
Appendix 1-K
Paleontological Resources Inventory Memorandum

MEMORANDUM

To: SoCalGas
From: Michael Williams, PhD (Dudek)
Subject: Paleontological Resources Inventory Memorandum for the Ventura Compressor Station Modernization Project Avocado Site Alternative
Date: August 19, 2025
cc: Sarah Siren (Dudek)
Heather Imgrund (SoCalGas)
Ronelle Candia (Dudek)
Attachments: A: Figures
B: NHMLA and SBMNH Records Search Results – CONFIDENTIAL (available on request)

In accordance with federal and state laws and the Society of Vertebrate Paleontology (SVP 2010) guidelines, Dudek conducted a paleontological resources inventory for the SoCalGas® Ventura Compressor Station Modernization Project – Avocado Site Alternative in the City of Ventura, California (Figure 1, Avocado Site Location; all figures are provided in Attachment A to this Paleontological Resources Inventory Memorandum [memo]). The inventory included paleontological records searches through the Natural History Museum of Los Angeles County (NHMLA) and the Santa Barbara Museum of Natural History (SBMNH) and a review of geological mapping and geological and paleontological literature. The results of the NHMLA and SBMNH paleontological records searches indicated there are no previously recorded fossil localities that appear directly within the Avocado Site; however, both institutions reported fossil localities nearby from the same geological units that underlie the Avocado Site on the surface and at depth.

As portions of the Avocado Site have never been developed, and the Avocado Site is underlain by geological units with high paleontological resource sensitivity on the surface and/or at depth, there is a potential to encounter intact subsurface paleontological resources at depth. Therefore, a paleontological monitoring program is necessary because construction activities associated with the Avocado Site Alternative are anticipated to impact these geological units. This memorandum was prepared by Michael Williams, PhD, with editorial comments by Sarah Siren, MSc. Williams and Siren are qualified Principal Investigators (PIs) for Paleontology in accordance with federal guidelines, the California Environmental Quality Act (CEQA) Guidelines, and SVP (2010) standards.

1 Avocado Site Location

The Avocado Site is composed of three portions: a compressor station area, a Temporary Staging Area, and a roadway/utility corridor. The compressor station and roadway/utility corridor areas are considered permanent, and the Temporary Staging Areas are considered temporary. The compressor station area of the Avocado Site is located in unincorporated Ventura County, approximately 0.56 miles west of the City of Ventura, and the Temporary Staging Area is located along the western boundary of the City of Ventura, in Ventura County, California (see Figure 1). The compressor station area consists of approximately 64 acres of land located within portions of two parcels (Assessor's

Parcel Numbers [APNs] 060-031-017 and 060-031-018). The Temporary Staging Area consists of approximately 5.6 acres of land located within a portion of one parcel (APN 060-0302-019). The roadway/utility corridor portion of the Avocado Site is an approximately 2-mile-long winding route that connects the compressor station area and the Temporary Staging Area and is located within portions of APNs 060-031-018 and 060-032-025.

2 Paleontological Resources

Paleontological resources are the remains or traces of plants and animals that are preserved in Earth’s crust, and per the SVP (2010) guidelines, are older than written history or older than approximately 5,000 years, which approximates the middle Holocene, according to Cohen et al. (2024). Paleontological resources are limited, nonrenewable resources of scientific and educational value, which are afforded protection under federal and state laws and regulations. The analysis in this memo complies with federal laws, the CEQA statute and CEQA Guidelines, and with significance criteria specified by SVP (2010) and Murphey et al. (2019). Table 1 provides definitions for high, undetermined, low, and no potential for paleontological resources (or paleontological sensitivity), as set forth in and by the SVP (2010) guidelines.

Table 1. Paleontological Sensitivity Criteria

Resource Potential	Definition
High	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. Rock units classified as having high potential for producing paleontological resources include, but are not limited to, sedimentary formations and some volcanoclastic formations (e.g., ashes or tephtras); 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 (1) 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 (2) 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 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.
Undetermined	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 or low potential to contain significant paleontological resources. A field survey by a qualified professional paleontologist to specifically determine the paleontological resource potential of these rock units is required before a paleontological resource impact mitigation program can be developed. In cases where no subsurface data are available, paleontological potential can sometimes be determined through strategically located excavations into subsurface stratigraphy.

