PALEONTOLOGICAL RESOURCES ASSESSMENT

FOR THE
ALAMO SOLAR PROJECT

SAN BERNARDINO COUNTY, CALIFORNIA

Prepared for:

E.ON Climate & Renewables, North America
20 California Street, Suite 500
San Francisco, California 94111

Prepared by:

4225 Executive Square, Suite 1600
La Jolla, CA 92037

URS Project Number 28907452

July 30, 2013

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LIST OF ABBREVIATIONS AND ACRONYMS

AC	alternating current
CEQA	California Environmental Quality Act
KA	thousand years ago
kV	kilovolts
MA	million years ago
MW	megawatt
PV	photovoltaic
SBCM	San Bernardino County Museum
SCE	Southern California Edison
SCLA	Southern California Logistics Airport
SVP	Society of Vertebrate Paleontology

SECTION 1.0
INTRODUCTION

1.1 PROJECT DESCRIPTION

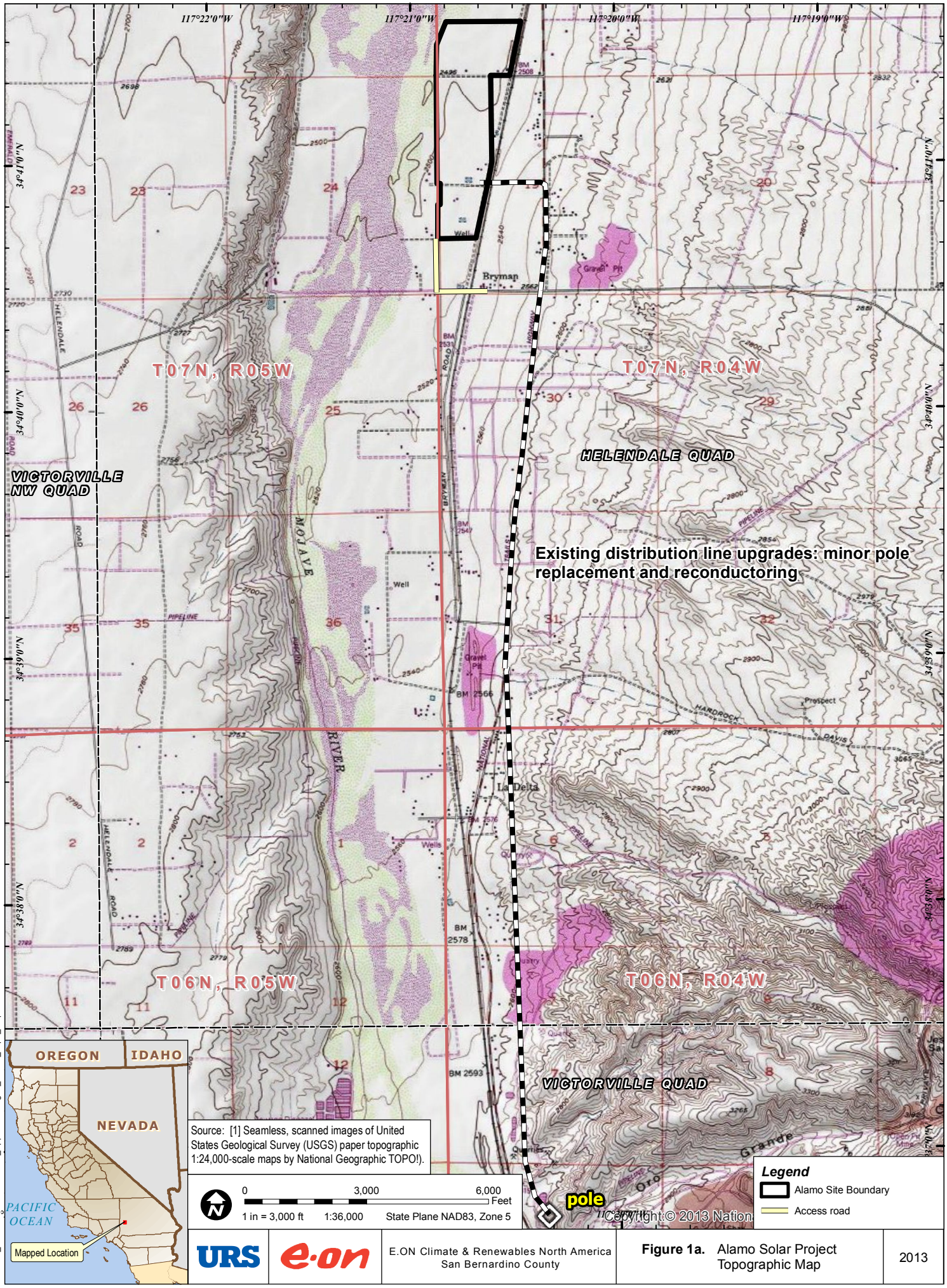
E. ON Climate & Renewables commissioned a paleontological assessment of the Alamo Solar Project as part of the California Environmental Quality Act (CEQA) review process. The Alamo Solar Project (Project) is being developed by Alamo Solar, LLC. (Applicant) to provide solar photovoltaic (PV) power to serve the electrical load requirements of California. The Project will generate approximately 20 MW of alternating current photovoltaic modules on approximately 123 acres of the 175-acre site. The Project will tie in electrically to a new project substation that would be located near the northwest corner of Melrose Road and Bryman Road. This substation will be the project's point of change of ownership from the project developer to the interconnection utility, Southern California Edison (SCE). From the substation the Project will connect electrically with the existing SCE Victor-Helendale 33-kV transmission line that runs north-south along National Trails Highway (SR-66). SCE will undertake distribution line upgrades and modifications along this line that are described in the following pages. This assessment addresses potential project impacts to paleontological resources that may result at the Project site and along the SCE distribution line.

