PALEONTOLOGICAL RESOURCES IDENTIFICATION AND EVALUATION REPORT

FOR

STATE ROUTE 74 WIDENING PROJECT

CITY OF SAN JUAN CAPISTRANO

ORANGE COUNTY, CALIFORNIA

DISTRICT 12 – ORA – 74, KP 1.7/3.0 (PM 1.0/1.9)
EA No. 086920

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SUMMARY OF FINDINGS

The State of California Department of Transportation (Department) proposes to widen State Route 74 (SR-74) from two lanes to four lanes from Calle Entradero in the City of San Juan Capistrano (City) to the eastern City limits at the City/County boundary. The area of disturbance covers all areas to be impacted by construction of the proposed project, including areas for access, temporary construction easements, and temporary construction signage. No specific areas for construction staging are identified within the project limits. Staging may occur within the highway right-of-way (ROW) where feasible.

The study area contains five types of sediments: artificial fill, young alluvium, older alluvium, the late Miocene to Early Pliocene Capistrano Formation, and the Middle to Late Miocene Monterey Formation. Neither the artificial fill nor young alluvium are sensitive for paleontological resources. However, the three remaining sediments do have the potential to contain significant nonrenewable paleontological resources. Recommendations from the California Environmental Quality Act (CEQA), and guidelines from the Department and the County are consistent with recommendations of the Society of Vertebrate Paleontology (SVP) and indicate that impacts to nonrenewable paleontological resources must be considered during project design and construction within sensitive sediments. The literature review and records searches conducted through museums and data maintained at LSA Associates, Inc. (LSA) produced information showing that sediments dating from the Middle Miocene to the Pleistocene Period within the project have the potential to contain significant nonrenewable paleontological resources. Thus, it is likely that paleontological localities will be encountered during the project excavation phase within these sediments.

This study reviews definitions of paleontological significance and definitions for rock units to have high potential and high sensitivity for the presence of nonrenewable paleontological resources. The results of the research and a field survey conducted for this project show that fossiliferous sediments deposited during the last 17.5 million years may be encountered during excavation in undisturbed soils. Most of these sensitive sediments are located on the north side of the project, primarily in the areas where retaining walls will be constructed. A small area on the south side of the project may encounter sensitive sediments during installation of sound walls.

In order to reduce impacts to any paleontological resources that may be present within the study area, it is recommended that a Paleontological Mitigation Plan (PMP) be prepared that follows the guidelines of the Department, the County of Orange, and the SVP. These recommendations include:

- A preconstruction field survey should be conducted, followed by salvage of any observed surface paleontological resources prior to the beginning of grading.
- Attendance at the pregrade meeting by a qualified paleontologist or his/her representative. At this meeting the paleontologist will explain the likelihood for encountering paleontological resources, what resources may be discovered, and the methods that will be employed if anything is discovered (see below).

- During construction excavation, a qualified vertebrate paleontologic monitor shall initially be present on a full-time basis whenever excavation will occur within the sediments that have a high sensitivity rating and on a spot-check basis in sediments that have a low sensitivity rating. Monitoring may be reduced to a part-time basis if no resources are being discovered in sediments with a high sensitivity rating (monitoring reductions and when they occur will be determined by the qualified Principal Paleontologist). The monitor shall inspect fresh cuts and/or spoils piles to recover paleontological resources. The monitor shall be empowered to temporarily divert construction equipment away from the immediate area of the discovery. The monitor shall be equipped to rapidly stabilize and remove fossils to avoid prolonged delays to construction schedules. If large mammal fossils or large concentrations of fossils are encountered, the Department shall consider using heavy equipment on site to assist in the removal and collection of large materials.
- Localized concentrations of small (or micro-) vertebrates may be found in all native sediments. Therefore, it is recommended that these native sediments occasionally be spot-screened through one-eighth to one-twentieth-inch mesh screens to determine whether microfossils are present. If microfossils are encountered, additional sediment samples (up to 3 cubic yards, or 6,000 pounds) shall be collected and processed through one-twentieth-inch mesh screens to recover additional fossils.
- Any recovered specimens shall be prepared to the point of identification and permanent preservation. This includes the picking of any washed mass samples to recover small invertebrate and vertebrate fossils, the removal of surplus sediment from around larger specimens to reduce the volume of storage for the repository and the storage cost, and the addition of approved chemical hardeners/stabilizers to fragile specimens.
- Specimens shall be identified to the lowest taxonomic level possible and curated into an institutional repository with retrievable storage. The repository institutions usually charge a one-time fee based on volume, so removing surplus sediment is important. The repository institution may be a local museum or university that has a curator who can retrieve the specimens on request. The Department requires that a draft curation agreement be in place with an approved curation facility prior to the initiation of any paleontological monitoring or mitigation activities.

By following the above guidelines, impacts to nonrenewable paleontological resources will be reduced to levels that are less than significant. During the development of the PMP, additional measures may be added; this list is only meant to provide a summary of what may be involved.

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PROJECT SUMMARY

PROJECT LOCATION

The State of California Department of Transportation (Department) proposes to widen State Route 74 (SR-74) from two lanes to four lanes from Calle Entradero in the City of San Juan Capistrano (City) to the eastern City limits at the City/County boundary (Figure 1). SR-74, also known as Ortega Highway, is a major east-west arterial in south Orange County extending from Interstate 5 (I-5) in the City of San Juan Capistrano northeast to Riverside County, where it intersects with Interstate 15 (I-15). SR-74 then extends further northeast toward the City of Palm Desert in Riverside County.

The existing SR-74 alignment in the vicinity consists of four through lanes from I-5 to approximately 100 meters (m) (330 feet [ft]) east of Calle Entradero, where it transitions to two through lanes. The proposed project would widen SR-74 from two lanes to four through lanes from Calle Entradero, Kilometerpost (KP) 1.6 (Postmile [PM] 1.0) in the City to the City/County line, KP 3.0 (PM 1.9). The total length of the project is approximately 1.3 kilometers (km) (0.9 mile [mi]).

Five roadways intersect with SR-74 from the south within the project limits: Calle Entradero, Via Cordova, Via Cristal, Via Errecarte, and Avenida Siega. North of SR-74, Via Cordova becomes Hunt Club Drive and Avenida Siega becomes Shade Tree Lane. Additionally, to the north, Palm Hill Drive and Toyon Drive provide access to private property. In addition, sidewalks have been partially constructed through the project area. The north sidewalk currently terminates at Palm Hill Drive, and the south sidewalk currently terminates just east of Avenida Siega.

The project is also known as the Lower-74 widening. As part of the widening, portions of the hillside to the north will be excavated into to build retaining walls and realign driveways. The study area for the project is larger than the current area of direct effects and consists of a 100 m (328 ft) radius beyond the area of direct impacts (ADI); this larger study area was selected to accommodate minor changes to the project design that may require excavation in additional areas.

The study area is located on the United States Geological Survey (USGS) *San Juan Capistrano, California* 7.5-minute topographic quadrangle (1968, photorevised 1981) in portions of Section 32, Township 7 South; Range 7 West; and Sections 5 and 6; Township 8 South, Range 7 West San Bernardino Base Line and Meridian (SBBM). The location of the project and the project vicinity are shown on Figure 1.

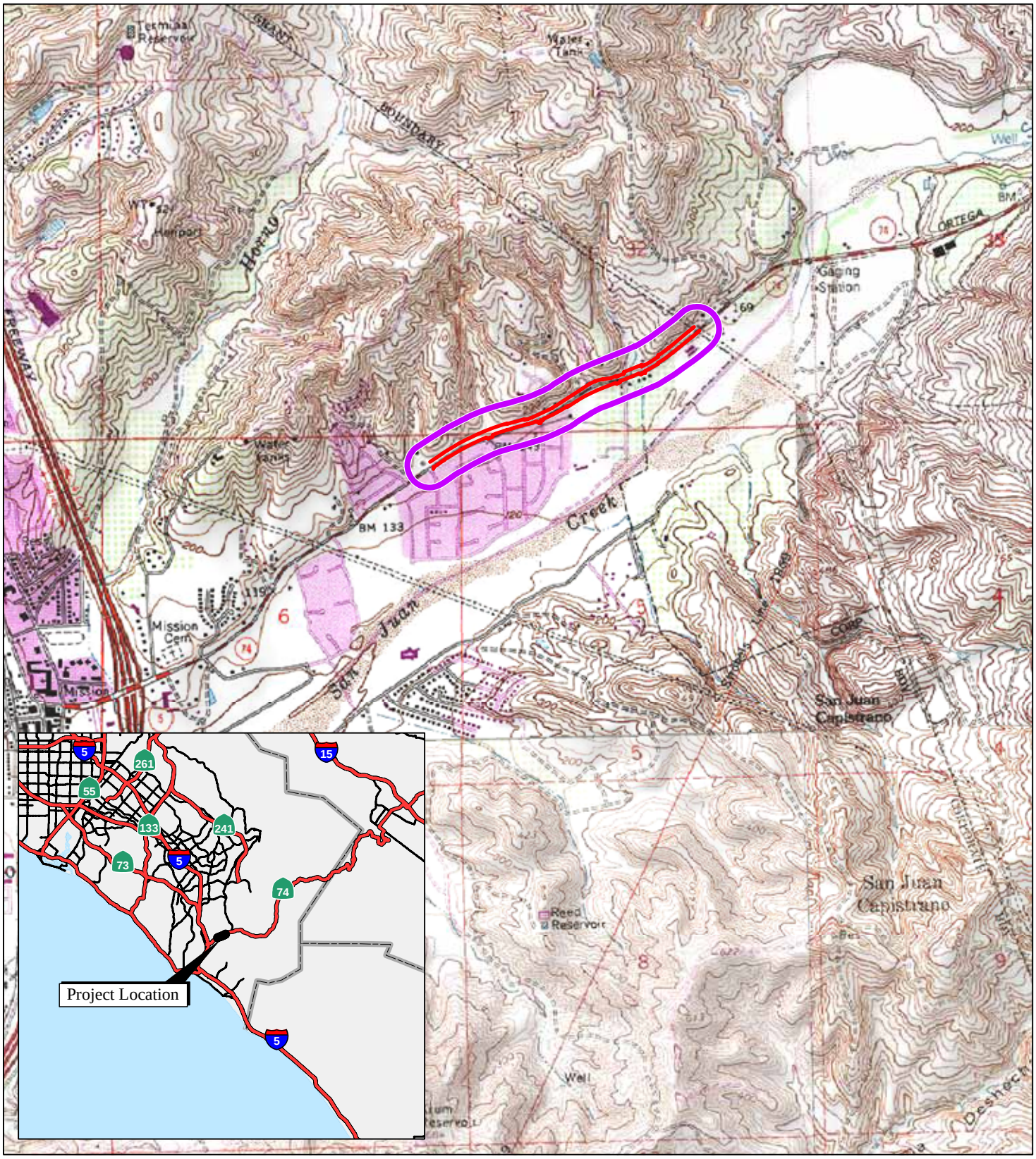

FIGURE 1

Lower SR-74 Widening Project

Project Location Map

12-ORA-74 PM 1.0/1.9 (KP 1.7/3.0)
EA# 086920

SOURCE: USGS 7.5'QUADS - DANA POINT ('75), SAN JUAN CAPISTRANO ('81); CALIF.

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SUMMARY OF EXCAVATION PARAMETERS

The SR-74 widening project runs in a northeast/southwest direction roughly following the trend of San Juan Creek. Construction of the project improvements will require excavation into the hillside that forms the northern edge of San Juan Canyon. Preliminary data regarding the extent of excavation suggests that it may extend up to 30.5 m (100 ft) to the northwest from the existing northwest shoulder. In addition, excavation will occur for the construction of footings for sound walls on the south side of the road and retaining walls on the north side of the road. Several existing driveways on the north side of the project will have to be realigned as well. Since the study area includes exposures of several sediment types, from native sediments to artificial fill, this report addresses the potential for impacts to all sediments, native or artificial, that may be disturbed by the project. There are currently two build alternatives as well as a no build alternative. These are discussed below.

Build Alternatives 1 and 2

The following project features are common design elements for both Build Alternatives 1 and 2.

Currently, there are two 3.7 m (12 ft) lanes in each direction and no median throughout the project area. The Build Alternatives would provide one additional 3.7 m (12 ft) wide lane in each direction, as well as a 3.7 m (12 ft) wide painted median. A 1.5 m (5 ft) wide paved shoulder would be provided on each side of the roadway to accommodate Class II (striped on-road) bicycle facilities, except from Avenida Siega to the City/County limits, where it would transition to a 2.4 m (8 ft) wide shoulder to merge with the County portion of the project. The edge of the pavement would have concrete curbs on each side of the roadway. The proposed additional lanes, shoulders, median, drainages, driveways, and sidewalk have been developed consistent with the standards in the Department's Highway Design Manual. No specific areas for construction staging are identified within the project limits. Staging may occur within the highway right-of-way (ROW) where feasible.

Intersection Improvements. There are five roadways that intersect with SR-74 from the south within the project limits: Calle Entradero, Via Cordova, Via Cristal, Via Errecarte, and Avenida Siega. North of SR-74, Via Cordova becomes Hunt Club Drive, and Avenida Siega becomes Shade Tree Lane. Additionally, to the north, Palm Hill Drive and Toyon Drive provide access to private property. Each intersection would be modified/widened to accommodate the additional lanes, median, and shoulders. At intersections where there are existing right-turn pockets (Via Cordova and Via Cristal), the right-turn pocket would remain. No new intersections are proposed, and no existing intersections are proposed to be signalized.

Driveways. On the north side of SR-74 within the project limits, there are 11 existing driveways. Each of the 11 driveways would be modified to meet the grade of the widened roadway and to include reconstruction of the curb return. These driveways would be designed and built to Department standards in order to maintain sight distance and to avoid safety issues. Along the southside east of the project limits, there are currently two paved driveways. These would be paved and modified to be compliant with the Americans with Disabilities Act (ADA). No new driveways are proposed.

The parcel on the north side of SR-74 with the existing unpaved driveway located east of Shade Tree Lane and approximately 91.4 m (300 ft) west of the City/County limits was subdivided according to a parcel map recorded on August 29, 1979, in the Office of the Orange County Recorder. The vehicular access rights for these parcels, which abut SR-74, were offered for relinquishment and were accepted by the City. The parcel map also created legal access for those parcels to SR-74 through Shade Tree Lane. Alternatives 1 and 2 would construct a retaining wall that would prevent access to SR-74 at this location.

Pedestrian and Bicycle Facilities. The existing sidewalk on the south side of SR-74 would be maintained in its current location with the exception of a portion of sidewalk at the intersection of Via Cordova, where the sidewalk would be shifted to the south and reconstructed to provide for the right-turn pocket at this intersection. A new sidewalk would be constructed to the east beyond Avenida Siega and would connect to the County sidewalk system to provide continuity. In addition, Class II bicycle facilities are planned and would be provided on each side of the roadway as part of the 1.5 m (5 ft) wide paved shoulders throughout the project limits.

