PALEONTOLOGICAL INDENTIFICATION REPORT/ PALEONTOLOGICAL EVALUATION REPORT

San Diego Freeway (I-405) Improvement Project
SR-73 to I-605

Orange and Los Angeles Counties

12-ORA-405 PM 9.3/24.2 / 07-LA-405 PM 0.0/1.2
12-ORA-22 PM R0.7/R3.8 / 12-ORA-22 PM R0.5/R0.7
12-ORA-73 PM R27.2/R27.8 / 12-ORA-605 PM 3.5/R1.6
07-LA-605 PM R0.0/R1.2

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STATE OF CALIFORNIA
Department of Transportation

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Figures

Appendices

APD	area of potential disturbance
APE	area of potential effect
BMP	Best Management Practice
BRT	Bus Rapid Transit
CCO	Construction Change Order
C-D	collector-distributor
CEQA	California Environmental Quality Act
EA	Expenditure Authorization
FHWA	Federal Highway Administration
ft	foot
GP	General Purpose
HOV	High Occupancy Vehicle
ITS	Intelligent Transportation System
LACM	Natural History Museum of Los Angeles County
LORS	Laws, Ordinances, Regulations, Standards
mi	mile
MPAH	Master Plan Arterial Highway
MVP	Maintenance Vehicle Pullout
NEPA	National Environmental Policy Act
OC	Over crossing
OCTA	Orange County Transportation Authority
OH	Overhead
PEAR	Preliminary Environmental Analysis Report
PER	Paleontological Evaluation Report
PIR	Paleontological Identification Report
PM	Post Mile
PMP	Paleontological Mitigation Plan
POC	Pedestrian overcrossing
PSR	Project Study Report
ROW	Right of Way
RTARM	Real Time Adaptive Ramp Metering
RTP	Regional Transportation Plan
SCAG	Southern California Association of Governments
SDNHM	San Diego Natural History Museum
SER	Standard Environmental Reference
SR	State Route
SVP	Society of Vertebrate Paleontology
TDM	Transportation Demand Management
TSM	Transportation System Management
UCMP	University of California Museum of Paleontology
UPRR	Union Pacific Railroad
WCC	West County Connector

The California Department of Transportation—District 12 (Caltrans), in cooperation with the Orange County Transportation Authority (OCTA), proposes to improve mainline freeway and interchanges on Interstate 405 (I-405) for approximately 16 miles (mi). The project is primarily located in Orange County, California on I-405 (ORA PM 9.3/24.2; LA PM 0.0/1.2) between SR-73 (ORA PM R27.2/R27.8) and I-605 (ORA PM 3.5/R1.6; LA PM R0.0/R1.2). Encroachments into Los Angeles County and work on SR-22 (ORA PM R0.7/R3.8 and R0.5/R0.7) are associated with signing and striping to accommodate the transition from the existing to proposed facility. The direct area of potential disturbance (APD) extends along I-405 from PM 9.3 to PM 24.2. The footprint of the projects lies adjacent to or passes through the cities of Long Beach, Seal Beach, Garden Grove, Westminster, Fountain Valley, Huntington Beach, Costa Mesa, and Hawaiian Gardens

The paleontological literature and records search determined that the surface geology of the entire APD is mapped as Quaternary alluvium. Paleontological record and literature searches indicated that no paleontological resources have previously been recorded within the APD. Some known paleontological resources lie as near as one and one-half miles from the APD. These are of the same age as sediments below the APD. The only paleontological resources seen during the pedestrian survey were in imported fill, and are not significant.

The greatest likelihood for encountering paleontological resources will be where augering is taking place and where overhead structures are replaced. Monitoring for paleontological resources should take place where augering for overhead signage or where overhead structures foundations penetrate more than five feet into native sediments. Locations for overhead structures are fixed, but final determination of overhead signage placement is not yet available.

In order to reduce impacts to nonrenewable paleontological resources, development of a Paleontological Mitigation Plan (PMP) is recommended if a qualified paleontologist determines that augering or foundation construction will penetrate five feet or more into undisturbed sediments. These recommendations follow the guidelines of the Department, the County of Orange, and the Society of Vertebrate Paleontology (SVP).

1.1 PROJECT DESCRIPTION

The project is primarily located in Orange County, California on I-405 (ORA PM 9.3/24.2; LA PM 0.0/1.2) between SR-73 (ORA PM R27.2/R27.8) and I-605 (ORA PM 3.5/R1.6; LA PM R0.0/R1.2). Encroachments into Los Angeles County and work on SR-22 (ORA PM R0.7/R3.8 and R0.5/R0.7) are associated with signing and striping to accommodate the transition from the existing to proposed facility. The project covers a distance of approximately 16 miles. Within the limits of the proposed project, I-405 is a controlled-access highway facility with a fenced ROW, separated by grade from crossing traffic, with vehicular access limited to interchanges. Within the project area, I-405 consists of 8 to 12 mixed-flow general purpose (GP) lanes and two high-occupancy vehicle (HOV) lanes.

1.1.1 Project Alternatives

1.1.1.1 Common Design Features of the Build Alternatives

Build Alternatives 1, 2, and 3 would include the following features:

- One GP lane would be added in each direction of I-405 from Euclid Street to the I-605 interchange.
- Travel lanes on the I-405 mainline would be 12-ft-wide, and right side shoulders would be 10-ft-wide.
- The pedestrian bridge and local street overcrossings proposed for complete replacement under Alternatives 1, 2, and 3 are the following:
  - Ward Street
  - Talbert Avenue
  - Brookhurst Street
  - Slater Avenue
  - Bushard Street
  - Warner Avenue
  - Magnolia Street
  - Pedestrian overcrossing near Heil Avenue
  - Newland Street
  - Edinger Avenue
  - McFadden Avenue
  - Bolsa Avenue
  - Goldenwest Street
  - Edwards Street
  - Westminster Boulevard

  - Springdale Street
  - BolsaChica Road
- The Euclid Street/Ellis Avenue undercrossing bridgewould be modified and extended.
- Two railroad overheads would be modified and extended.[1]
- Each build alternative would include interchange reconfigurations at Euclid Street, Ellis Avenue, Brookhurst Street, Magnolia Street, Warner Avenue, Beach Boulevard, and Westminster Boulevard.
- Maintenance vehicle pullouts (MVP) would be included in various locations under each build alternative.

1.1.1.2 Unique Features of Build Alternatives

Alternative 1 – Add One GP Lane in Each Direction

Alternative 1 would add a single GP lane in each direction of I-405 from Euclid Street to the I-605 interchange.

Alternative 1 would provide a full standard highway cross section, with 12-foot[ft]-wide mainline travel lanes as well as 10-ft-wide shoulders on both left (inside) and right (outside) sides in both directions.

Alternative 2 – Add Two GP Lanes in Each Direction

Alternative 2 would add one GP lane in each direction of I-405 from Euclid Street to the I-605 interchange (as in Alternative 1), plus add a second GP lane in the northbound direction from Brookhurst Street to the SR-22/7th Street interchange and a second GP lane in the southbound direction from the Seal Beach Boulevard on-ramp to Brookhurst Street.

Alternative 2 would provide a full standard highway cross section, with 12-ft-wide mainline travel lanes and shoulders on the left and right sides in both directions. Right side (outside) shoulders would be 10-ft-wide, while left side (inside) shoulders would have a maximum width of 10 ft with a provision for a widened left shoulder for HOV enforcement areas under consideration.

Alternative 3 – Express Facility

Alternative 3 would add one GP lane in each direction of I-405 from Euclid Street to the I-605 interchange (as in Alternatives 1 and 2), plus add a tolled express lane in each direction of I-405 from SR-73 to I-605. The tolled express lane would be placed beside the existing HOV lane in each direction. The existing HOV lanes and new toll lanes would be managed jointly as an Express Lane Facility with two lanes in each direction.

[1]The freeway passes over the Union Pacific Railroad (UPRR) on the Bolsa Overhead (Bridge No. 55-269 at PM 17.21) and the U.S. Navy Railroad on the Navy Overhead (Bridge No. 55-272 at PM 18.36).

Alternative 3 would provide a full standard highway cross section, with 12-ft-wide mainline travel lanes and shoulders on the left and right sides in both directions. Right side (outside) shoulders would be10-ft-wide, while left side (inside) shoulders would have a maximum width of 10 ft with a provision for a widened left shoulder for enforcement areas under consideration. The joint HOV/toll lane Express Lane Facility would be separated from the GP lanes by a 1 to 4ft buffer.

1.1.1.3 No Build (No Action) Alternative

The No Build Alternative provides a "baseline" for comparing impacts associated with the build alternatives because environmental review must consider the effects of not implementing the proposed project. The Project Baseline conditions under the No Build Alternative would provide no additional lanes or interchange improvements to the I-405 corridor. The project area would continue to operate with no additional improvements and would not achieve the project's stated purpose and need

1.2 PROJECT LOCATION

The proposed project segment of I-405, from SR-73 (PM 9.3) to I-605 (PM 24.2), is situated just north of the common boundary of Los Angeles and Orange counties eastward to the common boundary of the cities of Costa Mesa and Newport Beach (Figures 1 and 2). The pertinent US Geological Survey 7.5 minute topographic maps are Los Alamitos, Seal Beach, and Newport Beach.

1.3 SUMMARY OF EXCAVATION PARAMETERS

The I-405 segment under consideration was constructed on the Downey Plain by adding fill to make an elevated freeway. All three build alternatives involve adding GP lanes. Fill would be added to existing shoulders in order to construct these GP lanes. No impact to native sediments is foreseen for these GP lane additions.

All three build alternatives involve replacing or modifying overcrossings at 15 streets, replacing a pedestrian overcrossing, and replacing two railroad overheads. Replacing or modifying the overcrossings would involve driving new piles of 33 to 100 feet (Group Delta Consultants, 2009b, d-i, k-l; 2010a-d, g, i). Replacing the railroad overheads would involve driving new piles of 61 to 91 feet (Group Delta Consultants, 2009a, 2009c). Replacing the pedestrian overcrossing would involve driving new piles of 60 to 65 feet (Group Delta Consultants, 2010e). Where these new piles are driven through fill, an auger would drill a pilot hole through the fill. Where there is native sediment, they would be driven without the benefit of a pilot hole. No significant augering in native sediments is anticipated for these new piles for overcrossings and overheads. Where foundations would be replaced, an excavation depth of 10 feet is expected (pers. com., Curt Scheyhing, 2010).

The location of the overhead signage is not known at this stage of planning. Where overhead signage would be installed, there would be augering of approximately 30 feet into native sediments (pers. com, Curt Scheyhing, 2010). Spoils from the augering could produce significant paleontological resources see Section 3 for discussion regarding significance). The adding of GP lanes is not pertinent to a consideration of paleontological resources, because they would be constructed with fill. The aspect of the project most likely to impact paleontological resources is the augering for overhead signage. At this stage of the project, the location and quantity of overhead signage is not known for any of the three

construction alternatives. Therefore, no difference can be determined for the excavation parameters of the three build alternatives. The no build alternative would have no excavation parameters.

1.4 PURPOSE OF INVESTIGATION

This Paleontological Identification Report/Paleontological Evaluation Report (PIR/PER) provides an assessment of the paleontological resource potential within the Paleontological Study Area (PSA) (Figure 2). Specifically, the PIR/PER is intended to summarize the proposed project, the assumed project footprint, and excavation parameters, to identify the data sources consulted, to document the results of a windshield survey, to identify the specific geology formations and fossils that may be encountered, to assess potential impacts to paleontologically sensitive geologic formations, and to provide a recommended course of action, including identification of specific formation and fossils that may be encountered. This report was prepared by Joe D. Stewart of URS Corporation, San Diego office (URS).

Paleontological resources, as defined here, are fossils and the geographic, geologic, phylogenetic, and taphonomic information associated with them. Fossils, as defined here, are the remains and/or traces of prehistoric plant and animal life.

Paleontological resources are classified as non-renewable scientific resources and are protected by several state statutes, most notably by the State of California's environmental regulation known as the California Environmental Quality Act (CEQA). Professional standards for assessment and mitigation of adverse impacts to paleontological resources have been established by the SVP (1995, 1996). Design, construction, and operations of the proposed project need to be conducted in accordance with laws, ordinances, regulations and standards (LORS) applicable to paleontological resources. Therefore, the LORS applicable to paleontological resources are briefly summarized below, together with SVP professional standards.

2.1 FEDERAL LORS

The Antiquities Act of 1906 is used as the basis for federal protection of paleontological resources on federal lands. The act authorizes the government to regulate the disturbance of objects of antiquity on federal lands through the responsible managing agency and to prosecute unauthorized damage or removal. The National Environmental Policy Act (NEPA) requires that important natural aspects of our national heritage be considered in assessing the environmental consequences of any proposed project. The Federal Land Policy Management Act of 1976 (P.L. 94-579; 90 Stat. 2743, U.S.C. 1701-1782) requires that public lands be managed in a manner that protects the quality of their scientific values. Paleontological resources are also afforded federal protection under 40 Code of Federal Regulations 1508.27 as a subset of scientific resources. The most explicit federal protection for paleontological resources was enacted in 2009. The Paleontological Resources Preservation Act of 2009 regulates who may collect fossils on public lands and where such fossils must be curated. It also provides for prosecution of violators.

2.2 STATE LORS

CEQA applies to projects within California. The legislation does not specifically address paleontological resources, but the Guidelines for the Implementation of CEQA, as amended in 2004, include a standard checklist which requires proponents and regulators to determine whether the proposed project will directly or indirectly destroy a unique paleontological resource or site. A paleontological mitigation plan is mandated if the answer is "yes" or "possibly."