Table 1. Paleontological Sensitivity Criteria

Resource Potential	Definition
Low	Reports in the paleontological literature or field surveys by a qualified professional paleontologist may allow determination that some rock units have 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, only preserve fossils in rare circumstances and 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 impact mitigation measures to protect fossils.
None	Some rock units have no potential to contain significant paleontological resources—for instance, high-grade metamorphic rocks (such as gneisses and schists) and plutonic igneous rocks (such as granites and diorites). Rock units with no paleontological resource potential require neither protection nor impact mitigation measures relative to paleontological resources.

Source: SVP 2010.

3 Regulatory Framework

Paleontological resources are considered non-renewable resources with scientific and educational value and thus are protected by federal, state, and local laws and regulations.

3.1 Federal Laws

Paleontological Resources Preservation Act of 2009

The Omnibus Public Land Management Act, Paleontological Resource Preservation Subtitle (16 USC 470aaa et seq.; known as the Omnibus Act or the Paleontological Resources Preservation Act) directs the Secretaries of the Interior and of Agriculture to manage and protect paleontological resources on federal land using scientific principles and expertise. The Omnibus Act incorporates most of the recommendations of the report of the Secretary of the Interior titled “Assessment of Fossil Management on Federal and Indian Lands” to formulate a consistent paleontological resources management framework. In passing the Omnibus Act, Congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. The Omnibus Act codifies existing policies of the Bureau of Land Management, National Park Service, U.S. Forest Service, Bureau of Reclamation, and the U.S. Fish and Wildlife Service, and provides the following:

- Uniform criminal and civil penalties for illegal sale and transport, and theft and vandalism of fossils from federal lands
- Uniform minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants)
- Uniform definitions for “paleontological resources” and “casual collecting”
- Uniform requirements for curation of federal fossils in approved repositories

Federal legislative protections for scientifically significant fossils apply to projects that take place on federal lands (with certain exceptions, such as the Department of Defense, that continue to protect paleontological resources under the Antiquities Act). Such protections involve federal funding, require a federal permit, or involve crossing state lines.

Antiquities Act of 1906

The Antiquities Act of 1906 (16 USC 431–433) states, in part:

... any person who shall appropriate, excavate, injure or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court.

Although there is no specific mention of natural or paleontological resources in the Antiquities Act, or in the Antiquities Act's uniform rules and regulations (43 CFR Part 3), "objects of antiquity" have been interpreted to include fossils by the National Park Service, Bureau of Land Management, U.S. Forest Service, and other federal agencies. Permits to collect fossils on lands administered by federal agencies are authorized under the Antiquities Act. Therefore, projects involving federal lands will require permits both for paleontological resource evaluation and for mitigation efforts.

Archaeological and Paleontological Salvage

Statute 23 USC 305, Archaeological and Paleontological Salvage, amends the Antiquities Act of 1906. Specifically, it states the following:

Funds authorized to be appropriated to carry out this title to the extent approved as necessary, by the highway department of any State, may be used for archaeological and paleontological salvage in that state in compliance with the Act entitled "An Act for the preservation of American Antiquities," approved June 8, 1906 (PL 59-209; 16 U.S.C. 431-433), and State laws where applicable.

This statute allows funding for mitigation of paleontological resources recovered pursuant to federal aid highway projects, provided that "excavated objects and information are to be used for public purposes without private gain to any individual or organization" (46 FR 9570).

National Registry of Natural Landmarks

The National Natural Landmarks (NNL) Program, established in 1962 (16 USC 461-467), is administered under the Historic Sites Act of 1935. Regulations were first published in 1980 under 36 CFR 1212 and the program was re-designated as 36 CFR 62 in 1981. An NNL is defined as follows (36 CFR 62.2):

... an area designated by the Secretary of the Interior as being of national significance to the United States because it is an outstanding example(s) of major biological and geological features found within the boundaries of the United States or its Territories or on the Outer Continental Shelf.

“National significance” describes the following (36 CFR 62.2):

... an area that is one of the best examples of a biological community or geological feature within a natural region of the United States, including terrestrial communities, landforms, geological features and processes, habitats of native plant and animal species, or fossil evidence of the development of life.

Federal agencies and their agents should consider the existence and location of designated NNLs, and of areas found to meet the criteria for national significance, in assessing the effects of their activities on the environment under Section 102(2)(c) of the National Environmental Policy Act (42 USC 4321). The National Park Service is responsible for providing requested information about the NNL Program for these assessments (36 CFR 62.6[f]). However, other than consideration under the National Environmental Policy Act, NNLs are afforded no special protection. Furthermore, there is no requirement to evaluate a paleontological resource for listing as an NNL. Finally, project proponents (state and local) are not obligated to prepare an application for listing potential NNLs, should such a resource be encountered during project planning and delivery.