1.1.1 Project Location

The Project site is situated in the western Mojave Desert, approximately 0.1 mile east of the seasonal Mojave River, and approximately 3 miles north of Oro Grande, 3.5 miles south of Helendale, 7.5 miles northeast of Adelanto, and approximately 10.5 miles northwest of downtown Victorville, California. Figures 1a and 1b illustrate the Project site and transmission line locations. The Project site is bordered to the north by agricultural lands; to the east by Bryman Road, the Atchison, Topeka & Santa Fe (AT&SF) Railroad, SR-66 and agricultural uses and vacant undeveloped lands; to the south by a combination of rural residential development and fallow agricultural land; and to the west by the Mojave River and agricultural uses. The parcels that make up the project site are primarily fallowed agricultural land with houses and outbuildings, all of which will be cleared prior to construction.

1.1.2 Interconnection and Distribution System Upgrades

The project includes distribution system upgrades that SCE will make from the project site to a point approximately five miles south near Oro Grande Canyon Road. These upgrades include wooden pole replacement and reconductoring. Construction of the upgrades will include use of staging areas, stringing locations, temporary construction easements and SCE's existing permanent 10-foot wide easement. Short segments of new poles will also be



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San Bernardino County

Figure 1a. Alamo Solar Project
Topographic Map

2013

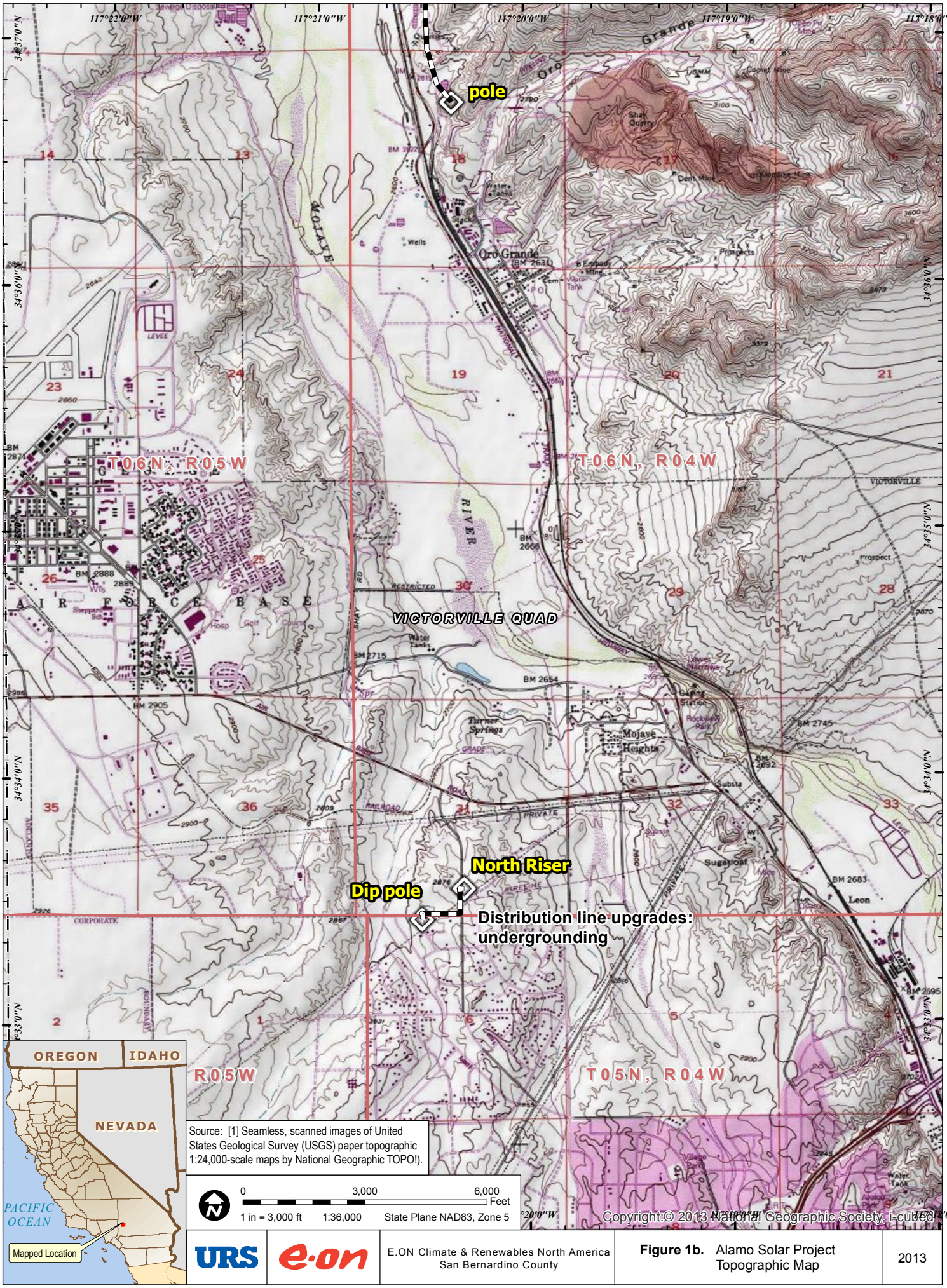

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Figure 1b. Alamo Solar Project
Topographic Map

2013

required and some existing 40-foot tall wooden poles would be replaced by 50-foot tall wooden poles.

Gen-tie line upgrades for the Project are planned to begin at the Project substation near the northwest corner of Melrose Road and Bryman /Aster Road, which represents the point of change of ownership between the project owner and SCE. Near the project substation, the Project owner will install a new customer-owned switch, and SCE will install a closer pole and a metering pole.

From this point, the current gen-tie line runs east for about 1,500 feet along the Melrose Road alignment, and then turns south along SR-66. Along the Melrose Road alignment, SCE will replace the existing 40-foot poles that now support a 4 kV line with taller, 50-foot poles to support both the existing 4 kV circuit and a new 33.5 kV circuit. Three new poles will be added along this segment; two within the project site and one additional pole at the intersection of the Melrose Road alignment and SR-66.

