CALIFORNIA HIGH-SPEED TRAIN

Program Environmental Impact Report/Environmental Impact Statement

BAKERSFIELD TO LOS ANGELES

PALEONTOLOGIC RESOURCES TECHNICAL EVALUATION

January 2004

Prepared for:

California High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH SPEED RAIL AUTHORITY

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CALIFORNIA HIGH-SPEED TRAIN PROGRAM EIR/EIS

Bakersfield to Los Angeles Paleontologic Resources Technical Evaluation

Prepared by:

SAN BERNARDINO COUNTY MUSEUM

For

Applied EarthWorks, Inc.

and

P&D Consultants, Inc.

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ACRONYMS

APE	AREA OF POTENTIAL EFFECT
AUTHORITY	CALIFORNIA HIGH-SPEED RAIL AUTHORITY
CEQA	CALIFORNIA ENVIRONMENTAL QUALITY ACT
EIR	ENVIRONMENTAL IMPACT REPORT
EIS	ENVIRONMENTAL IMPACT STATEMENT
EPA	ENVIRONMENTAL PROTECTION AGENCY
FAA	FEDERAL AVIATION ADMINISTRATION
FHWA	FEDERAL HIGHWAY ADMINISTRATION
FRA	FEDERAL RAILROAD ADMINISTRATION
FTA	FEDERAL TRANSIT ADMINISTRATION
NEPA	NATIONAL ENVIRONMENTAL POLICY ACT
RPLI	REGIONAL PALEONTOLOGIC LOCALITY INVENTORY, SBCM
RTP	REGIONAL TRANSPORTATION PLAN
SHPO	STATE HISTORIC PRESERVATION OFFICER
SBCM	SAN BERNARDINO COUNTY MUSEUM
SVP	SOCIETY OF VERTEBRATE PALEONTOLOGY
YBP	YEARS BEFORE PRESENT

1.0 INTRODUCTION

The California High-Speed Rail Authority (Authority) was created by the Legislature in 1996 to develop a plan for the construction, operation, and financing of a statewide, intercity high-speed passenger train system.[1] After completing a number of initial studies over the past six years to assess the feasibility of a high-speed train system in California and to evaluate the potential ridership for a variety of alternative corridors and station areas, the Authority recommended the evaluation of a proposed high-speed train system as the logical next step in the development of California's transportation infrastructure. The Authority does not have responsibility for other intercity transportation systems or facilities, such as expanded highways, or improvements to airports or passenger rail or transit used for intercity trips.

The Authority adopted a *Final Business Plan* in June 2000, which reviewed the economic feasibility of a 1,127-kilometer-long (700-mile-long) high-speed train system. This system would be capable of speeds in excess of 321.8 kilometers per hour (200 miles per hour [mph]) on a dedicated, fully grade-separated track with state-of-the-art safety, signaling, and automated train control systems. The system described would connect and serve the major metropolitan areas of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego. The high-speed train system is projected to carry a minimum of 42 million passengers annually (32 million intercity trips and 10 million commuter trips) by the year 2020.

Following the adoption of the Business Plan, the appropriate next step for the Authority to take in the pursuit of a high-speed train system is to satisfy the environmental review process required by federal and state laws which will in turn enable public agencies to select and approve a high speed rail system, define mitigation strategies, obtain necessary approvals, and obtain financial assistance necessary to implement a high speed rail system. For example, the Federal Railroad Administration (FRA) may be requested by the Authority to issue a *Rule of Particular Applicability*, which establishes safety standards for the high-speed train system for speeds over 200 mph, and for the potential shared use of rail corridors.

The Authority is both the project sponsor and the lead agency for purposes of the California Environmental Quality Act (CEQA) requirements. The Authority has determined that a Program Environmental Impact Report (EIR) is the appropriate CEQA document for the project at this conceptual stage of planning and decision-making, which would include selecting a preferred corridor and station locations for future right-of-way preservation and identifying potential phasing options. No permits are being sought for this phase of environmental review. Later stages of project development would include project-specific detailed environmental documents to assess the impacts of the alternative alignments and stations in those segments of the system that are ready for implementation.