2.3 LOCAL LORS

The California Planning and Zoning Law requires each county and incorporated city to adopt a comprehensive, long-term general plan for its physical development The general plan is a policy document designed to give long range guidance to those making decisions affecting the future character of the planning area. It represents the official statement of the community's physical development as well as its environmental goals. The general plan also acts to clarify and articulate the relationship and intentions of local government to the rights and expectations of the general public, property owners, and prospective investors. Through its general plan, each county or city informs these groups of its goals, policies, and development standards and thereby communicate what must be done to meet the objectives of the general plan. State planning law requires the county or city to identify environmental resources and to prepare and implement policies which relate to the utilization and management of these resources.

The following paleontological resource policies are taken from the Resources Element of the County of Orange General Plan (County of Orange 2005):

1. To identify paleontological resources through literature and records research and surface surveys.

2. To monitor and salvage paleontological resources during the grading of a project.

3. To preserve paleontological resources by maintaining them in an undisturbed condition.

2.4 PROFESSIONAL STANDARDS

The SVP is a national scientific organization of professional vertebrate paleontologists. It has established "standard guidelines" for assessment and mitigation of possibly significant impacts to paleontological resources that outline acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Many federal and state regulatory agencies have either formally or informally adopted these standard guidelines for the mitigation of construction-related impacts to paleontological resources.

Briefly, SVP guidelines recommend that each project have literature and museum archival reviews, a field survey, and, if there is a high potential for disturbing significant fossils during project construction, a mitigation plan that includes monitoring by one or more qualified paleontologist to salvage fossils encountered, identify salvaged fossils, determine their significance, and place curated fossil specimens into a permanent public museum collection.

It is the position of the SVP (1995) that a vertebrate fossil is considered significant unless otherwise demonstrated. Environmental statutes regard them in a like manner. This position is because of the relative rarity of vertebrate fossils. Vertebrate fossils are so uncommon that, in many cases, each recovered specimen will provide additional important information about the morphological variation or the geographic distribution of its species. The SVP recommendations (1995) also mention that significant invertebrate or botanical fossils are considered significant paleontological resources.

A rock unit is considered "sensitive" to adverse impacts if there is a high probability that grading, excavation, or other earth-moving activities will jeopardize significant fossil remains. Using criteria published by the SVP (1995), the paleontological importance or sensitivity (high, low, or undetermined) of each rock unit exposed in a project site or surrounding area is the measure most amenable to classifying the significance of paleontological resources. The paleontological sensitivity of a stratigraphic unit reflects its potential paleontological productivity as well as the scientific significance of the fossils it has produced. This method of paleontological resource assessment is the most appropriate because discrete levels of paleontological importance can be delineated on a topographic or geologic map.

Reasons for considering an individual fossil specimen scientifically important include:

- If it is well preserved.
- If it can be identified.
- If it is more complete than most specimens for that species.
- If it preserves one or more elements not known in most specimens of that species.
- If it is indicative of a particular time period.
- If it has not been recorded from that sedimentary unit.
- If it provides information concerning the environment in which it lived.
- If it could be the basis for description of a new species or comes from a site that produced the type (definitive) specimen of its species.
- If it belongs to a species rarely encountered.

URS considered the following criteria in establishing the importance and paleontological sensitivity of each rock unit exposed in the project site or within the one mile buffer zone:

- Estimation of the potential paleontological productivity of each rock unit on the evidence of fossil localities in or near the proposed project on the basis of published and unpublished sources.
- Consideration of the scientific significance of fossils from each of the rock units exposed within the proposed project area.

Categories of Sensitivity

In keeping with the Department's Standard Environmental Reference (SER) guide for paleontology (Caltrans 2010), the sensitivity of rock units and formations that may contain paleontological resources is assessed on the basis of high, low, or no potential for paleontological resources:

- **High Potential:** Rock units which, based on previous studies, contain or are likely to contain significant vertebrate, significant invertebrate, or significant plant fossils are classified as having high potential for containing significant paleontological resources. These include, but are not limited to, sedimentary formations that contain significant nonrenewable paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. These units may also include some volcanic and low-grade metamorphic rock units. Fossiliferous deposits with very limited geographic extent or an uncommon origin (*e.g.*, tar pits and caves) are given special consideration and ranked as highly sensitive. High sensitivity includes the potential for containing 1) abundant vertebrate fossils; 2) a few significant fossils (large or small vertebrate, invertebrate, or plant fossils) that may provide new and significant taxonomic, phylogenetic, ecologic, and/or stratigraphic data; 3) areas that may contain datable organic remains older than Recent, including *Neotoma* (sp.) middens; and /or 4) areas that may contain unique new vertebrate deposits, traces, and/or trackways. Areas with a high potential for containing significant paleontological resources require monitoring and mitigation.
- **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 because vertebrates are generally rare and found in more localized stratum. Rock units designated as low potential generally do not require monitoring and mitigation. However, as excavation for construction gets underway, it is possible that new and unanticipated paleontological resources might be encountered. If this occurs, a Construction Change Order (CCO) must be prepared in order to have a qualified Principal Paleontologist evaluate the resource. If the resource is determined to be significant, monitoring and mitigation is required.
- **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. For projects encountering only these types of rock units, paleontological resources can generally be eliminated as a concern when the Preliminary Environmental Analysis Report (PEAR) is prepared and no further action taken.

The SVP (1995) established three categories of sensitivity for paleontological resources in its standard guidelines for assessment and mitigation of adverse impacts to paleontological resources. The three categories are high, low, and undetermined.

- High sensitivity paleontological resources are categorized as rock units older than recent for which vertebrate or significant invertebrate fossils or a significant suite of plant fossils have been

recovered. In areas of high sensitivity, full-time monitoring is recommended during any project-related ground disturbance.

- Low sensitivity paleontological resources are categorized as rock units that are not sedimentary in origin. Likewise, sedimentary rock units that have been well examined and have not produced paleontological resources are considered to have low sensitivity. Monitoring is not usually recommended or needed during excavation in a rock unit with low sensitivity.
- Paleontological resources with undetermined sensitivity are categorized as sedimentary rock units for which little information is available. It is often possible for an experienced paleontologist to determine whether such a rock unit should be assigned a high or low sensitivity after he or she has performed a pedestrian survey and has made detailed observations of both natural and artificial exposures of the rock unit.

Given the range of criteria that may be used, assessments of significance should 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. Regardless of the format used by a paleontologist to rank formations, the importance of any rock unit must be explicitly stated in terms of specific fossils known or suspected to be present (and if the latter, why such fossils are suspected), and why these fossils are of paleontological importance. Some land-managing agencies may require the use of specific guidelines to assess significance, whereas others may defer to the expertise of local paleontologists and provide little guidance. Because each situation may differ, it is important that there is a clear understanding among project staff (Caltrans or local), consultants, and personnel from other agencies as to exactly what criteria will be used to assess the significance of rock units affected by a particular project.

As a practical matter, no consideration is generally afforded paleontological sites for which scientific importance cannot be demonstrated. If a paleontological resources assessment results in a determination that the site is insignificant or of low sensitivity, this conclusion should be documented in a PER and in the project's environmental document to demonstrate compliance with applicable statutory requirements.

If a paleontological resource is determined to be significant, of high sensitivity, or of scientific importance, a mitigation program must be developed and implemented. Mitigation can be initiated prior to and/or during construction. The latter is more common for Caltrans projects. It should be pointed out that mitigating during construction poses a greater risk of construction delays. Mitigation is an eligible federal project cost, in accordance with 23 U.S.C. 305, only if significant documentation acceptable to FHWA is submitted. Thus, coordination among Caltrans, FHWA, and all jurisdictional agencies is critical to formally establishing the significance of a resource.

Methods applied to this PIR/PER include both archival research and field survey. For the purposes of literature and records searches, a boundary of one mile was utilized.

4.1 LOCALITY SEARCH

Museums consulted for paleontological site records include the University of California Museum of Paleontology (UCMP), the Natural History Museum of Los Angeles County (LACM), and the San Diego Natural History Museum (SDNHM). Knowing the geology of a particular area, the published and unpublished relevant paleontological literature, and specimen and locality records from pertinent paleontological collection makes it possible to estimate where fossils will or will not be encountered.

4.2 LITERATURE SEARCH

URS conducted a review of relevant published (Fuller et al., 1981; Morton and Miller, 1981; Morton et al. 1971; Morton et al. 1976; Poland and Piper 1956; Poland et al. 1959; Vedder 1971; Vedder et al. 1957) and unpublished (Group Delta Consultants 2009a-l, 2010a-i) geologic reports, and published (Reynolds, 2003; Staley, 2003) and unpublished (Commendador-Dugeonet al.; 2006, Lander, 2006) paleontological reports.

4.3 FIELD INSPECTION

4.3.1 Vehicular Survey

A windshield survey of the PSA was conducted on 7 August 2010 by Dr. Joe D. Stewart of URS.

4.3.2 Pedestrian Survey

A pedestrian survey of the PSA was conducted on 20 August 2010 by Drs. Stewart and Michael Williams of URS. This survey was conducted to identify and document exposed paleontological resources within the PSA and determine the potential proposed construction-related impacts and their relevance to significant paleontological resources.

4.4 PERSONNEL

Dr. Joe Stewart, Principal Paleontologist with URS, completed the paleontological resources literature review and this PIR/PER. Dr. Stewart is a research associate of the Natural History Museum of Los Angeles County. He has over 30 years of paleontological experience and has worked 10 years in paleontological resource management. His qualifications are detailed in Appendix A. Dr. Michael Williams is a native of Orange County, completed his doctorate in Geology in 2009 at Louisiana State University, and recently joined URS Corporation. His qualifications are detailed in Appendix A.

5.1 PHYSICAL GEOLOGICAL SETTING

Orange County lies within the Peninsular Ranges geophysical province. The western portion of Orange County is made up of two broad sloping plains (Downey and Tustin plains) formed from alluvium transported from the mountains by the Santa Ana River, Santiago Creek, and other local streams. The Downey Plain is formed specifically by the outwash of the Santa Ana River, Coyote Creek, Carbon Creek, and Santiago Creek. The entire project lies within the Downey Plain as delineated by Poland and Piper (1956). The Downey Plain is characterized by interbedded marine and non-marine sedimentary rock units deposited during the Neogene. The elevation of the plain along the course of the project ranges from 22 to 30 feet (Group Delta Consultants 2009a-i, k-l, 2010a-e, g). The existing I-405 in the project area is generally 3 to 7 feet above grade, with overpasses 25 to 30 feet above grade (Group Delta Consultants 2009a-i, k-l, 2010a-d, g).

5.2 STRATIGRAPHY

The surficial stratigraphy of the project area has been mapped in greatest detail by Poland and Piper (1956) at a scale of 1:31,680. They mapped the surface geology of the entire area of the I-405 expansion project as Qal (Quaternary alluvium). Some of the coastal regions to the south are mapped by these authors as Qpu (Upper Pleistocene terrace cover including the Palos Verdes Sand and unnamed deposits). Erosional events that divided the terraces into mesas date to at least the Early Holocene; a radiocarbon date of 8,030 $\pm$ 300 years has been reported from a depth of 40 feet in the Santa Ana Gap (Morton *et al.*,1976). The stratigraphy of the subsurface has been mapped by Poland et al. (1959). They show an interpretation of the subsurface geology along a transect from the mouth of Newport Bay to Edinger Avenue (Smeltzer Avenue) (Poland *et al.*, 1959, pl. 4). The depicted sediments have an apparent dip toward Edinger Avenue. The section shows the Puente Formation (late Miocene) as being near the surface from the shore to Newport Boulevard and dipping northward. It shows the "Pico Formation" (Pliocene) as being near the surface from Newport Boulevard to Ajax Petroleum Company Well 1 and dipping northward. It shows the San Pedro Formation (Pleistocene) as being near the surface from Ajax Petroleum Company Well 1 to Adams Avenue and dipping northward. The near surface sediments from Adams Avenue to the Santa Ana River are mapped as "Upper Pleistocene deposits, undivided." Thus, drilling where the transect crosses I-405 would encounter Upper Pleistocene deposits followed by the San Pedro Formation, Pico Formation, and Puente Formation. These formations are shown on Figures 3A and 3B

5.3 STRATIGRAPHIC OCCURRENCE OF PALEONTOGICAL RESOURCES

What Poland *et al.* (1959) showed as the Puente Formation in the project area is now referred to the Monterey Formation by more recent authors (Barron, 1975, 1976; Morton and Miller, 1981). The Monterey Formation in the Newport Bay area has produced significant paleontological resources (Stewart *et al.*, 2008). The sensitivity of the Monterey Formation must be rated high. What Poland *et al.* (1959) mapped as the Pico Formation is now known as the Capistrano Formation (Barron, 1975a, b, 1976) or the Niguel and Capistrano formations (Morton and Miller, 1981) by more recent authors. The Capistrano Formation has produced abundant vertebrate fossils (Barnes and Raschke, 1991; Barnes et al., 1984; Conkling, 1991; Ebling, 1962; Fierstine, 2008; Hilton and Grande, 2006; Miller, 1951; Stewart, 2000;

Stewart and Raschke, 1999). I have observed vertebrate fossils in the Niguel Formation at multiple localities. The sensitivity of the Capistrano and Niguel formations must be rated as high.