From the intersection of Melrose Road and National Trails Highway, the line will run south for about 2,500 feet to the intersection of SR-66 and Bryman Road. Along this segment, the line will use the existing SCE right-of-way for approximately 1,500 feet. SCE will replace the 40-foot poles with 50-foot poles, and add a third circuit of 33 kV to the two existing 33 kV and 4 kV circuits. The number and positions of all poles along this segment will remain the same. At this point, the line will shift approximately 40 feet west before continuing to run south within the public right-of-way along SR-66. Approximately four new poles will be added within this 1,000 foot segment before the line reaches the intersection of Bryman Road and SR-66. The four new poles will assume roughly the same horizontal positions as the poles that run along the existing alignment.

From the intersection of Bryman Road and SR-66, the line continues south within its present alignment for approximately 1.75 miles. New wires will be installed along this segment, and some poles will be replaced due to age, though all poles will remain in the same location.

Just south of the intersection of Barbosa Road and SR-66, the line breaks from the right-of-way of SR-66 and proceeds south along the east side of the highway within SCE's current right-of-way. This segment will be upgraded with new wires. Due to the heavier conductor, some poles along this 35-pole segment will be added to shorten the spans, and some poles will be replaced due to age. Approximately 11 new poles will be added and 9 poles will be replaced.

A final portion of the Project's distribution upgrades will occur in an area that is not contiguous to the other upgrades and is located approximately 3.8 miles southeast of the terminus of the distribution feeder. This area is the southernmost portion of the distribution system illustrated in Figure 1b. This section occurs at the intersection of Village Drive and Rancho Road. The circuit starts at a riser pole on village road, runs south to Ranch Road, and

proceeds west to a second riser pole. The overall length of the affected duct bank is approximately 1,850 feet. Because the existing circuit was installed in conduit, the new conductors can be installed without modification to the conduit duct bank. Upgrades to this segment will occur without ground disturbance.

1.1.3 Project Operations

The solar facility would be unmanned and no new ground disturbance would occur.

