PALEONTOLOGICAL EVALUATION REPORT AND MITIGATION PLAN FOR THE STATE ROUTE 85 EXPRESS LANES PROJECT, SANTA CLARA COUNTY, CALIFORNIA

No. 0400001163/EA 4A7900 US 101 PM 23.1–28.6 SR 85 PM 0.0–24.1 US 101 PM 47.9–52.0

September 2012 DRAFT

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Cogstone Project Number: 2463
Type of Study: Paleontological Evaluation Report and Mitigation Plan
Localities: none
USGS Quadrangles: Cupertino, Los Gatos, Mountain View, San Jose West, San Jose East, Santa Teresa Hills, Morgan Hill
Area: 33.7 linear miles
Key Words: Santa Clara Formation, Pleistocene alluvial fan deposits, Holocene alluvial sediments, PFYC 3a, Pleistocene fossils

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EXECUTIVE SUMMARY

The purpose of this combined Paleontological Evaluation Report/Paleontological Mitigation Plan (PER/PMP) is to evaluate potential project effects on significant paleontological resources and to propose mitigation that would reduce those effects. This study supports the State Route 85 (SR 85) Express Lanes Project in Santa Clara County, California. The California Department of Transportation (Caltrans) is the federal and state lead agency. The project is proposed in cooperation with the Santa Clara Valley Transportation Authority (VTA).

The project would convert the existing SR 85 single HOV lanes into express lane facilities that would have one lane between US 101 in southern San Jose and SR 87, two lanes between SR 87 and I-280, and one lane between I-280 and US 101 in Mountain View. Conversion of the HOV lanes to express lanes would allow use by single-occupant vehicles (SOVs) with active FasTrak accounts and transponders. The project would include multiple intermediate access points between the express lanes and the adjacent mixed-flow lanes. The access points would consist of entrance and exit openings in a striped 2-foot-wide buffer zone where traffic can enter and exit the express lane facility. All work would be done in the existing right-of-way on both sides of the road and in the median. No work will be done in waterways in or adjacent to the project area.

The project limits include the entire length of SR 85, 5.5 miles of United States Highway 101 (US 101) in southern San Jose and 4.1 miles of US 101 in Mountain View, for a total of 33.7 miles (Figure 1).

The vertical Project Study Area (PSA) varies as detailed below. Road widening, utilities and stormwater components would require grading or trenching of 1 to 5 feet. Bridge footings would require excavations of 5 to 6 feet. Bridge piles would require excavations of 7 to 8 feet followed by deep-driven piles. Overhead tolling structures would require drilling or driving piles to 12 feet with a diameter of about 3.5 feet. Overhead signs would require drilling or driving piles to 25 feet with a diameter of 5 feet, 9 inches. Bridge abutments would require drilling or driving piles to 50 feet with a diameter of 1 to 2 feet.

The Santa Clara Valley is a subsiding Quaternary alluvial basin flanked by mountains. Surface geology suggests that the Quaternary basin fill has been deposited principally as alluvial fans emanating from the flanking uplands with an axial trough draining northwestward between them. Sediment cored in deep boreholes indicates this pattern has persisted through time.

The project area is mapped as Mesozoic igneous and metamorphic rocks, overlain by the Plio-Pleistocene Santa Clara Formation, which is in turn overlain by Pleistocene and Holocene alluvial sediments. Generally the northern half of the PSA crosses surficial Holocene deposits. The southern half of the PSA crosses surface exposures of the igneous and metamorphic rocks, the Santa Clara Formation and both Pleistocene alluvium and Holocene units.

The University of California Museum of Paleontology reported that no fossils are known within the PSA or within a 1-mile radius. However, there are 33 known localities in the Santa Clara Formation and 35 known localities in Pleistocene alluvial fan deposits in Santa Clara County. Based on these results, the Pleistocene alluvial fan deposits and the Santa Clara Formation are ranked as Caltrans high or Potential Fossil Yield Classification (PFYC) 3a for paleontological sensitivity. All other formations are ranked as low on both Caltrans and PFYC scales.

The potential to affect fossils varies with depth of impacts, previous disturbance and presence of non-fossiliferous sediments. Logistics of excavation also affect the possibility of recovering scientifically significant fossils since information on exact location, vertical elevation, rock unit of origin, and other aspects of context are critical.

Road widening, grading, and trenching may affect Pleistocene alluvial fan deposits and the Santa Clara Formation where those geologic units are exposed at or near the surface. Grading and trenching may reveal fossils or fossil assemblages *in situ*. Significance will need to be assessed subsequent to recovery and identification, but generally single fossil bones will not meet significance criteria.

Drilling and pile driving for various project components may potentially affect both Pleistocene alluvial fan deposits and the Santa Clara Formation. Drilling would be conducted using truck-mounted rotary drills. This type of tool may rotate out fossil bones or other materials but the specimens will lack context, depth/elevation, formation identification and other elements that are critical to establishing scientific significance. These types of unprovenienced fossils will only be significant if they result in identification of new species that are currently not known in the county. If they are identified as already-known species, they will be suitable for educational uses.

The paleontological mitigation plan (PMP) provides for full-time monitoring only of grading and trenching of the limited surface exposures of Pleistocene alluvial fan deposits (totaling 1 linear mile) and surface exposures of the Santa Clara Formation (totaling 1 linear mile). For other excavations and drilling activities, the monitor will be on call to respond in the event of an unanticipated discovery. The PMP details paleontological awareness training for earthmoving personnel, procedures for communication and coordination, necessary data to be taken at the fossil discovery, subsequent minimum laboratory and identification work, guidance on significance determinations, and reporting.

INTRODUCTION

PURPOSE OF DOCUMENT

The purpose of this combined PER/PMP is to evaluate potential project effects on significant paleontological resources and to propose mitigation that would reduce those effects. This study supports the SR 85 Express Lanes Project in Santa Clara County, California (Figure 1). Caltrans is the federal and state lead agency. The project is proposed in cooperation with the VTA.

PROJECT DESCRIPTION

The project would convert the existing SR 85 single HOV lanes into express lane facilities that would have one lane between US 101 in southern San Jose and SR 87, two lanes between SR 87 and I-280, and one lane between I-280 and US 101 in Mountain View. Conversion of the HOV lanes to express lanes would allow use by SOVs with active FasTrak accounts and transponders. The project would include multiple intermediate access points between the express lanes and the adjacent mixed-flow lanes. The access points would consist of entrance and exit openings in a striped 2-foot-wide buffer zone where traffic can enter and exit the express lane facility.

All work would be done in the existing right-of-way on both sides of the road and in the median. No work will be done in waterways in or adjacent to the project area.

Road Widening

In the section between SR 87 and I-280, where the median width is approximately 46 feet, pavement widening would be conducted in the median to accommodate the second express lane. The median would be paved, and the existing thrie-beam barrier would be replaced with a Type 60 concrete barrier. In the areas where the median width is less than 46 feet, widening would occur in the available median width. No outside widening is currently proposed. Conversion of the HOV lanes into single express lanes on SR 85 between US 101 in southern San Jose and SR 87 and between I-280 and US 101 in Mountain View would include restriping and installation of overhead signs and tolling devices in the median. The single express lane would continue in both directions of US 101 in southern San Jose and would include the installation of overhead signs in the median.

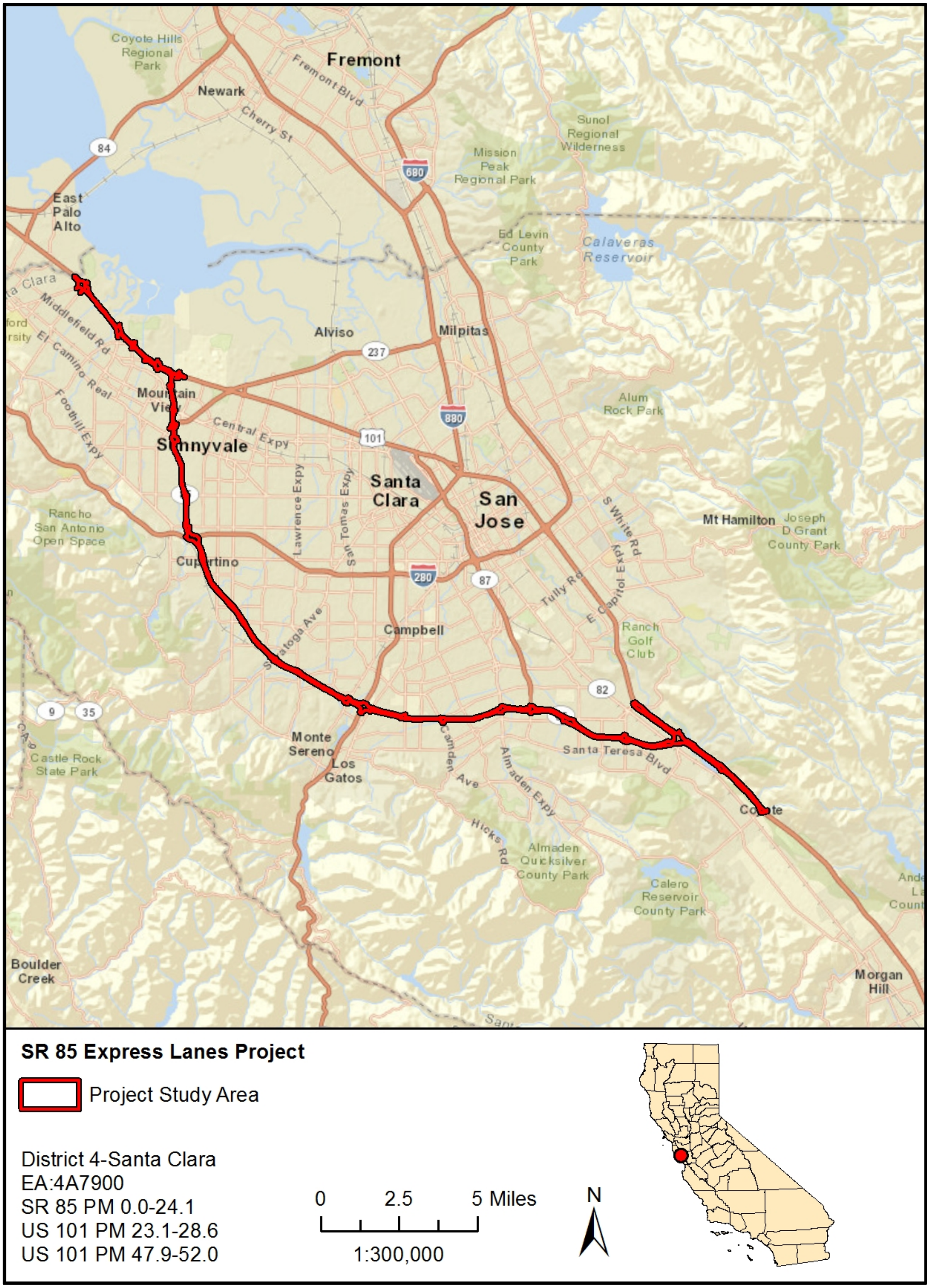

Figure 1. Project Vicinity Map

Signage, Tolling and Operations Systems

Up to 58 overhead signs and 25 tolling devices would be mounted on cantilever structures supported on cast-in-drilled-hole (CIDH) or driven piles in the median. The piles for the overhead signs are expected to be 5 feet 9 inches in diameter and extend to approximately 25 feet below ground surface. The piles for the tolling devices would be approximately 3.5 feet in diameter and extend to approximately 12 feet below ground surface.