The San Pedro Formation (Early to Middle Pleistocene) also has produced significant paleontological resources (Lander 2006). A high level of sensitivity is assigned to the San Pedro Formation. Some Late Pleistocene deposits in the project area are referred to the Palos Verdes Sands (Bruff, 1946; DeLong, 1941; Kanakoff, 1953; Kanakoff and Emerson, 1959; Lance, 1948; Long, 1993). These also have been the source of significant paleontological resources (Howard 1949; Lance 1948; Long 1993) and must be assigned a high level of sensitivity.

6.1 RECORDS SEARCH RESULTS

No recorded paleontological sites producing vertebrate fossils were found within one mile of the project. Several recorded paleontological sites were found within a little more than one mile of the project.

Natural History Museum of Los Angeles County

Dr. Samuel McLeod of the LACM provided data for numerous localities near the project (Appendix B). No known paleontological locality was found to be within a mile of the project boundaries, but several were within two miles. There were no paleontological localities found to be within the younger terrestrial alluvium that occurs at the surface throughout the project. These deposits typically do not contain significant fossils, but are underlain by deposits that do.

The first LACM locality lies just over one mile west of the project, south of 7th Street and east of the Pacific Coast Highway. This locality produced bat rays (*Myliobatis*), guitar fish, white sharks (*Carcharodon*), blue sharks (*Prionace*), requieum sharks (*Carcharhinus*), three species of bony fish, two birds, and five mammal species, including horse and camel. A bit farther west lies a second locality that produced remains of mammoth (*Mammuthus*). A third locality along Warner Avenue near BolsaChica Street, produced bones of mammoth at six to eight feet and bison (*Bison*) at 14 to 20 feet below the surface, respectively. Bison no longer lived in southern California after about 9,500 years ago; thus, any bison remains found here are clearly of Pleistocene age. Three localities are from wells drilled for the Orange County Water District. These wells are along Ellis Avenue east of Beach Boulevard. These wells produced four shark species and seven species of bony fish between 100 and 300 feet below the surface. These fossils are from the San Pedro Formation. The last pertinent locality from the LACM is from a roadcut on SR-55 near Santa Isabel Avenue. At about 15 feet below the original surface, the bones of a camel and a marine turtle were recovered. This locality is in the Palos Verdes Sand formation.

University of California Museum of Paleontology

Dr. Pat Holroyd of the UCMP (UC Berkeley) relayed data for one locality near the eastern terminus of the project. The only pertinent UCMP locality is also from SR-55 near Santa Isabel Avenue. Locality UCMP V-93124 was discovered in a cutbank during work on the highway. It lies less than two miles directly south of the eastern terminus of the project. The locality is in the Palos Verdes Sand Formation. Screening of sediments from the Palos Verdes Sand at this site produced the remains of 17 species of sharks and rays, 25 species of bony fish, a turtle, four bird species, and seven species of mammals, including a rabbit, sea lions, a sea otter, horse, and bison (Long 1993).

San Diego Museum of Natural History

Kesler Randall of the San Diego Museum of Natural History reported that that institution has no records of any paleontological localities within a one-mile radius of the project (Appendix C).

6.2 LITERATURE SEARCH RESULTS

6.2.1 Unpublished Literature

An account of the construction monitoring of the Costa Mesa Water District Reservoir 2 indicates that an extensive collection of fossil plants, vertebrates, and invertebrates was made from the Palos Verdes Sands near the Lindbergh School (23rd Street and Orange Street)(Govean 1994). This locality produced several species of plant fossils, including pine and redwood, as well as 61 species of invertebrates, ten species of sharks, six species of bony fish, reptiles, amphibians, 17 species of birds, and three type of mammals (Govean 1994). Significant vertebrate fossils of the San Pedro Formation were recovered from wells dug approximately 1.75 miles southwest of the intersection of I-405 and Brookhurst Street (along Ellis Avenue between Beach Boulevard and Newland Street). Ten species of bony fish and four species of sharks were recovered there (Lander, 2006). An important collection of Pleistocene vertebrates, primarily ground sloths, was collected in eastern Irvine, only 2.5 miles from the eastern terminus of the project (Commendador-Dudgeon *et al.*, 2006). Geotechnical studies done near some of the project structures noted plant fibers and peat layers in augering samples (Group Delta Consultants 2009f, 2010d). This could indicate the presence of identifiable plant fossils. Marine fossils were also reported 30 to 50 feet below the surface at another structure (Group Delta Consultants 2009b).

6.2.2 Published Literature

Reynolds (2003) and Staley (2003) documented an extensive Late Pleistocene fauna in eastern Irvine near Jamboree Road and Michelson Drive. The fossils were deposited in the San Joaquin Marsh. The fossils were found 10 to 15 feet below original ground level (Reynolds, pers. comm., 2010). The site is about 2.5 miles east of the eastern terminus of the project.

Axelrod and Govean (1996) investigated the plant fossils from the Costa Mesa Water District Reservoir 2 collection and described the most diverse assemblage of Pleistocene conifers species in the Pacific coastal region. They identified the Bishop pine (*Pinus muricata*), the island Bishop pine (*Pinus remorata*), the Monterey pine (*Pinus radiata*), and the Monterey cypress (*Cupressus macrocarpa*). The invertebrate and vertebrate fossils came from the Palos Verdes Sand, but the plant fossils came from unnamed clay underlying the Palos Verdes Sand (Govean 1994).

6.3 RESULTS OF FIELD INSPECTION

This portion of the I-405 was built on the Downy Plain. The surface of the plain is mapped as Quaternary alluvium. Figure 4 illustrates the appearance of the alluvium naturally present adjacent to the freeway. In order to have this freeway stand above the surrounding plain, the majority of the structures constructed for the freeway were built on fill. In general, within the project area, I-405 is 3 to 7 feet above the historic grade. Some of the overpasses are as much as 35 feet above the plain. As much as 31 feet of fill was added to make the approach ramps to these overpasses (Group Delta Consultants 2009d, 2010b).

The earthwork around most structures examined contained shells of marine mollusks. Marine mollusks were found at 85% of the overcrossings, both railroad overheads, and the pedestrian overcrossing. These are probably of Pleistocene age. They are certainly the result of using fossiliferous alluvium for the artificial fill. In some places the shells are mixed with crushed rock and fragments of concrete and asphalt. The identification of the mollusks was not deemed to be important because these are not in undisturbed sediments and because we cannot know their original localities. Figures 5 and 6 show marine mollusk fossils present in the fill used to construct the freeway. Figure 7 shows the location of the exposure in Figure 4 as well as the localities where the fossil shells were observed.

7.1 INTRODUCTION

Direct impacts to paleontological resources are the effects that occur to fossiliferous sediments during construction. These effects include mass grading, cutting, tunneling, and boring. The direct impacts are the destruction of the fossil remains and the geographic, geologic, phylogenetic, and taphonomic information associated with them. These resources are considered to be nonrenewable because the organic remains preserved from any given time period are finite and are diminished through time due to natural and artificial processes. The direct impacts to paleontological resources can be significant and, under CEQA guidelines, require mitigation.

Impacts to paleontological resources are rated in accordance with the sensitivity ratings of the rock units impacted. Below is a summary of the criteria for these ratings.

- *High Significance:* Direct impacts to high sensitivity rock units (unnamed Pleistocene sediments, Palos Verdes Sand, San Pedro Formation).
- *Low significance:* Direct impacts to low sensitivity rock units (alluvium at the surface).
- *Zero significance:* Direct impacts to zero sensitivity rock units (artificial fill).

7.2 SITE SPECIFIC IMPACTS

Earth moving activities associated with construction are the most common source of impacts to significant paleontological resources. Geotechnical studies completed near some of the project structures noted plant fibers and peat layers in augering samples (Group Delta Consultants 2009f, 2010d). These findings could indicate the presence of identifiable plant fossils. Marine fossils were also reported 30 to 50 feet below the surface at another structure (Group Delta Consultants 2009b). Because Pleistocene vertebrates have been found at 10 to 15 feet below ground level and deeper near the project, and because vertebrate fossils have been recovered from borings in the project vicinity, it is concluded that improvements proposed for the project are situated above paleontologically sensitive sediments, and therefore disturbance of sediments below grade has the potential to impact paleontological resources along most of the right-of-way. The main anticipated impacts will be where there is augering for overhead signage and where the overcrossings and railroad overheads are replaced, particularly in the foundations and augering. The augering can be up to 30 feet deep and five feet in diameter. Foundations extend 10 feet below the surface.

7.3 RECOMMENDED COURSE OF ACTION

On the basis of the occurrence of (1) known significant paleontological resources within a mile and one-half mile of the PSA, (2) with probable significant paleontological resources being located beneath the project, and (3) with currently unknown placement of overhead signage, it is recommended that a decision whether to prepare a PMP be postponed until placement is known. Once placement is known, a qualified paleontologist will consider available information on depth of augering and depth of fill at each location. If some of the augering will penetrate 5 feet or more into undisturbed sediment, a PMP will be prepared.

Caltrans, in cooperation with OCTA, proposes to improve mainline freeway and interchanges on I-405 in Orange County for approximately 16 mi. Geotechnical reports and geologic and paleontological literature indicate that fine-grained sediments conducive to the preservation of Quaternary paleontological resources underlie the Project. Thus, the Project may disturb fossiliferous Quaternary sediments. Design details are not known to the extent necessary to state all impacts, but at least the augering for overhead signage is a definite impact. This study presents definitions of significance and sensitivity, the results of records search, and summarizes pertinent geological and paleontological literature regarding paleontological resources near the study area, especially those of the same age as the sediments that underlie the project.

This study does not anticipate special paleontological situations that would require project design to avoid critical localities or strata. If augering or foundation construction will penetrate five feet or more into undisturbed sediments, preparation of a Paleontological Mitigation Plan (PMP) is recommended to minimize potential impacts. The PMP should be synthesized from guidelines provided by Caltrans, the County of Orange, and the Society of Vertebrate Paleontology.

Axelrod, D. I., and F. Govean. 1996. An early Pleistocene closed-cone pine forest at Costa Mesa, southern California. International Journal of Plant Science 157:323-329.

Barnes, L. G., and R. E. Raschke. 1991. *Gomphotariapugnax*, a new genus and species of late Miocene dusignathineotariidpinniped (Mammalia: Carnivora) from California. Natural History Museum of Los Angeles County Contributions in Science 426:1-16.

Barnes, L. G., R. E. Raschke, and J. C. Brown. 1984. A fossil baleen whale from the Capistrano Formation in Laguna Hills, California. Memoirs of the Natural History Foundation of Orange County 1:11-18.

Barron, J. A. 1975A. Late Miocene – Early Pliocene marine diatoms from Southern California. PalaeontographicaAbt.B 151:97-170.

Barron, J. A. 1975b. Marine diatom biostratigraphy of the upper Miocene-lower Pliocene strata of southern California. Journal of Paleontology 49:619-632.

Barron, J. A. 1976. Revised Miocene and Pliocene diatom biostratigraphy of Upper Newport Bay, Newport Beach, California. Marine Micropaleontology 1:27-63.

Bruff, S. C. 1946. The paleontology of the Pleistocene molluscan fauna of Newport Bay area, California. University of California Publication Bulletin Department of Geological Sciences 27:213-240.

Caltrans. 2010. Standard Environmental Reference.

Commendador-Dudgeon, A., B. Padon, and J. D. Stewart. 2006. Archaeological and paleontological monitoring for the Plaza Irvine Development, Phase 1, City of Irvine, Orange County, California. Prepared by: Discovery Works, Inc., P.O. Box 92136, Long Beach, CA 90809. Prepared for: OWR Construction, Inc., 2020 Main Street, Suite 800, Irvine, California 92614.

Conkling, S. W. 1991. Report on a new Hemphillian (Miocene) fauna from the El Toro area of Orange County, California, and a comparison of it with Hemphillian faunas of the Mojave Desert. San Bernardino County Museum Associates Quarterly 38(2): 46.

County of Orange. 2005. The County of Orange General Plan. Resource Element.

DeLong, J. H., Jr. 1941. The paleontology and stratigraphy of the Pleistocene at Signal Hill, Long Beach, California. Transactions of the San Diego Society of Natural History 9:231-250.

District Groundwater Replenishment System Project Huntington Beach, Orange County, California. Prepared by: PEA. Prepared for: Orange County Water District, 10500 Ellis Avenue, Fountain Valley, California 92708.

Ebeling, A. W. 1962. *Scopelogadus* (?) *capistranensis*, a new fossil melamphaid (Pisces: Teleostei) from Capistrano Beach, California. Postilla 71:1-6.

Fierstine, H.L. 2008. A fossil skull of the extant blue marlin (*Makairanigricans*Lacèpede, 1802) from the Late Miocene of Orange County, California. Bulletin of the Southern California. Bulletin of the Southern California Academy of Sciences 108:45-56.

Fuller, D. R., E. AC. Sprotta, R. B. Greenwood, H. A. Humm, C. R. Real, and R. W. Sherburne. 1981. Classification and mapping of Quaternary sedimentary deposits for purposes of seismic zonation, south coastal Los Angeles Basin, Orange County, California. US Geological Survey Open-File Report OF-81-966. 1:48,000.

Govean, F. 1994. Paleontological Report; Monitoring and Salvage; Mesa Reservoir No. 2 Site, Lindberg School, 23rd and Orange Street, Costa Mesa, California. Prepared for: Mesa Consolidated Water District. Prepared by: Petra Resources, Inc. 33 p.

Group Delta Consultants. 2009A. Technical Memorandum, Navy OH, Structure Preliminary Geotechnical Report.