Cut and Fill. The roadway widening within the project limits would require cut slopes and retaining walls on the north side of SR-74. Improvements on the south side of SR-74 would be limited to two sound walls that would be constructed on piles that are drilled approximately 6.1 m (20 ft) deep. The exception to this is an approximately 213.4 m (700 ft) section of roadway east of Avenida Siega that would be widened to the south by constructing a fill slope up to 2.4 m (8 ft) high.

As a part of the project, five to seven retaining walls are planned on the north side of SR-74. The retaining walls would be up to 7.6 m (25 ft) high and are anticipated to be founded on piles that are drilled to a depth of approximately twice the wall height. Minor cut slopes (i.e., less than 1.5–3 m [5-10 ft] high) would occur on the north side of SR-74 in areas where sufficient area is available. The designed fill slopes on the south side of SR-74 would require toe-of-slope keyways approximately 0.9–1.5 m (3–5 ft) deep by 4.6 m (15 ft) wide. The designed cut slopes on the north side of SR-74 would require buttress keyways approximately 0.9–1.5 m (3–5 ft) deep by 4.6 m (15 ft) wide.

Drainage Improvements. Since most of the widening would occur on the north side of SR-74, all existing drainage facilities would be modified and extended to intercept flows at the proposed edge of pavement. An additional 10 drainage systems would be added on the north side of SR-74 throughout the project limits. There would be no drainage systems added to the south side. However, existing drainage on the south side from Avenida Siega, where widening would occur to the City/County line, would be modified to intercept flows at the proposed edge of pavement.

Retaining Walls and Sound Walls. There are four types of retaining walls under consideration, all of which are designed to meet Department Division of Structures requirements. They are: (1) Type 1 retaining wall; (2) soil nail wall; (3) soldier pile wall; and (4) secant/tangent wall. During the design phase the wall type will be finalized. However, vertical walls with slump block finish are proposed. The front of the walls facing SR-74 would be covered with landscape materials to meet the City's aesthetic requirements and to blend the engineered structures into the natural environment.

The noise study recommended noise abatement measures to protect the residences on the south side of SR-74. Two sound walls are proposed on the south side of SR-74, spanning two consecutive blocks. One sound wall would start at Via Cordova and end at Via Cristal and the other sound wall would start at Via Cristal and end at Via Errecarte. Both sound walls would follow the alignment of the existing garden wall and construction would occur from the highway side, thereby requiring minimal removal of existing vegetation. The height of the sound walls would be 4.3 m (14 ft).

Signals and Lighting. Currently, there are no traffic signals within the project limits. This project does not warrant any signals at the existing intersections. However, in the future, should there be a need for a signal/pedestrian crossing, the current design does not preclude the opportunity to install a signal. All streetlights affected by the widening of SR-74 would be relocated and replaced in kind.

Utilities. All utilities such as power, gas, sewer, and telephone lines impacted by this project would be relocated or replaced in kind within the project limits.

Landscaping. North of SR-74, in locations where retaining walls are proposed, new landscaping is proposed in front of the retaining walls. This proposed landscaping, with input from the City, would be designed to blend with the natural environment. From Calle Entradero to Hunt Club Drive, new landscaping is proposed along the north side of SR-74, where the existing sidewalk would be removed. This landscaping would match the existing landscape of the area. South of SR-74, the type of sound wall would be determined during final design and would be selected to result in minimal construction disturbance to reduce vegetation removal. Any vegetation that is removed south of SR-74 would be replaced with vegetation wherever there is an opportunity and with coordination with the City.

Pavement Rehabilitation. The project would also rehabilitate the existing pavement. The remaining existing pavement would be ground and overlaid with new asphalt concrete (AC) pavement to provide adequate strength to accommodate the projected traffic demand.

Build Alternative 1 Specific Project Features

Highway Widening. Build Alternative 1 would be constructed on both the north and south sides of SR-74, but primarily on the north side, to minimize removal of mature trees and the existing sidewalk on the south side of SR-74. This alternative would result in the roadbed changing from the current varying width of 19 m (62.3 ft) at Calle Entradero and 7.5 m (24.6 ft) at the City/County Line to a width varying from 21.3 to 23.2 m (70 to 76 ft), including lanes, shoulders, and median.

In order to minimize impacts to the existing City parkway and equestrian trail from Alternative 1, the Department and the City decided to eliminate the sidewalk on the north side of the street from Calle Entradero to Palm Hill Drive, a length of 321.9 m (1,056 ft) of sidewalk.

Retaining Walls and Sound Walls. For Build Alternative 1, five retaining walls are proposed to accommodate the widening improvements on the north side of SR-74. The first retaining wall would begin east of Hunt Club Drive and end west of Palm Hill Drive. The second retaining wall would run east of Palm Hill Drive and end at the terminus of the driveway opposite Via Cristal. The third retaining wall would start at Station 91+20 and would be 30.4 m (100 ft) in length. The fourth retaining wall would start approximately 61 m (200 ft) east of Toyon Drive and would be 70.1 m (230 ft) long. The fifth retaining wall would be the longest at 259 m (850 ft). It would start at Shade Tree Lane and extend to the end of the project limits at the City/County line. These retaining walls would vary in height from 1.5 to 7.6 m (5 to 25 ft).

Build Alternative 2 Specific Project Features

Highway Widening. Build Alternative 2 would widen SR-74 primarily on the north side to minimize removal of mature trees and to avoid removal of the existing sidewalk on the south side of SR-74. This alternative would result in the roadbed changing from the current varying width of 19 m (62.3 ft) at Calle Entradero and 7.5 m (24.6 ft) at the City/County Line to a width varying from 23.8 to 24 m (78 to 79 ft), including lanes, shoulders, and median.

The sidewalk on the north side of SR-74 between Calle Entradero and Via Cordova would be reconstructed to the north of its existing location. The existing meandering sidewalk would be reconstructed as a straight sidewalk (not curvilinear) within the existing public ROW. A short retaining wall would be required at some locations along the existing limit of the public ROW, which is delineated by the south side edge of the existing equestrian trail. With this alternative, most (if not all) trees within this section of the roadway would be removed as a part of the construction.

Retaining Walls and Sound Walls. For this Build Alternative, seven retaining walls are proposed to accommodate the widening improvements on the north side of SR-74. The first retaining wall would begin east of the Hunt Club Drive entrance at Calle Entradero at Station 73+71 and end at Station 74+25. The second retaining wall would begin at Station 77 and end at Station 78+40. The third retaining wall would begin east of Hunt Club Drive and end west of Palm Hill Drive. The fourth retaining wall would run east of Palm Hill Drive and end at the terminus of the driveway opposite Via Cristal. The fifth retaining wall would start at Station 91+20 and would be 30.4 m (100 ft) in length. The sixth retaining wall would start approximately 61 m (200 ft) east of Toyon Drive and would be 70.1 m (230 ft) long. The seventh retaining wall would be the longest at 259 m (850 ft). It would start at Shade Tree Lane and extend to the end of the project limits at the City/County line. These retaining walls would vary in height from 1.5 to 7.6 m (5 to 25 ft)

The proposed Build Alternative 2 would minimize impacts to noise, visual, and cultural resources by implementing noise abatement measures, shifting the widening of the alignment to the north, and avoiding a masonry wall at the locally designated historic site, Hankey-Rowse House, located at the intersection of SR-74 and Via Cristal.

No Build Alternative

The No Build Alternative would not include any improvements to the project. SR-74 traffic would flow at approximately 35 miles per hour (mph) or below and result in significant delays. SR-74 would be maintained in its existing two-lane condition and would continue to be used by commuters, recreation traffic, and commercial trucks.

PURPOSE OF INVESTIGATION

Significant nonrenewable paleontological resources, including vertebrate fossils and unique or scientifically important invertebrate fossils and remains of fossil plants, are recognized as important resources by the State of California and the Federal Government (Appendix A).

The paleontological records search and field assessment were conducted pursuant to the California Environmental Quality Act (CEQA); Public Resources Code (PRC) 21000 (Division 13); California Code of Regulations (CCR) 15000 (Title 14, Division 3, Chapter 1); CEQA Appendix G; PRC 5097.5. The assessment documents the potential for paleontological resources older than 10,000 years to occur in the study area. According to the Department's Standard Environmental Reference (SER) Volume 1, Chapter 8,[1] the usual approach to addressing project-related paleontological resources involves three steps that include identification, evaluation, and, if necessary, mitigation. These three steps generally entail preparation of several documents that include: (1) a Paleontological Identification Report (PIR); (2) a Paleontological Evaluation Report (PER); and if a potential for encountering significant resources is determined, (3) a Paleontological Mitigation Plan (PMP). At the conclusion of grading, two additional documents may need to be prepared: a Paleontological Mitigation Report (PMR) and a Paleontological Stewardship Summary (PSS). Per CEQA, the County also may require the preparation of a paleontological resource impact mitigation program (PRIMP) to reduce impacts to paleontological resources to a less than significant level. The Department's PMP will meet the County's definition of a PRIMP, as it will entail equivalent mitigation measures.

[1] Available on the Web at http://www.dot.ca.gov/ser/vol1/sec3/physical/Ch08Paleo/chap08paleo.htm.

METHODS

To ensure that research was comprehensive, the paleontological resources "study area" was expanded to a 100 m (328 ft) radius beyond the project ADI. Prior to the field survey, research was conducted to locate fossil localities both within the project area and in an area much larger than the study area. Research focused on locating sediments and formations conducive to the preservation of paleontological resources, including review of available geological and paleontological literature concerning or related to the formations that are likely to be encountered during excavation for this project and requests for paleontological locality data from Southern California museums in the vicinity of the project.

LITERATURE REVIEW AND RECORDS SEARCH

A paleontological literature review was conducted for the proposed project using unpublished reports, paleontological assessment and monitoring reports, field notes, published literature, and maps. A paleontological resource records search was conducted through the Natural History Museum of Los Angeles County (LACM) and through the University of California Museum of Paleontology (UCMP) in Berkeley, California. Paleontological resource locality forms housed in these institutions record fossil localities in sediments equivalent in age to these on the proposed project. As geologic formations and units can be exposed over large geographic areas but contain similar lithologies and fossils, the literature review and fossil locality search includes areas well beyond the study area.

The purpose of the locality search was to establish the status and extent of previously recorded paleontological resources within and adjacent to the project ADI. With this knowledge, LSA could make an informed assessment of the potential effects of the proposed project on paleontological resources and evaluate the types of fossils that might be uncovered during ground-disturbing activities. In addition, the sensitivity of the sediments expected to be encountered within the project could be determined.

Appendices B and C contain a summary of the records search results.

FIELD INSPECTION

Pedestrian Survey

A pedestrian survey of the proposed project ADI was conducted by paleontologists Meredith Staley and Vanessa Rhue on April 10, 2008. The surveyors examined the proposed areas of excavation, paying special attention to areas where bedrock might be exposed in existing road cuts or in rodent burrows. As the area is developed and contains some private property, the survey was restricted to areas that were not built on or were not fenced off.

The purpose of this survey was to confirm the accuracy of the geologic mapping and to identify whether any paleontological resources might be exposed on the surface. In this way, LSA could

document the existence of paleontological material prior to the beginning of ground-disturbing activities and locate areas within the project that might contain abundant remains.

Key Personnel

Brooks R. Smith, LSA paleontologist and County of Orange Certified Paleontologist, completed the paleontological resource literature review and report preparation. Mr. Smith (Appendix D) is a paleontological project manager at LSA's Irvine office. He has 16 years of experience with paleontological salvage programs and has extensive experience collecting paleontological resources as well as writing paleontological assessment reports; surveying for paleontological resources; salvage of large fossil specimens; fossil identification and curation; and final mitigation monitoring reports at the conclusion of construction projects.

This report was reviewed by Steven W. Conkling, a County of Orange Certified Paleontologist who has worked at LSA for 16 years. He has also prepared numerous paleontological assessment and mitigation monitoring reports. Mr. Conkling also worked as the Museum Director for Clark Interpretive Center, County of Orange, for 7 years prior to joining LSA. He is a research associate or a member of several local museums and scientific societies, including the Orange County Natural History Museum, Los Angeles County Museum of Natural History, San Bernardino County Museum, Mojave Desert Quaternary Research Society, and the Society of Vertebrate Paleontology. Mr. Conkling's resume is included in Appendix D.

Meredith Staley, LSA Paleontologist, was the lead field surveyor for the project. Ms. Staley has been the director of the archaeology and paleontology laboratory for LSA's Irvine office for the past 3 years. Prior to coming to LSA, first as a student intern in 2001, then full time in 2003, she was a student curator at the paleontology lab at California State Polytechnic University, Pomona, for 2 years. In addition to working at LSA, Ms. Staley also works as a vertebrate paleontology preparator at the Los Angeles County Natural History Museum. She has also volunteered as a preparator at the George C. Page Museum of La Brea Discoveries in Los Angeles. She has worked on all aspects of paleontology analysis while at LSA, including: preparing assessment reports; surveys; mitigation monitoring; fossil salvage; fossil preparation, identification, and curation; and writing mitigation monitoring reports.