The following TOS equipment would be installed along the outside edge of pavement within the existing right-of-way: approximately 25 closed circuit television (CCTV) cameras, 70 remote traffic monitoring station (RTMS) poles, and 120 cabinets and controllers. Maintenance pullouts would be installed in shoulder areas to allow access to the TOS equipment. The specific locations of these features would be developed during final project design.

Bridge Widening

To conform to current Caltrans standards, the following SR 85 bridges will be widened: Almaden Expressway, Camden Avenue, Oka Road, Pollard Road, Saratoga Avenue, San Tomas Aquino Creek, and Saratoga Creek. All of the bridges will be widened toward the median (the area between the two spans, northbound and southbound), except at Almaden Expressway, where the only northbound bridge would be widened toward the median.

Driven piles would likely be used to close the bridge gaps unless there is a compelling reason not to (such as noise-sensitive land uses or vibration concerns). Excavation would be required prior to the pile driving for the construction of the pile cap. At each bridge footing location, a 7- or 8-foot-deep area would be excavated for the column footings. Piles would be driven into the bottom, the pile cap would be reinforced, and then concrete would be poured. Depending on the location, the excavated area may also need to be shored up with sheet piles.

The Pollard Road bridges were constructed using spread footings. To close the gap in the bridge decks, the footing foundations would require subsurface excavation up to 5 or 6 feet deep.

The widened bridges would be constructed using precast, prestressed concrete beams. At each bridge location, the bridge decks are expected to be extended in width from the existing structures and supported by new abutments on either end to free-span the roads or creeks underneath. Bridge deck abutments would be supported on CIDH or driven piles of 1.5 to 2 feet in diameter that would extend to approximately 50 feet below ground surface.

At San Tomas Aquino and Saratoga creeks, the existing northbound and southbound bridge structures are cast-in-place prestressed concrete box girders. The approximately 100-foot-long, single-span structures are supported on diaphragm-type abutments founded on single row of driven concrete piles, extending approximately 50 feet below ground surface. The proposed superstructure type for the widened structure will likely be precast, prestressed bulb tee concrete beams supported on diaphragm-type abutments. The use of precast beams will minimize impacts to the creeks below because falsework will not be required during construction.

The existing riprap between the abutments will be removed from the banks of San Tomas Aquino and Saratoga creeks using a backhoe positioned at the top of the bank. All other construction activities such as pile driving and abutment construction will be done from the existing bridge median. No construction equipment will be used below the decks of either bridge.

Storm Water Treatment

Biofiltration swales are proposed to provide stormwater treatment for impervious areas that would be added or reworked as part of the project. The impervious areas are anticipated to total 64.6 acres. Biofiltration swales would be installed within the SR 85 interchanges at Cottle Road, Blossom Hill Road, Santa Teresa Boulevard, Almaden Expressway, Camden Avenue, Union Avenue, SR 17, South De Anza Boulevard, and I-280. Biofiltration swales would be a minimum of 3.5 feet deep; maximum depth would be determined during final project design.

Utility Work

Trenching would be conducted along the outside edge of pavement for installation of conduits. The maximum depth of trenching would be 3 to 5 feet below the roadway surface. Conduits would be jacked (tunneled) across the freeway to the median where needed to provide power and communication feeds to the new overhead signage and tolling equipment. The exact locations and impacts associated with the auxiliary structures will be determined during final design. Some deeper excavations may be required in spot locations where casings of existing utility crossings need to be extended.

PROJECT STUDY AREA

The Project Study Area (PSA) includes the entire length of SR 85, 5.5 miles of US 101 in southern San Jose and 4.1 miles of US 101 in Mountain View, for a total of 33.7 miles (Figure 2). The PSA is mapped on eight 7.5’ United States Geological Survey (USGS) topographic maps. Township, range and section are in relation to the Mt. Diablo Base Meridian (Table 1).

The vertical Project Study Area (PSA) varies as detailed below. Road widening, utilities and stormwater components would require grading or trenching of 1 to 5 feet. Bridge footings would require excavations of 5 to 6 feet. Bridge piles would require excavations of 7 to 8 feet followed by deep-driven piles. Overhead tolling structures would require drilling or driving piles to 12 feet with a diameter of about 3.5 feet. Overhead signs would require drilling or driving piles to 25 feet with a diameter of 5 feet, 9 inches. Bridge abutments would require drilling or driving piles to 50 feet with a diameter of 1 to 2 feet.

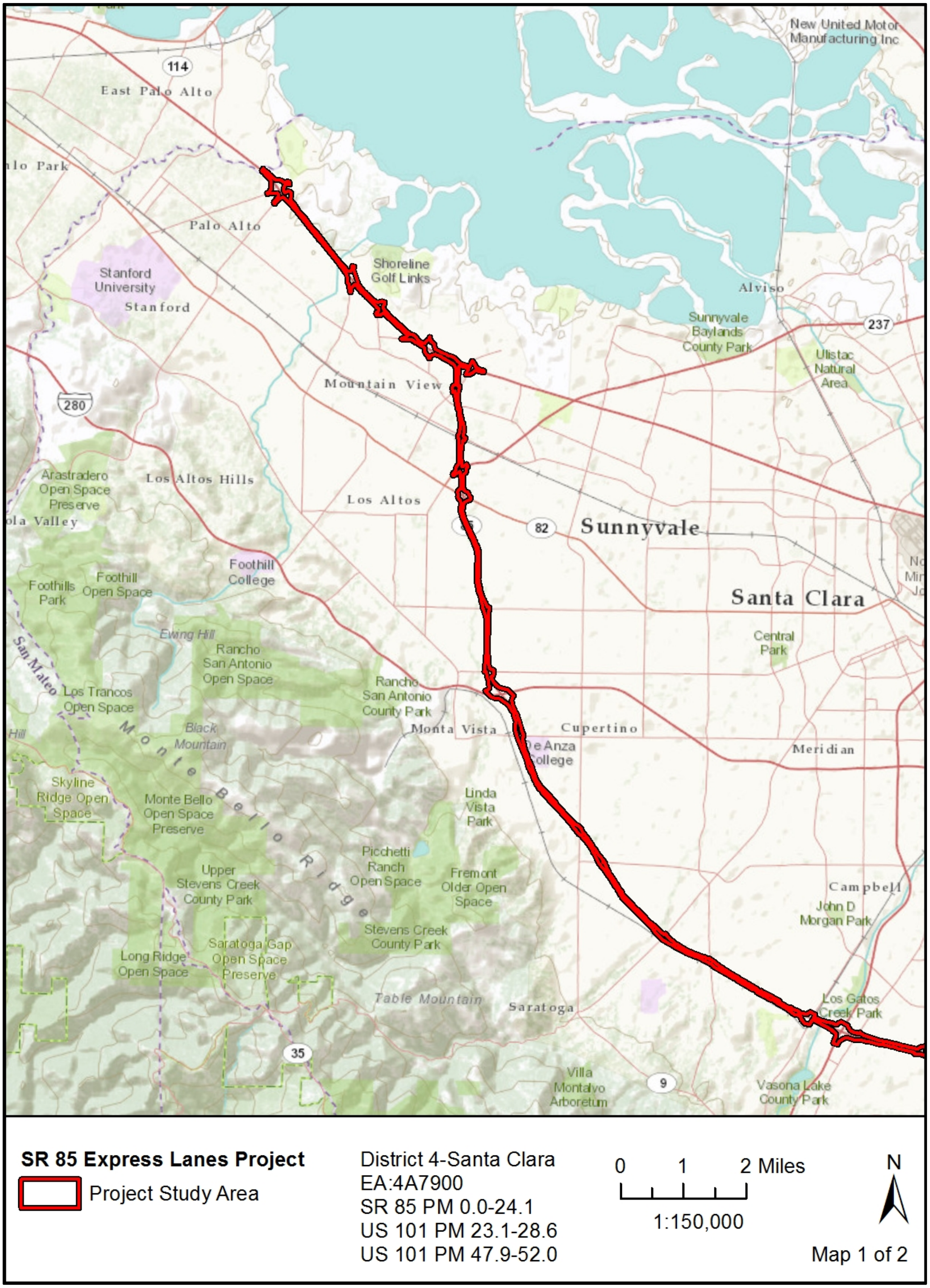

Figure 2a. Project Location, north segment

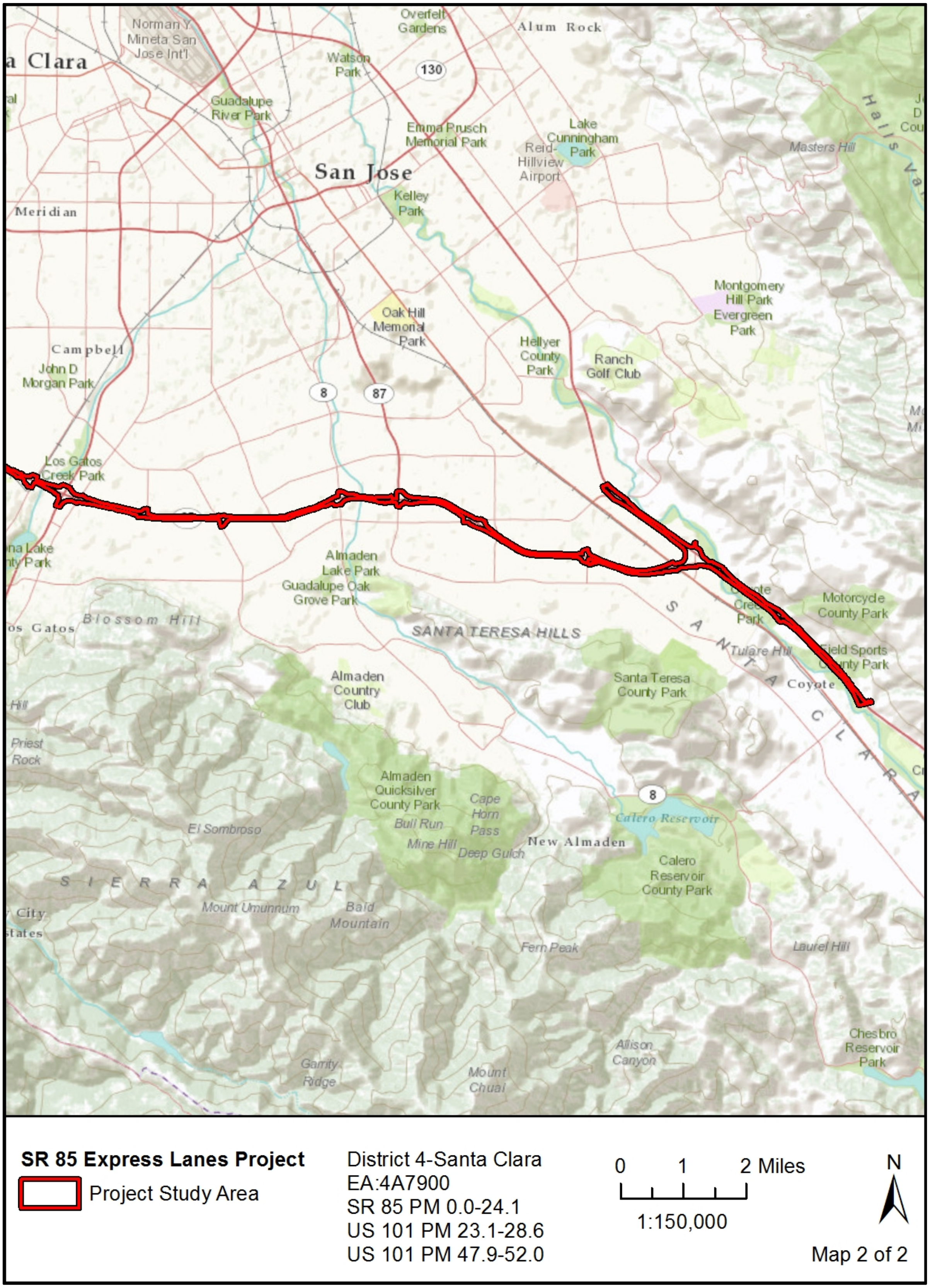

Figure 2b. Project Location, south segment

Table 1. Project Location Details

USGS 7.5' Quad	Quad Year (PR)	Township	Range	Sections
Palo Alto	1991	5 South	2 West	31
Mountain View	1991	5 South	2 West	31
Mountain View	1991	6 South	2 West	5, 6, 8, 9, 15, 16, 22, 27
Cupertino	1991	6 South	2 West	27, 34
Cupertino	1991	7 South	2 West	2, 3, 10, 11, 14, 23, 24, 25
Cupertino	1991	7 South	1 West	30, 31, 32
San Jose West	1980	7 South	1 West	32
San Jose West	1980	8 South	1 West	5, 4, 3, 10, 11, 12
San Jose West	1980	8 South	1 East	7, 8, 9
Los Gatos	1980	8 South	1 East	7
San Jose East	1980	8 South	1 East	9, 10, 11
San Jose East	1980	8 South	2 East	6, 7, 8
Santa Teresa Hills	1980	8 South	1 East	11, 12, 14,
Santa Teresa Hills	1980	8 South	2 East	7, 8, 16, 17, 18
Morgan Hill	1980	8 South	2 East	15, 22, 23, 26