_____ 2009B. Technical Memorandum, Ward St OC, Structure Preliminary Geotechnical Report.

_____ 2009C. Technical Memorandum, Bolsa OH, Structure Preliminary Geotechnical Report.

_____ 2009D. Technical Memorandum, McFadden Ave OC, Structure Preliminary Geotechnical Report.

_____ 2009E. Technical Memorandum, Talbert Ave OC, Structure Preliminary Geotechnical Report.

_____ 2009F. Technical Memorandum, Brookhurst St OC, Structure Preliminary Geotechnical Report.

_____ 2009G. Technical Memorandum, Bushard St OC, Structure Preliminary Geotechnical Report.

_____ 2009H. Technical Memorandum, Edinger Ave OC, Structure Preliminary Geotechnical Report.

_____ 2009I. Technical Memorandum, Slater Ave OC, Structure Preliminary Geotechnical Report.

_____ 2009J. Technical Memorandum, Santa Ana River Bridge, Structure Preliminary Geotechnical Report.

_____ 2009K. Technical Memorandum, Springdale St OC, Structure Preliminary Geotechnical Report.

_____ 2009L. Technical Memorandum, Edwards St OC, Structure Preliminary Geotechnical Report.

Group Delta Consultants. 2010A. Technical Memorandum, Magnolia Street OC, Structure Preliminary Geotechnical Report.

_____ 2010B. Technical Memorandum, BolsaChica Rd OC, Structure Preliminary Geotechnical Report.

_____ 2010C. Technical Memorandum, Westminster Ave OC, Structure Preliminary Geotechnical Report.

_____ 2010D. Technical Memorandum, Golden West Street OC, Structure Preliminary Geotechnical Report.

_____ 2010E. Technical Memorandum, Heil Avenue POC, Structure Preliminary Geotechnical Report.

_____ 2010F. Technical Memorandum, Service Road UC-Box Culvert, Structure Preliminary Geotechnical Report.

_____ 2010G. Technical Memorandum, Warner Ave On Ramp Connector OC, Structure Preliminary Geotechnical Report.

_____ 2010H. Technical Memorandum, 405/73 HOV Connector Separation, Structure Preliminary Geotechnical Report.

_____ 2010I. Technical Memorandum, Fairview Rd OC, Structure Preliminary Geotechnical Report.

Hilton, E. J., and L. Grande. 2006. Review of the fossil record of sturgeons, family Acipenseridae (Actinopterygii: Acipenseriformes) from North America. Journal of Paleontology 80:672-683.

Howard, H. 1949. Avian fossils from the marine Pleistocene of southern California. Condor 51:20-28.

Kanakoff, G. P. 1953. A new fossil shell from the Palos Verdes Sand. Southern California Academy of Sciences Bulletin 52:67-70.

Kanakoff, G. P., and W. K. Emerson. 1959. Late Pleistocene invertebrates of the Newport Bay area. Natural History Museum of Los Angeles County Contributions in Science 31:1-47.

Lance, J. F. 1948. Mammals from the Palos Verdes Pleistocene. Geological Society of America Bulletin 59:1375.109-133.

Lander, E. B. 2006. Paleontologic Resource Impact Mitigation Program Final Technical Report of Results and Findings prepared in support of Orange County Water District Groundwater Replenishment System Project Huntington Beach, Orange County, California. Prepared by: PEA. Prepared for: Orange County Water District, 10500 Ellis Avenue, Fountain Valley, California 92708.

Lander, E. B. 2009. Paleontologic Resource Impact Mitigation Program Final Technical Report of Results and Findings prepared in support of Police Headquarters Facility, Low Angeles, California. Prepared by: PEA. Prepared for: City of Los Angeles Department of Public Works Environmental Management Group, 1149 South Broadway, Suite 600, Los Angeles, California 90015,

Long, D. J. 1993. Preliminary list of the marine fishes and other vertebrate remains from the late Pleistocene Palos Verdes Sand Formation at Costa Mesa, Orange County.

Miller, L. 1951. A Miocene petrel from California. The Condor 53:78-80.

Morton, P. K., and R. V. Miller. 1981. Geologic map of Orange County, California, showing mines and mineral deposits. California Division of Mines and Geology Bulletin 204. 1:48,000.

Morton, P. K., R. V. Miller, and J. R. Evans. 1976. Environmental Geology of Orange County, California. California Division of Mines and Geology Open-File Report 79-08. 1:48,000.

Poland, J. F. and A. M. Piper. 1956. Ground-water geology of the coastal zone, Long Beach – Santa Ana area, California. US Geological Survey Water-Supply Paper 1109. 1:31,680.

Poland, J. F., A. Sinnot, W. W. Paulsen, and R. C. Newcomb. 1959. Hydrology of the Long Beach – Santa Ana area, California, with a section on the withdrawal of ground water, 1832-41. US Geological Survey Water-Supply Paper 1471. 1:31,680.

Reynolds, R. E. 2003. The Park Place Fauna: a faunal assemblage from Irvine, Orange County, California. 2003 Desert Symposium 66-67.

Staley, M. A. 2003. Taphonomic evidence for predation of *Capromeryx minor* (Artiodactyla, Antilocapridae) from Park Place, Irvine, California (Pleistocene: Ranchoabrean). 2003 Desert Symposium: 67.

Stewart, J. D. 2000. Late Miocene ontogenetic series of true *Carcharodon* teeth. Journal of Vertebrate Paleontology 20:71A.

Stewart, J. D., and R. Raschke. 1999. Correlation of stratigraphic position with *Isurus-Carcharodon* tooth serration size in the Capistrano Formation and its implication for the ancestry of *Carcharodon carcharias*. Journal of Vertebrate Paleontology 19:78A.

Stewart, J. D., S. A. Siren, L. G. Barnes, and G. H. Archer. 2008. Report of archaeological and paleontological monitoring program, Pelican Hill, Newport Beach, California. Prepared for:

Investment Properties Group, Newport Beach, California. Prepared by: Stantec Consulting Inc., Irvine, California.

SVP (Society of Vertebrate Paleontology). 1995. Assessment and mitigation of adverse impact to nonrenewable paleontological resources: standard guidelines: Society of Vertebrate Paleontology News Bulletin 163:22-27.

_____ . 1996. Conditions of receivership for paleontological salvage collections. Society of Vertebrate Paleontology News Bulletin. 166:31-32.

Vedder, J. G. 1971. Revised geologic map of the San Joaquin Hills – San Juan Capistrano area, Orange County, California. US Geological Survey open-file Report OF-75-552. 1:24,000.

Vedder, J. G., R. F. Yerkes, and J. E. Schoellhamer. 1957. Geologic map of the San Joaquin Hills-San Juan Capistrano area, Orange County, California. US Geological Survey Oil and Gas Investigations Map OM-193. 1:24,000.

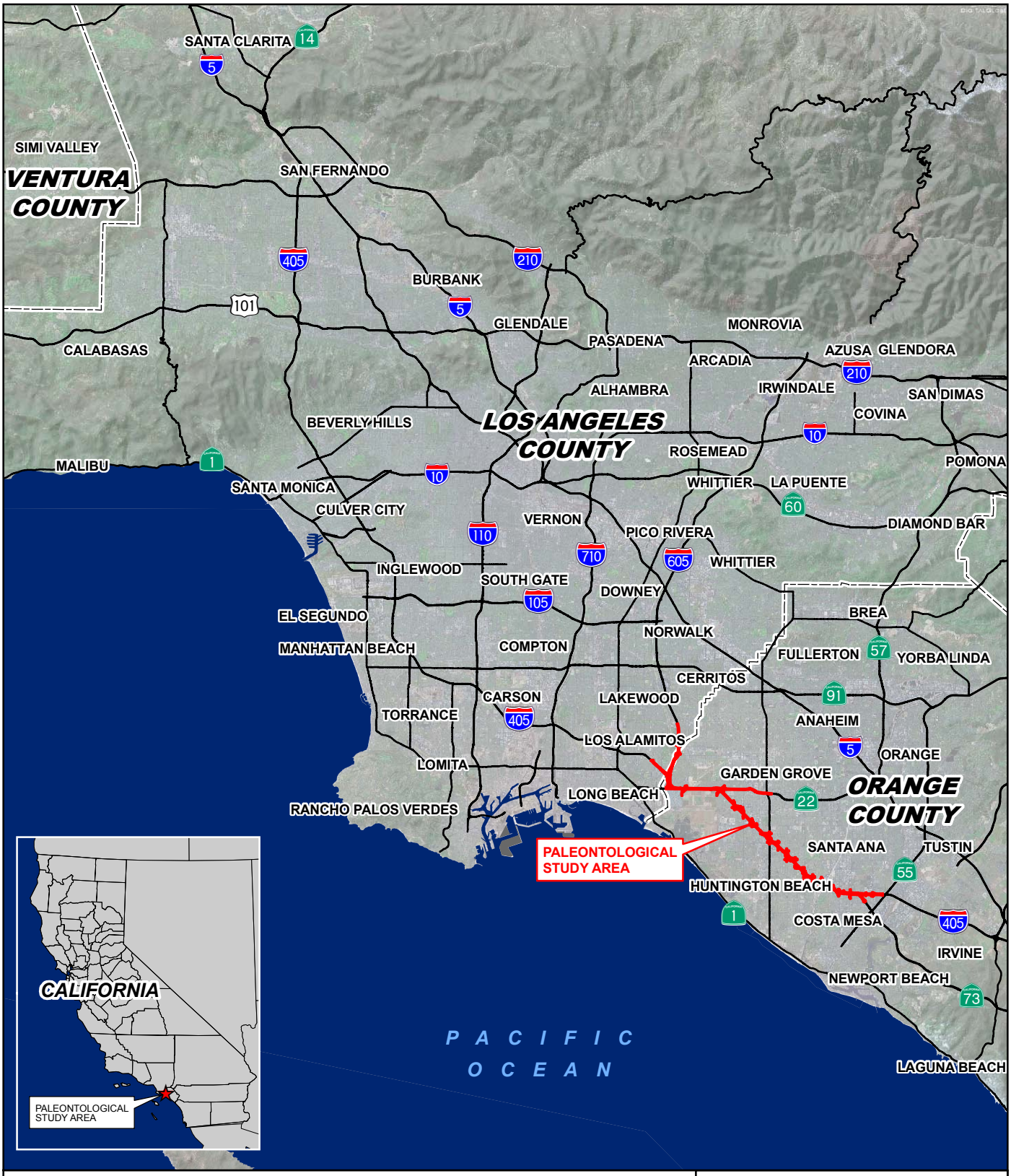
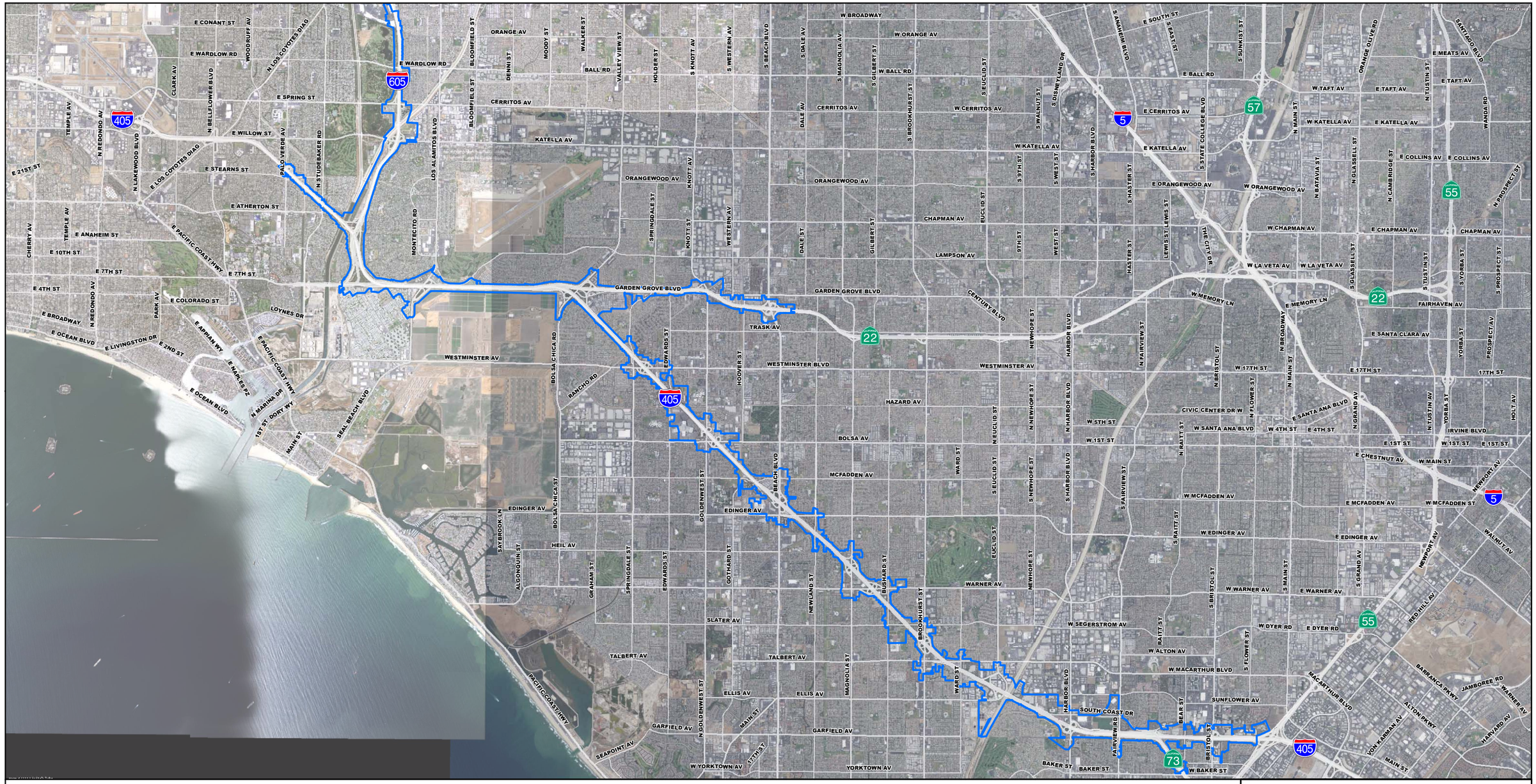