RESULTS

LOCALITY SEARCH

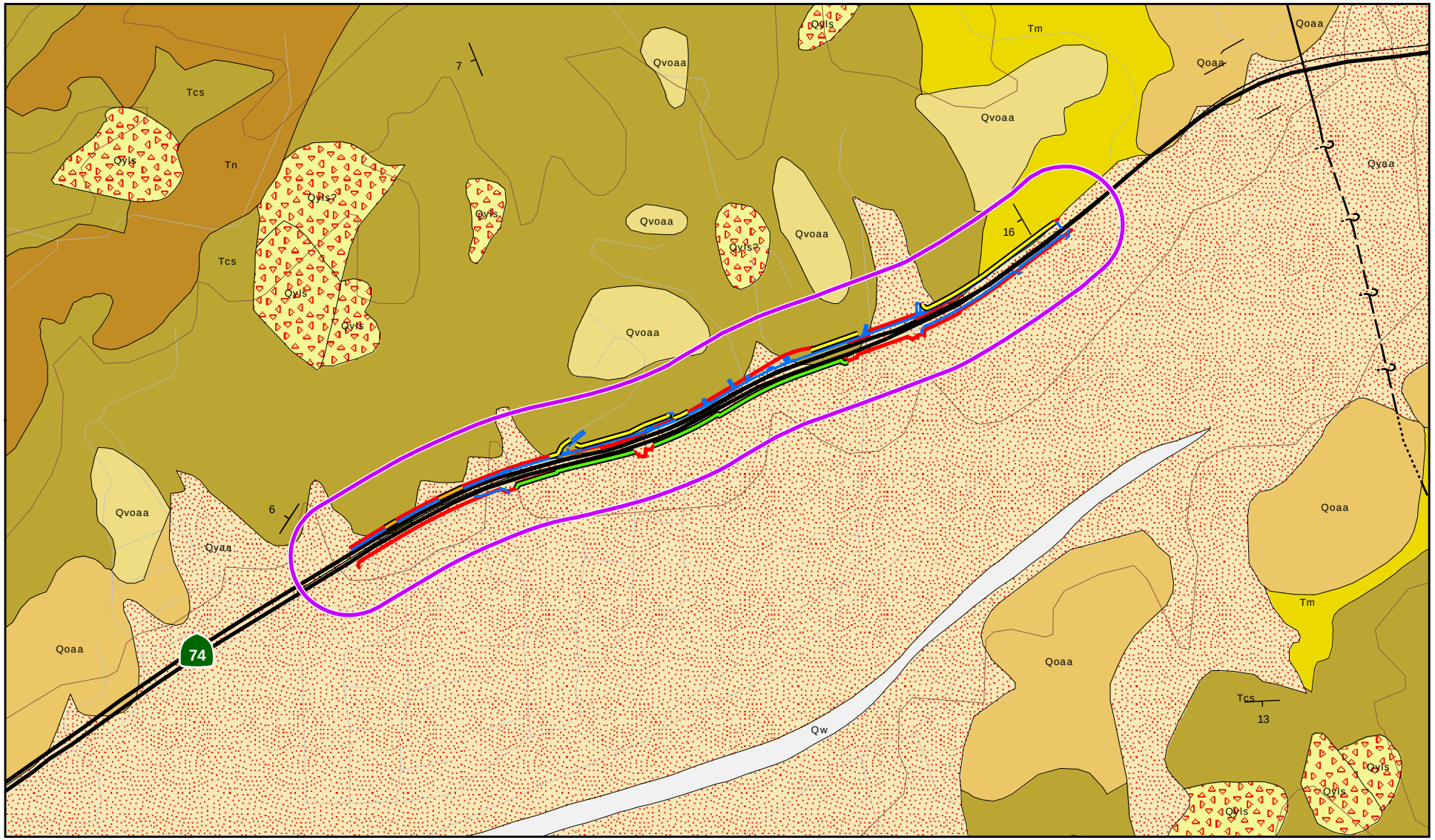
Geology

The proposed SR-74 widening project is located at the northern end of the Peninsular Range geomorphic province, a 1,450 km (900 mi) long northwest-southeast-trending structural block that extends from the tip of Baja California to the Transverse Ranges and includes Los Angeles Basin (Norris and Webb, 1976). The total width of the province is approximately 362 km (225 mi), with a maximum landbound width of 105 km (65 mi) (Sharp, 1976). It contains extensive pre-Cretaceous (more than 65 million years ago) igneous and metamorphic rocks covered by limited exposures of post-Cretaceous sedimentary deposits. Within Orange County, these post-Cretaceous sedimentary deposits are believed to be some of the most important Tertiary marine fossil-producing areas in the world due to the completeness of the geologic record and general abundance of the fossils (Raschke, 1984). Belyea and Minch (1989) report that the Santa Ana Mountains contain exposures of the most complete section of Late Mesozoic and Cenozoic (approximately 150 million years ago to the present) stratigraphy in the entire Peninsular Ranges.

Geologic mapping (Morton 2004) indicates that the current alignment of Ortega Highway is located on sediments of Holocene Alluvium and Late Miocene Monterey formation (Figure 2). During excavation for the project, sediments from Holocene Alluvium, Late Miocene Capistrano Formation, and the Middle Miocene Monterey Formation will likely be encountered. Within the 100 m (328 ft) study area are also sediments from Early to Middle Pleistocene older alluvium, although in the current project design, these will likely not be encountered. Table A lists the ages for the Formations and units exposed within the study area. These units are described in more detail below and are depicted on Figure 2. Each of these sediments is described in more detail below.

Table A: Geologic Time Periods and Geologic Units within the Study Area

Epoch	Age (years)	Geologic Formation/Unit	Map Symbol
Quaternary Period			
Holocene	Less than 10,000	Young alluvium	Qya
Pleistocene	10,000–2 million	Older alluvium	Qvoa
Tertiary Period			
Late Miocene to Early Pliocene	8–10 million	Capistrano Formation – Siltstone Member	Tcs
Middle Miocene	10–12 million	Monterey Formation	Tm



Study Area
(Project Area with 100 meter Buffer)
Existing Right-of-Way
Project Improvements
Retaining Wall
Sound Wall
Retaining Wall
(Only represented in Alternative 2)

Contact, approx. located
Contact, certain
Fault, certain
Fault, concealed
Fault, inferred

Strike and Dip of Beds
70 Inclined

Geologic Units
Young alluvium, arenaceous (Qyaa)
Very old alluvium, arenaceous (Qvoaa)
Capistrano Formation, siltstone facies (Tcs)
Monterey Formation (Tm)

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SOURCE: Morton (2004).

FIGURE 2

Lower SR-74 Widening Project

Study Area Geology

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EA# 086920

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Monterey Formation. The Monterey Formation is a well-studied rock unit that is found along the west coast of North America. It was named after exposures near Monterey, California, a little over 482 km (300 mi) to the northwest of the study area. It is famous for its rich petroleum reserves that were formed from the abundant organic matter, primarily microscopic diatoms, contained within the sediments. In general, the Monterey Formation is composed primarily of deep marine deposits of diatomite, diatomaceous siltstone, mudstone, dolostone, and chert. The upper section of the marine Monterey Formation is Middle to Late Miocene (Luisian and Mohnian) and possibly older in the lower section (Morton et al., 1974). South of the Orange/San Diego County line, Ehlig (1979) reports that the basal Monterey consists of conglomerates and coarse-grained sandstones derived from the underlying San Onofre Breccia. Sandstone and siltstone can range from thinly to massively bedded. Some of the shale contains very thin, well-developed bedding that is locally rhythmic.

Locally, along the coastline, the Monterey Formation is approximately 366 m (1,200 ft) thick, thinning to 91.4 m (300 ft) as it moves inland (Smith, 1960). It unconformably overlies the Sespe, Vaqueros, San Onofre Breccia, and Topanga Formations. Locally, however, it has a gradational and interfingering contact with the San Onofre Breccia. It has a gradational contact with the overlying Capistrano Formation east of Oso Creek; elsewhere, it is unconformably overlain by the Niguel Formation, Marine Terrace Deposits, and nonmarine terrace deposits. It is widespread in the southern coastal ranges of California, but in Orange County is exposed only in the southern portion of the County.

It correlates with the parts of the Puente Formation in the central to northern Santa Ana Mountains and Puente Hills of Orange County and the Modelo Formation of Los Angeles County. Vedder et al. (1957) have made an arbitrary boundary between the Monterey and correlative members of the Puente. East of the Cristianitos Fault, Oso Creek is the boundary; west of the Cristianitos Fault, a general east-west line from near Lambert Reservoir to the Cristianitos Fault is the boundary.

The Capistrano Formation. The Capistrano Formation is a Late Miocene to Early Pliocene marine deposit that was named by Woodford (1925) for exposures in the vicinity of San Juan Capistrano. It was deposited in an ancient marine embayment of moderate depths. The formation is composed of a thick marine succession of mudstone, shale, siltstone, and minor silty sandstone and concretion layers. It has been divided into three distinct members: a Siltstone Member, a primarily sandy member known as the Oso Member, and a Turbidite Facies. The member exposed within the project area is the Siltstone Member.

The Siltstone member is yellowish gray to medium brownish gray concretionary siltstone and mudstone with lenticular whitish gray sandstone and thin calcareous mudstone interbeds. This member can be locally diatomaceous and tuffaceous and may contain breccia or conglomerate at its base (Morton et al., 1976). The Siltstone Member of the Capistrano Formation is mostly poorly bedded to massive and has a maximum thickness of approximately 2,400 ft (Yerkes et al., 1965). It appears to have a gradational contact with the underlying Monterey Formation in most areas and an unconformable contact west of Oso Creek. The contact with the overlying Niguel Formation has a marked unconformity except in upper Newport Bay. It grades laterally into the Oso Member of the formation and is unconformably overlain by the turbidite facies of the formation.

Older Alluvium. Older alluvium is an alluvial deposit older than 10,000 years and is often called a nonmarine terrace deposit, as it is often the sediment contained within the stream terraces that is above, and flank, the active stream channel. However, these sediments can also be found at depths below the active stream channel. These deposits consist of interbedded silt, clayey sand, and conglomeratic coarse-grained sands. Colors can vary from light yellows to browns to reds. The sand grains are generally subangular to subrounded, while the gravels and cobbles are rounded to well-rounded.

Young Alluvium. Young alluvium, also known as recent alluvium, can range in age from Recent to Latest Pleistocene. It is similar to Older alluvium, but is usually located closer to an active stream channel. These deposits consist of loosely consolidated gravel, sand, and silt ranging from poorly sorted to well sorted, composed of mainly quartz, but also containing feldspar and biotite. The sand grains are generally subangular to subrounded, while the gravels and cobbles are rounded to well rounded. Color is usually yellow-brown to gray-brown, and is somewhat dependent on the nearby, or upstream, geology.

Artificial Fill. Artificial fill is not mapped within the project area on the geology map (Morton, 2004); however, due to the project being located in a developed area, it no doubt exists in some areas. Artificial fill consists of sediments that have been removed from one location and transported to another by humans. Sometimes the transportation distance can be a few meters (few feet) to dozens of kilometers (dozens of miles). Composition is dependent on the source. When it is compacted and dense, it is known as "engineered fill," but it can be unconsolidated and loosely compacted. Artificial fill will sometimes contain modern debris such as asphalt, wood, bricks, concrete, metal, glass, plastic, and even plant material. Depending on the area, thickness can be less than 0.3 m to over 75 m (1 ft or less to several hundred feet).

Paleontology

Monterey Formation. Several significant invertebrate and vertebrate localities are recorded from the south County area. These include: fossils of crocodilians, fish, shark, ray, whale, dolphin, sea lion, sea cow, desmostylan, bivalves, gastropods, barnacles, bryozoan, and sand dollars. Morton et al. (1974) state that the upper part of this formation contains Late Miocene forms (Luisian and Mohinian), and the lower section contains sandstones with megafossils that suggesting slightly older stages (*Pecten crassicardio* and *Vaquerosella* cf. *merriama*). Eisentraut and Cooper (2002) report that numerous fossil fish and marine mammal remains have been recovered from this formation in the Irvine coast and Laguna Hills area. They also state that a localized limestone deposit in the Aliso Viejo area known as "Pecten Reef" has produced abundant invertebrate and vertebrate fossils.

The UCMP cites a 1965 paper by Bruce Parker and E. Yale Dawson in which Parker and Dawson indicate that occasionally rare blue, red, and brown algae have been preserved in the Monterey Formation. The paper by Parker and Dawson identified 22 species of algae from 10 different genera.

Capistrano Formation. Late Miocene to Early Pliocene (Upper Mohnian, Delmontian, and Repettian) foraminifera have been identified in this member (Smith, 1960). Recent work by John

Minch and Associates has identified plants, fish *(Clupeidae* and *Sciaenidae),* Aves (cf. *Mancala* sp.), *Desmatophocidae,* pinnipeds *(Otaridae* and *Phocidae), Delphinidae* and *Mysticeti* from this formation. LSA and Pertra Resources, Inc. recovered whales, sharks and terrestrial and marine plants in the Prima Deshecha Landfill, approximately 3.2 km (2.0 mi) to the southeast. Eisentraut and Cooper (2002) report that the siltstone member of this formation produced abundant and diverse marine vertebrates, including fish, shark, whale, dolphin, porpoise, sea lion, sea cow, and seagoing birds. They also report that the Marblehead project near San Clemente yielded voluminous and exceptional fauna.

Older Alluvium. Fossils have been collected in similar deposits from excavations for roads, housing developments, retention basins, and quarries in the Los Angeles Basin and vicinity (Lander, 2003; Jefferson, 1991a and 1991b; Conkling, 1997 and 1988; Miller, 1971). Remains of Rancholabrean animals, including elephant, horse, bison, camel, saber tooth cat, deer, and sloth are known from these localities. The potential exists to encounter similar fossils in all Pleistocene alluvium.

Young Alluvium. Young alluvium can contain remains of once-living things such as bones, shells, and plants; however, as these are less than 10,000 years old, not enough time has passed to mineralize the remains, and they are not considered to be "fossils." In addition, most of the remains that are found are contemporaneous with modern species. Occasionally, fossils from older upstream formations are eroded out and transported to a new location. However, it is usually impossible to determine where the fossils originally came from.

Artificial Fill. Artificial fill can contain fossils, but these fossils have been removed from their original location and are thus out of context. They are not considered to be important for scientific study

Museum Records

The LACM does not have any recorded localities within the project area. Its closest locality in the Capistrano Formation is LACM 5792, located approximately 1.4 km (0.9 mi) to the west near the mouth of Horno Creek. At LACM 5792, a substantial and diverse collection of mainly marine vertebrates was discovered, including sharks, bony fishes, sea lions, whales, dolphins, and sea cows. In addition, some terrestrial specimens were also collected, including elephants and pond turtles. The LACM also reports that they have a large number of vertebrate fossils from the Monterey Formation. The closest is LACM 3510, located northwest of Sulphur Creek Reservoir, approximately 8.0 km (5 mi) to the northwest. Remains from a sea lion and a toothed whale were collected at this locality.

The LACM believes that shallow excavations on the southeast portion of the project containing alluvium are unlikely to encounter paleontological resources, but excavations that extend into the hillside on the northwest (the Miocene Monterey and Capistrano Formations of Morton, 2004) may encounter paleontological resources and should be monitored closely to quickly and professionally recover fossil resources without impeding development. The LACM further recommends that any collected resources be placed in an accreted scientific institution. A copy of the LACM letter is attached in Appendix B and includes a list of species list collected from LACM 5792.

A review of the records maintained at UCMP indicates 21 fossil localities within the Capistrano Formation in Orange County; 3 are vertebrate localities, 2 are invertebrate localities, and 16 are microfossil localities. Locational data is general, but none appear to be within the project area, with most being located within the Newport Beach area. The closest appears to be either the "Sulphur Creek Reservoir" locality (vertebrates) or "Crown Valley Parkway" locality (invertebrates); both are approximately 6.4 to 8.0 km (4 to 5 mi) to the northwest. UCMP records also list 111 localities within the Monterey Formation in Orange County; 4 are vertebrate localities, 7 are invertebrate localities, and 100 are microfossil localities. Like the Capistrano Formation, locations are rather general, but one invertebrate locality is named "San Juan Canyon." Based on the outcrops of the Monterey Formation, it is likely that this locality is within one mile of the project area. A copy of the UCMP localities within both the Capistrano and Monterey Formation is attached in Appendix C

FIELD SURVEY

The field survey verified the results of the literature review and analysis of the geologic mapping along the study area (Morton 2004). Although much of the ground surface was covered by vegetation, soil, or paving, enough was visible to confirm that young alluvium, the Capistrano Formation, and the Monterey Formation are all located within the ADI and will be excavated during grading for this project.

In addition, one fossil was observed during the survey. It consisted of a small 1.5-centimeter (0.6-inch) diameter bivalve. It was located on the north side of SR-74 just to the east of Toyon Drive, within sediments of the Capistrano Formation. No fossils were observed within the Monterey Formation.

SIGNIFICANCE

DEFINITIONS OF SIGNIFICANCE

The Society of Vertebrate Paleontology (SVP) (SVP, 1995) provides the following definitions of significance.

