three General Electric natural gas-fired combustion turbine generators in an unincorporated area on Otay Mesa in San Diego County. Development of this project will include clearing and grading of the project area, construction of the power plant, and installation of the power plant as well as natural gas lines and electricity transmission lines, all within paleontologically sensitive sediments of the Late Oligocene (23.03–28.1 million years ago) Otay Formation. The Paleontological Resources Monitoring and Mitigation Plan followed all applicable State, County, and California Energy Commission requirements and guidelines.

Vernola Marketplace Apartments Project: Phases A and B
Jurupa Valley, California

Dr. Rieboldt prepared the Paleontological Resources Assessment for Phases A and B of the Vernola Marketplace Apartments Project in the City of Jurupa Valley in Riverside County. This project involves the development of 597 multifamily residential units on approximately 25.7 acres of land near the intersection of Interstate 15 and 68th Street. It includes excavation into Holocene through Early Pleistocene deposits, some of which are sensitive for paleontological resources. The paleontological assessment documented the location and nature of the sensitive sediments and made recommendations to ensure project development does not adversely impact those resources.

SR-60/Theodore Street Interchange Project
Moreno Valley, California

LSA is conducting environmental technical studies for air quality and biological, cultural, and paleontological resources for the State Route 60 (SR-60)/ Theodore Street Interchange Project in the City of Moreno Valley in

PROJECT EXPERIENCE (CONTINUED)

Riverside County. The proposed project involves reconstruction of the local interchange at SR-60 and Theodore Street in order to reduce congestion, improve traffic flow, and accommodate forecasted traffic demands in and around Moreno Valley. Project development includes removal and replacement of the Theodore Street bridge over SR-60, auxiliary lanes along SR-60, and new entrance and exit ramps from SR-60 to Theodore Street. Dr. Rieboldt prepared the Paleontological Identification Report/Paleontological Evaluation Report for this project.

San Onofre Nuclear Generating Station Project
San Diego County, California

As part of an on-call contract with SCE, Dr. Rieboldt prepared the Paleontological Resources Assessment for the San Onofre Nuclear Generating Station (SONGS) Project, located on the Camp Pendleton Marine Corps Base in San Diego County. This assessment provided a review of the 17 geologic units within the surrounding SONGS facilities and their paleontological sensitivity ratings. Based on the paleontological sensitivities of these 17 geologic units and potential construction methods, the assessment also provided recommendations for mitigating impacts to paleontological resources that may be encountered during development of any future projects at the SONGS facilities.

Central Region Landfills – Frank R. Bowerman Landfill Wetlands Basin, Phase VIIIC, and East Flank Landslide Projects
Orange County, California

Dr. Rieboldt prepared the Final Paleontological Mitigation Monitoring Report for the Wetlands Basin, Phase VIIIC, and East Flank Landslide Projects. To date, LSA has collected over 100 fossil specimens from these combined projects, and the recovery of these specimens was completed without delay to the project schedule. The most notable specimens collected included several early Miocene (18–20 million years before present) whale fossils and leaves and molluscs from the Cretaceous (72–83 million years before present). As part of the mitigation monitoring report, Dr. Rieboldt documented project compliance with the applicable State and County requirements for paleontological resources. She also identified and described the scientific significance of the fossils recovered.

Newport Coastal Coverage Solution Project
Crystal Cove State Park
Orange County, California

The Newport Coastal Coverage Solution Project, located in Crystal Cove State Park in Orange County, involved installation of a building for communications equipment with associated access roads to improve safety communications in that area. The project included excavation into paleontologically sensitive deposits of the Middle Miocene Topanga Group and possibly Middle to Late Miocene Monterey Formation. Because this project was within the boundaries of a State Park, Dr. Rieboldt obtained the required permit for paleontological field work on State lands and prepared the Paleontological Resources Impact Mitigation Plan, which outlined best practices for paleontological monitoring during project excavation, as well as procedures for preparing, curating, and documenting any recovered fossils.