FIGURE 1
REGIONAL LOCATION

I-405 CORRIDOR IMPROVEMENT PROJECT FROM SR-73 TO I-605

Project No.: 29866416

Date: August 2010



Legend

Area of Potential Effects (APE)

0 1 2
Miles

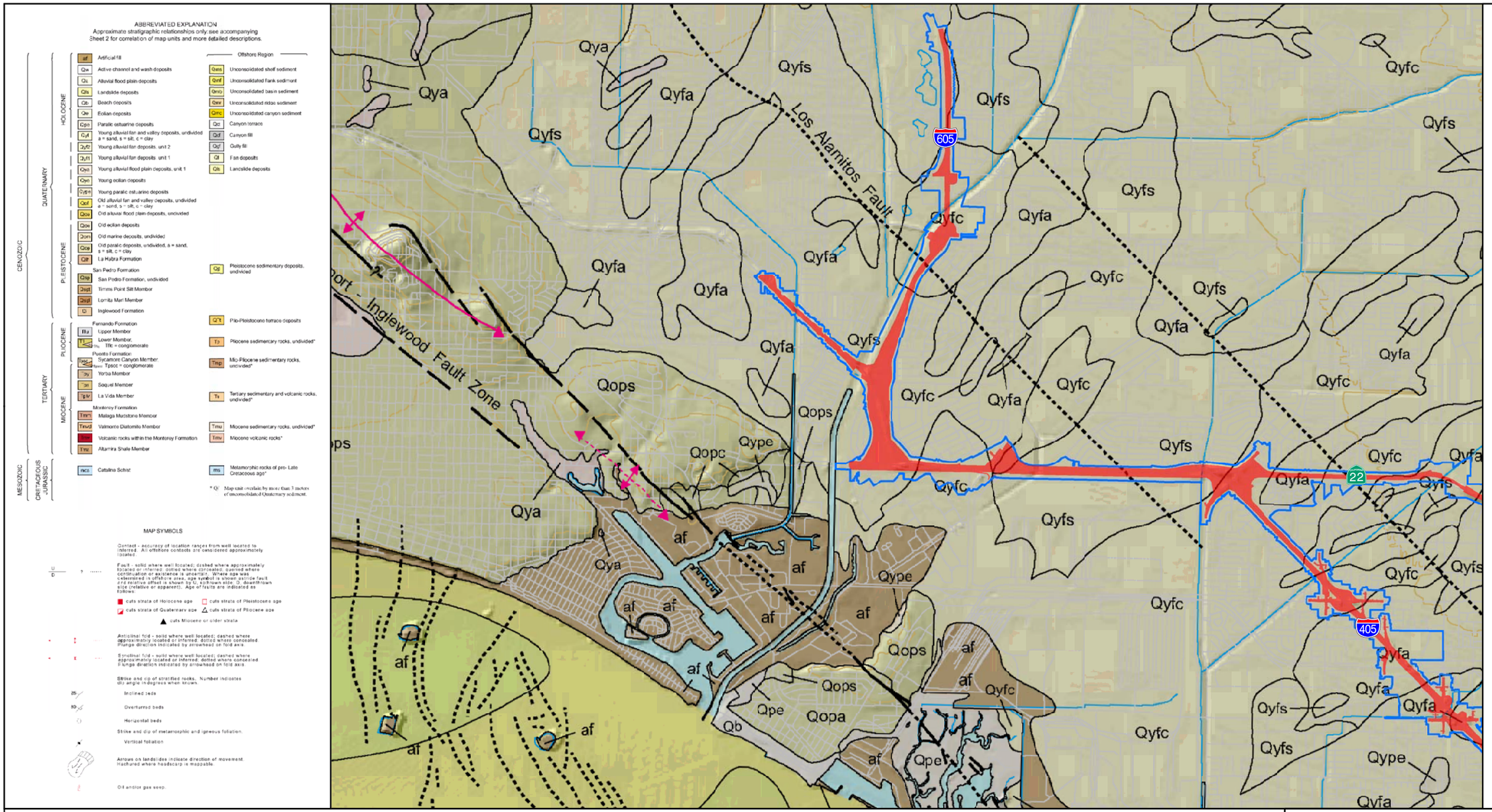
FIGURE 2

AREA OF POTENTIAL EFFECTS

I-405 CORRIDOR IMPROVEMENT
PROJECT FROM SR-73 TO I-605

Project No.: 29866416

Date: August 2010



SEE FIGURE 3B
(PRELIMINARY DIGITAL GEOLOGIC MAP OF THE SANTA ANA 30'x60' QUADRANGLE, USGS, 2004)

Legend

- Disturbance Area
- Area of Potential Effects (APE)

0 4,500
Feet

SOURCE: *PRELIMINARY DIGITAL GEOLOGIC MAP OF THE LONG BEACH 30'x60' QUADRANGLE*, USGS, 2003

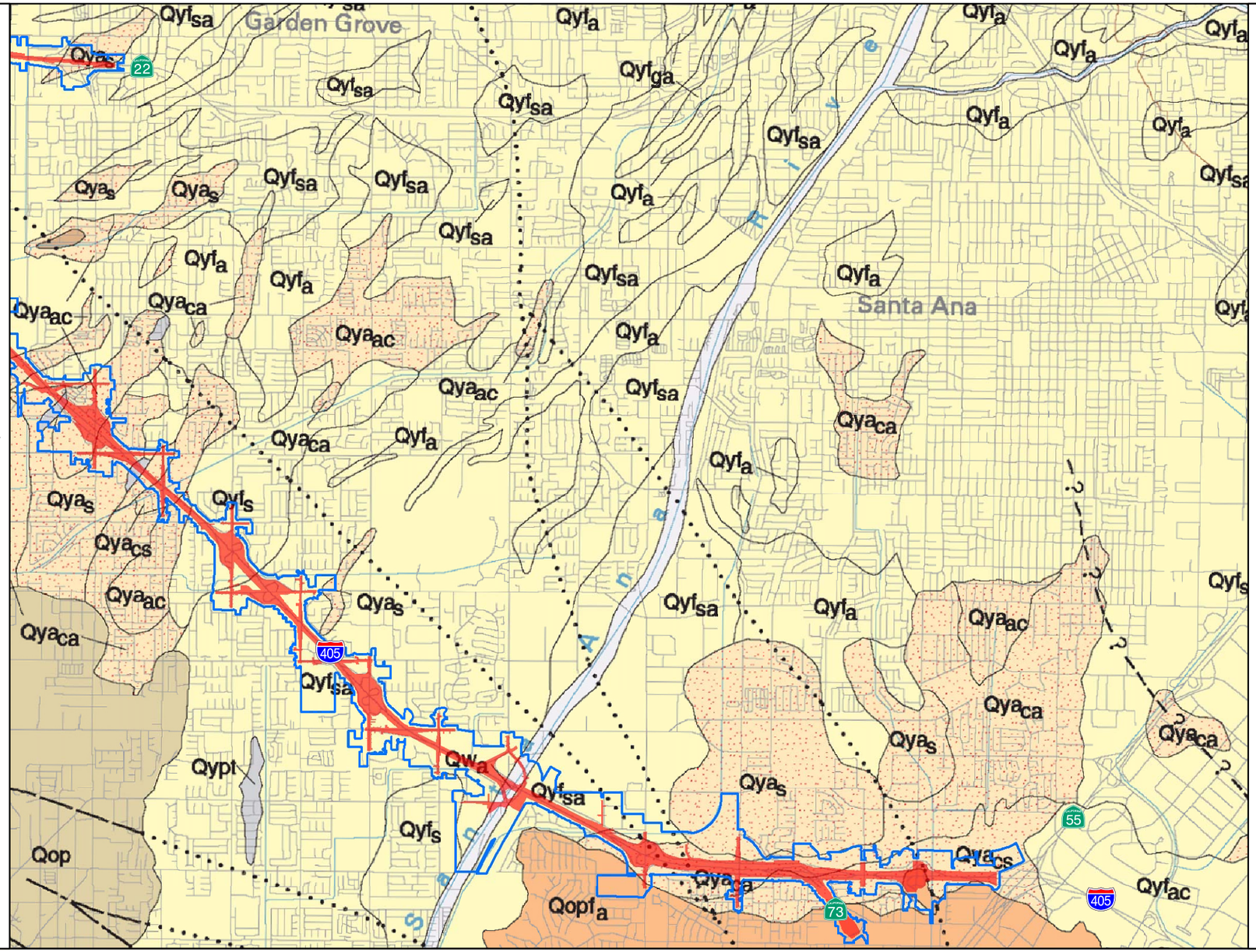
FIGURE 3A

PALEONTOGICAL SENSITIVITIES

I-405 CORRIDOR IMPROVEMENT
PROJECT FROM SR-73 TO I-605

Project No.: 29866416
Date: August 2010

SEE FIGURE 3A
(GEOLOGIC MAP OF THE LONG BEACH 30'x60' QUADRANGLE, USGS, 2003)



$Qopf_a$	Old marine deposits (late & middle Pleistocene) sand
Qya_a	Young axial channel deposits (Holocene & late Pleistocene) sand
Qya_{ac}	Young axial channel deposits (Holocene & late Pleistocene) sandy clay
Qya_{ca}	Young axial channel deposits (Holocene & late Pleistocene) clayey sand
Qya_{cs}	Young axial channel deposits (Holocene & late Pleistocene) clayey silt
Qya_s	Young axial channel deposits (Holocene & late Pleistocene) silt
Qyf_a	Young alluvial fan deposits (Holocene & late Pleistocene) sand
Qyf_{ca}	Young alluvial fan deposits (Holocene & late Pleistocene) clayey sand
Qyf_{ga}	Young alluvial fan deposits (Holocene & late Pleistocene) gravelly sand
Qyf_s	Young alluvial fan deposits (Holocene & late Pleistocene) silt
Qyf_{sa}	Young alluvial fan deposits (Holocene & late Pleistocene) silty sand

Legend

- Disturbance Area
- Area of Potential Effects (APE)

0 4,500
Feet

SOURCE: *PRELIMINARY DIGITAL GEOLOGIC MAP OF THE SANTA ANA 30'x60' QUADRANGLE*, USGS, 2004

FIGURE 3B

PALEONTOGICAL SENSITIVITIES

I-405 CORRIDOR IMPROVEMENT
PROJECT FROM SR-73 TO I-605

Project No.: 29866416
Date: August 2010

QUATERNARY ALLUVIUM JUST SOUTH OF I-405 AND EAST OF LOS ALAMITOS INTERCHANGE

PROJ. NO: 29866416

FIG. NO: 4

FOSSIL MOLLUSKS NEAR THE
1-405/EUCLID INTERCHANGE

PROJ. NO: 298866416

FIG. NO:
5

FOSSIL MOLLUSKS NEAR THE
I-405/BROOKHURST INTERCHANGE

PROJ. NO: 29866416

FIG. NO:
6

NOTES:
FIGURE 4 PHOTOGRAPH WAS TAKEN AT LOCATION 6.
FIGURE 5 PHOTOGRAPH WAS TAKEN AT LOCATION 8.
FIGURE 6 PHOTOGRAPH WAS TAKEN AT LOCATION 9.

Legend

- Fossil Mollusk Location
- Area of Potential Effects (APE)

0 1 2
Miles

FIGURE 7

LOCATIONS WHERE FOSSIL MOLLUSKS WERE FOUND IN CONSTRUCTION FILL

I-405 CORRIDOR IMPROVEMENT
PROJECT FROM SR-73 TO I-605

Project No.: 29866416

Date: August 2010

Areas of Expertise

Paleontology

Total Years of Experience

34
URS 3
Other Firms 5

Education

MA/1979/Systematics & Ecology/University of Kansas
Ph.D./1984/Systematics & Ecology/University of Kansas

Registration/Certification

Certified Paleontologist, Orange and Riverside counties

Overview

Joe Stewart is a vertebrate paleontologist with over 30 years of experience in paleontology and 22 years of experience in the geology and paleontology of California, particularly in Merced, Fresno, Kern, Santa Barbara, Los Angeles, Orange, San Bernardino, Riverside, Imperial, and San Diego counties. Joe has been involved in the permitting or construction of more than ten power plants, and has directed the paleontological monitoring and mitigation program for Path 15, a major transmission line project. He is also a certified paleontologist for the Counties of Orange and Riverside. His publications include 35 peer-reviewed articles in books and journals. His research specialties are fossil fishes and Pleistocene vertebrate faunas.

Project Experience

Mesquite Nevada Replacement General Aviation Airport. Wrote the paleontolgical Resource Assessment for the Federal Aviation Administration **(2009)**.