1.2 SCOPE OF STUDY AND PERSONNEL

The scope of work for this paleontological assessment included searches of paleontological resource records at the San Bernardino County Museum (SBCM) and a search of pertinent published and unpublished geological and paleontological literature. No field visit was made for this study. The paleontological records search was requested of the SBCM on 24 May, 2013. Eric Scott of the SBCM provided the records search report on July 9, 2013 (Appendix A). URS paleontologist Dr. Joe Stewart prepared this assessment in conformance with the guidelines established by the SVP (SVP 1995).

SECTION 2.0
ENVIRONMENTAL SETTING

2.1 TOPOGRAPHY AND PHYSIOGRAPHY

The Project site lies on the eastern floodplain and terraces of the Mojave River. The site is relatively flat; elevation of the site ranges from approximately 2,490 feet above sea level (asl) to 2,520 feet asl, with topography gradually sloping to the north-northwest. Topographically, the Project site is dominated by the Mojave River and much high ground to the west and by the rolling slopes of Silver Mountain, Sparkhule Mountain, and Quartzite Mountain to the east. The Project site and most of the SCE gen-tie improvement corridor are located on the Helendale 7.5' quadrangle. The rest of the gen-tie is located on the Victorville 7.5' quadrangle. The Project lies within the Mojave Desert physiographic province (Norris and Webb 1990).

2.2 GEOLOGIC SETTING

The project site is situated on the southwestern edge of the Mojave block. The geology of the Project site is dominated by mountains, alluvial fans, and the Mojave River.

Multiple authors have mapped the geology of the project area. Dibblee (1967) mapped the Quartzite Mountain area at a scale of 1:36,875 and the western Mojave block at a scale of 1:125,000. Bortugno and Spittler (1986) mapped the San Bernardino quadrangle at a scale of 1:250,000. Hernandez et al., (2008) mapped the Victorville 7.5' quadrangle at a scale of 1:24,000. Bezore and Shumway (1994) mapped the geology of southwestern San Bernardino County at a scale of 1:62,500.

Our study area lies within the southwest part of Northeast Mojave block. For millions of years, all of what is now southern California was part of the North American Plate. During this time, the Pacific Plate was being subducted beneath the California plate. Volcanism in the Barstow area accompanied this subduction. When subduction ceased in offshore southern California around 17-18 ma, the Pacific-North American transform boundary (San Andreas Fault) formed and associated rotation of the northeast Mojave block took place. Both crustal rotation and strike-slip faulting occurred in the area 17-18 Ma. After creation of the Pacific-North American transform boundary (the San Andreas Fault system), the Project area remained part of the North American Plate, but more southerly and westerly parts of southern California became part of the Pacific Plate.

Cox and Hillhouse (2000) summarized previous research and documented their own findings on Pleistocene geologic events of the Victorville/Helendale area.

SECTION 3.0
REGULATORY SETTING

CEQA provides regulations concerning significant impacts to paleontological resources. The following is a concise description of the state and local laws and regulations.

3.1 STATE LEVEL

3.1.1 California Environmental Quality Act

CEQA provides protection for paleontological resources through environmental legislation. Direction regarding significant impacts on paleontological resources is found under Appendix G (part V) of the CEQA Guidelines. The guidelines state, "A project will normally result in a significant impact on the environment if it will disrupt or adversely affect a paleontological resource or site or unique geologic feature, except as part of a scientific study." Per section 5097.5 of the Public Resources Code, it is unlawful to remove paleontological remains without authorization and can result in a misdemeanor. In addition, Section 622.5 of the California Penal Code sets the penalties for damage or removal of paleontological resources.

3.2 LOCAL LEVEL

3.2.1 County of San Bernardino

The County of San Bernardino's Development Code requires evaluation of potential paleontological resources as part of its CEQA review of proposed projects.

SECTION 4.0
METHODS

The methods used to develop the paleontological resource inventory of the Project site and surrounding area are described below. These procedures follow guidelines from the County of San Bernardino (County of San Bernardino, 2007) and the Society of Vertebrate Paleontology (SVP) (1995) and include both a literature search and a paleontological records search. No field visit was done for this study.

4.1 PALEONTOLOGICAL RESOURCES RECORDS SEARCH

On February 12, 2013, URS enlisted a paleontological records search through the Division of Geological Sciences at the SBCM in Redlands, California. Site records with supporting maps and documents are maintained at this facility. The record search included the examination of current geologic maps and any fossil localities inside the Project locality and within a one-mile radius around the Project boundaries. The record search is used to determine if any paleontological resources have been recovered within and around the project site, and establish a foundation for gauging the sensitivity of the Project site for additional and buried paleontological resources.