REPORT PREPARERS

Cogstone Resource Management Inc. prepared this document. Sherri Gust was the Principal Paleontologist. She supervised all work and prepared the sensitivity analysis, definition of sensitive areas and mitigation plan. She has an M.S. in Anatomy (Evolutionary Morphology) from the University of Southern California, a B.S. in Anthropology from the University of California, Davis and over 30 years of experience in California. Kim Scott wrote the stratigraphy section. Scott has a B.S. in Geology with an emphasis in Paleontology from the University of California, Los Angeles and over 15 years of experience in California paleontology and geology. Molly Valasik prepared the GIS maps throughout this report. Valasik has an M.A. in Anthropology, cross-training in paleontology and more than four years of experience.

RESOURCE CONTEXT

GEOLOGIC SETTING

The Santa Clara Valley is a subsiding Quaternary alluvial basin flanked by mountains. Surface geology suggests that the Quaternary basin fill has been deposited principally as alluvial fans emanating from the flanking uplands with an axial trough draining northwestward between them.

The valley is floored by Holocene alluvium that is inset into, and overlaps most of, the older late Pleistocene fans as a relatively thin sheet of sediment that is typically 33 to 66 feet (10 to 20 meters) thick in the center of the valley. The base of the Holocene unit, which was the topographic surface in latest Pleistocene time prior to Holocene alluviation, mimics the shape of the present ground surface, with a similar axial trough down with northward flow. This must have persisted through time, because gravel in cores and cuttings in deep boreholes derived from the Santa Cruz Mountains on the southwest (Wentworth and Tinsley 2005: 5-7).

As ancient levels of San Francisco Bay fluctuated in response to ice ages, and as the basin and shallow marine deposits consolidated, the coarse-grained deposits advanced onto fine-grained deposits, and were subsequently covered by fine-grained deposits as San Francisco Bay levels rose. The result is a subsurface merging of alluvial fan deposits and basin and marine deposits in a complex and random pattern of interfingering and interlayering. Silt and clay beds are interbedded with sand and gravel beds, which often are sinuous individual buried ancient stream channels with limited lateral continuity (CG 2003:8).

STRATIGRAPHY

The project area is mapped as Mesozoic igneous and metamorphic rocks, overlain by the Plio-Pleistocene Santa Clara Formation, which is in turn overlain by Pleistocene and Holocene alluvial sediments (Figure 3; Dibblee 1973, Helley et al. 1994). Generally the northern half of the PSA crosses surficial Holocene deposits. The southern half of the PSA crosses surface exposures of the igneous and metamorphic rocks, the Santa Clara Formation and both Pleistocene alluvium and Holocene units.

Extensive geological borings in the Santa Clara Valley indicate that fluvial deposits including the Santa Clara Formation and both Pleistocene and Holocene alluvium have a combined depth of approximately 330 to 1,315 feet (100 to 400 meters) below the surface (Stanley et al. 2002:14, 20). Deeper formations are not discussed here as the maximum impact is 50 feet below the surface. The Holocene sediments have been extensively subdivided by geologists but are grouped here by depositional environment.