Examples of geological and paleontological NNLs in California include the following:

- **Imperial Sand Hills:** Imperial Sand Hills is one of the largest dune patches in the United States. It is an outstanding example of dune geology and ecology in an arid land. (Designated: 1966. Ownership: federal, private.)
- **Eureka Dunes:** Eureka Dunes, located within Death Valley National Park, is an excellent example of aeolian (wind) geological processes. It is the tallest dune complex in the Great Basin biophysiological province. The site contains an endangered grass genus, one species of which is the only plant capable of surviving on and stabilizing the steep dune slopes. (Designated: 1983. Ownership: federal.)
- **Amboy Crater:** Amboy Crater is an excellent example of a recent volcanic cinder cone with an unusually flat crater floor. (Designated: 1973. Ownership: federal, private.)
- **Rainbow Basin:** Composed of deep erosion canyons with rugged rims, Rainbow Basin is an outstanding example of geologic processes. The site also contains significant fossil remains and traces (e.g., footprints) of Miocene plants, insects, and land mammals. (Designated: 1966. Ownership: federal.)

National Historic Preservation Act of 1966

Section 106 of the National Historic Preservation Act (16 USC 470) does not apply to paleontological resources unless the paleontological specimens are found in culturally related contexts (e.g., fossil shell included as a mortuary offering in a burial, or a culturally related site, such as petrified wood locale used as a chipped stone quarry). In such instances the materials are considered cultural resources and are treated in the manner prescribed for the site in question. Mitigation is almost exclusively limited to sites determined eligible for, or listed in, the National Register of Historic Places. Cooperation between the cultural resources and paleontological disciplines is expected in such instances.

3.2 State Laws

California Environmental Quality Act

This paleontological resources evaluation was completed to satisfy the requirements of CEQA. The CEQA Guidelines require that all private and public activities not specifically exempted be evaluated against the potential for environmental impacts, including effects on paleontological resources. Paleontological resources, which are limited, nonrenewable resources of scientific, cultural, and educational value, are recognized as part of the environment under these state guidelines.

Paleontological resources are explicitly afforded protection by CEQA, specifically in Section VII(f) of CEQA Guidelines Appendix G, the “Environmental Checklist Form,” which addresses the potential for adverse impacts to any “unique paleontological resource or site or unique geological feature.” This provision covers scientifically significant fossils, which include, but are not limited to, newly discovered species or genera; fossils exhibiting morphological features not previously recognized for a given animal group; fossils that increase the temporal range of a species; fossils discovered from geological units within which they were previously unknown; fossils that expand the biogeographic range of a species; and/or localities that yield fossils significant in their abundance, diversity, and preservation.

California Public Resources Code Section 5097.5

California Public Resources Code Section 5097.5 states the following:

- (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, rock art, or any other archaeological, paleontological or historical feature, situated on public lands [lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof], except with the express permission of the public agency having the jurisdiction over the lands.
- (b) A violation of this section is a misdemeanor.

California Code of Regulations

The following two sections of the California Code of Regulations (14 CCR Division 3, Chapter 1), applicable to lands administered by the California Department of Parks and Recreation, address paleontological resources:

14 CCR Section 4307 – Geological Features

- (a) No person shall destroy, disturb, mutilate, or remove earth, sand, gravel, oil, minerals, rocks, paleontological features, or features of caves.

14 CCR Section 4309 – Special Permits

The Department [California Department of Parks and Recreation] may grant a permit to remove, treat, disturb, or destroy plants or animals or geological, historical, archaeological or paleontological

materials; and any person who has been properly granted such a permit shall to that extent not be liable for prosecution for violation of the foregoing.

4 Methods

This section describes the techniques employed to identify and evaluate paleontological resources within the Avocado Site and determine the potential for paleontological resources to be recovered during Avocado Site Alternative implementation. All methods conform to federal and state regulations and SVP (2010) guidelines for assessment and mitigation of impacts to significant paleontological resources.

4.1 Geological Map and Literature Review

Published geological mapping and literature and paleontological literature were reviewed to identify geological formations/units and fossil localities in and near the Avocado Site, glean information on their stratigraphic sequence, and determine the paleontological sensitivity of the Avocado Site.