Starwood Power-Midway, LLC Peaking Project Construction. Wrote mitigation plan for paleontological resources, oversaw monitoring for paleontological resources, and wrote final report **(2008-2009)**

I-805 Managed Lanes South Project. Directed paleontological survey of 11.4-mile long project area in San Diego, National City, and Chula Vista and wrote the Paleontological Resource Assessment for SANDAG. **(2008-2009)**

I-805 North Corridor Project. Directed paleontological survey of 4.4-mile long project area in San Diego and wrote the Paleontological Resource Assessment for SANDAG. **(2008)**

Calnev Pipeline Project. Directed paleontological survey of 234-mile long project area in San Bernardino County, California and Clark County, Nevada and wrote the paleontological assessment. **(2008-present)**

SES Solar One Application for Certification. Directed paleontological pedestrian survey of project area in San Bernardino County and wrote the paleontological resource section of the AFC. **(2008-present)**

San Joaquin One and Two Application for Certification. Directed paleontological pedestrian survey of project area in Fresno County and wrote the paleontological resource section of the AFC. **(2008)**

Willow Pass Generating Station Application for Certification. Participated in paleontological pedestrian survey of project area in Contra Costa County and wrote the paleontological resource section of the AFC. **(2008)**

Marsh Landing Generating Station Application for Certification. Participated in paleontological pedestrian survey of project area in Contra Costa

County and wrote the paleontological resource section of the AFC. **(2008)**

SES Solar Two Application for Certification. Participated in paleontological pedestrian survey of project area, edited the paleontology section of the AFC, and am serving as Paleontological Resource Specialist. **(2008-Present)**

IID Niland Gas Turbine Plant Phase III project construction. Served as Paleontological Resource Specialist Oversaw the work of the paleontological resource monitors, made numerous site visits, and will write final report on paleontological resources. **(2007-2008)**

Carrizo Energy Solar Farm (Ausra) Application for Certification. Participated in paleontological pedestrian survey of project area and edited the paleontology section of the AFC. **(2007)**

Starwood Power-Midway, LLC Peaking Project Application for Certification. Participated in the responses to the CEC Provisional Staff Assessments. **(2007)**

BNSF Cajon Main Third Track Summit to Keenbrook permitting. Participated in the writing, editing, and production of the Paleontologic Resources Monitoring and Mitigation Plan and the Paleontological Resource Assessment. **(2007)**

Path 15 500-kV Power Transmission Line between Los Banos and Gates substations. Supervised paleontological resource monitoring, excavations, specimen preparation, specimen identification, and report writing for 80-mile power line. **(2003-2005)**

Professional Associations

Society of Vertebrate Paleontology

Professional History

URS Corporation, Principal Paleontologist, San Diego, California, 2007-Present.

PCR Services Corporation, Principal Paleontologist, Irvine, California, 2005-2007.

Jones and Stokes, Project Paleontologist, Sacramento, California, 2003-2005.

Natural History Museum of Los Angeles County, California, Assistant Curator of Vertebrate Paleontology, 1985-2003.

Publications

Bell, M. A., J. D. Stewart, and J. Park. 2009. The world's oldest fossil threespine stickleback. Copeia 2009:256-265.

Tseng, J.Z., X. Wang, and J.D. Stewart. 2009. A new otter-like immigrant mustelid (Carnivora, Mammamlia) from the middle Miocene Temblor Formation of Central California. PaleoBios 29:13-23.

Kelly, T. S., and J. D. Stewart. 2008. New records of Middle and Late Miocene Perissodactyla and Artiodactyla from the western border of the San Joaquin Valley, Diablo Range, Fresno County, California. Los Angeles County Museum of Natural History Contributions in Science 516:1-29.

Tseng, Z., X. Wang, and J. D. Stewart. 2007. Tough New World. Discovery of an unusual immigrant mustelid with crushing dentition from the middle Miocene of coastal California. Journal of Verterate Paleontology 27:160A.

Stewart, J. D. and M. Hakel. 2006. Ichthyofauna of the Mowry Shale (Early Cenomanian) of Wyoming. New Mexico Museum of Natural History & Science Bulletin 35:161- 163.

Stewart, J. D., E. Zaborsky, and M. Hakel. 2006. A new Middle Miocene terrestrial fauna from the Temblor Formation of Central California. New Mexico Museum of Natural History & Science Bulletin 34:40.

Stewart, J. D. 2003. Quantifiable change in the *Isurus hastalis* populations in Middle and Late Miocene rocks of California. Journal of Vertebrate Paleontology 23:101A.

Stewart, J. D., and F. Perry. 2002. The first paleomagnetic framework for the *Isurus hastalis – Carcharodon* transition in the Pacific Basin: the Purisima Formation, Central California. Journal of Vertebrate Paleontology 22:111A.

Hakel, M., and J. D. Stewart. 2002. First fossil Molidae (Actinopterygii: Tetraodontiformes) in western North America. Journal of Vertebrate Paleontology 22:62A.

Geist, N. R., S. Carpenter, and J. D. Stewart. 2002. Chemical and morphological analysis of soft tissue preservation in a mosasaur. Journal of Vertebrate Paleontology 22:75A.

Stewart, J. D., and V. Friedman. 2001, Oldest American records of Saurodontidae (Teleostei: Ichthyodectiformes). Journal of Vertebrate Paleontology 21:104A.

Stewart, J. D. 2000. Late Miocene ontogenetic series of true *Carcharodon* teeth. Journal of Vertebrate Paleontology 20:71A.

Martin, L. D., and J. D. Stewart. 1999. Implantation and replacement of bird teeth. Smithsonian Contributions to Paleobiology 89:295-300.

Stewart, J. D., and R. Raschke. 1999. Correlation of stratigraphic position with *Isurus-Carcharodon* tooth serration size in the Capistrano Formation and its implication for the ancestry of *Carcharodon carcharias*. Journal of Vertebrate Paleontology 19:78A.

Stewart, J. D. 1999. A new genus of Saurodontidae (Teleostei: Ichthyodectiformes) from the Upper Cretaceous rocks of the Western Interior of North America. P. 335-360 in: G. Arratia (ed.) Mesozoic Fishes – Systematics and the Fossil Record. Verlag Dr. Friedrich Pfeil, Munich. 576 p.

Fielitz, C., J. D. Stewart, and J. Wiffern. 1999. *Aethocephalichthys hyrainarhinos* n. gen. and n. sp., a new and enigmatic Late Cretaceous actinopterygian from North America and New Zealand. P. 95-106 in: G. Arratia (ed.) Mesozoic Fishes – Systematics and the Fossil Record.

Barnes, L. G., M. Berkhoff, D. P. Domning, S. K. Jarvis, S. A. McLeod, E. D. Mitchell, R. E. Raschke, J. D. Stewart, C. C. Swift, and H. W. Thomas. 1999. The Middle Miocene Sharktooth Hill local fauna and paleoecology of the Sharktooth Hill Bonebed, Kern County, California. Paleobios 19:2A.

Stewart, J. D., and F. Govean. 1998. The first Cenozoic record of *Symphurus* (Pleuronectiformes: Cynoglossidae) and the first North American Cenozoic cynoglossid fosils. Journal of Vertebrate Paleontology 18:79A-80A.

Stewart, J. D., and S. B. Hunter. 1997. *Deprandus lestes* Jordan is a synonym of *Thyrsocles velox* (Jordan) (Teleostei: Perciformes) and is not an eel. Journal of Vertebrate Paleontology 17:79A.

Cumbaa, S. L., T. T. Tokaryk, C. Collom, J. D. Stewart, T. S. Ercit, and R. G. Day. 1997. A Cenomanian age bond bed of marine origin, Saskatchewan, Canada. Journal of Vertebrate Paleontology 17:40A.

Schwimmer, D. R., J. D. Stewart, and G. D. Williams. 1997. *Xiphactinus vetus* and the distribution of *Xiphactinus* species in the eastern United States. Journal of Vertebrate Paleontology 17:610-615.

Stewart, J. D. 1997. Nuevos peces del Miocene Tario de la Formación Almejas de Isla Cedros, Baja California, México. [New late Miocene fishes from the Almejas Formation of Cedros Island, Baja California, Mexico.] Abstract, Memorias de la IV Réunion Intermational sobre Geologia de la Peninsula de Baja California, Ensenada, Baja California, México, 6-9 April, 1997.

Schwimmer, D. R., J. D. Stewart, and G. D. Williams. 1997. Scavenging by sharks of the genus *Squalicorax* in the late Cretaceous of North America. Palaios 12:71-83.

Stewart, J. D. 1996. Cretaceous acanthomorphs of North America. P. 383-394 in: Arratia, G., and G. Viohl (eds,), Mesozoic Fishes – Systematics and Palaeoecology, Verlag Dr. Friedrich Pfeil, Munich. 576 p.

Stewart, J. D. 1996. The validity of *Saurodon pygmaeus* Loomis 1900 (Teleostei: Ichthyodectiformes) and its relationship to other Ichthyodectiformes. Journal of Vertebrate Paleontology 16(3):67A.

Feige, S. F., and J. D. Stewart. 1996. Preliminary findings concerning increase in size through time of the clupeiform teleost, *Xyne grex*. San Bernardino County Museum Association Quarterly 43:149.

Stewart, J. D., and J. E. Martin. 1996. Osteichthyes of the Turonian deposits in the Ortonville-Milbank Granite Quarries, Grant County, South Dakota. Geological Society of America Abstracts With Programs 28(4):39.

Schwimmer, D. R., J. D. Stewart, and G. D. Williams. 1995. Evidences of scavenging by selachian genus *Squalicorax* in the Late Cretaceous of North America. Geological Society of America Abstracts with Programs 2:A368.

Stewart, J. D. 1995. Confirmation of pomatomid affinities of *Pseudoseriola* David (Teleostei: Percifrormes). Journal of Vertebrate Paleontology 15:54A-55A.

Everhart, M. J., P. A. Everhart, and J. D. Stewart. 1995. Notes on the biostratigraphy of a small coelacanth from the Smoky Hill Member of the Niobrara Chalk (Upper Cretaceous) of western Kansas. Abstracts, Kansas Academy of Science 14:18.

Alexander, C. K., S. Feige, D. Foley, E. Topping, D. K. Valdez, and J. D. Stewart. 1995. Temporal trends in fossil guitarfish Rhinobatos teeth from Upper Cretaceous rocks of the U. S. Western Interior. Journal of Student Research 1:99.

Stewart, J. D, S. A. Bilbey, D. J. Chure, and S. K. Madsen. 1994. Vertebrate fauna of the Mowry Shale (Cenomanian) in northeastern Utah. Journal of Vertebrate Paleontology 14:47A.

Schwimmer, D. R., J. D. Stewart, and D. Williams. 1994. Giant fossil coelacanths from the Late Cretaceous in the Eastern United States. Geology 22:503-506. Stewart, J. D., and G. L. Bell, Jr. 1994. North America's oldest mosasaurs are teleosts. Los Angeles County Museum of Natural History Contributions in Science 441:1-9.

Hunter, S. B., and J. D. Stewart. 1994. Resurrection of Sarda stocki David, 1943. Paleobios 16:9.

Stewart, J. D., and J. E. Martin. 1993. Late Cretaceous selachians and associated marine vertebrates from the Dakota Rose Granite Quarry, Grant County, South Dakota. Proceedings of the South Dakota Academy of Sciences 72:241-248.

Stewart, J. D., and J. E. Martin. 1993. A snowshoe hare, *Lepus americanus*, from the Lange Ferguson Clovis Kill Site, Shannon County, South Dakota. Current Research in the Pleistocene 10:110-112.

Stewart, J. D. 1993. A skeleton of *Platecarpus* sp. (Lacertilia: Mosasauridae) with stomach contents and extensive integument. Journal of Vertebrate Paleontology 13:58A-59A.

Stewart, J. D. 1993. The case of the sword-swallowing shark. Terra 31:42-43.

Stewart, J. D., and M. Roeder. 1993. Razorback sucker (*Xyrauchen*) fossils from the Anza Borrego Desert and the Ancestral Colorado River. Special Publication of the San Bernardino County Museum Association 93:94-96.

Stewart, J. D., and F. J. Aranda-Manteca. 1993. Nuevos teleosteos del Miembro Los Indios de la Formacion Rosarito Beach, Baja California)new teleosts from the Los Indios member of the Rosarito Beach Formation, Baja California). lI Reunion Internacional de Geologia de la Peninsula de Baja California, p. 79.

Barradas, H., and J. D. Stewart. 1993. Posible contenido estomacal de un pinipedo del Mioceno Medio de la Mision, Baja California, México (Possible Middle Miocene pinniped gut contents from La Mision, Baja California, Mexico). II Reunion Internacional de Geologia de la Peninsula de Baja California, p. 24-25.

Stewart, J. D. 1992. First Mississippi records of *Holocentrites ovalis* (Beryciformes: Holocentridae), and confirmation of its myripristin affinities. Journal of Vertebrate Paleontology 12:53A.

Schwimmer, D. R., J. D. Stewart, and D. Williams. 1992. Late Cretaceous *Xiphactinus* fossils in eastern United States are not necessarily *X. audax.* Journal of Vertebrate Paleontology 12:51A.

Stewart, J. D., and J. M. Harris. 1992. Acquisitions. Terra 30:44-45.

Schwimmer, D. R., J. D. Stewart, and D. Williams. 1991. Upper Cretaceous coelacanths in eastern Alabama: suggestion of a Gondwanan-Eastern Gulf lineage. Abstract, Geological Society of America Abstracts with Programs 23:A169.