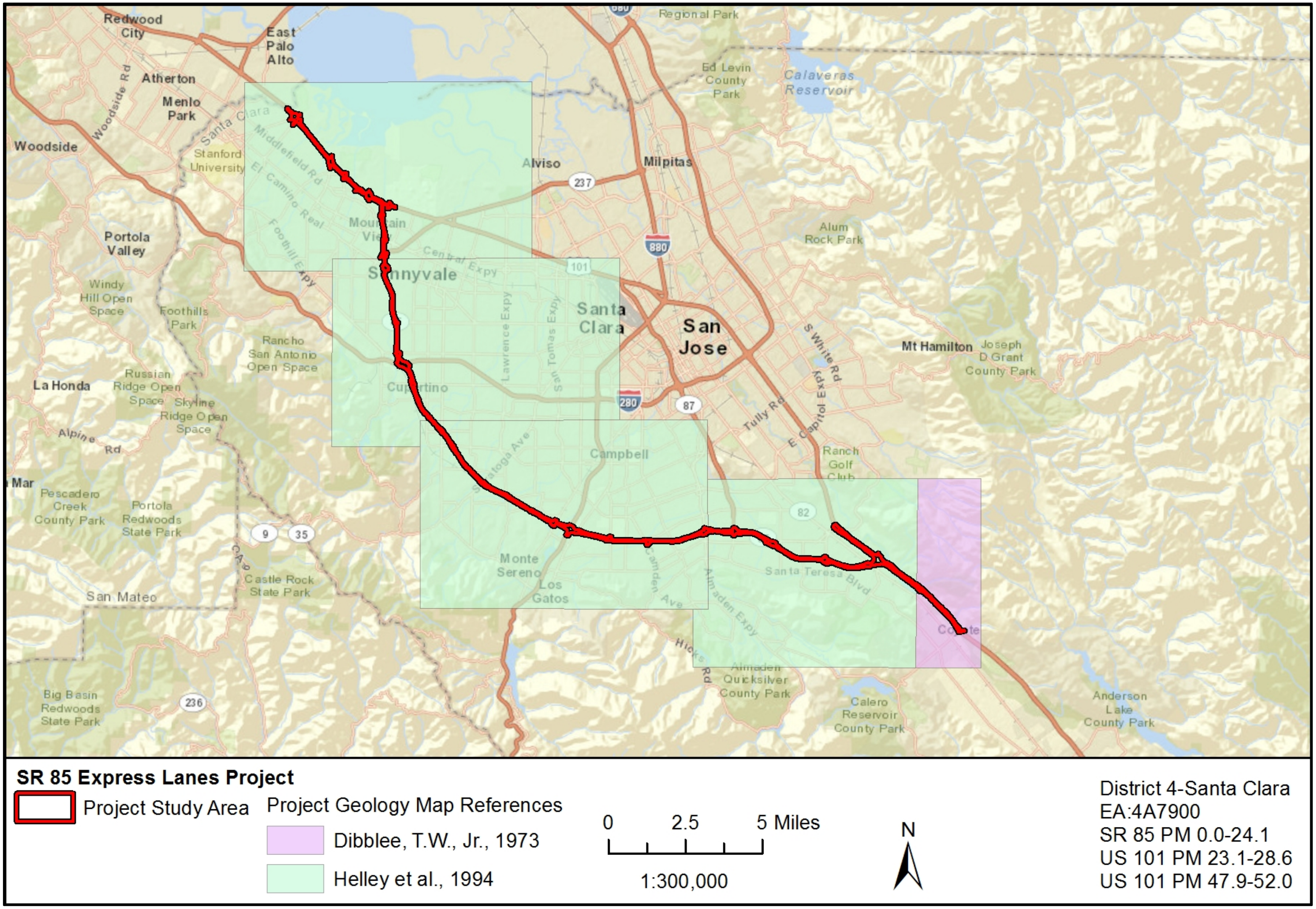

Figure 3a. Geology Overview Map

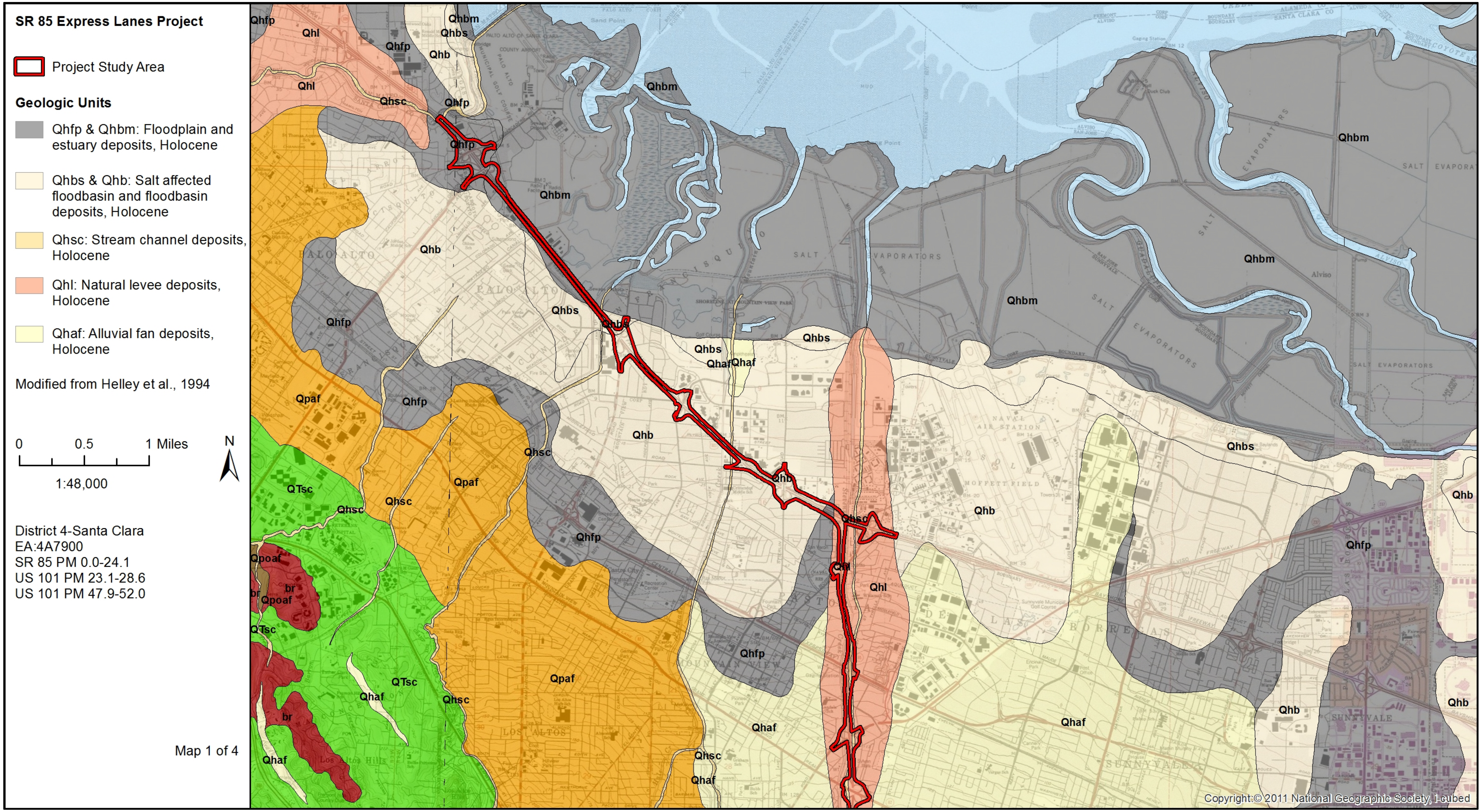

Figure 3b. Geology Map 1 of 4

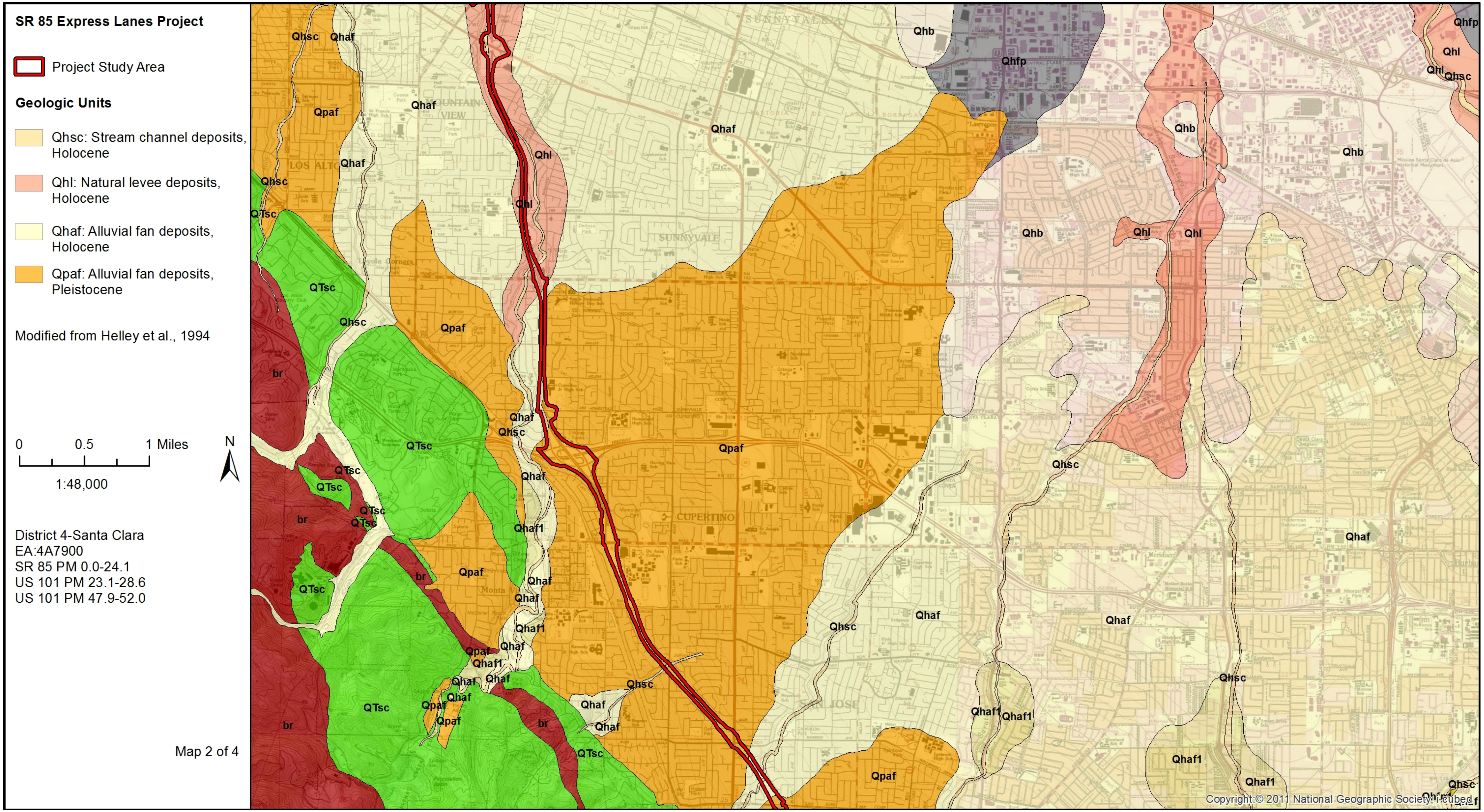

Figure 3c. Geology Map 2 of 4

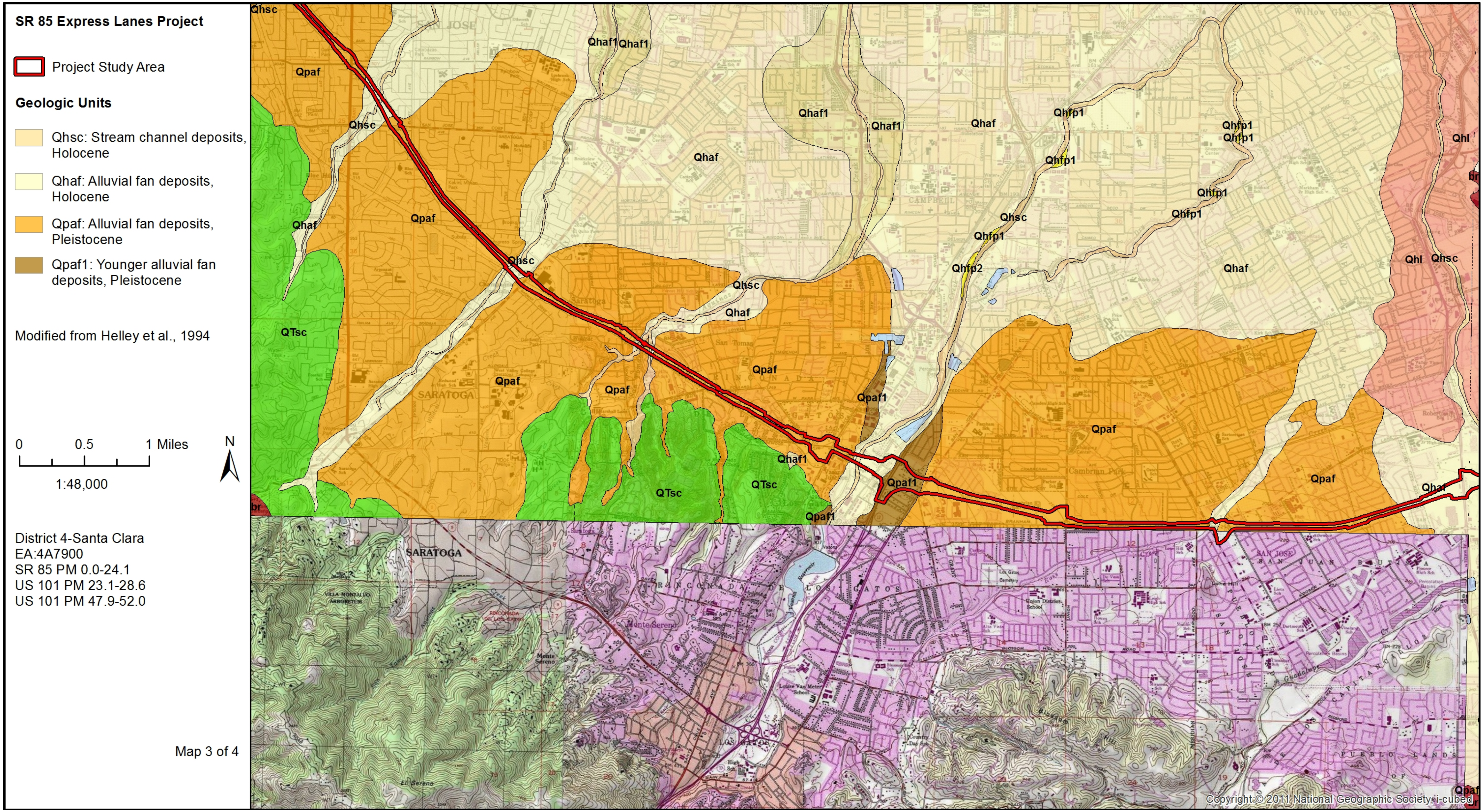

Figure 3d. Geology Map 3 of 4

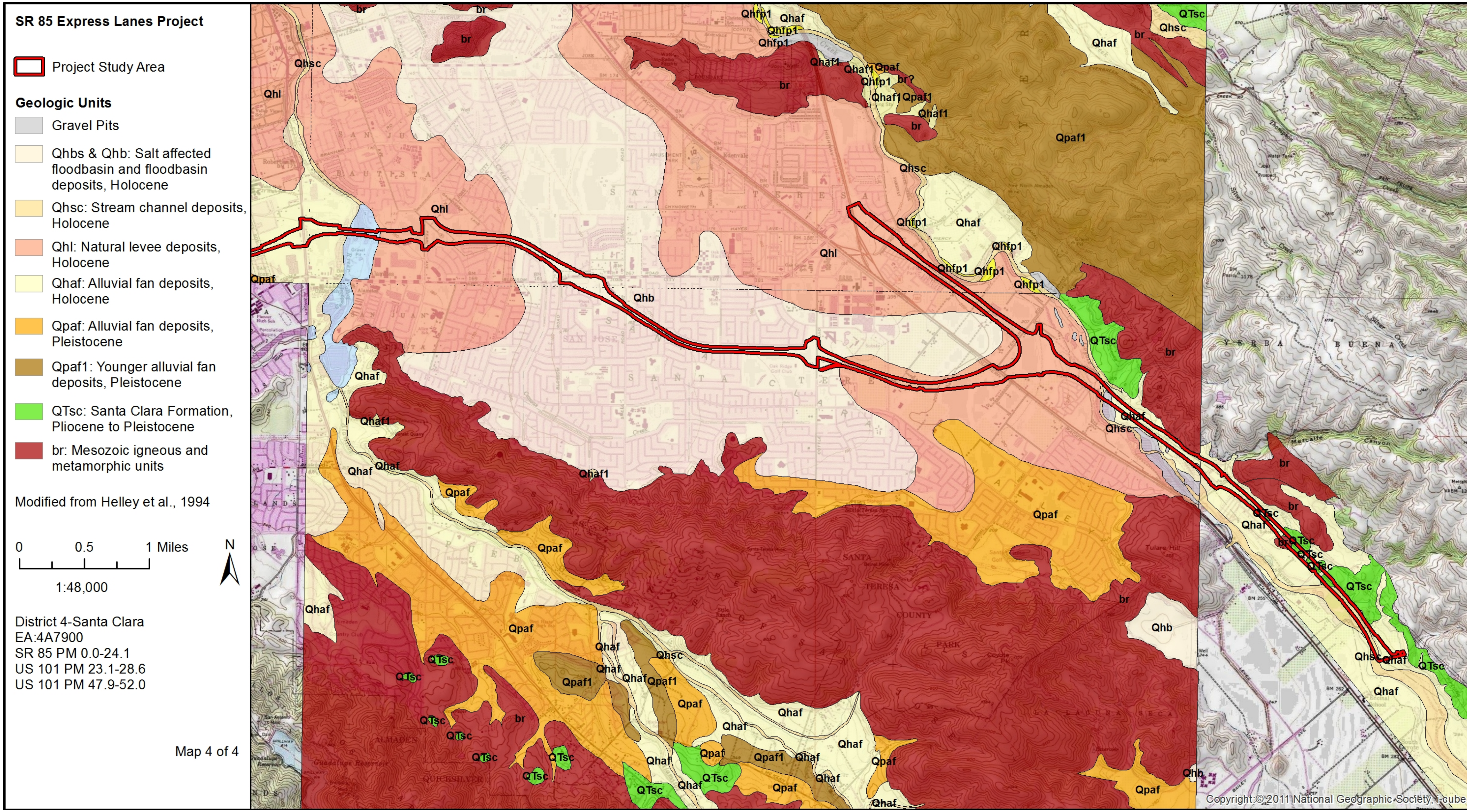

Figure 3e. Geology Map 4 of 4

MESOZOIC IGNEOUS AND METAMORPHIC UNITS

Jurassic serpentinized ultramafic rocks (Jps) could be either Coast Range ophiolite or Franciscan basement. Rocks include serpentinized harzburgite, dunite, and peridotite (Wentworth et al. 1998). Flat thrust sheets of serpentinized rock were thrust onto the fault-folded Santa Clara Formation which would normally overlie the serpentinized rocks (Page et al. 1999:494). Lower Cretaceous basaltic volcanic rocks (fpv) include pillow basalts and flow breccias with siliceous tuff near the top of the unit (Wentworth et al. 1998). These rocks have been dated to 135 million to 120 million years old (McLaughlin et al. 1991, 1996). The Upper Cretaceous and Lower Tertiary mélange (fm) consists of argillite and lithic metasandstone with blocks of blue schist amphibolites, chert or mafic igneous rocks (Wentworth et al. 1998).