4.2 LITERATURE SEARCH

Pertinent published and unpublished geological literature, paleontological literature, and geologic mapping were searched for information on the area of the Project.

SECTION 5.0
RESULTS

5.1 PALEONTOLOGICAL RESOURCES RECORDS SEARCH

The SBCM sent the records search report on April 18, 2013. Citing a detailed geological map of Bortugno and Spittler (1986), the SBCM reported that within the Project area crosses Holocene alluvium (= map unit **Q**), late Holocene and active wash sediments of the Mojave River (= **Qw**), Pleistocene older alluvium (= **Qo**), and well dissected alluvial fan deposits of Pleistocene age (= **Qod)** (Figure 2). Only the Pleistocene older alluvial deposits (Qo and Qod) have potential to contain significant paleontological resources; Holocene alluvium (**Q**) and Holocene and active wash sediments of the Mojave River (**Qw**) are thought to be too young to contain significant paleontological resources.

The SBCM report states that there are no previously known paleontological resource localities along the proposed corridor, but that seven localities are located within 0.5 mile of the southern extent of the proposed study area in geologic contexts that could be disturbed along the SCE distribution line. Those localities have produced fossils of *Mammuthus meridionalis* (mammoth), *Paramylodon harlani* (giant ground sloth), *Arctodus simus* (short-faced bear), *Equus* sp. cf. *E. scotti* (extinct horse), *Hemiauchenia* (extinct llama), *Camelops hesternus* (extinct large camel), *Lepus* (jackrabbit), *Sylvilagus* (cottontail rabbit), *Thomomys* (pocket gopher), *Dipodomys* (kangaroo rat), *Perognathus* (pocket mouse), *Vulpes* (fox), *Phrynosoma* (desert horned lizard), and *Crotalus* (rattlesnake).

5.2 LITERATURE SEARCH

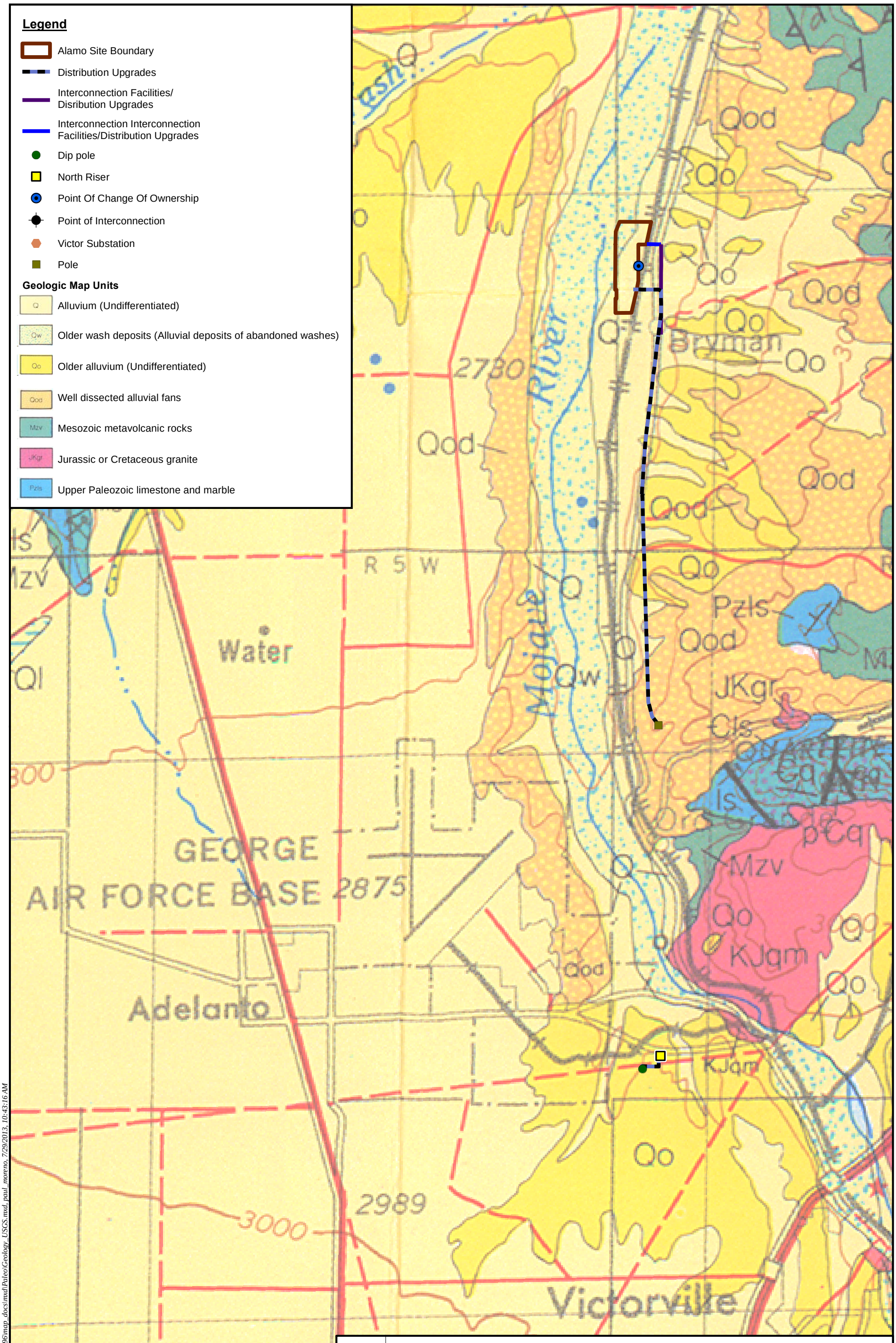
The listings of Jefferson (1991a, 1991b) mention six SBCM localities in Victorville that produced vertebrate fossils. They are all listed as being in the Old Alluvium of Noble or the Shoemaker Gravel in the middle and upper units of the Victorville Fan (Cox and Hillhouse 2000). Cox and Hillhouse (2000) demonstrated that the Pleistocene sediments mapped by Bortugno and Spittler (1986) as older alluvium (Qo), lying on both sides of the Mojave River, are actually older Mojave River terrace deposits expressed as the George surface. They also document a specimen of *Mammuthus meridionalis* found southeast of the former George Air Force Base, which is now the Southern California Logistics Airport (SCLA) (Scott et al. 1997). The fossils found near the SCLA are from Mojave River sediments, and are from the later part of the Irvingtonian North American Land Mammal Age (780 to 350 KA; Cox and Hillhouse 2000). This includes the localities that Jefferson (1991a and 1991b) listed as being from subdivisions of the Victorville alluvial fan. Optically stimulated luminescence dating of sediments immediately beneath the fossil soil that caps that deposit suggest that it is approximately 65 thousand years ago (KA) (Cox and Hillhouse 2000). The southern part of the gen-tie improvement corridor crosses this alluvium. There are also Pleistocene alluvial fan deposits on both sides of the Mojave River in the Project region.