4.2 Paleontological Records Search

A paleontological records search request was sent to NHMLA on January 30, 2023, and an additional paleontological records search was requested from SBMNH on May 28, 2025. The purpose of the museum records searches was to determine whether there are any known fossil localities in or near the Avocado Site, assist in determining the potential for the Avocado Site Alternative to destroy paleontological resources, and aid in determining whether a paleontological resource impact mitigation program is warranted to avoid or minimize potential adverse effects of construction on paleontological resources.

5 Results

5.1 Geological Map and Literature Review

The Avocado Site is within the Transverse Ranges Geomorphic Province, which extends from Point Conception in the west to the San Bernardino Mountains in the east. The province also includes the San Gabriel, Santa Monica, and Santa Ynez Mountains and the offshore San Miguel, Santa Rosa, and Santa Cruz Islands (CGS 2002; Morton and Miller 2006). This geomorphic province structure is east-west trending and is oblique to the normal northwest trend of coastal California.

To avoid redundancies, discussions regarding the lithological characteristics and paleontological sensitivities of geological units/formations that are present within more than one Avocado Site area will be limited to the first mention of the geological unit/formation, as the lithology and paleontological sensitivity remain the same regardless of where the geological unit occurs within the Avocado Site.

The geological ages presented below are from the ICS International Chronostratigraphic Chart (Cohen et al. 2024).

Compressor Station Area

The compressor station area is underlain by Holocene to Pleistocene (recent to approximately 2.6 million years ago [mya]) landslide deposits (map unit Qls), the Pleistocene (approximately 11,700 years ago to 2.6 mya) undivided Santa Barbara claystone (Formation) (map unit Qsb), Pleistocene undivided stream terrace deposits (map unit Qpt), and the Pliocene (approximately 2.6 mya to 5.33 mya) undivided Pico Formation (map unit Tp) (Figure 2, Geologic Map). The landslide deposits are composed of weathered, broken rocks and sediments deposited on land; the Santa Barbara claystone (Formation) and undivided Pico Formation are marine geological units composed of claystone (both units), siltstone, sandstone, and local pebbles (the undivided Pico Formation) (Tan et al. 2003).

The geological units mapped within the compressor station area have produced significant paleontological resources in Ventura County. Landslide deposits are assigned low paleontological sensitivity because any fossils contained within these deposits have been displaced from their original area of deposition and thus are not in situ. However, deeper excavations into landslide deposits can encounter undisturbed strata with high paleontological resource sensitivity. In general, terrestrial Pleistocene deposits, which include the undivided terrace deposits, have yielded important terrestrial vertebrate specimens in Ventura County. In his compilation of Holocene to late Pleistocene vertebrates from California, Jefferson (1991) listed the following taxa from terrestrial Pleistocene deposits in Ventura County: mastodon (*Mammuthus americanus* and *Mammuthus* sp.), mammoth (*Mammuthus* sp.), giant ground sloth (*Paramylodon* sp.), bison (*Bison* sp.), horse (*Equus occidentalis* and *Equus* sp.), and camel (*Camelops* sp.) The marine Santa Barbara claystone and undivided Pico Formation have produced scientifically significant invertebrate and vertebrate fossils. Casanova (1992) discussed the presence of scallop fossils found within the Santa Barbara claystone (Formation), and Fierstine et al. (2012) reported on fossil fishes from the geological unit. Pico Formation fossils include numerous species of fossil invertebrates (Squires et al. 2006); marine mammals, including sea cow (Frederico and McLain 2021); and fishes (Fierstine et al. 2012). The Santa Barbara claystone (Formation) and Pico Formation are assigned high paleontological sensitivity.

Roadway/Utility Corridor

As indicated on Figure 2, the Avocado Site Alternative roadway/utility corridor intersects Holocene (<11,700 years ago) stream terrace deposits (map unit Qht); Holocene to Pleistocene landslide deposits; Pleistocene undivided stream terrace deposits, the Las Posas sandstone (Formation) (map unit Qlp), and Santa Barbara claystone (Formation); and the Pliocene undivided Pico Formation. The Holocene stream terrace deposits typically consist of sandy clays with some gravels and are unconsolidated, and the Pleistocene stream deposits are lithologically similar to these deposits, with the addition of cobbles and some boulders (Tan et al. 2003).

Given the young age of Holocene stream terrace deposits, they do not usually preserve fossils and are assigned low paleontological sensitivity on the surface, increasing with depth, where they may be underlain by older, fossiliferous geological units. The Pleistocene Las Posas sandstone (Formation) is assigned high paleontological sensitivity because of the many fossil mammals recovered from these deposits in Ventura County (Confidential Attachment B; Jefferson 1991). Jefferson (1991) reported mammoth (*Mammuthus* sp.), unidentified fossil elephant (Proboscidea), and horse (*Equus* cf. *occidentalis* and *Equus* sp.) from the Las Posas sandstone (Formation).