PLIO-PLEISTOCENE SANTA CLARA FORMATION

The Santa Clara Formation consists of fluvially deposited, poorly sorted and poorly consolidated thin-bedded lacustrine mudstones, silts, sands, pebble and boulder conglomerates. Erosion is significant in some areas with more than 100 feet of exposure (Helley et al. 1994; Wentworth et al. 1998).

Two lithofacies have been defined. The older Arastradero facies is late Pliocene to early Pleistocene in age and consists of greywacke, greenstone, chert, siliceous laminated shale and exotic siliceous clasts. Planar flow and cross-stratification indicate the Arastradero facies was deposited by northward flow of an extensive system of coarse-grained braided streams with minor associated floodplain and lacustrine environments (Vanderhurst et al. 1982:23-29).

The younger Stevens Creek facies is early to middle Pleistocene in age and consists of locally derived Franciscan clasts deposited as the proximal portion of fans. This facies includes an ash that has been dated to 0.4-0.6 million years (Sarna-Wojcicki et al. 1991; Lanphere et al. 1999). Imbrication of conglomeratic clasts were measured to determine paleocurrent. This indicates easterly flow by coalescing fans (Vanderhurst et al. 1982:29-32). It is possible that younger Santa Clara Formation can be distinguished from overlying alluvium by presence of red chert cobbles and pebbles (Stanford 2006:8).

PLEISTOCENE ALLUVIAL FAN DEPOSITS

Pleistocene alluvial fan deposits (Qpaf1) include poorly bedded clast-supported gravels, cobbles, and boulders in sands with occasional coarse sand lenses. Clasts are at most approximately 1.2 feet (35 centimeters) in diameter (Helley et al. 1994). These deposits appear to be middle to late Pleistocene in age.

HOLOCENE UNITS

During the Holocene, the area was subject to river deposits, floods, and bay incursions with intervening soil development. Fault activity and altering sea levels has allowed for incursions of the ocean into Santa Clara Valley. Holocene alluvial fan deposits (Qhaf) are brown to tan, gravels, clayey gravel, and sands that grade upward to sandy and silty clay. Holocene estuary deposits (Qhbm) consist of water saturated estuarine clay and silty clay from the base of mudflats, marshes, and salt evaporators. This unit ranges from 0 to 33 feet (0 to 10 meters) thick and may contain shell or organic layers that interfinger with basin deposits. Holocene floodbasin deposits (Qhbs, Qhb) consist of clay to very fine silty-clay. While the Qhb deposits are organic-rich, the Qhbs deposits contain carbonate and iron nodules. Holocene floodplain deposits (Qhfp) are medium to dark grey sandy to silty clays and include occasional lenses of coarser material of silts to pebbles. Holocene alluvial terrace deposits (Qhfp1, Qhfp2) are typically less than 3 feet (1 meter) thick and border the rivers. These sediments consist of unconsolidated clays to rounded pebbles with historic artifacts. Holocene levee deposits (Qhl) consist of unconsolidated, moderately to well sorted clays to pebbles and minor boulder conglomerates. Sediments are graded as levee deposits result from rivers overflowing their banks during flooding events. Holocene stream channel deposits (Qhsc) consist of unconsolidated clays to pebbles and minor boulder conglomerates. Many channels in the area are now lined with concrete or rip-rap (Helley et al. 1994).

SOURCES CONSULTED

KNOWN PALEONTOLOGICAL RESOURCES

A paleontological records request was submitted to the University of California Museum of Paleontology (UCMP) by URS. The response indicated no fossils are known within the PSA or within a 1-mile radius.

Online record searches (UCMP, CAS, Paleobiology Database, accessed July 15, 2012) and reviews of literature revealed that additional fossils are known in Santa Clara County from rock units present in the PSA. We report results only for Pleistocene alluvial fan deposits and the Santa Clara Formation as these are the only fossiliferous formations likely to be impacted by the project (refer to Appendix C for listings).

Santa Clara Formation Plio-Pleistocene fossils include mammals, bird, freshwater fish, freshwater invertebrates and plants. Mammals include camel, long-horned bison, horse, deer, and cheetah-like cat. The sole bird is ruddy duck. Fish include Saratoga surfperch, Sacramento perch, sucker, blackfish, hardhead and minnows. Freshwater invertebrates include ram’s horn snails and three types of ostracod crustaceans. Trees known include fir, alder, incense cedar, stone oak, spruce, pine, pitted fruit, Douglas fir, live oak, canyon live oak, coast redwood and hemlock. Shrubs known include serviceberry, madrone, manzanita, ceanothus, mountain mahogany, dogwood, coffeeberry, buckthorn and gooseberry. Brake fern is also known. Freshwater pond plants include pondweed, sedge, algae, microalgae and quill wort.

Contrary to older published accounts, most of these fossils are not diagnostic of a defined time period aside from late Quaternary. The Saratoga Creek fossil assemblage discussion (Adam et al. 1983) based an assignment to the Blancan Land Mammal Age (4.9 to 1.8 MYA) on a single incisor tooth of a horse they referred to as *Dolichohippus* sp. and on presence of a cheetah-like cat referred to as *Acinonyx studeri* based on similarities to specimens from Texas. It is now recognized that a single horse tooth is not diagnostic of species and the cheetah-like cat, while represented by a skull and partial skeleton, has never been formally evaluated for taxonomic affiliation. Presence of long-horned bison in the composite assemblage indicates that the Santa Clara Formation extends into the Rancholabrean Land Mammal Age (240 to 11 thousand years before present; Bell et al. 2004).

In contrast, the fossils from Pleistocene alluvial fan deposits in Santa Clara County are clearly Rancholabrean. Mammals include Columbian mammoth, mastodon, giant ground sloth, yesterday’s camel, long-horned bison, horse, deer, peccary, dwarf pronghorn antelope, rabbit, ground squirrel, wood rat, kangaroo rat, pocket gopher, western harvest mouse, bear, reptiles and fish.

RELEVANT PREVIOUS STUDIES

Paleontological Identification Report

The PIR identified the Pleistocene alluvial deposits and the Santa Clara Formation as potentially fossil-bearing deposits (URS 2012). A Paleontological Evaluation Report (PER) to be based on evaluation of locations of construction components was recommended.

Geotechnical Report

In most cases, the geotechnical report did not differentiate between native Holocene or Pleistocene alluvium and the Santa Clara Formation. However, boring results indicated overall presence of sediments and other relevant conditions (Table 2; URS 2011). Also, based on geology, the area north of I-880 is likely to be Holocene alluvium to substantial depth.

Table 2. Bore Results

Location of Bores	**Fill**	**Alluvium**	**Pleistocene Alluvium**	**Santa Clara Formation**
Coyote Creek Bridge	10'	10'		20-82'
Great Oaks Interchange		to 101'		
Perimeter Rd UC		to 35+'		
Almaden Expressway Interchange		to 30+'		
Ross Creek culvert		to 40+'		
Russo Dr OC		to 81'		
Meridian Ave OC		to 30+'		
Dent Ave OC		to 30+'		
Camden Ave Interchange		depths not stated		
Leigh Ave OC		to 100'		
Union Ave Interchange		to 10+'		
Samaritan/White Oaks OC		to 40+'		
Bascom Ave to Winchester Blvd			to 60+'	
Winchester Rd to Quito Rd			to 70+'	
Quite Road to Cox Ave			to 39+'	
Cox Ave to Rodeo Creek			no depth given	
Rodeo Creek			to 75+'	
Stevens Creek Blvd			to 100+'	
Homestead Rd OC		to 48+'		
Dalles PC		to 28'		
Stevens Creek Bridge		to 80'		
El Camino Real		to 75'		
Mountain View Overhead		to 75'		
Middlefield Rd OC		to 72'		
Moffett Blvd UC		to 93'		
North Shoreline to Oregon ExpWy	3-10'	to 50'		
All raised embankments	to 36'			

PALEONTOLOGICAL SENSITIVITY

Caltrans utilizes a tripartite scale to characterize paleontological sensitivity, consisting of no potential, low potential and high potential (Caltrans 2012a). The Caltrans scale is used as the primary sensitivity evaluation method for this PER/PMP. A multilevel ranking system, the Potential Fossil Yield Classification (PFYC) system (BLM 2009), is based on demonstrated yield of fossils. The PFYC system provides additional guidance regarding assessment and management for different fossil yield rankings and is therefore used in this PER/PMP to complement the Caltrans scale. More detailed information on the Caltrans sensitivity criteria in correlation with the PFYC scale is appended (Appendix B).

Occurrences of fossil resources are closely tied to the geologic units (e.g., formations or members) that contain them. The probability for finding significant fossils in a project area can be broadly predicted from previous records of fossils recovered from the geologic units present in and/or adjacent to the study area. Geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts. This ranking is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher ranking; instead, the relative abundance of localities is intended to be the major determinant for the value assignment.

There are 33 known localities in the Santa Clara Formation and 35 known localities in Pleistocene alluvial fan deposits. No localities are known in any other formations. Based on these results, the Pleistocene alluvial fan deposits and the Santa Clara Formation are ranked as Caltrans high or PFYC 3a (Table 3). All other formations are ranked as low on both PFYC and Caltrans scales.

Table 3. Paleontological Sensitivity Rankings

Caltrans ranking	**high**			**low**		**no**
PFYC ranking	**5: very high**	**4: high**	**3a: moderate-patchy**	**3b: moderate-undemonstrated**	**2: low**	**1: very low**
Rock Units						
Holocene units					X	
Pleistocene alluvial fan deposits			X			
Santa Clara Formation			X			
Igneous and Metamorphic units					X	

IMPACT ANALYSIS

BASELINE CONSIDERATIONS

Pleistocene alluvial fan deposits and the Santa Clara Formation have been demonstrated to be the only paleontologically sensitive sediments within the PSA that may be affected by project activities. Caltrans guidance for evaluating fossil deposits and sensitivity of resources states:

> 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 between 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 resource assessment results in a determination that the site is insignificant or of low sensitivity, this conclusion should be documented in a Paleontological Evaluation Report (PER) and in the project's environmental document in order to demonstrate compliance with applicable statutory requirements.
>
> If a paleontological resource is determined to be significant, of high sensitivity, or of scientific importance, and the project impacts it, 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, however, 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 acceptable significance documentation is submitted. Thus, coordination between Caltrans, FHWA, and all jurisdictional agencies is critical to formally establishing the significance of a resource. [PER Instructions, Chapter 8, Vol. 1, SER, http://www.dot.ca.gov/ser/vol1/sec3/physical/Ch08Paleo/chap08paleo.htm, accessed August 14, 2012]

DEFINITION OF SIGNIFICANCE FOR PALEONTOLOGICAL RESOURCES

Only qualified, trained paleontologists with specific expertise in the type of fossils being evaluated can determine the scientific significance of paleontological resources. Fossils are considered to be significant if one or more of the following criteria apply:

1. The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct;
2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

3. The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;
4. The fossils demonstrate unusual or spectacular circumstances in the history of life;
5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

As so defined, significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or diagnostically important. Significant fossils can include remains of large to very small aquatic and terrestrial vertebrates or remains of plants and animals previously not represented in certain portions of the stratigraphy. Assemblages of fossils that might aid stratigraphic correlation, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, and paleoclimatology are also critically important (Scott and Springer 2003; Scott et al. 2004).