Hidden Canyon Project
Orange County, California

Dr. Rieboldt prepared the Paleontological Mitigation Monitoring Report for the Hidden Canyon Project. LSA collected specimens of sharks, rays, whales, and mollusks from the Early Miocene to Early Oligocene (15.97–33.9 Ma) Vaqueros Formation. As part of the mitigation monitoring report, Dr. Rieboldt documented project compliance with the applicable State and City of Irvine requirements for paleontological resources. She also identified and described the fossils recovered.

PROJECT EXPERIENCE (CONTINUED)

Aldi Distribution Center Project
Moreno Valley, Riverside County, California

Dr. Rieboldt prepared the Final Paleontological Mitigation Monitoring Report for the Aldi Distribution Center Project in Moreno Valley in Riverside County. This project involved excavation into paleontologically sensitive Late Pleistocene deposits and produced specimens of horse (*Equus*), camel (*Hemiauchenia*) and giant ground sloth (*Megalonyx jeffersonii or Nothrotheriops shastensis*). For the final report, Dr. Rieboldt identified and described the recovered material and documented project compliance with the applicable State, City, and project-specific requirements for paleontological resources.

City of Menifee On-Call Cultural Resources Studies Peer Review Projects
Menifee, California

LSA is under contract with the City of Menifee in Riverside County to provide on-call peer review of cultural and paleontological resources documents prepared for project compliance with applicable federal, State, City, and project-specific requirements and guidelines for cultural and paleontological resources. These documents may include field survey reports, assessments, mitigation monitoring programs, and final mitigation reports. Dr. Rieboldt is conducting the peer review of all paleontological documents under this contract.

Ball Road Sanitary Sewer and Storm Drain Improvements Project
Anaheim, California

Dr. Rieboldt prepared the Paleontological Analysis Memorandum for the Ball Road Sanitary Sewer and Storm Drain Improvements Project in the City of Anaheim in Orange County. This project involved the replacement and upgrade of the sewer and storm drain facilities along Ball Road and into Carbon Creek, demolishing an abandoned railroad bridge. It includes excavation into Holocene to Late Pleistocene deposits, some of which were sensitive for paleontological resources. The paleontological analysis documented the location and nature of the sensitive sediments and made recommendations to ensure project development did not adversely impact those resources.

Howland's Landing Well Project
Santa Catalina Island, California

As part of an on-call contract with SCE, Dr. Rieboldt prepared the Paleontological Resources Assessment for the Howland's Landing Well Project on Santa Catalina Island in Los Angeles County. This emergency project involved drilling exploration wells to determine where fresh water could be reached and then drilling, constructing, and testing the final well, which would provide fresh water for the Howland's Landing area. The project included excavation into Holocene to Late Pleistocene deposits and metamorphic rocks of the Late Cretaceous Catalina Schist, a part of the Franciscan Formation. Although Pleistocene sediments could have been present at depth and had the potential to contain scientifically important fossils, the excavation methods used for this project precluded the recovery of paleontological resources. The paleontological assessment documented the location and nature of the sensitive sediments and, based on the excavation methods, recommended that no paleontological mitigation was required for the project.

Sesi Property Landfill Closure Project
San Diego, California

Dr. Rieboldt prepared the Paleontological Mitigation Monitoring Report for the Sesi Property Landfill Closure Project. This project involved constructing a monolithic landfill cover with surface drainage facilities and other improvements for closure of landfilled auto-shredder waste on the Sesi property in the City of San Diego, San Diego County. Development of this project involved excavation into the paleontologically sensitive Otay and Lindavista Formations and therefore, required full-time monitoring during ground-disturbing activities in native deposits.

PROJECT EXPERIENCE (CONTINUED)

Morse Street Townhomes Project
Oceanside, California

Dr. Rieboldt prepared the Paleontological Assessment for the Morse Street Townhomes Project. This project involved the development of 38 townhomes on a 2.3-acre parcel of land near the intersection of Morse Street and the Pacific Coast Highway in the City of Oceanside in San Diego County. Development of this project included clearing and grading to prepare the project area, construction of the various buildings, and the installation of utilities.