Temporary Staging Area

As indicated on Figure 2, the Avocado Site Temporary Staging Area intersects Holocene stream terrace deposits.

5.2 Paleontological Records Searches

The NHMLA records search results letter was received on February 19, 2023, and the SBMNH results were received on June 27, 2025. No fossil localities were reported from within the Avocado Site; however, NHMLA did report one locality from an unknown Pleistocene formation, seven localities from the Las Posas sandstone (Formation), and two localities from the Pleistocene Saugus Formation (map unit Qs), and SBMNH reported numerous Pleistocene (alluvial deposits and the Saugus Formation) fossils from the region and one fossil locality from the sandstone member of the Pico Formation (Confidential Attachment B). The Saugus Formation is not mapped on the surface of the Avocado Site but may underlie some of the younger geological units within the Avocado Site, given that it is mapped a few hundred meters to the west of the Avocado Site Temporary Staging Area. It should be noted that SBMNH cited the geological mapping of Dibblee (1988), which is of the same scale as Tan et al. (2003) but used different names for the geological units. The NHMLA and SBMNH fossil localities are detailed in Table 2.

Table 2. NHMLA and SBMNH Paleontological Records Search Results

Locality Number or Name	Location	Formation or Unit	Taxa	Depth
LACM IP 7373	Hill in Ventura	Unknown Pleistocene unit	Unspecified invertebrates	Unknown
LACM VP 583	West side of Main Aliso Canyon	Las Posas	Horse (<i>Equus</i> sp.)	Surface
LACM VP (CIT) 584	West of Sexton Canyon, northeast of junction of Sexton and Lake Canyons	Las Posas	Horse (<i>Equus</i> sp.)	Surface
LACM IP 42051 –42054, 42915	North and west of the City of Ventura, along U.S. Highway 101	Las Posas	Unspecified invertebrates collected from a shell bed	Unknown
LACM VP 3204	Bluffs on west side of Harmon Canyon	Saugus Formation	Horse (Equidae)	Unknown
LACM VP 6470	Long Canyon, northwest of where Long Canyon enters the Santa Clara Valley	Saugus Formation	Horse (Equidae)	Unknown
Veronica Springs Locality	Approximately 25.5 miles northwest of the Avocado Site	Pleistocene alluvium	Hundreds of unidentified bird bones, mollusks, bryozoans, and a pinecone	Not specified
Not given	Approximately 25 miles northwest of the Avocado Site in Santa Barbara	Pleistocene gravel deposits	Mastodon tooth (<i>Mammut pacificus</i>)	Not specified
Not given	Approximately 27 miles northwest of the Avocado Site	Pleistocene alluvium	Mastodon mandible (<i>Mammut pacificus</i>)	Not specified
Not given	Approximately 33.5 miles northwest of the Avocado Site	Pleistocene alluvium	Mastodon skull (<i>Mammut pacificus</i>)	Not specified

Table 2. NHMLA and SBMNH Paleontological Records Search Results

Locality Number or Name	Location	Formation or Unit	Taxa	Depth
Not given	El Capitan Beach, approximately 42 miles northwest of the Avocado Site	Pleistocene alluvium	Columbian mammoth (<i>Mammuthus columbi</i>)	Not Specified
Not given	Moorpark, approximately 24 miles east of the Avocado Site	Saugus Formation	Southern mammoth (<i>Mammuthus meridionalis</i>), Columbian mammoth, western horse (<i>Equus occidentalis</i>), large-headed llama (<i>Hemiauchenia macrocephala</i>), cottontail rabbit (<i>Sylvilagus</i> sp.), pocket gopher (<i>Thomomys</i> sp.), pocket mouse (<i>Perognathus</i> sp.), kangaroo rat (<i>Dipodomys</i> sp.), harvest mouse (<i>Reithrodontomys</i> sp.), woodrat (<i>Neotoma</i> sp.), and Mead's pine mouse (<i>Pitymys meadensis</i>)	Not specified
Not given	Moorpark, approximately 24 miles east of the Avocado Site	Saugus Formation	mastodon (<i>Mammuthus pacificus</i>)	Not specified
Not given	Happy Camp Regional Park, approximately 27 miles east of the Avocado Site	Sandstone member of the Pico Formation	Unidentified baleen (Mysticeti) whale skull	Not specified

Notes: NHMLA = Natural History Museum of Los Angeles County; SBMNH = Santa Barbara Museum of Natural History; LACM = Los Angeles County Museum; IP = Invertebrate Paleontology; VP = Vertebrate Paleontology; CIT = California Institute of Technology.