SIGNIFICANCE EVALUATION

The potential to affect fossils varies with depth of impacts, previous disturbance and presence of non-fossiliferous sediments. Logistics of excavation also affect the possibility of recovering scientifically significant fossils since, as outlined above, information on exact location, vertical elevation, rock unit of origin, and other aspects of context are critical.

Road widening, grading and trenching may affect Pleistocene alluvial fan deposits and the Santa Clara Formation where those geologic units are exposed at or near the surface. Drilling and pile driving for various project components may potentially affect both Pleistocene alluvial fan deposits and the Santa Clara Formation.

Grading and trenching may reveal fossils or fossil assemblages *in situ*. Significance will need to be assessed subsequent to recovery and identification, but generally single fossil bones will not meet significance criteria.

Drilling would be conducted using truck-mounted rotary drills. This type of tool may rotate out fossil bones or other materials but the specimens will lack context, depth/elevation, formation identification and other elements that are critical to scientific significance. These types of unprovenienced fossils will only be significant if they result in identification of new species that are currently not known in the county. If they are identified as already-known species, they will be suitable for educational uses.

PALEONTOLOGICAL MITIGATION PLAN

PROPOSED RESEARCH

The primary research goal is to better define the chronology of the Santa Clara Formation and Pleistocene alluvial fan deposits. This would require recovery of one or more fossil assemblages meeting significance criteria. The second research goal is to conduct chronostratigraphic research on cores or exposures that would differentiate the facies of the Santa Clara Formation from both the Pleistocene alluvial fan deposits and the Holocene alluvial units including their environments.

SCOPE OF WORK

This PMP was developed to meet the requirements of Caltrans guidance on mitigation plans (Caltrans 2012a). Implementation of the PMP will guide and facilitate the identification and treatment of paleontological resources located during the project in an effort to reduce adverse effects on significant resources.

This PMP summarizes identified paleontologically sensitive areas within the PSA, the organization and responsibilities of the paleontological team, the responsibilities of other parties, and the treatment and communications procedures to be implemented if paleontological resources are encountered during the project.

DEFINITION OF PALEONTOLOGICALLY SENSITIVE AREAS

Grading and trenching may affect surface exposures of Pleistocene alluvial fan deposits which are mapped from approximately PM 10.2 to 10.5 on SR 85 (shown as Qpaf1 on Figure 3d), within the SR 17 interchange and eastward to South Bascom Avenue.[1] These activities may also affect surface exposures of the Santa Clara Formation mapped from approximately PM 23.3 to 25.0 on US 101 in southern San Jose (shown as QTsc on Figure 3e), between Metcalf Road and Bailey Avenue. These rock units may be present subsurface in other locations, but work to date has not identified specific locations and depths.

[1] PMs in this section were estimated by correlating the geologic units shown in Figures 3d and 3e with aerial mapping and with freeway structure PMs listed in the Log of Bridges on State Highways (Caltrans 2012b).

DECISION THRESHOLDS

Grading and trenching may affect surface exposures of Pleistocene alluvial fan deposits and the Santa Clara Formation as defined in the preceding section. These areas will require full-time paleontological monitoring.

While subsurface drilling may affect these formations in other parts of the project, precise locations and depths have not been determined. The potential to recover fossils that meet significance criteria is low. A paleontologist should be on call to respond in the event a fossil is recovered from drilling and to perform subsequent work to determine whether it can be identified and whether it meets significance criteria.

Unidentifiable fossils will generally not meet significance criteria and should not be collected unless the amount and preservation is sufficient for dating purposes (criterion 5 above). For identifiable fossils, significance will need to be assessed subsequent to recovery but generally single fossils are isolated finds that will not meet significance criteria unless they represent previously unknown species in the area or they provide a useful radiocarbon date that assists with local sedimentary sequencing (criteria 2 and 5 above). This is because single fossils, such as a left bison tibia, do not have sufficient data potential to evaluate evolutionary relationships, development of biological communities, interaction between paleobotanical and paleozoological biotas, or unusual or spectacular circumstances in the history of life (criteria 1, 3 and 4 above). Associations of whole or partial skeletons of different animals are likely to meet multiple significance criteria.

JUSTIFICATION OF COST ESTIMATE

The cost estimate is provided in Appendix D. A supervisor with a geology degree will attend the project kickoff and work with the onsite personnel to understand where and when excavations will occur. For the purposes of the estimate, we assume one monitor for full-time monitoring of sensitive surface exposures and on-call response to finds. A total of 10 days of full-time monitoring (8 hours per day) is assumed during construction between approximately PM 10.2 and 10.5 on SR 85 (Pleistocene alluvial fan deposits, shown as Qpaf1 on Figure 3d), and between approximately PM 23.3 and 25.0 on US 101 in southern San Jose (Santa Clara Formation, shown as QTsc on Figure 3e). The following construction activities would be monitored:

- Utility trenching to a depth of up to 5 feet and installation of one or more biofiltration swales along SR 85 at the SR 17 interchange and westward to South Bascom Avenue.
- Utility trenching to a depth of up to 5 feet along US 101 between Metcalf Road and Bailey Avenue.

Dependent upon the construction strategy, one or more monitors may be needed if multiple areas are excavated simultaneously. A total of 2 days (16 hours) is assumed for periodic sediment checks and on-call response.

The budget assumes we will field qualified personnel from the local area. The cost estimate assumes recovery and preparation of two fossils. Expendable field supplies would include stabilization chemicals, plaster, burlap, specialists and similar materials. Preparation of recovered fossils includes removal of sediment and stabilization of the fossil's condition to allow identification and potentially removal from a plaster jacket. Identification is necessary to meet the research goals of the monitoring and make significance determinations. Curation is necessary to provide research access to any significant fossils recovered so they contribute to scientific knowledge and education.

PALEONTOLOGICAL TEAM

Personnel Organization and Qualifications

The principal paleontologist will meet the qualifications outlined under preparer qualifications in the Caltrans Standard Environmental Reference, Volume 1, Chapter 8. The principal paleontologist will be responsible to implement the mitigation plan and maintain professional standards of work.

The principal paleontologist will designate the project team to include a qualified field supervisor and qualified paleontological monitors. These personnel will meet the qualifications outlined under preparer qualifications in the Caltrans Standard Environmental Reference, Volume 1, Chapter 8.

Construction Phase

The Contractor shall provide the Resident Engineer with a schedule of ground-disturbing activities to be conducted within the project limits in writing at least 15 working days prior to construction and update the schedules as needed. The Resident Engineer will make arrangements for the Paleontological Team to be at the work sites in accordance with these requirements.

Training

All project personnel shall receive training prior to commencement of work. Specific training requirements are presented below as they apply to project personnel.

Paleontological Personnel

All paleontological personnel will receive a copy of this PER/PMP, daily monitoring logs and appropriate maps, and the project safety plan. Attendance at a job site safety meeting is required of all field personnel. Field personnel must wear clothing appropriate to the jobsite and are required to wear hard hats, safety vests, steel-toed boots and hearing protection in active construction zones. If special conditions exist on the project, additional safety measures will be implemented.

Construction Field Personnel Environmental Resources Briefing

The principal paleontologist or paleontological supervisor will prepare and present paleontological awareness training. Attendance is mandatory for all earthmoving personnel and their supervisors. Attendance rosters will be submitted to verify training and hard-hat stickers issued. This allows quick visual assessment of which construction personnel have been trained and which need to be trained.

Schedule, Methods and Documentation

Monitors will be fielded during active construction within the small sections of surface exposures of Pleistocene alluvial fan deposits and Santa Clara Formation. Monitors will also be available to respond to unanticipated discoveries in other areas. Monitors may perform microscopic examination of exposed sediments for microfossils.

The paleontological monitor is responsible to maintain close communication with the on-site earthmoving personnel in order to maintain a safe working environment and to be fully appraised of the upcoming areas of impact and any schedule changes.

The paleontological monitor is to work in cooperation with the Resident Engineer and Construction Manager and is responsible to complete daily documentation of presence and daily documentation of activities including the location of activities throughout the day and the type, observations of sediment type and distribution, observations regarding fossils, collection of fossils and other information. The paleontological technician is responsible to photograph activities, sediments and paleontological resources for documentation purposes and to fill out a Photograph Record Sheet for each digital roll. All paperwork and photographs will be submitted to the principal paleontologist weekly. As needed, paperwork and photographs will be submitted to the Task Order Manager and Resident Engineer. All documentation will be filed and maintained by the principal paleontologist and submitted to the repository along with any significant fossils upon completion of the project.

REPORTING

A weekly email summary will be submitted to the Task Order Manager and conveyed to the Resident Engineer as needed. If fossils are recovered, additional documentation regarding lab work will also be incorporated. These records and the field notes will be used to prepare a monthly letter report. The monthly reports will summarize the activities of the previous period, discoveries made, progress of lab work, incidents and actions taken. Monthly reports will be submitted to the Task Order Manager and conveyed to the Resident Engineer as needed.

Upon conclusion of earthmoving, a Paleontological Mitigation Report (PMR) will be prepared. The PMR will include the inclusive dates of activity, personnel utilized including qualifications, summarize the paleontological mitigation effort and coverage using text and maps, documentation of paleontological localities discovered, paleontological resources identified, interpretation of fossils, non-compliance issues and their resolution, evaluation of the adequacy of this PMP and suggestions for improving paleontological resource monitoring procedures and include all specialists' reports as appendices. The PMR will be submitted to the Task Order Manager for approval. Copies of the PMR will go to Caltrans, the repository if one is utilized, and other parties as requested.

DISCOVERY AND TREATMENT OF FOSSILS

FOSSIL DISCOVERY AND RECOVERY

Discovery of fossils potentially meeting significance criteria requires immediate notice to the Task Order Manager for the project. Agency personnel will be party to all discussions regarding recovery, documentation, analysis and curation.

Fossils observed will be treated differently depending on type and circumstance. Generally, discovery of identifiable invertebrate (shells, crustaceans, etc.) fossils requires a scientifically significant sample to be collected for identification and analysis and that the locality be documented (see below). Similar procedures are followed for microvertebrates such as rodents. Current professional standards call for testing of 200-pound samples (four or five full-5 gallon buckets) from each locality followed by processing of up to 6,000 pounds of matrix if significant fossils are recovered by testing. Documentation of localities is required.

Larger fossils observed must be evaluated to determine their condition. Generally the monitor will be able to quickly determine if the fossils are sufficiently well-preserved to meet preliminary significance criteria. If necessary, the monitor will cordon off the immediate area around the fossil to permit a safe work zone to recover the fossil and notify the construction foreman. The monitor will also immediately notify the field supervisor if assistance is needed and sufficient personnel to perform the work will be fielded. Documentation of localities is required.