- **Significant Nonrenewable Paleontological Resources** are fossils and fossiliferous deposits, here restricted to vertebrate fossils and their taphonomic and associated environmental indicators. This definition excludes invertebrate and botanic fossils except when present within a given vertebrate assemblage. Certain plant and invertebrate fossils or assemblages may be defined as significant by a project paleontologist, local paleontologist, specialist, special-interest groups, Lead Agencies, or local governments.
- A **Significant Fossiliferous Deposit** is a rock unit or formation that contains significant nonrenewable paleontological resources, here defined as comprising one or more identifiable vertebrate fossils, large or small, and any associated invertebrate and plant fossils, traces, and other data that provide taphonomic, taxonomic, phylogenetic, ecologic, and stratigraphic information (ichnites and trace fossils generated by vertebrate animals; e.g., trackways or nests and middens, which provide datable material and climatic information). Paleontological resources are considered to be older than recorded history and/or older than 5,000 years before the present (BP).

According to the Department, the significance of a paleontological resource may be stated for a particular fossil species, fossil assemblage, or a rock unit as a whole. 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, diagnostically or stratigraphically important, and add to the existing body of knowledge in specific areas, stratigraphically, taxonomically, or regionally (SVP, 1995). 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 on the amount of scientific study needed to adequately characterize an individual species and therefore affects how relative sensitivities are assigned to formations and rock units.

During the development of a model curation program for the County, Eisentraut and Cooper (2002) stated that fossils are judged to be scientifically significant if they meet any of the following criteria within the following categories:

- **Taxonomy:** Assemblages that contain rare or unknown taxa such as defining new (previously unknown to science) species or represent a species that is the first or have very limited occurrence within the area or formation.
- **Evolution:** Fossils that represent important stages or links in evolutionary relationships or 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) to even whether the area was in a high energy location like a beach or low energy like 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 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.

SUMMARY OF SIGNIFICANCE

This document uses the following abbreviated summary to define significance as it relates to paleontological resources:

All vertebrate fossils that can be related to a stratigraphic context are significant and are considered a significant nonrenewable paleontological resource. Invertebrate and plant fossils as well as other environmental indicators associated with vertebrate fossils are considered significant. Certain invertebrate and plant fossils that are regionally rare or uncommon, or help to define stratigraphy, age, or taxonomic relationships, are considered significant.

SENSITIVITY

DEFINITIONS OF SENSITIVITY

The SVP (1995) provides the following definitions of sensitivity.

- **Paleontological Sensitivity** is determined only after a field survey of the rock unit in conjunction with a review of available literature and paleontologic locality records. In cases where no subsurface data are available, sensitivity may be determined by subsurface excavation.
- **Paleontological Potential** is the potential for the presence of significant nonrenewable paleontological resources. All sedimentary rocks, some volcanic rocks, and some metamorphic rocks have the potential for the presence of significant nonrenewable paleontological resources. The SVP has only three categories of sensitivity: High, Low, and Undetermined. The determination of a rock unit's degree of paleontological potential is first founded on a review of pertinent geological ad paleontological literature and on locality records of specimens deposited in institutions. This preliminary review may suggest particular areas of known high potential. 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 or Low. The field survey may extend outside the defined project to areas where rock units are better exposed. Each of the potentials is defined below in more detail.
    - **High Potential.** Rock units from which vertebrate or significant invertebrate fossils or significant suites of plant fossils have been recovered are considered to have a have potential for containing significant nonrenewable fossiliferous resources. These units include but are not limited to, sedimentary formations and some volcanic 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. Sensitivity comprises both (1) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical, and (2) the importance of recovered evidence for new and significant taxononic, phylogenetic, ecologic, or stratigraphic data. Areas that contain potentially datable organic remains older than Recent, including deposits associated with nests or middens, and areas that may contain new vertebrate deposits, traces, or trackways are also classified as significant.
    - **Low Potential.** Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow determination that some areas or units have low potentials for yielding significant fossils. Such units will be poorly represented by specimens in institutional collections. These deposits generally will not require protection or salvage operations.
    - **Undetermined Potential.** Specific areas underlain by sedimentary rock units for which little information is available are considered to have undetermined fossiliferous potentials. Field surveys by a qualified vertebrate paleontologist to specifically determine the potentials of the rock units are required before programs of impact mitigation for such areas may be developed.

If an area is determined to have a high potential for containing paleontologic resources, the SVP recommends that a program to mitigate impacts should be developed. In areas of high sensitivity, a preexcavation survey prior to excavation is also recommended to locate surface concentrations of fossils that might need special salvage methods.

During the development of a model curation program for the County, Eisentraut and Cooper (2002) developed a slightly more detailed sensitivity scale that is more graduated than the "high," "none," and "unknown" sensitivity ratings developed by the SVP (SVP 1995) for each formation that exists within the County. These sensitivities are based on the fossils that have (or have not) been recovered within each formation. However, Eisentraut and Cooper (2002) state that based on future findings, these ratings can and may change. The rating system by Eisentraut and Cooper (2002) is as follows:

- **Very High:** Scientifically very significant fossils and fossils from critical geologic time periods–Very important for scientific study
- **High:** Quality preservation and scientifically significant fossils–Important for research and/or very important for public display
- **Moderate:** Abundant fossils of good quality–Important for education and public display
- **Low:** Poorly preserved fossils–Only useful for educational purposes
- **None:** Contains no fossils, either too young or nondepositional rock units

According to the Department, significance is often stated as "sensitivity" or "potential." In most cases, decisions about how to manage paleontological resources must be based on this potential because the actual situation cannot be known until construction excavation for the project is underway. Significance may also be stated for a particular rock unit, predicated on the research potential of fossils suspected to occur in that unit. The Department uses the following tripartite scale.

- **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. Areas with a high potential for containing significant paleontological resources require monitoring and mitigation.
- **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 for containing 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. Rock units designated as Low Potential generally do not require mitigation monitoring.
- **No Potential:** Rock units of intrusive igneous origin, most extrusive igneous rocks, and moderately to highly metamorphosed rocks are classified as having no potential for containing significant paleontological resources. In addition, artificial fill falls into this category.

Given the range of criteria that may be used, significance assessments should necessarily be based on the recommendations of a professional Principal Paleontologist with expertise in the region under study and the resources found in that region. An evaluation of a particular rock unit's significance rests on the known importance of specific fossils. Often this significance is reflected as a sensitivity ranking relative to other rock units in the same region.

SUMMARY OF SENSITIVITY

This document uses the following abbreviated summary to define paleontological sensitivity and the potential for significant paleontological resources:

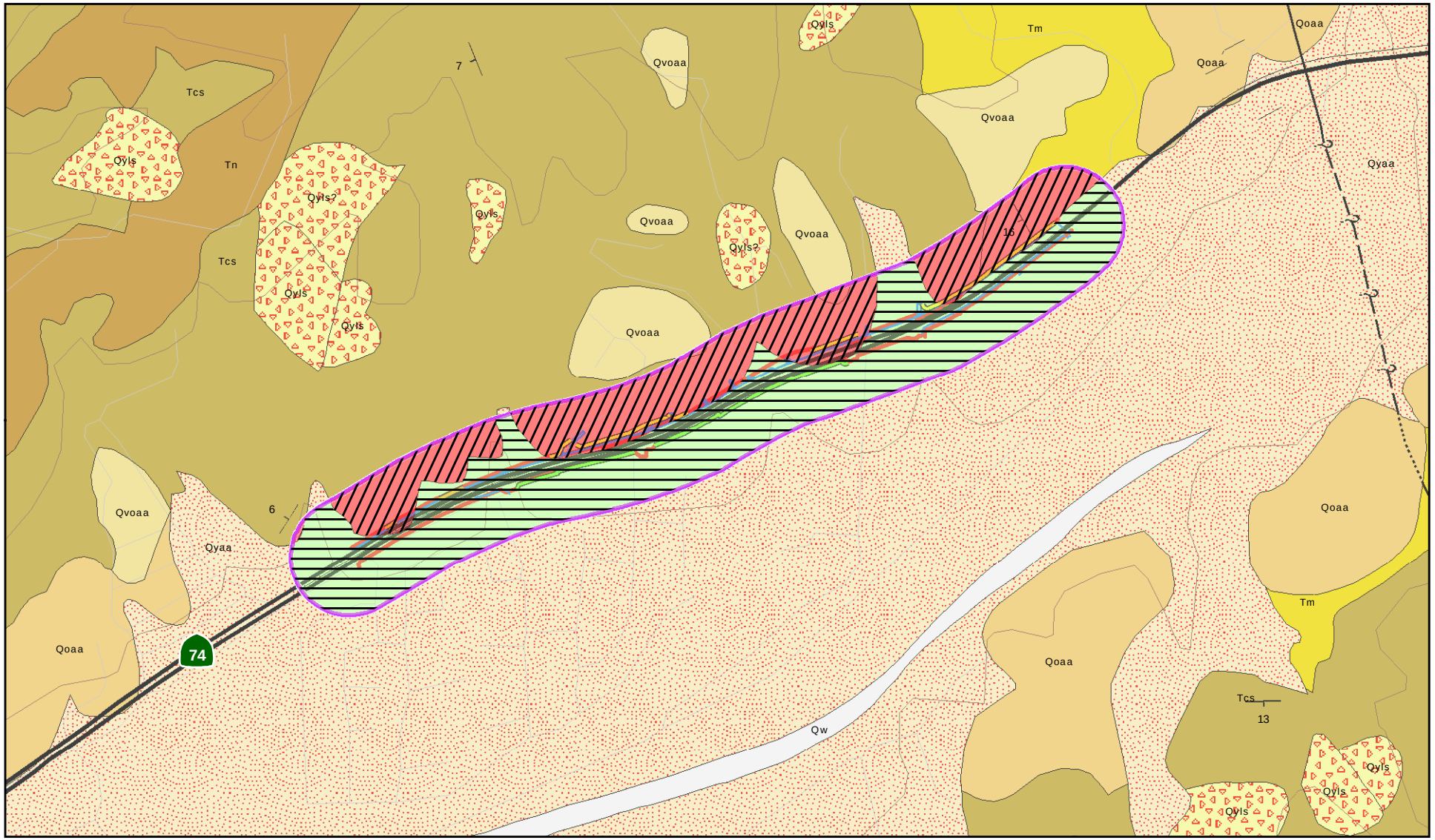
- A formation or rock unit has paleontological sensitivity or the potential for significant paleontological resources if it has previously produced or has lithologies conducive to the preservation of vertebrate fossils and associated or regionally uncommon invertebrate and plant fossils. All sedimentary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

The specific sensitivities for formations and units within the study area are listed in Table B. This lists the sensitivities determined by Eisentraut and Cooper (2002) and the corresponding Paleontological Potential scale used by the Department. Sensitivities (and potential) for the older alluvium, the Capistrano Formation, and the Monterey Formation are all high to very high based on the presence of significant fossil remains that have been recovered from these units in other areas. It is likely that similar significant resources may be encountered during this project. The young alluvium has no sensitivity, as it is too young to contain paleontological resources.

Table B: Paleontological Sensitivity of the Geologic Units within the Study Area

Geologic Unit	Paleontological Sensitivity (Eisentraut and Cooper 2002)	Paleontological Potential (the Department)
Young Alluvium	None	None
Older Alluvium	High	High
Capistrano Formation	Very High	High
Monterey Formation	Very High	High

A Sensitivity Map (Figure 3) depicts the sensitivity of each geologic unit that may be encountered during this project using the scale developed by Eisentraut and Cooper (2002). Table C lists the approximate location where each unit may be encountered during grading within the current ADI. As noted in Table B, "Very High" and "High" sensitivities are the same as the Department's "High" potential rating. It should also be noted that it is possible that excavation in sediments with a "Low" or "None" rating, especially close to sediments having "High" rating, could encounter the "High" potential sediments during excavation at shallow depths. Therefore, this sensitivity map should only be used as a rough guide, not as an exact location for where sensitive sediments will outcrop. In addition, based on the scale of the geologic mapping, it is likely that contacts could vary by tens of meters (50–100 ft). Not plotted on this map, because its extent is not known, is artificial fill, which has no paleontological sensitivity, This material will likely be limited to areas within the existing roadway and shoulder that were placed during earlier construction or utility work.



Study Area
(Project Area with 100 meter Buffer)
Existing Right-of-Way
Project Improvements
Retaining Wall
Sound Wall
Retaining Wall
(Only represented in Alternative 2)

Contact, approx. located
Contact, certain
Fault, certain
Fault, concealed
Fault, inferred

Strike and Dip of Beds
70 Inclined

Geologic Units
Young alluvium, arenaceous (Qyaa)
Very old alluvium, arenaceous (Qvoaa)
Capistrano Formation, siltstone facies (Tcs)
Monterey Formation (Tm)

Paleontological Sensitivity
High
None

N

0 400 800
FEET

SOURCE: Morton (2004).

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FIGURE 3

Lower SR-74 Widening Project

Paleontological Sensitivities

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Table C: Approximate Location Where Each Geologic Unit May be Encountered Within the ADI

Geologic Unit	North Side Station Numbers*	South Side Station Numbers*
Young Alluvium	70+00–72+00 76+00–83+50 96+00–98+00 102+50–106+00	70+00–97+00 and 101+00–115+50
Capistrano Formation	72+00–76+00 83+50–96+00 98+00–102+00 106+00–107+00	97+00–101+00
Monterey Formation	107+00–115+50	-

* Station numbers are in feet

RECOMMENDATIONS FOR THE PMP

INTRODUCTION

The Department, the County, and the SVP all present similar guidelines for adequate mitigation of impacts to significant nonrenewable paleontological resources. Excerpts from individual guidelines follow.

ORANGE COUNTY

As far back as the 1970s the County recognized the need to try to preserve the County's fossil heritage. The County developed a set of guidelines (Resolution 77-866) that stated that developers on projects that involved earthwork were required to hire a professional paleontologist to:

- Conduct literature and records research prior to the start of grading to determine whether fossils might be encountered during construction;
- Conduct surveys prior to the beginning of grading to determine the significance and extent of fossils of fossil-bearing sediments within the project;
- Provide trained paleontological monitors to collect fossil remains during grading; and
- Preserve any collected fossils by maintaining them in an undisturbed condition, or excavation and salvage in a scientific manner and keeping the fossils readily accessible for future study, if possible.