Stewart, J. D., P. A. Everhart, and M. J. Everhart. 1991. Small coelacanths from Upper Cretaceous rocks of Kansas. Abstract, Journal of Vertebrate Paleontology 11:56A.

Stewart, J. D. 1991. Fossil teeth tell part of the story. Terra 30:34-35.

Espinosa-Arrubarena, L. G. Barnes, S. P. Applegate, S. A. McLeod, F. J. Aranda-Manteca, and J. D. Stewart. 1991. Depredadores y mamiferos marinos: la evidencia del registro fosil. Programa y Resumenes, Abstracts, XVI Reunion Internacional para el Estudio de los Mamiferos Marinos, Nuevo Vallarta, Nayarit, México, p. 5

Stewart, J. D. 1990. Niobrara Formation symbiotic fish in inoceramid bivalves, p. 31-41 in: S. C. Bennett (ed.), Niobrara Chalk Excursion Guidebook. Kansas Geological Survey, Lawrence.

Stewart, J. D. 1990. Niobrara Formation vertebrate stratigraphy. P. 19-30 in: S. C. Bennett (ed.), Niobrara Chalk Excursion Guidebook. Kansas Geological Survey, Lawrence.

Stewart, J. D., C. Bennett, and R. J. Zakrzewski. 1990. Road log from Lawrence to the type area of the Niobrara Chalk, October 9-10, 1990. p. 3-12 in: S. C. Bennt (ed), Niobrara Chalk Excursion Guidebook. Kansas Geological Survey, Lawrence.

Stewart, J. D. 1990. Niobara Formation vertebrate biostratigraphy. Journal of Vertebrate Paleontology 10:44A.

Stewart, J. D. 1990. Niobara Formation symbiotic fish in inoceramid bivalves. Journal of Vertebrate Paleontology 10:44-44A.

Stearley, R. F., and J. D. Stewart. 1990. Phylogenetic significance of *Onchorhynchus rastrosus*. Journal of Vertebrate Paleontology 10:43A.

Schwimmer, D., J. D. Stewart, and G. D. Williams. 1990. A giant Upper Cretaceous coelacanth form eastern Alabama. Journal of Vertebrate Paleontology 10:41A.

Stewart, J. D., and K. Carpenter. 1990. Examples of vertebrate predation on cephalopods in the Late Cretaceous of the Western Interior. p. 203-207 in: A. J. Boucot (ed.), Evolutionary paleobiology of behavior and evolution. Elsevier.

Stewart, J. D. 1990. Examples of Late Cretaceous commensalism from Kansas. p. 51-57 in: A. J. Boucot (ed.), Evolutionary paleobiology of behavior and evolution. Elsevier.

Stewart, J. D. 1989. Paleontology and paleoecology of the 1987 excavation of the North Cove Site, 25HN164. p. 63-106 in: M. J. Adair (ed.), Archaeological investigations at the North Cove Site, Harlan County Lake, Harlan County Nebraska. Report submitted to U. S. Army Corps of Engineers, Kansas City District, CACW41-86-0167, Modification P00003.

Stewart, J. D., and G. Bell, Jr. 1989. The earliest North American mosasaur records are not mosasaurs. Journal of Vertebrate Paleontology 9:39A.

Coney, C. C., and J. D. Stewart. 1989. Comparative shell morphometrics in some related species of fossil and Recent *Gastrocopta* (Pulmonata: Pupillidae). The Western Society of Malacologists Annual Report 22:10.

Anonymous. 1989. The fossil fish that almost got away. Terra 27(5-6):48.

Whistler. D. W., and J. D. Stewart. 1989. A Late Pleistocene (Rancholabrean) assemblage from the northwestern Mojave Desert. San Bernardino County Museum Quarterly 36:67-68.

Stewart, J. D. 1988. Paleoecology and the first North American West Coast record of the shark genus *Ptychodus*. Journal of Vertebrate Paleontology 8:27.

Stewart, J. D. 1988. Stratigraphic distribution of Cretaceous *Protosphyraena* in Kansas and Alabama. Fort Hays Studies, third series, Science series, no 10:80-94.

Stewart, J. D. 1987. Paleontology and paleoecology of the North Cove Site, 25HN164. p. 298-335 in: M. J. Adair and K. L. Brown (eds.), Prehistoric and Historic Cultural Resources of Selected Sites at Harlan County Lake, Harlan County, Nebraska. Report submitted to U. S. Army Corps of Engineers, Kansas City District.

Stewart, J. D. 1987. Late Cretaceous fish-pelecypod symbiosis. Ningxia Geology 1:14-17.

Stewart, J. D. 1987. Late Wisconsinan biota and artifacts from the Kansas-Nebraska border. Journal of Vertebrate Paleontology 7:27A.

Wells, P. V., and J. D. Stewart. 1987. Cordilleran-boreal taiga and fauna on the Central Great Plains of North America, 14,000-18,000 years ago. American Midland Naturalist 118:94-106.

Stewart, J. D. 1987. Latitudinal effects in Wisconsinan mammalian faunas of the Plains. p. 153-158 in: W. C. Johnson (ed.), Quaternary environments of Kansas. Kansas Geological Guidebook Series 5.

Wells, P. V., and J. D. Stewart. 1987. Spruce charcoal, conifer macrofossils, and landsnail and small-vertebrate faunas in Wisconsinan sediments on the High Plains of Kansas. p. 129-140 in: W. C. Johnson (ed.), Quaternary environments of Kansas. Kansas Geological Guidebook Series 5.

Martin, L. D., W. V. Koenigswald, and J. D. Stewart. 1986. Pleistocene *Phenacomys* from Kansas and the fossil history of the genus. Transactions of the Nebraska Academy of Science 14:35-39.

Johnson, W. C., G. G. Fredlund, P. V. Wells, J. D. Stewart, and W. Dort Jr. 1986. Late Wiconsinan biogeography of south central Nebraska: the North Cove site. American Quaternary Association – Program and Abstract of the ninth biennial meeting, p. 89.

Cross, F. B., R. L. Mayden, and J. D. Stewart. 1986. Fishes in the western Mississippi drainage. P. 363-412 in: C. H. Hocutt and E. O. Wiley, (eds.), Zoogeography of North American Freshwater Fishes. Wiley and Sons, New York.

Dort, W. Jr., W. C. Johnson, G. G. Fredlund, R. A. Rogers, L. D. Martin, J. D. Stewart, and P. V. Wells. 1985. Evidence for an open conifer woodland in the Central Great Plains during the Late Wisconsin glacial maximum. Abstract, Canadian Quaternary Association Abstracts, p. 23. Lethbridge.

Johnson, W. C., L. D. Martin, W. Dort, Jr., C. J. Sorensen, R. A. Rogers, and J. D. Stewart. Evidence for a pine parkland in Central and Western Kansas and adjacent Nebraska during Mid- and Late-Wisconsinan time. TER-QUA Symposium Series 1:197.

Martin, L. D., and J. D. Stewart. 1985. Homologies in the avian tarsus. Nature 315:159.

Stewart, J. D. 1984. The montane vole in the Late Pleistocene of the Plains. Annual Plains Conference, Programs and Abstracts p.41-42.

Stewart, J. D. 1984. Taxonomy, paleoecology, and stratigraphy of the halecostsome-inoceramid associations of the North American Upper Cretaceous epicontinental seaways. Ph.D. dissertation, University of Kansas, Lawrence, 201 p.

Stewart, J. D., and L. D. Martin. 1984. Bird teeth and avian origins. One hundred second stated meeting of the American Ornithologists' Union: Abstracts no. 95.

Martin, L. D., and J. D. Stewart. 1984. The avian pretibial bone and the relationship between ratites and carinates. One hundred second stated meeting of the American Ornithologists' Union: Abstracts no. 13.

Stewart, J. D. 1984. Snowshoe hare, Lepus americanus, from the Peoria Loess of Kansas. Abstracts, Kansas Academy of Science 3:39.

Stewart, J. D., and R. A. Rogers. 1984. Analysis of pollen from the Trapshoot local fauna quarry (Rancholabrean) of Kansas. American Midland Naturalis 112:198-200.

Schultze, H.-P., J. D. Stewart, A. M. Neuner, and P. M. Coldiron. 1982. Type and figured specimens of fossil vertebrates in the collection of the University of Kansas Museum of Natural History. Part I. Fossil Fishes. Miscellaneous Publications of the University of Kansas Museum of Natural History No. 73, 53 p.

Martin, L. D., and J. D. Stewart. 1982. An ichthyornithiform bird from the Campanian of Canada. Canadian Journal of Earth Sciences 19:324-327.

Stewart, J. D. 1982. Actinopterygian – pelecypod commensalism in Kansas Cretaceous deposits. Abstracts, Kansas Academy of Science 1:52-53.

Wiley, E. O., and J. D. Stewart. 1981. *Urenchelys abditus*, the first undoubted eel from the Cretaceous of North America (Teleostei: Anguilliformes). Journal of Vertebrate Paleontology 1:43-47.

Stewart, J. D. 1980. Reevaluation of the phylogenetic position of the Ptychodontidae. Transactions of the Kansas Academy of Science 83:154.

Martin, L. D., J. D. Stewart, and K. N. Whetstone. 1980. The origin of birds: structure of the tarsus and teeth. The Auk 97:86-93.

Stewart. J. D. 1979. Paleontology and paleoecology of the Trapshoot local fauna, Rooks County, Kansas. M.A. thesis, University of Kansas, Lawrence. 146 p.

Stewart, J. D. 1979. A new Late Blancan local fauna from Rooks County, Kansas. Transactions of the Kansas Academy of Science 82:100.

Stewart, J. D. 1979. Biostratigraphic distribution of species of *Protosphyraena* (Osteichthyes: Actinopterygii) in the Niobrara and Pierre formations of Kansas. Proceedings of the Nebraska Academy of Sciences and Affiliated Societies 1979:51-52.

Stewart, J. D. 1978. Mammals of the Trapshoot local fauna, Late Pleistocene of Rooks County, Kansas. Proceedings of the Nebraska Academy of Sciences and Affiliated Societies 1978:45-46.

Stewart, J. D. 1978. Earliest record of the Toxochelyidae. Transactions of the Kansas Academy of Sciences 81:9-16.

Stewart, J. D. 1978. Enterospirae (fossil intestines) from the Upper Cretaceous Niobrara Fromation of western Kansas. Kansas University, Paleonotlogical Contributions paper 89:9-16.

Wiley, E. O., and J. D. Stewart. 1977. A gar (*Lepisosteus* sp.) from the marine Cretaceous Niobrara Formation of western Kansas. Copeia 1977:761-762.

Martin, L. D., and J. D. Stewart. 1977. Oldest (Turonian) mosasaurs from Kansas Journal of Paleontology 51:973-975.

Martin, L. D., and J. D. Stewart. 1977. Teeth in *Ichthyornis* (Class: Aves). Science 195:1331-1332.

Stewart, J. D. 1976. Teuthids of the North American Late Cretaceous. Transactions of the Kansas Academy of Science 79:94.

ARTICLES SUBMITTED:

Stewart, J. D., and M. Triebold. The oldest triakid shark (Carchariniformes) from North America. Journal of Paleontology.

Stewart, J. D., and S. B. Hunter. The supposed Miocene eel, *Deprandus lestes* Jordan and Gilbert 1921, is a scombroid teleost (Teleostei: Perciformes). Natural History Museum of Los Angeles County Contributions in Science.

Stewart, J. D., and M. Hakel. First records of fossil Molidae on the Pacific Coast of North America. Journal of Vertebrate Paleontology.

Areas of Expertise
Vertebrate Paleontology

Total Years of Experience
13
URS
1
Other Firms
12

Education
PhD/Geology and Geophysics/2009/Louisiana State University
BS/Zoology/2002/Louisiana State University

Registration/Certification
Member of Society of Vertebrate Paleontology

Project Experience

2010

Cahuilla Gold Project
Participated in pedestrian survey for paleontological resources.

I-405 Improvement Gold Project
Participated in pedestrian survey for paleontological resources.

Professional Associations

Awards
2007/Halliburton/ BakerHughes Travel Grant
2007/National Sigma Xi Travel Grant
2004/Shell Scholarship
2003/Louisiana State University, Department of Geology and Geophysics travel award to present a poster to the Society of Vertebrate Paleontology
2002/Louisiana State University Graduate School enhancement award

Publications

Schiebout, J.A., Wrenn, J.H., Ting, S., Hill, J.L., Hagge, M.D., **Williams, M.J.**, Boardman, G.S., and Ellwood, B.B. 2006. Miocene Vertebrate Fossils Recovered from the Pascagoula Formation in Southeastern Louisiana. Gulf Coast Association of Geological Societies Transactions, v. 56, p. 745-760.

Williams, M.J. and Schiebout, J.A., 2003. Miocene lower vertebrates from Fort Polk, La: A preliminary report: Transactions, Gulf Coast Association of Geological Societies and Gulf Coast Section SEPM, v. 53, p. 856-863.

Schiebout, J. A., S. Ting, **Williams, M.J.**, Boardman, G., Wulf Gose, Wilhite, D. R., White, P.D., and Kilbourne, B. 2004.

Paleofaunal & environmental research on Miocene fossil sites TVOR SE and TVOR S on Fort Polk, Louisiana, with continued survey, collection, processing, and documentation of other Miocene localities. Louisiana. Corps of Engineers, Fort Worth District. Open-File Report, 56 pp.