Stratford Ranch Residential Project
Perris, California

Dr. Rieboldt prepared the Paleontological Resources Assessment for the Stratford Ranch Residential Project in the City of Perris in Riverside County. The project included a new residential community with 400 lots and a 15-acre Stockpile Plan on approximately 80 acres in northeastern Perris. Project development involved clearing and grading to prepare the project area, construction of a new road within the area, and installation of on-site storm drains, new water service, new sewer lines, new electric service, new natural gas lines, and a new telecommunication infrastructure system to serve the planned residential uses.

34202 Del Obispo Street Project
Dana Point, California

LSA conducted environmental technical studies for the 34202 Del Obispo Street Project in the City of Dana Point in Orange County. This mixed-use project involves the development of a residential community, commercial space, and a small amount of parkland/open space. Dr. Rieboldt prepared the Paleontological Resources Assessment for this project.

Spieker Continuing Care Retirement Community Project
San Juan Capistrano, California

Dr. Rieboldt prepared the Paleontological Resources Assessment as one of several environmental technical studies LSA conducted for the Spieker Continuing Care Retirement Community Project in the City of San Juan Capistrano in Orange County. This project involved the development of a Continuing Care Retirement Community designed for residents over the age of 60 years and included the construction of independent living residences, community buildings, and a health care center.

Kaiser Bellflower East Center Demolition Project
Los Angeles County, California

The proposed project involves demolition of the existing Administration Building and East Center Wing of the Kaiser Bellflower Medical Center and remodeling of the exterior and lobby of the West Wing of the Medical Center. Excavation activities associated with this project are anticipated to reach 15–20 feet below ground surface. Dr. Rieboldt wrote the Paleontological Resources Memorandum and the Paleontological Resources Impact Mitigation Program for this project.

Vancouver Street Sewer Extension Project
Carlsbad, California

Dr. Rieboldt prepared the Paleontological Resources Monitoring and Mitigation Plan for the Vancouver Street Sewer Extension Project. This project involved the extension of an existing sewer line from Vancouver Street to Via de Canto through Hidden Canyon Community Park in the City of Carlsbad in San Diego County. Development of this project included traditional excavation, as well as horizontal directional drilling, for the installation of the sewer line segments.

PROJECT EXPERIENCE (CONTINUED)

Durfee Avenue Grade Separation Project
Pico Rivera, California

LSA conducted environmental technical studies for the Durfee Avenue Grade Separation Project in the City of Pico Rivera in Los Angeles County. The project proposed to lower Durfee Avenue below the Union Pacific Railroad (UPRR) tracks to improve safety for vehicular, rail, and pedestrian traffic along Durfee Avenue and nearby streets and the railroad right-of-way. Project development included lowering Durfee Avenue, Walnut Avenue, and Stephens Street; raising the UPRR tracks; and relocating various wet and dry utilities. Following through on due diligence for the client, Dr. Rieboldt prepared the paleontological assessment for this project.

SR-94/SR-125 Interchange Branch Connector Project
San Diego County, California

LSA conducted cultural and paleontological resources assessments for the State Route 94/State Route 125 (SR-94/SR-125) Interchange Branch Connector Project in San Diego County. The project involved the construction of a freeway-to-freeway connector to allow direct south-to-east movement for the SR-94/SR-125 interchange in order to improve regional circulation and reduce traffic on local streets in the Cities of La Mesa and Lemon Grove, and in the unincorporated community of Spring Valley. Project development included construction of a freeway connector between southbound SR-125 and eastbound SR-94, auxiliary lanes on those freeways, and new noise barriers and retaining walls, as well as modifications to existing structures. Dr. Rieboldt prepared the Paleontological Identification Report/Paleontological Evaluation Report for this project.

Surfside Inn Pedestrian Overcrossing Project
Dana Point, California

LSA conducted cultural and paleontological resources assessments for the Surfside Inn Pedestrian Overcrossing Project in the City of Dana Point in Orange County. The project involved replacement and rehabilitation of the pedestrian overcrossing across the Pacific Coast Highway and Metrolink right-of-way from the Capistrano Surfside Inn to Doheny State Beach. Dr. Rieboldt prepared the paleontological resources assessment.