These guidelines were further refined by Eisentraut and Cooper (2002) during their preparation of a model curation program for Orange County. This program conforms to the recommendations of the SVP guidelines and is similar to those provided by the Department to reduce construction-related impacts to significant nonrenewable paleontological resources. After the potential for paleontological resources has been determined by a records search and field inspection, the following steps are recommended to occur with construction excavation:

- **Monitoring of excavation operations** to discover unearthed fossil remains, generally involving close inspection/surveillance of ongoing excavation exposures. Monitoring time will be in accordance with the paleontological sensitivity rating (see previous discussion of paleontological sensitivity scale) for the particular stratigraphic unit being excavated. Routinely, very high sensitivity units will require full-time monitoring; high sensitivity units will require a minimum of three-quarter-time monitoring; moderate sensitivity units will require at least half-time monitoring; low sensitivity units will require one-quarter-time monitoring; no sensitivity units will require no monitoring. Monitoring time can be increased or decreased over time dependent on what is being discovered or not discovered.
- **Salvage of unearthed fossil remains**, typically involving simple excavation of the flagged-off exposed specimen but possibly also plaster-jacketing of large and/or fragile specimens or

concentrations of fossils, or more elaborate quarry excavations of richly fossiliferous deposits; decisions about what is collected will be based on in-field assessment of determined or potential paleontological significance

- **Recovery of stratigraphic and geologic data** to provide a context for the recovered fossil remains, typically including legible, well-organized field note descriptions of lithologies of fossil-bearing strata, and measurement and description of the overall stratigraphic section if possible,
- **Careful recording of specimen localities** on maps, including site or grading maps, and, most importantly, on standard, most up-to-date USGS 7.5-minute (1:24,000) quadrangle sheets; accurate longitude-latitude and Universal Transverse Mercator (UTM) coordinates should be given for each locality, and global positioning system (GPS) technology should be employed whenever possible. Additional information such as formation name; sediment description; elevation; field identification; location within the stratigraphic section, if possible; and a general to specific description of the fossil location should also be recorded.
- **Laboratory preparation** to the point of taxonomic identification. This generally involves removal of the enclosing sediment; stabilization of fragile specimens using glue and other hardeners; and repair of broken specimens. In addition, bulk material should be screen-washed to recover small specimens such as vertebrate bones and teeth that are difficult to see because of their small size.
- **Cataloguing and identification** of prepared fossil remains to the lowest taxonomic level feasible. Taxonomic experts should be consulted to assist with the identification and ensure that identification is accurate and note whether the specimen is new and/or unique to the formation or region.
- **Transferal, for accessioning for storage**, of catalogued fossil remains, including the specimens themselves, copies of all field notes, maps (with locality information accurately posted), stratigraphic sections, and any photographs.
- **Preparation and submittal of a final report** summarizing the project area investigated, the field and laboratory methods used, the stratigraphic units inspected, the types of fossils recovered, the scientific significance of the curated collection, and recommendation for further work, if needed.

SOCIETY OF VERTEBRATE PALEONTOLOGY

Recommended general guidelines for conformable impact mitigation to significant nonrenewable paleontological resources have been published by the SVP (1995) along with conditions of receivership that the repository institution can require when receiving fossils recovered from construction projects (SVP, 1996). In area determined through a records check and field survey to have a high potential for significant paleontological resources, an adequate program for mitigating the impact of development should include:

- A preliminary survey and surface salvage of any observed fossils prior to construction;
- Monitoring and salvage during project excavation;
- Preparation, including screen washing to recover small specimens (if applicable) and specimen preparation to a point of stabilization and identification;

- Identification, cataloging, curation, and storage into a museum or university that has a curator who can retrieve the specimens upon request; and
- A final report of the finds and their significance after all operations are completed

All phases of mitigation are to be supervised by a professional paleontologist who maintains the necessary paleontological collecting permits and repository agreements. The Lead Agency ensures compliance with the measures developed to mitigate impacts of excavation during the initial assessment. To ensure compliance from the start of the project, a statement that confirms the site's potential sensitivity confirms the repository agreement with an established institution and describes the program for impact mitigation should be deposited with the Lead Agency and contractors before work begins. The program will be reviewed and accepted by the Lead Agency's designated vertebrate paleontologist. If a mitigation program is initiated early during the course of project planning, construction delays due to paleontologic salvage activities can be minimized or avoided.

CALIFORNIA DEPARTMENT OF TRANSPORTATION

The Department has developed a set of guidelines similar those of the SVP to reduce impacts to paleontological resources. These recommendations start with avoidance of the resource area by the project and continue with recommendations for impact mitigation measures during construction excavation.

Avoidance

Avoidance of project impacts can be achieved by project redesign so that paleontological resources are completely outside the project's impact area (e.g., a different alignment route that misses the resource or a construction approach that does not entail construction excavation that would impact fossiliferous strata).

Environmentally Sensitive Areas

A related strategy creates Environmentally Sensitive Areas (ESAs) around paleontological localities. ESAs are a standard part of the Department and FHWA toolkit to protect resources within or immediately adjacent to a project while concurrently delivering the project. Generally, these involve some combination of fencing or cyclic monitoring as an alternative to excavation monitoring. In the event that the special measures prove ineffective for one reason or another, more traditional mitigation is necessarily called for. This fallback sometimes impacts delivery schedules and/or total project costs. If viable and properly implemented, however, ESAs can reduce costs and time associated with more extensive traditional mitigation approaches.

The Department's PMP

Since the geology of California is diverse and the nature of the fossils that it contains varies from one outcrop to the next, the Department does not provide generic paleontological resource impact mitigation, but instead presents a format for the PMP that can be utilized by the professional project paleontologist who has been retained to manage paleontological resources during project

development. A full list of sections of the PMP is included in the Department's SER Environmental Handbook, Volume 1, Chapter 8. Briefly, the PMP sections are:

- **Introduction:** a brief discussion of the goals of the proposed study, a discussion of the construction project effects, and why mitigation is needed (e.g., compliance with CEQA).
- **Background:** Pertinent information should be provided in order to demonstrate familiarity with the project area and the type of fossils and rock units under study.
- **Description of the Resource:** A description of the rock units, boundaries of the fossiliferous formations, and locations of exposures in the vicinity of the project area and in the ADI.
- **Proposed Research:** A clear, concise description of why the paleontological resource is significant or has scientific importance and how the study is expected to address current gaps in the paleontological data.
- **Scope of Work:** The work plan to mitigate project effects, including all fieldwork and laboratory efforts. This may include:
    - Procedures for interfacing paleontological and construction personnel developed in consultation with the Resident Engineer (RE).
    - Construction monitoring programs should be outlined.
    - Salvage methods should be outlined from large specimen recovery to collection and processing of microfossils.
    - Recovered specimens should be prepared to a point of identification and stabilized for preservation in conformance with individual repository requirements.
    - All recovered specimens should be cataloged using the format of the proposed curation facility
    - Not all located fossils need to be recovered. Criteria for the discarding of specific fossil specimens should be made explicit.
- **Decision Thresholds:** How and when fieldwork will achieve the study goals, allowing fieldwork to cease; or, of any circumstances in which additional effort might be needed to achieve study goals.
- **Schedule:** The schedule for completing the proposed work may appear as text or in graphic form (e.g., timeline) and include a start date, duration of fieldwork and laboratory processing, and time for report preparation.
- **Justification of Cost Estimate:** Provide narrative support for the cost estimate, including the basis for person-hour estimates, clarification of overhead percentages, and any other costs.
- **Cost Estimate:** Presented as an appendix, this documentation should present a tabular summary of costs for the proposed effort and include all proposed numbers and levels of personnel, time, and costs.
- **Bibliography:** The bibliography should include only those references cited in the plan.
- **Curation:** The curation facility should be identified and a draft curation agreement included. A curation agreement with an approved facility must be in place prior to initiating any paleontological monitoring or mitigation activities.

The plan should be prepared by or under the supervision of a qualified Principal Paleontologist and submitted for review sufficiently in advance of an anticipated start work date so that all involved agencies have time to comment, the Lead Agency has time to adjust the plan to accommodate such input, and for the plan to be resubmitted for all necessary approvals. In the case of Department projects, coordination with other agencies should be accomplished through Department staff rather than consultants directly approaching land managing/regulatory agencies. It is imperative that all agencies with jurisdiction over a paleontological site are in agreement as to the level of effort in the mitigation plan, including agreement on the applicability of pertinent laws, regulations, and permit requirements. When properly designed, the Paleontological Mitigation Plan serves as a basis for obtaining any necessary permits from other agencies

Specific interagency issues may include, but are not limited to, health and safety issues, employee access and egress, collection, removal and stockpiling of fossiliferous sediment, water washing, wet screen processing of fossiliferous sediment and disposal of muddy wastewater, and the use of chemicals (kerosene) to break down specific types of indurated fossiliferous sediment. Agency permits that may be needed for access or to conduct the work of monitoring and salvage should be applied for and obtained in advance of the project.

CONCLUSION

The SR-74 widening project is within an area that contains sediments with potential to contain significant nonrenewable paleontological resources. The potentially fossiliferous sediments will mostly be encountered on the northwest side of the project during excavation for retaining walls, driveway realignments, and the additional lanes. This study presents definitions of paleontological significance, the results of locality searches, reviews of geological and paleontological literature, and appends paleontological resource locality records from around the study area.

This study does not anticipate special paleontological situations that would require project redesign to avoid critical localities or strata. Consequently, a PMP is recommended to mitigate impacts to significant paleontological resources that may be encountered within the project footprint or that contain native sediments that will be encountered during excavation. This PMP should be synthesized from outlines and guidelines provided by the Department, the County, and the SVP, and specifically tailored to the older Alluvium, the Late Miocene to Early Pliocene Capistrano Formation, and the Middle Miocene Monterey Formation within the project footprint. At a minimum, the monitoring portion of the PMP should include the following:

- A preconstruction field survey should be conducted, followed by salvage of any observed surface paleontological resources prior to the beginning of grading.
- Attendance at the pregrade meeting by a qualified paleontologist or his/her representative. At this meeting, the paleontologist will explain the likelihood for encountering paleontological resources, what resources may be discovered, and the methods that will be employed if anything is discovered (see below).
- During construction excavation, a qualified vertebrate paleontologic monitor shall initially be present on a full-time basis whenever excavation will occur within the sediments that have a high sensitivity rating and on a spot-check basis in sediments that have a low sensitivity rating. Monitoring may be reduced to a part-time basis if no resources are being discovered in sediments with a high sensitivity rating (monitoring reductions and when they occur will be determined by the qualified Principal Paleontologist). The monitor shall inspect fresh cuts and/or spoils piles to recover paleontological resources. The monitor shall be empowered to temporarily divert construction equipment away from the immediate area of the discovery. The monitor shall be equipped to rapidly stabilize and remove fossils to avoid prolonged delays to construction schedules. If large mammal fossils or large concentrations of fossils are encountered, the Department shall consider using heavy equipment on site to assist in the removal and collection of large materials.
- Localized concentrations of small (or micro-) vertebrates may be found in all native sediments. Therefore, it is recommended that these native sediments occasionally be spot-screened through one-eighth to one-twentieth-inch mesh screens to determine whether microfossils are present. If microfossils are encountered, additional sediment samples (up to 3 cubic yards, or 6,000 pounds) shall be collected and processed through one-twentieth-inch mesh screens to recover additional fossils.

- Any recovered specimens shall be prepared to the point of identification and permanent preservation. This includes the picking of any washed mass samples to recover small invertebrate and vertebrate fossils, the removal of surplus sediment from around larger specimens to reduce the volume of storage for the repository and the storage cost, and the addition of approved chemical hardeners/stabilizers to fragile specimens.
- Specimens shall be identified to the lowest taxonomic level possible and curated into an institutional repository with retrievable storage. The repository institutions usually charge a one-time fee based on volume, so removing surplus sediment is important. The repository institution may be a local museum or university that has a curator who can retrieve the specimens on request. The Department requires that a draft curation agreement be in place with an approved curation facility prior to the initiation of any paleontological monitoring or mitigation activities.

By following the above guidelines, impacts to nonrenewable paleontological resources will be reduced to levels that are less than significant. During the development of the PMP, additional measures may be added; this list is only meant to provide a summary of what may be involved.

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APPENDIX A

SUMMARY OF LEGISLATION

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SUMMARY OF LEGISLATION

Laws, Regulations, and Guidance

This section summarizes federal and State laws and regulations pertaining to paleontological resources and how these integrate with project development and delivery activities. Policies and/or contact information for federal and State land managing and regulatory agencies that have paleontological authorities and responsibilities are provided directly or by hotlink. In the event that a project involves land owned or administered by another federal or State agency, that agency should be contacted in order to ascertain specific requirements they may have relative to paleontological resources. In addition to federal and State requirements, project proponents may also be subject to local ordinances concerning paleontological resources. Local ordinances are not summarized in this document and local entities such as cities and counties should be contacted to determine if there are additional local requirements that must be met.

Federal Legislation

A variety of federal statutes specifically address paleontological resources. They generally become applicable to specific projects if that delivery crosses federal lands or involves a federal agency license, permits, approval, or funding.

Antiquities Act of 1906 (16 United States Code [USC] 431–433). The Antiquities Act of 1906 states, in part: That 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 Act itself, or in the Act's uniform rules and regulations (Title 43 Part 3, Code of Federal Regulations [43 CFR 3]), "objects of antiquity" has been interpreted to include fossils by the National Park Service (NPS), the Bureau of Land Management (BLM), the Forest Service (FS), and other federal agencies. Permits to collect fossils on lands administered by federal agencies are authorized under this Act (see "Permit Requirements of federal Agencies section, below). Therefore, projects involving federal lands will require permits for both paleontological resource evaluation and mitigation efforts.

Archaeological and Paleontological Salvage (23 USC 305). Statute 23 USC 305 amends the Antiquities Act of 1906. Specifically, it states: 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 USC 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" (Federal Register [FR] 46(19): 9570; [Also see FHWA policy section, below]).

Federal-Aid Highway Act of 1935 (20 USC 78). Section 305 of the Federal Aid Highway Act of 1956 (20 USC 78, 78a) gives the Federal Highway Administration (FHWA) authority to use federal funds to salvage archaeological and paleontological sites affected by highway projects.

National Registry of Natural Landmarks (16 USC 461-467). The National Natural Landmarks (NNL) program was established in 1962 and is administered under the Historic Sites Act of 1935. Implementing regulations were first published in 1980 under 36 CFR 1212 and the program was re-designated as 36 CFR 62 in 1981. A National Natural Landmark is defined as:

> *…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 (36 CFR 62.2).*

National significance describes:

> *… 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 (36 CFR 62.2).*

Federal agencies (e.g., FHWA) and their agents (e.g., the Department) 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 (NEPA) (42 USC 4321). The NPS is responsible for providing requested information about the National Natural Landmarks Program for these assessments (36 CFR 62.6(f)). However, other than consideration under NEPA, 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 paleontological NNLs in California include:

- Rancho La Brea—Hancock Park, Wilshire Boulevard, Los Angeles
- Sharktooth Hill—Kern County

- Rainbow Basin—near Barstow, San Bernardino County

For an up-to-date listing of NNLs in California, visit the National Natural Landmarks website.

National Historic Preservation Act of 1966 (NHPA; 16 USC 470). Section 106 of the NHPA 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 being almost exclusively limited to sites determined eligible for or listed on the National Register of Historic Places. It should be emphasized that cooperation between the cultural resource and paleontological disciplines is expected in such instances.

Section 4(f) of the Department of Transportation Act of 1966 (23 USC 138; 49 USC 1653). Section 4(f) of the Department of Transportation Act does not specifically address paleontological resources. This section of the law places restrictions on the ability of the FHWA to take publicly owned land 4(f) properties (which include parks, recreation areas, wildlife or waterfowl refuges, and National Register of Historic Places eligible or listed properties). Paleontological resources would only be addressed under this law if located within a 4(f) property.

National Environmental Policy Act of 1969 (42 USC 4321). The National Environmental Policy Act (NEPA) directs federal agencies to use all practicable means to "Preserve important historic, cultural, and natural aspects of our national heritage…" (Section 101(b) (4)). Regulations for implementing the procedural provisions of NEPA are found in 40 CFR 1500 1508.