Legend

- Alamo Site Boundary
- Distribution Upgrades
- Interconnection Facilities/ Disribution Upgrades
- Interconnection Interconnection Facilities/Distribution Upgrades
- Dip pole
- North Riser
- Point Of Change Of Ownership
- Point of Interconnection
- Victor Substation
- Pole

Geologic Map Units

- Q — Alluvium (Undifferentiated)
- Qw — Older wash deposits (Alluvial deposits of abandoned washes)
- Qo — Older alluvium (Undifferentiated)
- Qod — Well dissected alluvial fans
- Mzv — Mesozoic metavolcanic rocks
- JKgr — Jurassic or Cretaceous granite
- Pzls — Upper Paleozoic limestone and marble



SOURCES:
Geologic Map (USGS, 1986)

SITE GEOLOGY MAP
ALAMO SOLAR
SAN BERNARDINO COUNTY, CA

URS

0.5 0 0.5 1 Miles

SCALE: 1" = 1 Mile (1:63,360)
SCALE CORRECT WHEN PRINTED AT 11X17

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Research for permitting of a petroleum pipeline indicated that the Los Angeles County Museum of Natural History (LACM) has a locality on the bluffs of the west side of the Mojave River [presumably in the Qod (well-dissected alluvial fan deposits)] northwest of La Delta and southwest of Bryman (URS 2008). This would be just west of the Project. That locality produced fossils of *Equus* (horse) and *Mammuthus columbi* (mammoth). The same Qod sedimentary unit is crossed by the gen-tie improvement corridor (see Figure 2).

More recent geologic mapping (Hernandez et al. 2008) shows more detailed mapping of the Project area, and indicates that part of the southern end of the project may pass through landslide sediments. If this proves to be true, landslide sediments usually do not have high paleontological sensitivity.

SECTION 6.0
SUMMARY OF RESULTS AND MITIGATION

The paleontological resources records search conducted by SBCM and literature search shows that portions of the SCE gen-tie improvement corridor cross Pleistocene older alluvial deposits (Qo and Qod) that have potential to contain significant paleontological resources in surface and near surface contexts. Grading, trenching or other earth-moving activities in in such deposits have high potential to adversely impact significant nonrenewable paleontologic resources. County Development Code 82.20.040 requires that a qualified paleontologist develop a paleontological mitigation program including, but not limited to, a field survey before grading, monitoring during grading, and recovery, preparation, identification, reporting, and curation of recovered fossils. The paleontological monitor shall have the authority to halt grading to collect uncovered paleontological resources. However, if geotechnical evidence reveals that undisturbed Pleistocene sediments will not be impacted by excavations, paleontological monitoring would not be recommended.