6 Summary

No paleontological resources were identified from within the Avocado Site or within the 1-mile-radius buffer around the proposed Avocado Site as a result of the institutional records searches and desktop geological and paleontological review. However, numerous paleontological resource localities were identified in the vicinity of the Avstaginocado Site.

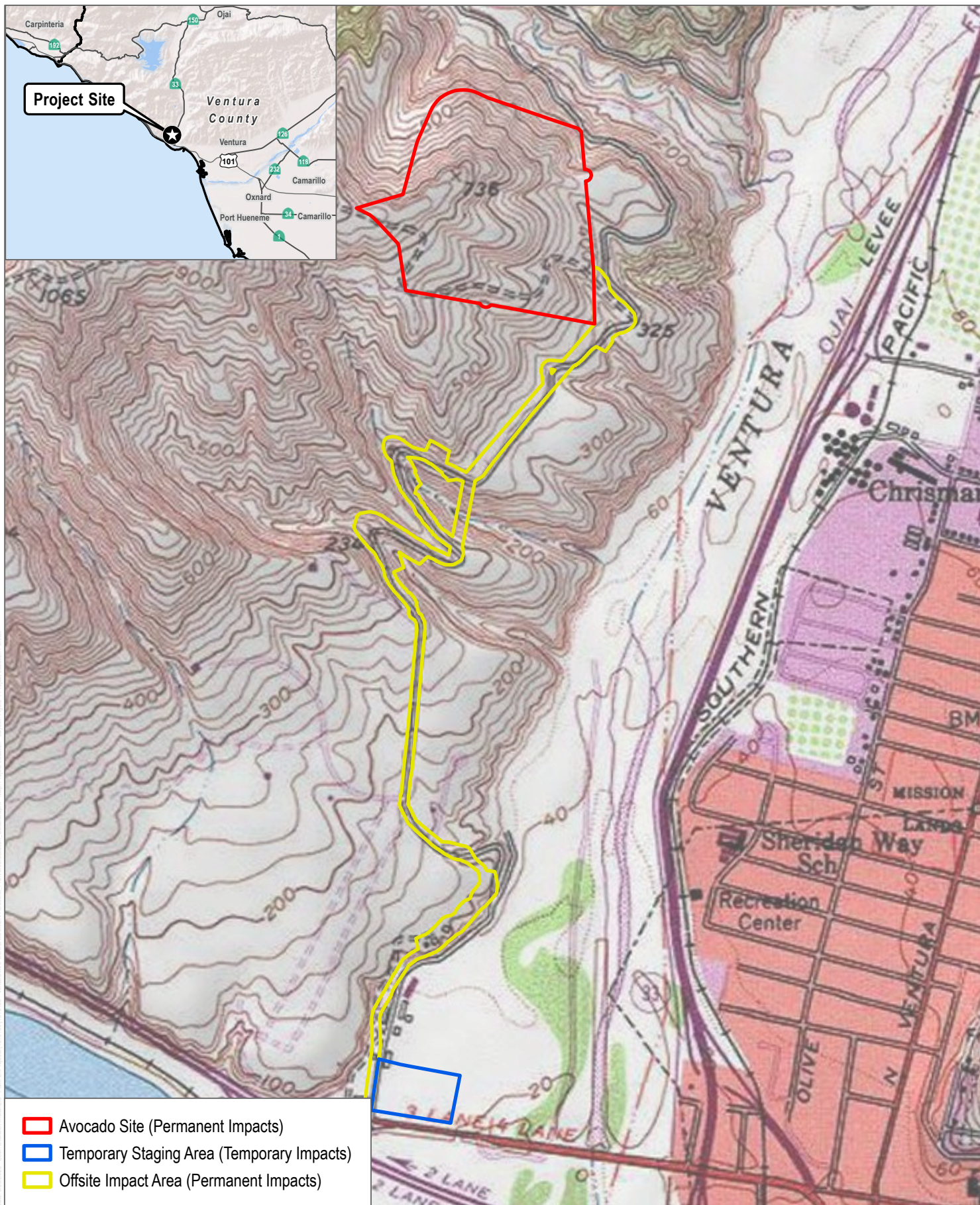
7 References

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Attachment A

Figures



Attachment B

NHMLA and SBMNH Records Search Results -
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