If the presence of a significant environmental resource is identified during the scoping process, federal agencies and their agents must take the resource into consideration when evaluating project effects. Consideration of paleontological resources may be required under NEPA when a project is proposed for development on federal land, or land under federal jurisdiction. The level of consideration depends upon the federal agency involved (see section, below, entitled Identification of Regulatory/Management Agencies.

- **1872 Mining Law, amended 1988.** Excludes fossils (including petrified wood) from claim or patent. U.S. Forest Service and Bureau of Land Management regulate surface effects of development under this law. BLM regulations specifically state that operators may not knowingly disturb or destroy any scientifically important paleontological remains on federal lands; that they notify an authorized officer of such finds; and that said officer shall take action to protect or remove the resource(s).
- **Mineral Leasing Act of 1920 (sec. 30).** Requires and provides for the protection of interest of the United States. Natural resources, including paleontologic resources, are commonly regarded as such interests.
- **Executive Order 11593, May 31, 1971, Protection and Enhancement of the Cultural Environment (36 CFR 8921).** Requires federal agencies to inventory and protect properties

under their jurisdiction. National Park Service regulations under 36 CFR provide that Paleontologic specimens may not be disturbed or removed without a permit.

- **Archaeological and Historic Data Preservation Act of 1974 (P.L. 86-253, as amended by P.L. 93-921, 16 U.S.C. 469).Act of May 24, 1974 (88 Stat 174, sec. 3 a0, 4a).** Provides for the survey, recovery, and preservation of significant scientific, prehistoric, historic, archaeological, or paleontological data when such data may be destroyed or irreparably lost due to a federal, federally licensed, or federally funded project. A "Statement of Program Approach" was published in the *Federal Register* on March 26, 1979 (40 FR 18117) to advise the manner in which this law will be implemented.
- **36 CFR Part 800 (39 FR 3365, January 25, 1974, and 44 FR 6068, January 30, 1979):** Procedures for the Protection of Historic and Cultural Properties. Establishes procedures to ensure that historic and cultural resources are given proper consideration in the preparation of environmental impact statements.
- **Federal Land Management and Policy Act of 1976 (FLPMA, P.L. 94-579, 43 U.S.C. 1701-1782).** Provides authority for BLM to regulate lands under its jurisdiction, managed in a manner to "protect the quality of scientific, scenic, historic, ecological, environmental...and archaeological values." Authority is given to establish areas of critical environmental concern (ACEC).
- **Surface Mining Control and Reclamation Act of 1977 (SMCRA, P.L. 95-87, 30 U.S.C. 1201-1328).** Regulates surface coal mining and provides designation as unsuitable for surface mining if mining would ."..result in significant damage to important cultural, scientific, and esthetic values and natural systems...."
- Paleontological Resource Management 1998, Bureau of Land Management Handbook H-8270-1 General Procedural Guidance for Paleontological Management.

State of California Legislation

The following state laws and regulations are applicable, or potentially applicable, to the Department and locally sponsored projects.

California Environmental Quality Act of 1970 (CEQA, 13 PRC, 2100, et seq.). Requires identification of potential adverse impacts of a project to any object or site of scientific importance (Div. 1, PRC 5020.1(b)).

The California Environmental Quality Act (CEQA) (Chapter 1, Section 21002) states that:

> *it is the policy of the state that public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects, and that the procedures required are intended to assist public agencies in systematically identifying both the significant effects of proposed projects and the feasible alternatives or feasible mitigation measures which will avoid or substantially lessen such significant effects.*

Guidelines for the Implementation of the California Environmental Quality Act, as amended May 10, 1980 (14 Cal. Admin. Code: 15000, et seq.). Requires mitigation of adverse impacts to a Paleontologic site from development on public land by construction monitoring.

The CEQA Guidelines (Article 1, Section 15002(a)(3)) state that CEQA is intended to: prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.

Guidelines for the Implementation of CEQA, 1992, Appendix G, section J (Significant effects). CEQA Guidelines, Appendix G, states, in part, that: A project will "normally" have a significant effect on the environment if it, among other things, will disrupt or adversely affect …a paleontological site except as part of a scientific study. If paleontological resources are identified during the Preliminary Environmental Analysis Report (PEAR), or other initial project scoping studies, as being within the proposed project area, the sponsoring agency (the Department or local) must take those resources into consideration when evaluating project effects. The level of consideration may vary with the importance of the resource.

Periodic review of CEQA-related court cases for decisions related to paleontology is also recommended. These cases can be found at the California Environmental Resources Evaluation System (CERES) web site.

California Environmental Quality Act, State of California Public Resources Code, 2100–21177 as amended January 1, 1999, Appendix G Environmental Checklist Form. Impacts to known, important paleontological resources are specifically covered under CEQA as potentially significant effects (i.e., the project will have a significant effect on the environment). Specifically, each California project must answer the question: Cultural Resource - would the project directly or indirectly destroy a unique paleontological resource or site or unique geological feature? There are four possible answers: Potentially Significant Impact, Potentially Significant Unless Mitigation Incorporated, Less than Significant Impact, No Impact.

California Coastal Act. The California Coastal Act, in part, authorizes the California Coastal Commission (CCC) to review permit applications for development within the coastal zone and, where necessary, to require reasonable mitigation measures to offset effects of that development. Permits for development are issued with "special conditions" to ensure implementation of these mitigation measures.

Section 30244 of the Act, "Archaeological or Paleontological Resources," states that: Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.

If the CCC determines that a paleontological resource is present within an applicant's proposed project area, they generally look for evidence that the applicant has taken the resource into consideration (e.g., through formal survey by a professional paleontologist with implementation of

resulting recommendations). If a paleontological site is present, special permit conditions may range from avoidance of the site to construction monitoring and/or salvage of significant fossils. This approach virtually parallels the level of protection afforded to paleontological resources by CEQA. Additionally, the CCC relies heavily on project sponsoring or permitting agencies to ensure compliance with CEQA (and consequently, the California Coastal Act).

Warren-Alquist Act (PRC 25000 et seq.). Requires the California Energy Commission to evaluate energy facility siting in unique areas of scientific concern (Section 26627).

Public Resources Code, Section 5097.5 (State 1965, c. 1136, p. 2792). Section 50987.5 of the California Public Code Section states: 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.

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. Consequently, the Department as well as local project proponents, are required to comply with PRC 5097.5 for their own activities, including construction and maintenance, as well as for permit actions (e.g., encroachment permits) undertaken by others.

Public Resources Code, Section 30244. Requires reasonable mitigation of adverse impacts to paleontological resources from development on public land.

California Administrative Code. Four sections of the California Administrative Code (Title 14, State Division of Beaches and Parks) administered by the California Department of Parks and Recreation CDPR) address paleontological resources. These include:

- Section 4306: Geological Features–"No person shall destroy, disturb, mutilate, or remove earth, sand, gravel, oil, minerals, rocks, or features of caves."
- Section 4307: Archaeological Features–"No person shall remove, injure, disfigure, deface, or destroy any object of paleontological, archaeological, or historical interest or value."
- Section 4308: Property–"No person shall disturb, destroy, remove, deface, or injure any property of the state park system. No person shall cut, carve, paint, mark, paste, or fasten on any tree, fence, wall, building, monument, or other property in the state parks, any bill, advertisement, or inscription."
- Section 4309: Special Permits–"Upon a finding that it will be for the best interest of the state park system and for state park purposes, the director 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. "

These sections of the California Administrative Code establish authority and processes to protect paleontological resources while allowing mitigation through the permit process.

Local Laws and Regulations

Various cities and counties have passed ordinances and resolutions related to paleontological resources within their jurisdictions. Examples include the counties of Orange, Riverside and San Bernardino and the cities of San Diego, Carlsbad, Palmdale, and Chula Vista. These regulations generally provide additional guidance on assessment and treatment measures for projects subject to CEQA compliance. Project staff should periodically coordinate with local entities to update their knowledge of local requirements.

Further Reference

Additional information is posted on the SVP's Web site. In the event that a project involves lands administered by either federal or State entities, the local offices of those organizations should also be contacted for guidance and direction.

APPENDIX B

RECORDS SEARCH RESULTS: LACM LETTER

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

Vertebrate Paleontology Section
Telephone: (213) 763-3325
FAX: (213) 746-7431
e-mail: smcleod@nhm.org

2 April 2008

LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, California 92614-4731

Attn: Brooks Smith, Cultural and Paleontological Resources Group

re: Paleontological Resources Records Search for the proposed Lower SR-74 Widening Project, LSA Project # CDT0801B, in the City of San Juan Capistrano, Orange County, project area

Dear Brooks:

I have searched our paleontology collection records for the locality and specimen data for the proposed Lower SR-74 Widening Project, LSA Project # CDT0801B, in the City of San Juan Capistrano, Orange County, project area as outlined on the section of the San Juan Capistrano USGS topographic quadrangle map that you sent to me via e-mail on 1 April 2008. We do not have any vertebrate fossil localities that lie within the proposed project site boundaries, but we do have localities nearby from the same sedimentary units that probably occur as subsurface deposits in the proposed project area.

On the southeastern side of the proposed project area the surface deposits consist of younger Quaternary Alluvium, either as fan deposits from the hills adjacent to the northwestern side or as fluvial deposits from San Juan Creek adjacent to the southeast. We have no vertebrate fossil localities anywhere nearby from these or similar younger Quaternary deposits and they are unlikely to contain significant vertebrate fossils, at least in the uppermost layers. Bedrock in the hills on the northwestern side of the proposed project area consist almost entirely of the marine late Miocene to early Pliocene Capistrano Formation. Our closest vertebrate fossil locality from the Capistrano Formation is LACM 5792, situated directly west of the southwestern portion of the proposed project area in the hills on the north side of Horno Creek. Locality LACM 5792 produced a substantial fossil fauna, primarily of marine vertebrates such as sharks, bony fishes, sea lions, whales, and sea cows, but also including some terrestrial and freshwater specimens, including elephants and pond turtles. A faunal list from locality LACM 5792 is provided in the appendix. At the very northeastern end of the proposed project area the bedrock in the hills consist of the marine late Miocene Monterey Formation. We have a great number of vertebrate fossil localities from the Monterey Formation in Orange County, primarily northwest of the

proposed project area. Our closest vertebrate fossil locality from the Monterey Formation is probably LACM 3510, northwest of the proposed project area northwest of Sulphur Creek Reservoir on the east side of Alicia Parkway, that produced fossil specimens of sea lion, *Imagotaria*, and toothed whale, Odontoceti.

Shallow excavations in the younger Quaternary Alluvium on the southeastern side of the proposed project area probably will not encounter any significant vertebrate fossils. Deeper excavations in that area that extend down into older deposits, or any excavations in the Capistrano Formation or Monterey Formation exposures on the northwestern side of the proposed project area, may well encounter significant fossil vertebrate remains. Any substantial excavations in the proposed project area, therefore, should be closely monitored to quickly and professionally collect any specimens without impeding development. 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

enclosures: appendix, draft invoice

Fossil fauna from the Capistrano Formation at locality LACM 5792

Chondrichthyes		
Carcharhiniformes		
Carcharhinidae		- requiem sharks
Carcharhinus	*obscurus*	
Hemipristis	*serra*	
Hexanchiformes		
Hexanchidae		- cow sharks
Hexanchus		
Lamniformes		
Lamnidae		- mackerel sharks
Carcharocles	*megalodon*	
Carcharodon	*carcharias*	
Isurus	*hastalis*	
Isurus	*oxyrinchus*	
Isurus	*planus*	
Lamna		
Myliobatiformes		
Myliobatidae		- eagle rays
Myliobatis		
Osteichthyes		
Perciformes		
Labridae		- wrasses
Semicossyphus	*pulcher*	
Chelonia		
Emydidae		- pond turtles
Clemmys	*marmorata*	
Aves		
Pelecaniformes		
Phalacrocoracidae		- cormorants
Podicipediformes		
Podicipedidae		- grebes
Podiceps	*parvus*	
Mammalia		
Artiodactyla		
Antilocapridae		- pronghorn antelopes
Camelidae		- camels
Carnivora		
Otariidae		- sea lions & walruses
Odobeninae		
Otariinae		
Cetacea		
Balaenidae		- right whales
Balaenopteridae		- rorqual whales
Cetotheriidae		- primitive baleen whales
Delphinidae		- dolphins
Stenella		
Phocoenidae		- porpoises
Physeteridae		- sperm whales
Scaldicetus		
Pontoporiidae		- "fresh water" dolphins
Parapontoporia		
Proboscidea		- elephants
Sirenia		
Dugongidae		- sea cows

APPENDIX C

RECORDS SEARCH RESULTS: UCMP DATA

UC Museum of Paleontology Localities

Number of matches: 111

next 11

- Download your results (tab-delimited text file with .xls file extension, 111 lines, file size = 13.5 K)
- Map localities with a US county

Query: SELECT FROM ucmp_loc2 WHERE state_prov_std = "California" and county_std = "Orange County" and formation like "%monterey%" ORDER BY loc_prefix,cast(loc_num as unsigned integer),loc_suffix

Click on the Loc ID to see the full locality record

Loc ID	Coll	Locality Name	County	State / Province	Country	Cont	Period	Epoch	Formation	Member	Storage Age	Flora/Fauna
2795-	I	San Juan Canyon	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12206	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12587	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12588	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12589	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12590	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12591	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12592	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12593	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12594	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12595	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12596	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12597	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12598	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12599	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			

12600	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12601	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12602	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12603	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12604	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12605	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12606	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12620	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12621	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12622	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12623	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12624	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12625	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12682	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			Forams
12683	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			Forams
12684	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			Forams
12685	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			Forams
12686	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12687	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12688	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			

12689	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12690	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12691	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12692	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12693	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12703	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12799	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12800	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12801	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12802	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12803	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12804	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12805	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12807	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12808	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12809	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12810	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12811	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12812	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12813	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			

12814	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12815	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12816	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12817	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12818	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12819	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12820	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12821	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12822	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12823	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12824	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12825	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12826	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12827	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12828	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12829	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12868	M	Laguna Hills Pecten Reef	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12869	M	Laguna Hills Pecten Reef	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12870	M	Laguna Hills Pecten Reef	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12871	M	Laguna Hills Pecten Reef	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
12873	M	Laguna Hills Pecten Reef	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
36217	I	Antonio	Orange	California	United	North	Tertiary	Miocene	Monterey			

		Parkway	County		States	America						
36218	I	Antonio Parkway	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
A1214	I	Santa Ana Mts.	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
A3467	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
A3468	M	NW side Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
A3469	M	NW side Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
A3470	M	NW side Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
D1473	M		Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
D1474	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
D1475	M		Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
D1476	M		Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
D1477	M		Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
D3363	I	Lake Forest	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
D6560	I	Pecten Reef	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
IP10665	I	Wood Canyon	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3649	M	Cedarbrook Ave	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3651	M	Leisure World	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3659	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			foraminifera
MF3663	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			foraminifera
MF3684	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3685	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3686	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3687	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3688	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			

UC Museum of Paleontology Localities

Number of matches: 111

prev 100

- Download your results (tab-delimited text file with .xls file extension, 111 lines, file size = 13.5 K)
- Map localities with a US county