The SBCM paleontology records review (Appendix A) provides a more detailed description of required mitigation measures.

SECTION 7.0
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APPENDIX A
PALEONTOLOGY RECORDS REVIEW, ALAMO SOLAR PROJECT, CITY OF VICTORVILLE AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA

9 July 2013

URS Corporation
attn: J.D. Stewart, Principal Paleontologist
4225 Executive Square, Suite #1600
La Jolla, CA 92037

re: **PALEONTOLOGY RECORDS REVIEW, ALAMO SOLAR PROJECT, CITY OF VICTORVILLE AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA**

Dear Dr. Stewart,

The Division of Geological Sciences of the San Bernardino County Museum (SBCM) has completed a literature review and records search for the above-referenced development in and around the City of Victorville, San Bernardino County, California. The proposed study alignment traverses portions of section 6, Township 5 North, Range 4 West, as well as portions of sections 6, 7, 18, and 31, Township 6 North, Range 4 West, and sections 18, 19, 30 and 31, Township 7 North, Range 4 West, San Bernardino Base and Meridian, as seen on the Helendale, California and the Victorville, California 7.5' United States Geological Survey topographic quadrangle maps (1956 editions, photorevised 1983 and 1981, respectively).

Previous geologic mapping of the region by Bortugno and Spittler (1986) indicates that the proposed project corridor crosses Quaternary and recent alluvium, including: Pleistocene older alluvium (= unit **Qo**), located throughout the flat-lying portions of the alignment; well dissected alluvial fan deposits of Pleistocene age (= **Qod**), located along the flanks of the low-lying hills along the proposed alignment; Holocene alluvium (= **Q**), also located in some flat-lying portions of the study area where it forms a thin sedimentary veneer overlying Pleistocene older alluvium; and late Holocene and active wash sediments of the Mojave River (= **Qw**), located in the present-day Mojave River drainage. Of these, only the Pleistocene older alluvial sediments (Qo and Qod) have potential to contain significant nonrenewable paleontologic resources.

Pleistocene sediments present at the surface and in the subsurface in the Victorville region were laid down by two separate depositional regimes: the ancestral Mojave River and the Victorville Fan (Cox and Tinsley, 1999; Sibbett, 1999; Cox and Hillhouse, 2000; Cox and others, 2003). Previous paleontologic investigations (Jefferson, 1989; Reynolds, 1989; Scott and others, 1997; Scott and Cox, 2008) have repeatedly demonstrated the high paleontologic sensitivity of the ancient Mojave River sediments in the Victorville region of the Mojave Desert. The following is a composite list of taxa recovered from Pleistocene older alluvial sediments in Victorville (Reynolds, 1989; Scott and others, 1997; Scott and Cox, 2008):

Sorex sp.	shrew
Paramylodon harlani	extinct giant ground sloth
Lepus sp.	jack rabbit
Sylvilagus sp.	cotton tail
cf. *Ammospermophilus leucurus*	possible antelope ground squirrel
Spermophilus townsendi	ground squirrel
Thomomys sp.	pocket gopher
Perognathus sp.	pocket mouse
Dipodomys sp.	kangaroo rat
Neotoma sp. cf. *N. lepida*	possible desert wood rat
Sigmodon medius or *minor*	extinct cotton rat
Microtus sp.	meadow vole
Arctodus sp. cf. *A. simus*	extinct short-faced bear
Mammuthus meridionalis	extinct southern mammoth
Equus sp. cf. *E. scotti*	possible Scott's horse
cf. *Titanotylopus* sp.	extinct long-limbed giant camel
Hemiauchenia sp.	extinct llama
Camelops sp.	extinct camel

Most of the vertebrate fossils recovered from the Victorville and Hesperia regions of the Mojave Desert were initially presumed to derive from "distal equivalents" of the Victorville Fan (Jefferson, 1989; Reynolds, 1989). However, recent studies of sediments in the Victorville and Hesperia regions (Cox and Tinsley, 1999; Sibbett, 1999; Cox and Hillhouse, 2000; Cox and others, 2003) have determined that two distinct sedimentary lithologies are present in this region: sediments of the Victorville Fan and alluvium deposited by the Pleistocene Mojave River. Research conducted by the SBCM in and around the Victorville area has determined that Pleistocene fossils from the region appear to be derived exclusively from exposures of the Mojave River sediments, rather than from the Victorville Fan. Exposures of the Victorville Fan may therefore be less fossiliferous than previously reported, save in those areas where the nature of the sediments of the Fan suggests an environment conducive to the preservation of fossil remains.