Adelanto Solar Project
San Bernardino County, California

Dr. Rieboldt prepared a paleontological resources analysis report for the Adelanto Solar Project in San Bernardino County. This report included a summary of the geology and potential paleontological resources of the project area, results from a paleontological locality search through the San Bernardino County Museum, and recommendations for mitigating potential impacts to paleontological resources.

North Star Solar Project
Fresno, California

LSA conducted a paleontological resources assessment for the proposed North Star Solar Switching Station and Generation Tie Line (Gen Tie) Project in Fresno County. The purpose of this project is to generate and transmit renewable solar electricity from proven technology at a competitive cost, with low environmental impact, and deliver it to market as soon as possible. The project consists of an approximately 1.5 mile-long gen tie line that will tie into a new 115-kilovolt switching station, an expansion of the existing PG&E Mendota substation. Project construction work will involve location preparation, foundation installation, power pole placement, generation line installation, and erection and connection of the gen tie line and switching station equipment. Dr. Rieboldt prepared the Paleontological Resources Assessment for this project.

PUBLICATIONS

Elrick, M., S. Rieboldt, M. Saltzman, and R.M. McKay
2011 Oxygen-isotope trends and seawater temperature changes across the Late Cambrian Steptoean positive isotope excursion (SPICE event). Geology 39(10): 987-990.

Lipps, J.H., and S.E. Rieboldt
2005 Habitats and taphonomy of life on Europa. Icarus 177:515-527.

Parham, J.F., and S.E. Rieboldt
2005 *Contia tenuis* (Sharp-tailed snake): Reproduction. Natural History Note. Herpetological Review 36(4):456.

SELECTED REPORTS

Mount Diablo State Park Paleontological Resources Inventory and Management Recommendations. Prepared for the State of California Department of Parks and Recreation, Bay Area District. December 2002.

Paleontological Resources Assessment for Bayside Covenant Church, Sierra College Boulevard and Cavitt-Stallman Road, City of Roseville, Placer County, California. Prepared for Bayside Covenant Church. June 2002.

Paleontological Resources Assessment for the Riverbend Park Project, Lompoc, California. Prepared for the City of Lompoc. January 2002.

Recommendations for Compliance with Regulatory Requirements and Mitigation Measures for Paleontological Resources for the Mountain Park Community Development Project. Prepared for the Irvine Company. November 2001.

Paleontological Resources Assessment and Mitigation Measures for the Sacramento Regional County Sanitation District 17-Mile Interceptor Project, Sacramento and Yolo Counties, California. (Co-authored with Jere Lipps, Ph.D.) Prepared for the Sacramento Regional County Sanitation District on behalf of Jones & Stokes Associates, Inc. October 2001.

Scope of Work for Paleontological Investigation Report/Paleontological Evaluation Report for I-680 Northbound Sunol Grade Project. Prepared for Caltrans and Alameda County Congestion Management Agency. August 2001.

PRESENTATIONS

RECS (Research Experience in Carbon Sequestration) Workshop, (Birmingham, Alabama). June 6, 2011.

Geological Society of America Annual Meeting, (Denver, Colorado), "Taphonomy of Jupiter's Icy Moon Europa." November 7–10, 2004.

Bioastronomy Meeting: Habitable Worlds, (Reykjavik, Iceland), "Life, Past and Present, on Jupiter's Icy Moon, Europa." July 12–16, 2004.

35th Lunar and Planetary Science Conference (Houston, Texas), "Geosciences at Jupiter's Icy Moons: The Midas Touch." March 16, 2004.

Seventh Field Conference of the International Subcommission on Cambrian Stratigraphy: The Cambrian System of South China, (Guiyang, China), "Cambrian Inarticulate Brachiopods from Nevada and Texas." August 2001.

PRESENTATIONS (CONTINUED)

Fourth International Brachiopod Congress (London, England), "Can Oxygen Isotopes from Inarticulate Brachiopods Resolve the Causes of Faunal Turnovers in the Cambrian?" July 10–14, 2000.

Geological Society of America Cordilleran Section Meeting, (Berkeley, California), "Inarticulate Brachiopods from the Pioche Formation (Lower and Middle Cambrian), Nevada and their Relation to the Extinction of the Olenellida." June 2–4, 1999.

KELLY VREELAND, M.S.