Click on the Loc ID to see the full locality record

Loc ID	Coll	Locality Name	County	State / Province	Country	Cont	Period	Epoch	Formation	Member	Storage Age	Flora/Fauna
MF3689	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			foraminifera
MF3690	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3691	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3692	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
MF3698	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			foraminifera
MF3699	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			foraminifera
MF3708	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene	Monterey			
V71020	V	El Toro 1	Orange County	California	United States	North America	Tertiary	Miocene	Monterey		Clarendonian	
V91240	V	LACM 7136, Moulton Parkway	Orange County	California	United States	North America	Tertiary	Miocene	Monterey		Clarendonian	
V99592	V	Geraldine's Turtle	Orange County	California	United States	North America	Tertiary	Miocene	Monterey		Clarendonian	
V99593	V	Scott's Turtle	Orange County	California	United States	North America	Tertiary	Miocene	Monterey		Clarendonian	

UC Museum of Paleontology Localities

Number of matches: 21

- Download your results (tab-delimited text file with .xls file extension, 21 lines, file size = 2.7 K)
- Map localities with a US county

Query: SELECT FROM ucmp_loc2 WHERE state_prov_std = "California" and county_std = "Orange County" and formation like "%capistrano%" ORDER BY loc_prefix,cast(loc_num as unsigned integer),loc_suffix

Click on the Loc ID to see the full locality record

Loc ID	Coll	Locality Name	County	State / Province	Country	Cont	Period	Epoch	Formation	Member	Storage Age	Flora/Fauna
12212	M	Laguna Niguel	Orange County	California	United States	North America	Tertiary	Miocene,Pliocene	Capistrano			
12607	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12608	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12609	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12610	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12611	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12612	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12613	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12614	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12615	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12616	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
		Upper										

12617	M	Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12618	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
12619	M	Upper Newport Bay, Newport Beach	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano			
IP10720	I		Orange County	California	United States	North America	Tertiary	Pliocene	Capistrano			
IP10721	I	Crown Valley Parkway	Orange County	California	United States	North America	Tertiary	Pliocene	Capistrano			
MF3650	M	Laguna Niguel	Orange County	California	United States	North America	Tertiary	Miocene,Pliocene	Capistrano			
MF3660	M	Upper Newport Bay	Orange County	California	United States	North America	Tertiary	Miocene,Pliocene	Capistrano			
V5049	V	Petrel	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano		Barstovian	
V72103	V	El Toro 2	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano		Hemphillian	
V72149	V	Sulpher Creek Reservoir	Orange County	California	United States	North America	Tertiary	Miocene	Capistrano	Siltstone	Hemphillian	

APPENDIX D

RESUMES:
BROOKS R. SMITH & STEVEN W. CONKLING

BROOKS R. SMITH

PALEONTOLOGIST/GEOLOGIST

EXPERTISE

Paleontological and Archaeological Resource Monitoring
Archaeological Excavation
Fossil Collection, Salvage, Identification and Curation
Geologic Data Collection and Interpretation
GPS Data Collection and Analysis
Paleontological Assessment Reports
Final Archaeological and Paleontological Mitigation Monitoring Reports

EDUCATION

University of California, Santa Cruz, B.S., Earth Science (Geology), 1989.

California State University, Fullerton, Archaeological field methods course on San Nicolas Island, June–July 1993.

CERTIFICATIONS

Forty-Hour Hazardous Materials Handling and Response, current through June 2008
County of Orange, Certified Paleontologist

PROFESSIONAL EXPERIENCE

Archaeological and Paleontological Surveyor, Monitor, Excavator and Report Preparer; and Paleontological Field Director, LSA Associates, Inc., Irvine, California, July 1992–present.

Geologist, Mission Geoscience, Newport Beach, California, November 1993–February 1994.

Paleontologist, John Minch and Associates, San Juan Capistrano, California, February–June 1992.

Geologist, Soil and Testing Engineers, Inc., Placentia, California, September 1989–February 1992.

PRINCIPAL PROFESSIONAL RESPONSIBILITIES

Intensive field surveys for paleontological and archaeological remains prior to grading activities; monitoring for and collecting cultural and scientific resources during grading activities; documentation and testing of archaeological sites; salvage of large fossil remains with the use of plaster casts; large-scale wet and dry screening of sediments for fossils; identification and curation of fossils after they have been collected; collection and analysis of data from hand held Global Positioning Satellite (GPS) units; collection of geologic data; and archaeological and paleontological report preparation.

RECENT REPORTS

Results of Paleontological Assessment for the 4000 Metropolitan Project, City and County of Orange, California. Letter report to West Millennium Homes. LSA project number WHM0602. January 2007.

Paleontological Resource Assessment of 33.54 Acres In the City of Perris, Riverside County, California. Prepared for DMC Design Group, Inc. LSA project number DMP0601. January 2007.

Paleontological Resources Assessment Chula Vista Energy Efficiency Upgrade Project In the City of Chula Vista San Diego County, California. Prepared MMC Energy, Inc. LSA project number MME0601. December 2006.

Paleontological Resources Mitigation Monitoring Report – Saint Mark Presbyterian Church Project, City of Newport Beach, Orange County, California. Prepared for Barnard Ventures, LLC. LSA project number BAV530. December 2006.

Paleontological Resource Assessment Canyon Ridge Residential Development – Upper Lots Assessor's Parcel Number 643-090-032 City of La Quinta, Riverside County, California. Prepared for Laing Luxury Homes. LSA project number LAH0601. November 2006.

Paleontological Resource Assessment – Del Mar Fairgrounds Master Plan Project, in the Cities of Del Mar and San Diego, San Diego County, California. Prepared for the 22nd District Agricultural Association. LSA project number DLM0601. November 2006.

Paleontological Resource Assessment Report – Integrated Waste Management District Frank R. Bowerman Landfill Master Development Plan, Orange County, California. (With Steve Conkling). Report prepared for the Integrated Waste Management District. LSA project number PND0601. September 2006.

Archaeological l Mitigation Monitoring Report – Orange County Regional Sheriff Training Facility, City of Tustin, Orange County California. (With Deborah K. B. McLean). Prepared for Rancho Santiago Community College District. LSA project number RSC531. September 2006.

Paleontological Mitigation Monitoring Report – Orange County Regional Sheriff Training Facility, City of Tustin, Orange County California. (With Steve W. Conkling). Prepared for Rancho Santiago Community College District. LSA project number RSC531. September 2006.

Cultural Resources Survey for the Frank R. Bowerman Landfill Master Development Plan, Orange County, California. (With Ivan H. Strudwick, Dustin R. Kay, and Antonia M. Delu). Prepared for the County of Orange Integrated Waste Management Department. LSA project number PND0601. August 2006.

Archaeological Survey Report for the Proposed South Orange County Transportation Infrastructure Improvements Project in Orange and San Diego Counties (with Phil Fulton, Ivan Strudwick, Terri Fulton, and Roderic McLean). Report prepared for the Federal Highway Administration, California Division. LSA project number PND130. May 2006. Revised October 2006

Pedestrian Survey, San Mateo and Cristianitos Valleys, Marine Corps Base Camp Pendleton, California (with Phil Fulton, Roderic McLean, and Ivan Strudwick). Report prepared for the Marine Corps Base Camp Pendleton. LSA project number PND130. May 2006. Revised October 2006

Results of Archaeological Resource Mitigation Monitoring for Crystal Cove Planning Areas 4A and 4B, Phase II, Upper Merchants Area D Rough Grading and Storm Drain Improvements, Crystal Cove Area, Orange County, California (with Deborah K. B. McLean). Report prepared for Irvine Community Development Company. LSA project number ICD431. April 2006.

Results of Paleontological Resource Mitigation Monitoring for Crystal Cove Planning Areas 4A and 4B, Phase II, Upper Merchants Area D Rough Grading and Storm Drain Improvements, Crystal Cove Area, Orange County, California (with Steven W. Conkling). Report prepared for Irvine Community Development Company. LSA project number ICD431. April 2006.

Archaeological Monitoring Report for the Orchard at Saddleback, Phase II, City of Lake Forest, Orange County, California. Report prepared for Wetrust America, Inc. (with Deborah K. B. McLean). LSA project number MPX531. April 2006.

Paleontological Monitoring Report for the Orchard at Saddleback, Phase II, City of Lake Forest, Orange County, California. Report prepared for Wetrust America, Inc. (with Steven W. Conkling). LSA project number MPX531. April 2006.

A Glimpse of the Past on Pimu: Cultural Resource Survey, Santa Catalina Island, Los Angeles County, California (with Ivan H. Strudwick, Roderic McLean, Jay Michalsky, and Joseph E. Baumann). Report prepared for Southern California Edison. LSA project number SCE330C. March 2006.

Paleontological Resource Assessment for the Lambert Ranch, City of Irvine, Northern Sphere, Orange County, California. Report prepared for Sapetto Group, Inc. LSA project number LAE430. January 2006.

Results of Archaeological Resource Mitigation Monitoring for Crystal Cove Planning Areas 4A and 4B, Phase II, Lower Customs Areas A and B and Upper Customs Area C including Disposal Site Grading, Sewer and Storm Drain Improvements, Crystal Cove Area, Orange County, California (with Deborah K. B. McLean). Report prepared for Irvine Community Development Company. LSA project number ICD351. January 2006.

Results of Paleontological Resource Mitigation Monitoring for Crystal Cove Planning Areas 4A and 4B, Phase II, Lower Customs Areas A and B and Upper Customs Area C, including Disposal Site Grading, Sewer and Storm Drain Improvements, Crystal Cove Area, Orange County, California (with Steven W. Conkling). Report prepared for Irvine Community Development Company. LSA project number ICD351. January 2006.

Archaeological Monitoring Report, Chino Hills Corporate Park, City of Chino Hills, San Bernardino County, California (with Shannon Carmack and Deborah K. B. McLean). Report prepared for Chino Hills Corporate Park, L. P. LSA project number RIL430. January 2006.

Paleontological Monitoring Report, Chino Hills Corporate Park, City of Chino Hills, San Bernardino County, California (with Shannon Carmack and Steven W. Conkling). Report prepared for Chino Hills Corporate Park, L. P. LSA project number RIL430. January 2006.

Paleontological Resource Assessment, The Peninsular Village Overlay Zone, City of Rolling Hills Estates, Los Angeles County, California (with Shannon Carmack). Report prepared for the Planning Department, City of Rolling Hills Estates. LSA project number RHT530. January 2006.

Archaeological Mitigation Monitoring Report, New Drainage Pond and Slide Repair, Joplin Youth Center, Trabuco Canyon, Orange County, California (with Deborah K. B. McLean). Report prepared for DMJMH+N. LSA project number DMJ431. December 2005.

Paleontological Mitigation Monitoring Report, New Drainage Pond and Slide Repair, Joplin Youth Center, Trabuco Canyon, Orange County, California (with Steven W. Conkling). Report prepared for DMJMH+N. LSA project number DMJ431. December 2005.

Results of Archaeological Mitigation Monitoring for Newport Coast, Phase IV-4 Residential Planning Areas 2C, 5 and 6, Newport Coast, Orange County, California. Report prepared for Irvine Community Development Company. LSA project number ICD238. November 2005.

Results of Paleontological Mitigation Monitoring for Newport Coast, Phase IV-4 Residential Planning Areas 2C, 5 and 6, Newport Coast, Orange County, California. Report prepared for Irvine Community Development Company. LSA project number ICD238. November 2005.

Paleontological Monitoring Report for the Orchard at Saddleback, City of Lake Forest, Orange County, California. Report prepared for W.A.L.F., LLC. LSA project number MPX530. June 2005.

Archaeological Mitigation Monitoring Report January 2003–June 2004, Integrated Waste Management District, Frank R. Bowerman Landfill, Orange County, California. Report prepared for Integrated Waste Management District. LSA project number IWM030. January 2005.

Paleontological Mitigation Monitoring Report January 2003–June 2004, Integrated Waste Management District, Frank R. Bowerman Landfill, Orange County, California. Report prepared for Integrated Waste Management District. LSA project number IWM030. January 2005.

Archaeological Mitigation Monitoring Summary Report January 2001–June 2004, Integrated Waste Management District, Frank R. Bowerman Landfill, Orange County, California. Report prepared for Integrated Waste Management District. LSA project number IWM030. January 2005.

Paleontological Mitigation Monitoring Report January 2001–June 2004, Integrated Waste Management District, Frank R. Bowerman Landfill, Orange County, California. Report prepared for Integrated Waste Management District. LSA project number IWM030. January 2005.

Paleontological Resource Assessment for the Melrose Triangle Project, City of West Hollwood, Los Angeles County, California. Report prepared for the City of West Hollywood. LSA project number CWH430. January 2005.

Paleontological Resources Assessment for the Stockton Waterfront West Arena Project, City of Stockton, San Joaquin County, California. Letter prepared for Foothill Resources, Ltd. LSA project number FRS430. June 2004.

Paleontological Mitigation Monitoring for the West Bluffs Project, TT 51122, City and County of Los Angeles. Report prepared for Catellus Residential Unit. LSA project number CRH230. May 2004.

Results of Archaeological Resource Mitigation Monitoring, Fire Station 55, Irvine, California. Report prepared for Irvine Community Development Company. LSA project number ICD352. March 2004.

Results of Paleontological Resource Mitigation Monitoring, Fire Station 55, Irvine, California. Report prepared for Irvine Community Development Company. LSA project number ICD352. March 2004.

Cultural Resource Assessment for the Olinda Alpha Landfill Expansion, Orange County, California (with Deborah K. B. and Roderic N. Mclean). Report prepared for the County of Orange Resources and Development Management Department. LSA project number PND830. February 2004.

Paleontological Resource Assessment for the Olinda Alpha Landfill Expansion, Orange County, California (with Steven W. Conkling). Report prepared for the County of Orange Resources and Development Management Department LSA project number PND830. February 2004.

Paleontological Assessment of 15.45 Acres, Sunset Aquatic Park Project, Orange County, California. Report prepared for County of Orange Public Facilities and Resource Division. LSA project number GRK330. January 2004.

Results of Archaeological Mitigation Monitoring for Wishbone Ridge Emergency Access Road, Crystal Cove Area, Orange County, California (with Kevin Buffington). Report prepared for Irvine Community Development Company LSA project number ICD338. December 2003.

Results of Archaeological Mitigation Monitoring for Beachtown II, Crystal Cove Area, Orange County, California (with Kevin Buffington). Report prepared for Irvine Community Development Company. LSA project number ICD140. December 2003.

Results of Paleontological Mitigation Monitoring for Beachtown II, Crystal Cove Area, Orange County, California. Report prepared for Irvine Community Development Company. LSA project number ICD140. December 2003.

Results of Archaeological Resource Mitigation Monitoring for PA 4A and 4B, Phase I, Crystal Cove Area, Orange County, California (with William Sawyer and Kevin Buffington). Report prepared for Irvine Community Development Company. LSA project number ICD241. December 2003.

Results of Paleontological Resource Mitigation Monitoring for PA 4A and 4B, Phase I, Crystal Cove Area, Orange County, California. Report prepared for Irvine Community Development Company. LSA project number ICD241. December 2003.

Cultural Resource Assessment, Far West Housing, LLC, Nastranero Project, Riverside County. Report prepared for Far West Housing, LLC. LSA project number FWH330. August 2003.