Williams, M.J. 2009. Neogene herpetofaunas from Louisiana, USA and their biogeographical and paleoenvironmental significance. *Bulletin, Southern California Academy of Sciences*, v. 108 no. 2 pp. 89-136.

Schiebout, J.A. S. Ting, J. L. Hill, M. D. Hagge, **M. J. Williams**, and G. S. Boardman.

2006. Quarrying in the Pascagoula Formation: First Miocene (Hemphillian) Fauna of Terrestrial Mammals from the Central Gulf Coast East of the Mississippi, *Journal of Vertebrate Paleontology, Abstracts of Papers*. V. 26 supplement to number 3.

Williams, M.J. 2005. A new late Miocene (late Barstovian) herpetofauna from Fort Polk, Louisiana. *Journal of Vertebrate Paleontology, Abstracts of Papers*,v. 25, supplement to # 3.

Williams, M.J., Boardman, G., Schiebout, J.A., Kilbourne, B., Nguyen, H., 2003. Miocene of Fort Polk, western Louisiana: *Journal of Vertebrate Paleontology, Abstracts of Papers*, v. 23, supplement to #3.

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9 August 2010

URS Corporation
1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108

Attn: J. D. Stewart, Principal Paleontologist

re: Paleontological resources for the proposed 405 freeway expansion in Orange County, URS project # 29866416.40204, Orange County, project area

Dear J. D.:

I have conducted a thorough check of our paleontology collection records for the locality and specimen data for the proposed 405 freeway expansion in Orange County, URS project # 29866416.40204, Orange County, project area as outlined on the sections of the Los Alamitos, Seal Beach, and Newport Beach topographic quadrangle maps that you sent to me via e-mail on 9 July 2010. We have no vertebrate fossil localities that lie directly within the outline boundaries of the proposed project area, but we do have localities nearby from sedimentary deposits similar to those that occur at the surface or at depth in the proposed project area.

In the very southeastern portion of the proposed project area, east of the Santa Ana River to the eastern terminus, there are surficial exposures of marine Quaternary Terrace deposits on the southern side of the proposed project area. Otherwise, surficial sediments in the proposed project site and in the surrounding area consist of younger terrestrial Quaternary Alluvium, with older terrestrial Quaternary sediments occurring at various depths, as part of the general floodplain or fan deposits in the Santa Ana Basin. We have no localities anywhere nearby from the younger Quaternary Alluvium, which is unlikely to contain significant vertebrate fossils, at least in the uppermost layers. These deposits typically do not contain significant vertebrate fossils, at least in the uppermost layers, but they are usually underlain by older Quaternary deposit that frequently do contain significant vertebrate fossils.

Our closest fossil vertebrate locality to the western portion of the proposed project area from older Quaternary deposits is locality LACM 3757, just west of the northern portion of the proposed project area south of 7th Street and east of the Pacific Coast Highway, that produced fossil specimens of rays, *Myliobatis* and Rhinobatoidea, sharks, *Carcharodon*, *Prionace* and Carcharhinidae, bony

fish, *Damalichthys*, *Genyonemus* and *Rhacochilus*, turtle, *Clemmys*, birds *Chendytes* and *Gavia*, and mammals, *Canis*, *Enhydra*, *Equus*, *Hemiauchenia* and *Thomomys*. Further to the west along 7th Street, west of the Pacific Coast Highway, we have locality LACM 6746 that produced fossil mammoth, *Mammuthus*.

Our closest fossil vertebrate locality to the middle portion of the proposed project area from older Quaternary deposits is locality LACM 4018, situated west of the proposed project area at the intersection of Warner Avenue and Golden West Street, that produced specimens of invertebrates, reptiles, birds, rodents, horses and deer in peat between four and eight feet below the surface, but these specimens were later determined to be of very late Holocene age. Further west along Warner Avenue, close to Bolsa Chica Street, our fossil vertebrate locality LACM 65113 from these deposits produced Pleistocene age specimens of mammoth, *Mammuthus*, between six and eight feet below the soil and specimens of fossil bison, *Bison*, between fourteen and twenty feet below the soil. Southeast of locality LACM 4018, along Ellis Avenue east of Beach Boulevard, our vertebrate fossil localities LACM 7657-7659 from the underlying Pleistocene San Pedro Sand produced fossil shark and fish specimens including soupfin shark, *Galeorhinus galeus*, skate, *Raja*, ray, *Myliobatis*, angel shark, *Squatina californica*, cusk eel, *Otophidium*, toadfish, *Porichthys notatus*, queenfish, *Seriphus politus*, sculpin, *Leptocottus*, goby, *Lepidogobius lepidus*, and sanddabs, *Citharichthys sordidus* and *Citharichthys stigmaeus*, from well cores over 100 feet below the surface.

The mesa area south of the southern portion of the proposed project site is mapped as Late Pleistocene marine terraces in general, although our fossil vertebrate localities on the west side of Upper Newport Bay have produced predominantly terrestrial vertebrate remains. Our closest vertebrate fossil locality to the southern portion of the proposed project area is LACM 1339, along Adams Avenue near the top of the mesa bluffs east of the Santa Ana River. Fossil mammoth, *Mammuthus*, and camel, Camelidae, bones were recovered from LACM 1339 in sand approximately 15 feet below the top of the mesa that is overlain by shell bearing silts and sands. Our next closest vertebrate fossil locality is LACM 4219, south of the eastern-most portion of the proposed project area in a roadcut for the Newport Freeway near Santa Isabel Avenue, that produced fossil sea turtle, Cheloniidae, and camel, Camelidae, bones in coarse poorly sorted friable sands about 30 feet below the grade of Newport Boulevard. We further have a large number of localities from the marine and terrestrial Late Pleistocene terraces deposits on the east side of Upper Newport Bay. Those localities have produced an extensive composite fauna.

Surface grading or very shallow excavations in the younger Quaternary Alluvium exposed in most of the proposed project area probably will not uncover significant vertebrate fossil remains. Deeper excavations in those areas that extend down into the older Quaternary deposits, as well as any excavations in the exposures of older Quaternary terrace deposits, however, have a very good chance of encountering significant fossil vertebrate specimens. Therefore, any substantial excavations in the proposed project area should be monitored closely to quickly and professionally

recover any fossil remains discovered while not impeding development. Additionally, because some of the nearby vertebrate fossil localities produced only small vertebrate remains that cannot be seen during normal excavation activities, it is recommended that sediment samples be collected and processed to determine the potential for small fossils in these deposits. 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 paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,

Samuel A. McLeod

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: draft invoice

SAN DIEGO NATURAL HISTORY MUSEUM
BALBOA PARK - SAN DIEGO SOCIETY OF NATURAL HISTORY - ESTABLISHED 1874

25 August 2010

Joe Stewart
URS Corporation
1615 Murray Canyon Road
Suite 1000
San Diego, CA 92108

RE: Paleontological record search; 405 Freeway

Dear Mr. Stewart:

This letter presents the results of a paleontological record search conducted for the 405 Freeway project alignment. This project includes work along a 15.5 mile section of Interstate 405 in Orange County, California. This section of freeway is between the interchange with State Route 55 to the southeast and the interchange with Interstate 605 to the northwest. This section of freeway extends through the cities of Los Alamitos, Seal Beach, Garden Grove, Westminster, Fountain Valley, Huntington Beach, Costa Mesa and Santa Ana. The sedimentary rocks underlying the project site have been mapped by Saucedo, et al. (2003), Morton and Miller (1981), and Morton (2004) as late to middle Pleistocene (~800,000 to 10,000 year old) old paralic terrace deposits, late Pleistocene to Holocene (~100,000 to recent) alluvial fan deposits, and late Pleistocene to Holocene (~100,000 to recent) young axial channel deposits.

The San Diego Natural History Museum has no recorded fossil localities within a one-mile radius of the project site (see attached map). The majority of the project is underlain by latest Pleistocene to Holocene alluvial fan deposits and latest Pleistocene to Holocene young axial channel deposits. These units would typically be too young to produce fossilized remains. However, the late to middle Pleistocene old paralic terrace deposits exposed on the southeastern end of the alignment near the interchange between Interstate 405 and State Route 55 would have the potential to produce fossil marine invertebrates and fossil vertebrates. Some projects in southern Huntington Beach have produced fossil vertebrates (e.g., mammoth) in similar aged paralic deposits.

Grading activities associated with the proposed 405 Freeway project have the potential to impact sedimentary units of old paralic deposits, young axial channel deposits and alluvial fan deposits. Based on fossil localities from other late to middle paralic deposits in the region, we would recommend implementing a paleontological monitoring program for excavations into middle to late Pleistocene units. Any fossils recovered from these exposures made at the project site are likely to be scientifically significant.

If you have any questions concerning these findings please feel free to contact me at 619-255-0310 or krandall@sdnhm.org.

Sincerely,

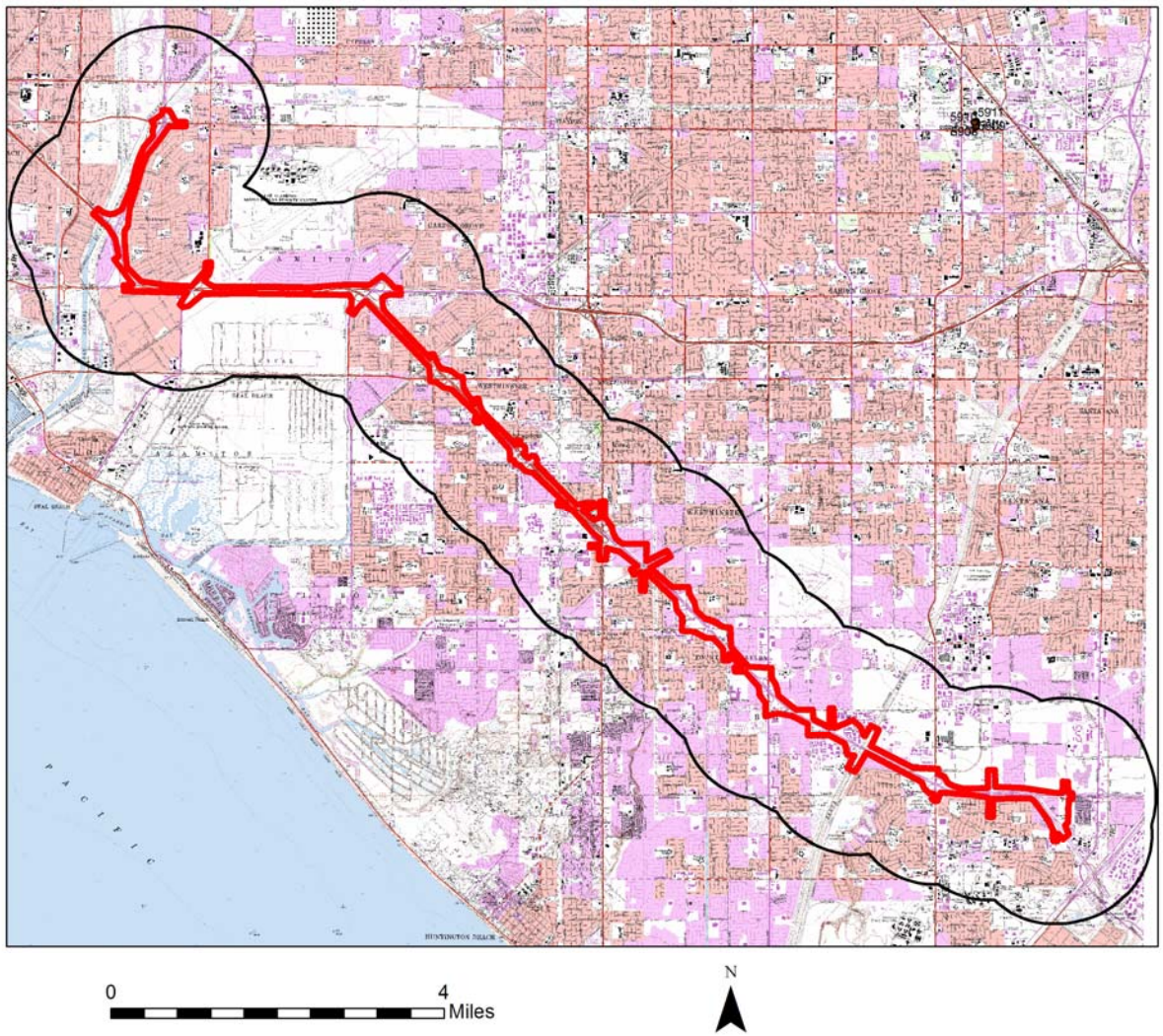
Kesler A. Randall
Collections Manager, Fossil Vertebrates
Department of Paleontology

Literature Cited:

Saucedo, George J., H.G. Greene, M.P. Kennedy, and S.P. Bezore. 2003. Geologic Map of the Long Beach 30' X 60' Quadrangle, California: version 1.0. California Geological Survey.

Morton, D.M. 2004. Preliminary Digital Geological Map of the 30' X 60' Santa Ana Quadrangle, southern California, version 2.0. California Geological Survey.

Morton, P.K. and R.V. Miller. 1981. Geologic Map of the Orange County California, showing mines and mineral deposits. California Division of Mines and Geology.



Fossil localities within a one-mile radius of the 405 Freeway project alignment, Cities of Los Alamitos, Seal Beach, Garden Grove, Westminster, Fountain Valley, Huntington Beach, Costa Mesa and Santa Ana. (Base maps, Anaheim, Newport Beach, Seal Beach, and Alamitos, CA, 7.5 minute quadrangles of the U.S. Geological Survey).