PALEONTOLOGICAL MONITOR

EXPERTISE

Paleontological Resource Monitoring

Fossil Collection, Salvage, Identification, and Curation

Archeological Resource Monitoring

Laboratory Analysis and Preparation

EDUCATION

California State University, Fullerton, M.S., Geology, 2014

California State University, Fullerton, B.S., Geology, 2010

PROFESSIONAL EXPERIENCE

Paleontological Monitor, LSA, Irvine, California, September 2015–Present.

Graduate Student Researcher, Department of Geological Sciences, California State University, Fullerton, January 2012–May 2014.

Undergraduate Student Researcher, Department of Geological Sciences, California State University, Fullerton, August 2006–August 2010.

PROFESSIONAL RESPONSIBILITIES

Mrs. Vreeland is a paleontologist at LSA. Her field and laboratory experience includes field work and research projects throughout California and Nevada, as well as conducting field work and surficial geologic mapping in Montana. She earned her Master of Science in Geology from California State University, Fullerton in 2014, where she focused her research in invertebrate paleontology and paleoecology. Her coursework and research at California State University, Fullerton, provided her with a strong knowledge of both the geology and the paleontology of the Southern California region.

PROJECT EXPERIENCE

Planning Area 40 East/East Rough Grading and Pipeline Trenching
Irvine, California

LSA conducted paleontological resources monitoring for the rough grading of PA 40 East/East for the development of a new residential community. Mrs. Vreeland served as paleontological and archeological monitor during all earth-disturbing activities on site.

Kinder Morgan Petroleum Pipeline
San Juan Capistrano, California

LSA conducted biological, archeological, and paleontological resource monitoring for the vegetation removal, grading, and beginning phase of trenching for placement of a new petroleum pipeline. Mrs. Vreeland served as paleontological and archeological monitor for the project during its initial phases of grading and trenching.

Hemet Master Drainage Plan Line C, Stage 4
Riverside County, California

LSA conducted paleontological resources monitoring for the Hemet Master Drainage Plan Line C, Stage 4 Project in Riverside County. The project provides 10-year flood protection to residents of the Hemet Master Drainage plan Line C, Stage 4 watershed by placing reinforced concrete pipe to accommodate storm drain construction. Mrs. Vreeland served as paleontological monitor during trenching.

Enclave at Yorba Linda Project
Orange County, California

Mrs. Vreeland assisted Dr. Sarah Rieboldt in the preparation of the Paleontological Resources Mitigation Monitoring Final Report for the Enclave at Yorba Linda Project, which involved the construction of a new residential community in the City of Yorba Linda. The report was completed for Toll Brothers, Inc. in October 2015.

KELLY VREELAND, M.S.

PALEONTOLOGICAL MONITOR

PROFESSIONAL AFFILIATIONS

Geological Society of America

The Paleontological Society

Society for Sedimentary Geology

Association for Women in Geoscience

AWARDS/HONORS

Geological Society of America Student Research Grant, 2013

Marilyn A. Brown Scholarship, California State University, Fullerton, 2012-2013

TEACHING

Teaching Associate, Department of Geological Sciences, California State University, Fullerton, January 2012–May 2014

Geology Tutor, University Learning Center, California State University, Fullerton, August 2012–December 2012

PRESENTATIONS

Southern California Academy of Sciences Annual Meeting, "Holocene Oyster Assemblage of Newport Bay, California: Understanding the Past to Help Restore the Future." May 3–4, 2013

Geological Society of America Annual Meeting, (Charlotte, North Carolina), "Holocene Oyster Assemblage of Newport Bay, California." November 4–7, 2012

Geological Society of America Cordilleran Section Meeting, (Anaheim, California), "Documenting Regional Brachiopod Abundance and Diversity Across the Mississippian-Pennsylvanian Boundary: Bird Spring Formation, Arrow Canyon, Nevada." June 3–4, 2010

SELECTED REPORTS

Vreeland, K.K.

2014 *Holocene Oyster Assemblage of Newport Bay, California: Understanding the Past to Help Restore the Future.* M.S. Thesis. California State University Fullerton. 140 pp.

Vreeland, K.K., and N. Bonuso

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