For this review, I conducted a search of the Regional Paleontologic Locality Inventory (RPLI) at the SBCM. The results of this search indicate that no previously known paleontologic resource localities are recorded by the SBCM from along the proposed project corridor. However, localities SBCM 1.114.28 - 1.114.30, 1.114.35 - 1.114.37, and 1.114.274 are situated within ½ mile of the southern extent of the proposed study area. All of these localities were identified from sediments mapped (Cox and Tinsley, 1999; Cox and Hillhouse, 2000) as derived from the Mojave River. Fossils recovered from these localities include specimens of *Mammuthus meridionalis* (extinct mammoth), *Paramylodon harlani* (giant ground sloth), *Arctodus simus* (short-faced bear), *Equus* sp. cf. *E. scotti* (extinct horse), *Hemiauchenia* (extinct llama), *Camelops hesternus* (extinct large camel), *Lepus* (jackrabbit), *Sylvilagus* (cottontail rabbit), *Thomomys* (pocket gopher), *Dipodomys* (kangaroo rat), *Perognathus* (pocket mouse), *Vulpes* (fox), *Phrynosoma* (desert horned "toad"), and *Crotalus* (rattlesnake).

Recommendations

The results of the literature review and the check of the RPLI at the SBCM demonstrate that excavation into undisturbed Pleistocene sediments deposited by the ancestral Mojave River, as well as into dissected older fan deposits flanking the river, has high potential to impact paleontologic resources. Such excavation will require a qualified vertebrate paleontologist to develop a program to mitigate impacts to significant nonrenewable paleontologic resources, including curation of recovered resources (Scott and others, 2004). Such a mitigation program must be consistent with the provisions of the California Environmental Quality Act (Scott and Springer, 2003), as well as with regulations currently implemented by the County of San Bernardino.

The County of San Bernardino (Development Code §82.20.040) defines a qualified vertebrate paleontologist as meeting the following criteria:

Education: An advanced degree (Masters or higher) in geology, paleontology, biology or related disciplines (exclusive of archaeology).

Professional experience: At least five years professional experience with paleontologic (not including cultural) resources, including the collection, identification and curation of the resources.

The County of San Bernardino (Development Code §82.20.030) requires that paleontologic mitigation programs include, but not be limited to:

(a) Field survey before grading. In areas of potential but unknown sensitivity, field surveys before grading shall be required to establish the need for paleontologic monitoring.

(b) Monitoring during grading. A project that requires grading plans and is located in an area of known fossil occurrence, or that has been demonstrated to have fossils present in a field survey, shall have all grading monitored by trained paleontologic crews working under the direction of a qualified professional, so that fossils exposed during grading can be recovered and preserved. Paleontologic monitors shall be equipped to salvage fossils as they are unearthed, to avoid construction delays, and to remove samples of sediments that are likely to contain the remains of small fossil invertebrates and vertebrates. Monitors shall be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens. Monitoring is not necessary if the potentially-fossiliferous units described for the property in question are not present, or if present are determined upon exposure and examination by qualified paleontologic personnel to have low potential to contain fossil resources.

(c) Recovered specimens. Qualified paleontologic personnel shall prepare recovered specimens to a point of identification and permanent preservation, including washing of sediments to recover small invertebrates and vertebrates. Preparation and stabilization of all recovered fossils is essential in order to fully mitigate adverse impacts to the resources.

(d) Identification and curation of specimens. Qualified paleontologic personnel shall identify and curate specimens into the collections of the Division of Geological Sciences, San Bernardino County Museum, an established, accredited museum repository with permanent retrievable paleontologic storage. These procedures are also essential steps in effective paleontologic mitigation and CEQA compliance. The paleontologist must have a written repository agreement in hand prior to the initiation of mitigation activities. Mitigation of adverse impacts to significant paleontologic resources is not considered complete until curation into an established museum repository has been fully completed and documented.

(e) Report of findings. Qualified paleontologic personnel shall prepare a report of findings with an appended itemized of specimens. A preliminary report shall be submitted and approved before granting of building permits, and a final report shall be submitted and approved before granting of occupancy permits. The report and inventory, when submitted to the appropriate Lead Agency along with confirmation of the curation of recovered specimens into the collections of the San Bernardino County Museum, will signify completion of the program to mitigate impacts to paleontologic resources.

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Please do not hesitate to contact us with any further questions you may have.

Sincerely,

Eric Scott, Curator of Paleontology
Division of Geological Sciences
San Bernardino County Museum