Discovery of a bone bed or other type of fossil sites containing multiple large fossils may require a formal Stop Work order. The monitor will cordon off the area until evaluation occurs. The principal paleontologist will consult with the Resident Engineer regarding the amount of time necessary. This type of discovery requires a detailed field map, a sedimentary structure analysis, one or more stratigraphic columns and data for taphonomic[2] analysis.

Depending on the formations being affected, additional samples collected may include specimens for dating analyses or materials for microfossil, botanical or pollen analyses. All fossils and sediment samples will be accompanied by a field tag with project and locality information including a unique field number.

LOCALITY DOCUMENTATION

Every fossil locality requires a standard set of data be taken. This includes one or more UTM readings using a global positioning system unit, an accurate elevation measurement if possible, the depth below surface for Holocene and Pleistocene fossils, a lithology, and true north reading. Additional information collected may include one or more stratigraphic columns, sedimentary structure analysis, taphonomic analysis and photographs of the fossil in situ.

FOSSIL PREPARATION

Many fossils require only cleaning and stabilization through the use of hardeners. Others require lab excavation of plaster jackets with gradual cleaning and hardening. Sometimes larger fossils require a "cradle," usually a form-fitted plaster lined with acid-free cloth to provide support and prevent breakage during storage or transport. Fossils found in bedrock formations may require more tedious preparation using mechanical devices such as zip scribes.

Processing of matrix samples for microvertebrates varies depending on the nature of the sediments and may be washed using water, may require chemical agents to break apart the rock or may require floatation using heavy liquids.

FOSSIL IDENTIFICATION

All fossils will be identified by experts. All identifications will be as specific as possible and include element, portion, side, sex, age, taphonomy and notes. Cataloging, including identification information, will be entered into a computer database. Each specimen will be maintained with a tag specifying the provenience and identification information.

2 The study of the processes (as burial, decay, and preservation) that affect animal and plant remains as they become fossilized.

FOSSIL ANALYSES

Analyses conducted depend to a great extent on the number of fossils recovered and their condition. Guild analysis (relative number of carnivores, herbivores and omnivores of various body weights in an ecosystem), demographic analysis (age and sex structure of populations), habitat analysis (certain types of animals indicate grasslands as opposed to deserts for example), paleoecology (use of botanical and/or pollen analysis to reconstruct the paleoenvironment) and comparative analysis (comparison to other faunas of the same time period regionally) are the most typical. Geological context analyses include stratigraphy of the fossil deposit, dating (to narrow the time range of the fossils), taphonomy (history of alteration of the fossils by scavengers, water transport, etc.) and other ancillary studies.

CURATION AND DISCARD PROTOCOL

Fossils meeting significance criteria will be curated in perpetuity at a state-approved repository along with all project data and a copy of the final report. Fossils are only to be removed from a collection at the discretion of the principal investigator. Typically specimens are discarded to educational uses because the fossil was not identifiable to at least family level, was not found in-situ or was part of a large collection of the same species from the same locality and individual specimens in poor condition were discarded. This situation would only occur in the case of plants or invertebrates where there are dozens or hundreds of the same plant or invertebrate that were collected from a locality.

REPOSITORY

The Museum of Paleontology at the University of California at Berkeley will have right of first refusal for fossils recovered. Their policy for accepting collections requires that all project paleontology data accompany the specimens (Figure 4). Ownership will be transferred from Caltrans to the Museum as both are state agencies. Project funds will be allocated to pay for costs of transporting, curating and housing the collection.

UNIVERSITY OF CALIFORNIA, BERKELEY

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MUSEUM OF PALEONTOLOGY
1101 Valley Life Sciences Bldg.

BERKELEY, CALIFORNIA 94720-4780

Date: Fiscal Year 2008 - 2009
Re: Collections Accessioned by the University of California Museum of Paleontology (UCMP)

To Whom It May Concern:

Fossils obtained by a third party through mitigation contract activities in accordance with the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), or similar state and federal requirements, may be accepted by UCMP only upon prior approval in writing by the UCMP Director or Assistant Director for Research and Collections. Upon approval, and meeting the following requirements: minimum standards for specimen preparation and associated data; payment of accession fee; donation of curatorial supplies, museum collection cabinets and drawers as required, shall UCMP care for and house the collection following standard museum protocols.

Minimum Standards

1. Specimens are prepared and ready for curation.
2. Specimens are accompanied by accurate stratigraphic and geographic data that are tied to a listing of field numbers. Specifically, specimens should be associated with descriptions of the lithologic unit, instructions for relocating the locality and determining its stratigraphic position, and both standard map data (section, township, range, quarter sections) and latitude and longitude.
3. Associated specimens must be clearly marked as having been found in association.
4. Field notes in UCMP format and copies of field maps will be deposited in the Museum archives concurrent with acceptance of the collection.
5. If specimens are collected from pre-existing published localities, specific references to the locality and publication shall accompany specimens.

All material collected will be curated into the collections of UCMP, where they will be available for scientific analysis and comparative study. Data pertaining to the location of finds, depositional environment, geologic and biostratigraphic age, and taxonomic assignments of fossils will be entered into our computerized databases. Non-sensitive data are freely available on our web site, and all data are available to land managers, government officials, and qualified researchers upon request.

Current UCMP policy in regard to accession of collections is available on
http://www.ucmp.berkeley.edu/science/collectionspolicies.php

Figure 4. Provisional Curation Agreement

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APPENDIX A. QUALIFICATIONS

SHERRI GUST
Project Manager & Principal Investigator, Paleontology and Archaeology

EDUCATION

1994 M. S., Anatomy (Evolutionary Morphology), University of Southern California, Los Angeles
1979 B. S., Anthropology (Physical), University of California, Davis

SUMMARY QUALIFICATIONS

Gust has more than 30 years of experience in California, acknowledged credentials for meeting national standards, and is a certified/qualified principal archaeologist and paleontologist in all California cities and counties that maintain lists. She holds BLM permits in paleontology and cultural resources. Gust is an Associate of the Natural History Museum of Los Angeles County in the Vertebrate Paleontology and Rancho La Brea Sections. She is a Member of the Society of Vertebrate Paleontology, Society for Archaeological Sciences, Society for Historical Archaeology, the Society for California Archaeology and others. She has special expertise in the identification and analysis of human, animal and fossil bone. In addition, she is a Reader at the Huntington Library and has performed extensive archival research.

SELECTED PROJECTS

Tehachapi Renewable Transmission Project, Segments 1-3. Project Included: Paleontological resources management plans, Phase I activities, archaeological and paleontological monitoring, artifact and fossil recovery, lab work, GIS mapping, multiple supplement survey and variance reports for construction of new electrical transmission facilities in Los Angeles, Kern, and San Bernardino Counties. Project Manager and Principal Archaeologist for Cogstone's work and Principal Paleontologist for entire project. 2007-9.

El Casco Transmission Project. Project Included: Preconstruction mitigation measures and prepared Paleontological Resources Treatment Plan for new SCE transmission project in Riverside County. Project Manager and Principal Paleontologist. 2009.

San Bernardino County Road Improvement Projects. Project Included: Paleontological Identification Reports, Paleontological Evaluation Reports and Paleontological Mitigation Plan for projects including I10, SR58, SR138, SR247. Supervised paleontological monitoring for SR138, recovered significant fossils and contributed to the Paleontological Mitigation Report. Project Manager and Principal Paleontologist. 2005-present.

SR178 Widening Project. Project Included: Historic Property Survey Report with appended Archaeological Survey Report and Paleontological Identification Report, Paleontological Evaluation Report and Paleontological Mitigation Plan for 8 mile segment east of Bakersfield. Project Manager and Principal Paleontologist and Archaeologist. 2007-9.

First Street Trunk Line Water Project. Project Included: Paleontological assessment and supervised monitoring of installation of new water main in Los Angeles. Project Manager and Principal Paleontologist. 2006-9.

Irvine Business Complex. Project Included: Archaeological and Paleontological Evaluation of business complex with recent high density housing additions in Irvine, California. Project Manager and Principal Paleontologist and Archaeologist. 2009.

Scattergood Olympic Line. Project Included: Archaeological and Paleontological Assessment and Mitigation Plan for new 11 mile underground electrical transmission line in Los Angeles. Project Manager and Principal Paleontologist and Archaeologist. 2008-9.

Spring Trails Project. Project Included: Archaeological and Paleontological Resources Assessment of 350 acre residential development with evaluation of previous work and Mitigation Plan in San Bernardino. Project Manager and Principal Paleontologist and Archaeologist. 2008-9.

KIM SCOTT
Field & Lab Director for Paleontology

EDUCATION

2000 B.S., Geology with paleontology emphasis, University of California, Los Angeles

SUMMARY QUALIFICATIONS

Scott has more than 15 years of experience in California paleontology. She is a qualified geologist and field paleontologist with extensive survey, monitoring and fossil salvage experience. In addition, she has special skills in fossil preparation (cleaning and stabilization) and preparation of stratigraphic sections and other documentation for fossil localities. Scott serves as company safety officer and is the author of the company safety and paleontology manuals.

SELECTED PROJECTS

Tehachapi Renewable Transmission Project, Segments 1-3. Prepared portions of paleontological resources management plans, supervised paleontological monitoring, fossil recovery and preparation for construction of new electrical transmission facilities in Los Angeles and Kern Counties. Field and Lab Director. 2007-9

Tehachapi Renewable Transmission Project, Segments 4-11. Prepared portions of paleontological resources management plan for construction of new electrical transmission facilities in Los Angeles and Kern Counties. Field and Lab Director. 2007-9

El Casco Transmission Project. Conducted preconstruction mitigation measures and prepared portions of Paleontological Resources Treatment Plan for new SCE transmission project in Riverside County. Field and Lab Director. 2009

First Street Trunk Line Water Project. Prepared portions of paleontological assessment and monitoring report and supervised monitoring of installation of new water main in Los Angeles. Field and Lab Director. 2006-9

San Bernardino County Road Improvement Projects. Prepared portions of Paleontological Identification Reports, Paleontological Evaluation Reports and Paleontological Mitigation Plan for projects including I10, SR58, SR138, SR247. Supervised paleontological monitoring for SR138, recovered significant fossils and prepared Paleontological Mitigation Report. Field and Lab Director. 2005-present

SR178 Widening Project. Prepared portions of Paleontological Identification Report, Paleontological Evaluation Report and Paleontological Mitigation Plan for 8-mile segment east of Bakersfield. Field and Lab Director. 2007-9

Scattergood Olympic Line. Prepared portions of Paleontological Assessment for new 11-mile underground electrical transmission line in Los Angeles. Field and Lab Director. 2008-9

Niland Solar Energy Project. Prepared portions of Paleontological Assessment and conducted Mitigation Sampling for a 1000-acre solar project in Imperial County. Field and Lab Director. 2008-9

Rosedale (former Monrovia Nursery) Project. Supervised paleontological monitoring, conducted survey, and supervised fossil recovery for 500-acre mixed use development in Azusa. Field and Lab Director. 2004-7

Owens Valley PM10 Planning Area. Conducted paleontological surveys and prepared portions of the Paleontological Assessments for two phases of evaluation of Dust Control Measures in Inyo County. Prepared pretions of the . Field and Lab Director. 2005-7