Paleontological Resource Assessment, Far West Housing, LLC, Nastranero Project, Riverside County. Report prepared for Far West Housing, LLC. LSA project number FWH330. August 2003.

Results of Archaeological Monitoring Robert B. Diemer Filtration Project. Carbon Canyon and Telegraph Creeks, Chino Hills State Park, Orange County, California. Report prepared for the Metropolitan Water District of Southern California (with Shannon Younger, William Sawyer and Kevin Buffington). LSA project number MWD130. July 2003.

Results of Paleontological Monitoring Robert B. Diemer Filtration Project. Carbon Canyon and Telegraph Creeks, Chino Hills State Park, Orange County, California. Report prepared for the Metropolitan Water District of Southern California (with Shannon Younger). LSA project number MWD130. July 2003.

Results of Archaeological and Paleontological Monitoring Upper Bommer Trail Emergency Access Road Improvements and Habitat Restoration Area, Bommer Canyon, City of Irvine, Orange County, California. Report prepared for The Irvine Company. LSA project number TIC245. June 2003.

Results of Paleontological Monitoring, The Bluffs Retail Center, Orange County, California. Report prepared for The Irvine Company. LSA project number TIC230. March 2003.

Results of Archaeological Construction Monitoring, Planning Area 27, Needle Grass Creek Conservation Area, Irvine, California (with Shannon Younger). Report prepared for Irvine Community Development Company. LSA project number ICD146. March 2003.

Results of Paleontological Monitoring, State Route 73 Median Improvements, Stations 74+00 to 82+00, City of Costa Mesa, Orange County, California. Report prepared for Coffman Specialties, Inc. LSA project number INC230. March 2003.

Results of Archaeological and Paleontological Monitoring Turtle Ridge (Planning Area 27) Habitat Mitigation Project. Bommer Canyon, City of Irvine, Orange County, California. Report prepared for Irvine Community Development Company (with Shannon Younger). March 2003.

PROFESSIONAL MEMBERSHIPS/AFFILIATIONS

San Diego Association of Geologists
South Coast Geologic Society
UCSC Alumni Association
Society of Vertebrate Paleontology

STEVEN W. CONKLING

PRINCIPAL/DIRECTOR, ARCHAEOLOGY/PALEONTOLOGY

EXPERTISE

Cultural Resource Mitigation
Paleontology Resource Assessment/Mitigation
Fossil Identification
Specimen Curation

EDUCATION

North Texas State University, Denton, B.A., Biological Sciences, 1985.

ACCREDITATION

County of Orange, Certified Paleontologist, 1989

PROFESSIONAL EXPERIENCE

Principal, Director of Cultural and Paleontological Division, LSA Associates, Inc., Irvine, California, 1993–present.

Clark Interpretive Center, County of Orange, Park Ranger/Paleontologist (Director of Museum), 1986–1993.

Orange County Natural History Museum, Curator, 1991–present.

Los Angeles County Museum of Natural History, Research Associate, 1991–present.

San Bernardino County Museum, Research Associate, 1989–present.

Scientific Resource Surveys, Paleontological Consultant, 1989–1993.

Field Research Support Group, Board of Directors, 1990–present.

Mojave Desert Quaternary Research Society, Steering Committee Member, 1990–present.

Society of Vertebrate Paleontology, Ethics Committee Member, 1991–present.

RMW Paleontological Consultants, Paleontological Consultant, 1993.

Foundation for Field Research, Principal Investigator, Mud Hills Excavations, 1990, 1991.

Western Association of Vertebrate Paleontology, Meeting Host, 1990.

Foundation for Field Research, Co-Principal Investigator, Pleistocene Megafauna Project, 1989.

Fullerton Museum Center, Paleontological Consultant, 1989.

Knott's Berry Farm, Paleontological Consultant, *Kingdom of the Dinosaurs* Attraction, 1987.

University of Kansas, Mammalogy Department, Curatorial Assistant, 1986.

Snow Entomology Museum, Curatorial Assistant, 1985.

Badlands National Park, Park Ranger/Paleontologist, 1984.

Texas A&M University, Agricultural Extension Center, Plant Taxonomist, 1983.

North Texas State University, Porphyrin Chemistry Laboratory Assistant, 1982.

Southern Methodist University, Shuler Museum of Paleontology, Curatorial Assistant, 1981, 1982.

Southern Methodist University, Shuler Museum of Paleontology, Field Assistant, 1981, 1982.

Southern Methodist University, Radiocarbon Laboratory, Laboratory Assistant, 1981, 1982.

Southern Methodist University, Geophysics Department, Seismograph Technician, 1980–1982.

Southern Methodist University, Biology Department, Field Assistant, Big Bend National Park, 1981.

Smithsonian Institution, Field worker, Lewisville Early Man Site, 1981.

PROFESSIONAL RESPONSIBILITIES

Conducting paleontological resource projects with responsibilities that include paleontological resource evaluation for Environmental Impact Reports, covering field surveys, literature reviews, and mitigation measures; directing field monitoring and salvage operations; collecting geologic data; fossil analyses; and report preparation.

Direct Cultural Resource Mitigation Group for LSA including directing archaeological field activities, overseeing budgets, coordinating Section 106 compliance with the U.S. Army Corps of Engineers. Review all cultural resources reports.

TEACHING EXPERIENCE

Began and continued programs at the Clark Interpretive Center. Conducted tours for over 150,000 students, from kindergarten through college level (1986–1993).

Lead Seminars for:

- UCLA Environmental Program - Cultural Resource Mitigation
- Saddleback College - Paleontology Classes
- Paleontology (LTU)
- Identification of Bone from Archaeological Sites (CSULA)
- Fullerton College, Sciences Seminar
- Teacher Mentor Program, Earth Sciences (CSUF)
- Physical Anthropology, Irvine Valley College
- Paleoecology, California State University, Long Beach
- Geology of Texas (NTSU)
- Evolution (NTSU)
- Vertebrate Paleontology (SMU)
- Mammalian Biology (SMU)

PUBLICATIONS AND REPORTS

Vertebrate Remains from CA-SDI-10156/12599/H, MCAS Camp Pendleton, San Diego County, California, Abstract, Society for California Archaeology, 30th Annual Meeting Program, 1996.

Report on Continuing Investigations of the Sespe Formation (Oligocene/Miocene: Terrestrial) in the San Joaquin Hills of Orange County, California, Abstract, San Bernardino County Museum Association Quarterly, 43(2), 1996.

Use of Global Positioning Systems (GPS) and Global Information Systems (GIS) in Cultural and Paleontological Resource Mitigation, with J. Staight, Abstract, San Bernardino County Museum Association Quarterly, 43(2), 1996.

Vertebrate Remains from CA-ORA-196/H, Michelson Bridge Widening, City of Irvine, Orange County, California, 1996.

Paleontological Resource Impact Mitigation Program - Playa Vista (Phase I) Project, Los Angeles County, California, 1996.

Paleontology Assessment Report for Parcel Number 4687, in the Moorpark Area, Ventura County, California, 1996.

Cultural Resources Assessment for Ritter Ranch, Planning Area 1, Los Angeles, California, with D. McLean, B. Sturm, and I. Strudwick, 1996.

Cultural Resources Assessment for Amargosa Creek Improvement Project, Los Angeles County, California, with D. McLean, B. Sturm, and I. Strudwick, 1996.

Report on Paleontological Monitoring, Fox Studios, Galaxy Way Parking Structure, City of Los Angeles, Los Angeles County, California, 1996.

Results of Archaeological Significance Testing at Sites CA-ORA-478 (Locus C), ORA-1453 and ORA-1454, Hicks and East Hicks Canyons, Orange County, California, with D. McLean, B. Sturm, W. McCawley, and I. Strudwick, 1996.

Cultural Resources Assessment for Newport Coast Drive Extension, Off-Site Mitigation Areas, Orange County, California, with D. McLean, and I. Strudwick, 1996.

Results of Archaeological Significance Testing at Site CA-SDI-10156/12599/H MCAS Camp Pendleton, San Diego County, California, with D. McLean, B. Sturm, W. McCawley, D. Taylor, and I. Strudwick, 1996.

Scientific Resources Assessment - Planning Area 12, City of Irvine, Orange County, California, with B. Smith, 1995.

Scientific Resource Assessment - Ryan Oil Properties, Riverside County, California, with B. Smith, 1995.

Scientific Resource Assessment - Sea West Wind Farm, Riverside County, California, with B. Smith, 1995.

Scientific Resource Assessment - Tentative Tract 14232, City of Redlands, San Bernardino County, California, 1995.

Cultural Resources Assessment, Planning Area 22, City of Irvine, Orange County, California, with B. Sturm and D. Taylor, 1995.

Confidential Appendix A, Cultural Resources Assessment, Planning Area 22, City of Irvine, Orange County, California, with B. Sturm and D. Taylor, 1995.

National Register of Historic Places Evaluation for the Proposed Mount San Antonio Historic Mining District, Angeles National Forest, Los Angeles County, California, with B. Sturm, 1995.

Scientific Resources Assessment for the Kohl Ranch Property, Riverside County, California, 1995.

Scientific Resources Assessment for an APE extension of the San Joaquin Hills Transportation Corridor Between Stations 900+00 and 910+00, Orange County, California, 1995.

Scientific Resources Assessment - City of Garden Grove, Orange County California, with B. Smith, 1995.

Archaeological and Historical Investigations of the Cram School Site and Tentative Tracts 13551 and 15554, East Highlands, San Bernardino County, California, with B. Sturm, D. McLean, W. McCawley and M.A. Pritchard-Parker, 1995.

Results of Paleontological Monitoring for the Northwood 5 Development (Tract 14540, Irvine, Orange County, California, with B. Smith, 1995.

Paleontology Assessment Report for Tentative Tract 26193, Corona South Quadrangle, Riverside County, California, 1995.

Paleontology Assessment Report for Tract 13551 and 15554, East Highland Ranch, Redlands Quadrangle, San Bernardino County, California, 1994.

Scientific Resources Assessment - Planning Area 10, City of Irvine, Orange County, California, 1994.

Cultural Resources Assessment - Ryan Oil Exchange Parcel, Riverside County, California, with B. Sturm, 1994.

Cultural Resources Assessment for five vacant lots and 42 Potentially Historic Buildings within the Northeast Anaheim Redevelopment Area, Orange County, California, with D. McLean and B. Sturm, 1994.

Paleontological Resource Assessment for five vacant lots within the Northeast Anaheim Redevelopment Area, Orange County, California, 1994.

Scientific Resources Assessment - Newport Coast Drive Extension, 1994.

Cultural Resources Assessment - Sea West Wind Energy Facility, Riverside County, California, with B. Sturm, 1994.

Paleoecology of Some Lower Pleistocene Habitats (San Pedro Formation) in Orange County, California, with D. Maurer, manuscript in preparation for submission to *Journal of Paleontology*, 1993.

Synecology and Origin of the Pawpaw Micromorph Fauna (Lower Cretaceous) of North-Central Texas, with D. Maurer, manuscript in preparation for submission to *Paleobiology*, 1993.

Identification of Fossil Sharks of Orange County, manuscript in preparation, 1993.

A New View of Coastal Southern California's Prehistory, with J. Mikalsky, manuscript in preparation for submission to *California Geology*, 1993.

New Geological Finds, Interpretations and Events form Orange County, California, Abstracts, *Journal of Vertebrate Paleontology* 12(3), p. 15A, September 1992.

The Geology and Paleontology of Orange County, California, Abstract, *San Bernardino County Museum Association Quarterly*, 39(2), summer 1992.

A Mechanical Screening System for Wet-Screening Large Quantities of Fossiliferous Matrix, and Its Adaptation for Field Work and Archaeological Studies, Abstract, *San Bernardino County Museum Association Quarterly*, with Forrest Michael Hudson, 39(2), summer 1992.

Report on a New Hemphillian (Miocene) Fauna from the El Toro Area of Orange County California, and a Comparison of It with Hemphillian Faunas from the Mojave Desert, Abstract, *San Bernardino County Museum Association Quarterly*, 38(2), summer 1991.

Geology and Paleontology Section, Interpretive Training, Upper Newport Bay, Prepared for the Environmental Management Agency Docent Training Program, Upper Newport Bay, 1991.

An Interpreter's Guide to the Fossils of Badlands National Park, Prepared and published for Badlands National Park, 1990.

Assessment of Archaeological and Paleontological Grading Monitoring for Tentative Tract 13214 of the Robinson Ranch Development Project, Trabuco Highlands, Orange County, California, *Scientific Resources Surveys*, 1989.

Assessment on Paleontological Grading Monitoring for Tentative Tract 13213 of the Robinson Ranch Development Project, Trabuco Highlands, Orange County, California, *Scientific Resources Surveys*, 1989.

Paleontological Resource Investigation of Two Road Alignments to Laguna Canyon Road, Village 34, Orange County, California, *Scientific Resources Surveys*, 1989.

Paleontological Resource Assessment of the Valley Vista Development, Orange County, California, *Scientific Resources Surveys*, 1989.

Report of Paleontological Survey of the Aliso and Wood Canyons Regional Park Access Road Improvement, September 15, 1989, *Environmental Management Agency, County of Orange*, 1989.

A Floral and Fauna Analysis of Clark Regional Park (La Habra Formation: Rancholabrean), Orange County California, Abstract, *San Bernardino County Museum Association Quarterly*, 36(2), summer 1989.

A Floral and Fauna Analysis of Clark Regional Park (La Habra Formation: Rancholabrean), Orange County California, Abstract, *Journal of Vertebrate Paleontology*, 8(3), p. 12A, September 1988.

The Function of the Mandibular Flange in Saber-tooth Carnivores, Abstract, *Journal of Vertebrate Paleontology*, 7(3), p. 14A, September 1987.

An Investigation of the Basicranial Anatomy of Certain Oligocene Sabertooth Cats (Nimravidae) and an Interpretation of Their Phylogenetic Relationship to Other Carnivora, Abstract, *Ter-Qua '85*, fall 1985.

A Dwarf Fauna from the Pawpaw Formation (Lower Cretaceous) of North-Central Texas: Its probable Origin and Synecology, Abstract, *Supplement to the 88th annual Program of the Texas Academy of Science*, 1985.

A New Species of Giant Fish, *Pachyrhizodus*, from the Upper Cretaceous of Texas, Abstract, *Supplement to the 85th Annual Program of the Texas Academy of Science*, fall 1982.

EXHIBITS PREPARED

Los Angeles County Fair, Featured Exhibit, Gems & Minerals
Irvine Park Nature Center
Fullerton Museum Center
Knott's Berry Farm, Discovery Center
Bircher Building Lobby Display
Orange County Fair, Rock and Mineral Building
Orange County Fair, Orange building
Laguna Niguel Regional Park
Whiting Ranch Regional Park
Orange County Natural History Museum
Ralph B. Clark Interpretive Center
Orange County Courthouse Museum

PROFESSIONAL MEMBERSHIPS/AFFILIATIONS

Society for California Archaeology
Sigma Xi, Scientific Research Society
Society of Vertebrate Paleontology
Society of Economic Paleontology and Mineralogy
Southern California Academy of Science
American Association of Mammalogists
Buena Park Rotary Club, President 1989–1990