APPENDIX B. SENSITIVITY RANKING CRITERIA

Caltrans Rank	Caltrans Description	PFYC Description	PFYC Rank
No	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.	Very Low. The occurrence of significant fossils is non-existent or extremely rare. Includes igneous or metamorphic and Precambrian or older rocks. Assessment or mitigation of paleontological resources is usually unnecessary.	1
Low	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. If the resource is determined to be significant, monitoring and mitigation is required.	Low. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils. Includes rock units too young to produce fossils, sediments with significant physical and chemical changes (e.g., diagenetic alteration) and having few to no fossils known. Assessment or mitigation of paleontological resources is not likely to be necessary.	2
		Potentially Moderate but Undemonstrated Potential. Units exhibit geologic features and preservational conditions that suggest fossils could be present, but no vertebrate fossils or only common types of plant and invertebrate fossils are known. Surface-disturbing activities may require field assessment to determine appropriate course of action.	3b
High	Rock units which, based on previous studies, contain or are likely to contain significant vertebrate, significant invertebrate, or significant plant fossils. 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; 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.	Moderate Potential. Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered and of low abundance. Common invertebrate or plant fossils may be found. Surface-disturbing activities may require field assessment to determine appropriate course of action.	3a
		High. Geologic units containing a high occurrence of significant fossils. Fossils must be abundant per locality. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. If impacts to significant fossils can be anticipated, on-the-ground surveys prior to authorizing the surface disturbing action will usually be necessary. On-site monitoring or spot-checking may be necessary during construction activities.	4
		Very High. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. On-the-ground surveys prior to authorizing any surface disturbing activities will usually be necessary. On-site monitoring may be necessary during construction activities.	5

APPENDIX C. FOSSIL LISTINGS

SANTA CLARA FORMATION COMPOSITE FOSSIL ASSEMBLAGE LIST

† indicates extinct animals

Identification	Common Name	Locality Name	Source	Locality
MAMMALS				
Camedlidae	camel	Anderson Lake	UCMP	V93037
Bison latifrons †	bison, long-horned	Molecular Medicine bldg.	UCMP	V90003
Eqqus sp. †	horse	Saratoga Creek	PBD	USGS M-1219
		Calabazas Creek	UCMP	V9005
		Strannigan Backyard	UCMP	V99497
Equidae indeterminate	horse	Saratoga Creek	PBD	USGS M-1219
Cervidae	deer family			
cf. *Miracinonyx studeri* †	cheetah-like cat			
BIRDS				
Oxyura sp.	duck, ruddy?	Saratoga Creek	Adam et al. 1983	USGS M-1219
FISH				
Damalichthys saratogensis †	surfperch, Saratoga	Saratoga Creek	Casteel 1978	USGS M-1219
Archoglites interruptus †	Sacramento perch			
Catostomus sp.	sucker			
Orthodon sp.	blackfish			
Mylopharodon sp.	hardhead			
Cyprinidae	minnow			
INVERTEBRATES, FRESHWATER				
Heliosoma (Carinifex) sanctaeclarae	snail, ram's horn	Santa Clara Lake	CAS	not given
Limnocythere itasca	ostacod crustacean	Saratoga Creek	Adam et al. 1983	USGS M-1219
Ilyocypris gibba				
Candona sp.				

Identification	Common Name	Locality Name	Source	Locality
PLANTS				
Trees				
Abies sp.	fir	Saratoga Creek	Adam et al. 1983	USGS M-1219
Alnus merriami	alder	Calabazas Canyon	UCMP	160
Calocedrus sp.	cedar tree, incense			
Lithocarpus (Pasania) densiflora	oak, stone	not given	CAS	not given
Picea sp.	spruce	Saratoga Creek	Adam et al. 1983	USGS M-1219
Pinus sp.	pine	Calabazas Canyon	UCMP	160
		Saratoga Creek	Adam et al. 1983	USGS M-1219
Prunus merriami	pitted fruit	Calabazas Canyon	UCMP	160
Psuedotsuga sp.	fir, Douglas	Saratoga Creek	Adam et al. 1983	USGS M-1219
Quercus (hannibali) pollardiana	oak, live	Calabazas Canyon	UCMP	160
Quercus chrysolepis	oak, canyon live	not given	CAS	not given
Sequoia sempervirens	redwood, coast	not given	CAS	not given
Tsuga sp.	hemlock	Saratoga Creek	Adam et al. 1983	USGS M-1219
Shrubs				
Amelanchier	serviceberry	Calabazas Canyon	UCMP	160
Arbutus menziesii	madrone	not given	CAS	not given
Arctostaphylos manzanita	manzanita, common	not given	CAS	not given
Ceanothus chaneyi	ceanothus	Calabazas Canyon	UCMP	160

Identification	Common Name	Locality Name	Source	Locality
Cercocarpus cuneatus	mahogany, mountain	Calabazas Canyon	UCMP	160
Cornus glabrata	dogwood, smooth	not given	CAS	not given
Rhamnus californica	coffeeberry	not given	CAS	not given
Rhamnus purshiana	buckthorn	not given	CAS	not given
Ribes stanfordianum	shrub, gooseberry	Calabazas Canyon	UCMP	160
Ferns				
Pteris calabazensis	fern, brake	Calabazas Canyon	UCMP	160
Other				
Potamogeton sp.	pondweed	Saratoga Creek	Adam et al. 1983	USGS M-1219
Cyperaceae	sedge			
Pediastrum sp.	algae, freshwater			
Botryococcus sp.	microalgae, planktonic			
Isoetes sp.	quill wort			

PLEISTOCENE ALLUVIAL FAN DEPOSITS COMPOSITE FOSSIL ASSEMBLAGE LIST
† indicates extinct animals

Identification	Common Name	Locality Name	Source	Locality
MAMMALS				
Mammuthus columbi †	mammoth, Columbian	Mountain View Dump	Jefferson 1991 updated	USGS 1227
		SCVWD "Lupe"		V99597
		Sunnyvale Sewer, Sunnyvale		USGS 1218
Mammuthus sp. †	mammoth	Alma Street Underpass at Page Mill Road		USGA 1203
		Stanford University, Corte de Madera Creek		none
		Lawrence Expressway E		V91128
		Veterans Hospital, Matadero Creek		USGS 1001/1202
Mammut sp. †	mastodon	Mountain View		none
Paramylodon harlani †	sloth, ground, Harlan's	Mountain View Dump	Jefferson 1991 updated	USGS 1227
		Veterans Hospital, Matadero Creek		USGS 1001/1202
Camelops hesternus †	camel, yesterday's	Mountain View Dump	Jefferson 1991 updated	USGS 1227
Camelops sp. †	camel	Rose Tombley's Backyard, San Jose	Jefferson 1991 updated	none
		Sunnyvale Sewer, Sunnyvale		USGS 1218
		Alma Street Underpass at Page Mill Road		USGA 1203
Bison sp. cf. *B. latifrons* †	bison, long-horned	Mountain View Dump	Jefferson 1991 updated	USGS 1227
Bison sp.	bison	Milpitas		V4916
		Sunnyvale Sewer, Sunnyvale		USGS 1218
Equus sp. †	horse	Alma Street Underpass at Page Mill Road	Jefferson 1991 updated	USGA 1203
		Mountain View Dump	Jefferson 1991 updated	USGS 1227
		Santa Clara Valley		
		Sunnyvale Sewer, Sunnyvale	Jefferson 1991 updated	USGS 1218
		Veterans Hospital, Matadero Creek		USGS 1001/1202

Identification	Common Name	Locality Name	Source	Locality
Odocoileus sp.	deer	Mountain View Dump	Jefferson 1991 updated	USGS 1227
Platygonus sp.	peccary	San Felipe, Gilroy	UCMP	V6561
Capromeryx sp. †	antelope, pronghorn, dwarf	Veterans Hospital, Matadero Creek	Jefferson 1991 updated	USGS 1001/1202
Sylvilagus sp.	rabbit, cottontail	Veterans Hospital, Matadero Creek	Jefferson 1991 updated	USGS 1001/1202
Spermophilus beldingi	squirrel, ground, Belding's	Mountain View Dump		USGS 1227
		Sunnyvale Sewer, Sunnyvale		USGS 1218
Neotoma fuscipes	rat, wood	Mountain View Dump		USGS 1227
		Veterans Hospital, Matadero Creek		USGS 1001/1202
Dipodomys heermanni	rat, kangaroo	Mountain View Dump		USGS 1227
Thomomys bottae	gopher, pocket	Sunnyvale Sewer, Sunnyvale		USGS 1218
Reithrodontomys sp.	mouse, western harvest	Veterans Hospital, Matadero Creek		USGS 1001/1202
Ursus sp.	bear	Sunnyvale Sewer, Sunnyvale	Jefferson 1991 updated	USGS 1218
REPTILES & FISH				
Reptilia	reptiles	Mountain View Dump	Jefferson 1991 updated	USGS 1227
Pisces	fish	Mountain View Dump	Jefferson 1991 updated	USGS 1227

APPENDIX D. COST ESTIMATE

URS Corporation Contract No. S06119 Santa Clara Valley Transportation Authority Highway 85 Express Lanes Cost Estimate	Title	Task Manager Principal Paleontologist	Director	Supervisor	GIS Specialist	Technician	Contract Manager	Clerical				
		ESTIMATED LABOR HOURS & COSTS										
Hourly Rates		$ 126.00	$ 83.00	$ 72.00	$ 68.00	$ 52.00	$ 90.00	$ 52.00				
		Hours	Hours	Hours	Hours	Hours	Hours	Hours	TOTAL LABOR HOURS	TOTAL LABOR COSTS	TOTAL OTHER DIRECT COSTS	GRAND TOTAL
SCOPE OF WORK												
13525 Paleontology Studies												
A. Project Management		12.00					8.00	16.00	36.00	$ 3,064.00	$ -	$ 3,064.00
B. Project Kick-Off Meeting			8.00						8.00	$ 664.00	$ -	$ 664.00
C. Paleontological Monitoring (10 8-hr days)						80.00		4.00	84.00	$ 4,368.00	$ -	$ 4,368.00
D. Periodic Sediment Checks/Supervision (n=2 checks)				16.00					16.00	$ 1,152.00	$ -	$ 1,152.00
F. Travel				4.00		40.00			44.00	$ 2,368.00	$ 1,387.50	$ 3,755.50
G. Fossil Preparation (n=2 fossils)						8.00			8.00	$ 416.00	$ -	$ 416.00
H. Preparation Supervision			2.00						2.00	$ 166.00	$ -	$ 166.00
I. Fossil Identification		2.00							2.00	$ 252.00	$ 4,700.00	$ 4,952.00
J. Repository Arrangements			2.00						2.00	$ 166.00	$ -	$ 166.00
K. Paleontology Mitigation Report		2.00	4.00		4.00	8.00		4.00	22.00	$ 1,480.00	$ -	$ 1,480.00
L. Requested Report Revisions		4.00	2.00		2.00				8.00	$ 806.00	$ -	$ 806.00
TASK 13525 Paleontology Studies Total		20.00	18.00	20.00	6.00	136.00	8.00	24.00	232.00	$ 14,902.00	$ 6,087.50	$ 20,989.50
GRAND TOTAL		20.00	18.00	20.00	6.00	136.00	8.00	24.00	232.00	$ 14,902.00	$ 6,087.50	$ 20,989.50

Other Direct Costs	UNITS	RATE	TOTAL
F. Mileage Reimbursement	2,500.00	$ 0.555	$ 1,387.50
I. Curation Fees	1.00	$ 3,500.000	$ 3,500.00
I. Expendable Supplies	1.00	$ 200.000	$ 200.00
I. Outside Studies (Radiocarbon Dating, etc.)	1.00	$ 1,000.00	$ 1,000.00
Total Other Direct Costs			$ 6,087.50

Assumptions:

Ten days of earthmoving in sensitive surface sediments

No more than 2 isolate fossils recovered

No more than 2 sediment checks necessary

UCMP curation fees included but not antticipated to be needed