The decisions of federal agencies, particularly the Federal Railroad Administration (FRA) related to high-speed train systems, would constitute major federal actions regarding environmental review under the National Environmental Policy Act (NEPA). NEPA requires federal agencies to prepare an Environmental Impact Statement (EIS) if the proposed action has the potential to cause significant environmental impacts. The proposed action in California warrants the preparation of a Tier 1 Program-level EIS under NEPA, due to the nature and scope of the comprehensive high-speed train system proposed by the Authority, the need to narrow the range of alternatives, and the need to protect/preserve right-of-way in the future. FRA is the federal lead agency for the preparation of the Program EIS, and the Federal Highway Administration (FHWA), the U.S. Environmental Protection Agency (EPA), the U.S. Corps of Engineers (USACE), the Federal Aviation Administration (FAA), the U.S. Fish and Wildlife Service (USFWS), and the Federal Transit Administration (FTA) are cooperating federal agencies for the EIS.

[1] Chapter 796 of the Statutes of 1996; SB 1420, Kopp and Costa

A combined Program EIR/EIS is to be prepared under the supervision and direction of the FRA and the Authority in conjunction with the federal cooperating agencies. It is intended that other federal, state, regional, and local agencies will use the Program EIR/EIS in reviewing the proposed program and developing feasible and practicable programmatic mitigation strategies and analysis expectations for the Tier 2 detailed environmental review process which would be expected to follow any approval of a high speed train system.

The statewide high-speed train system has been divided into five regions for study: Bay Area-Merced, Sacramento-Bakersfield, Bakersfield-Los Angeles, Los Angeles-San Diego via the Inland Empire, and Los Angeles-Orange County-San Diego. This Cultural Resources Technical Evaluation for the [name of region] is one of five such reports being prepared for each of the regions on the topic, and it is one of fifteen technical reports for this region. This report will be summarized in the Program EIR/EIS and it will be part of the administrative record supporting the environmental review of alternatives.

1.1 ALTERNATIVES

1.1.1 No-Project Alternative

The No-Project Alternative serves as the baseline for the comparison of Modal and High-Speed Train alternatives (Figure 1.1-1). The No-Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it existed in 1999-2000 and as it would be after implementation of programs or projects currently programmed for implementation and projects that are expected to be funded by 2020. The No-Project Alternative addresses the geographic area serving the same intercity travel market as the proposed high-speed train (generally from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego). The No-Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed.

The No-Project Alternative defines the existing and future statewide intercity transportation system based on programmed and funded (already in funded programs/financially constrained plans) improvements to the intercity transportation system through 2020, according to the following sources of information:

- State Transportation Improvement Program (STIP)
- Regional Transportation Plans (RTPs) for all modes of travel
- Airport plans
- Intercity passenger rail plans (California Rail Plan 2001-2010, Amtrak Five- and Twenty-year Plans)

As with all of the alternatives, the No-Project Alternative will be assessed against the purpose and need topics/objectives for congestion, safety, air pollution, reliability, and travel times.

1.1.2 Modal Alternative

There are currently only three main options for intercity travel between the major urban areas of San Diego, Los Angeles, the Central Valley, San Jose, Oakland/San Francisco, and Sacramento: vehicles on the interstate highway system and state highways, commercial airlines serving airports between San

Figure 1.1-1
No-Project Alternative - California Transportation System

Diego and Sacramento and the Bay Area, and conventional passenger trains (Amtrak) on freight and/or commuter rail tracks (Figures 1.1-2 and 1.1-3) The Modal/System Alternative consists of expansion of highways, airports, and intercity and commuter rail systems serving the markets identified for the High-Speed Train Alternative. The Modal Alternative uses the same inter-city travel demand (not capacity) assumed under the high-end sensitivity analysis completed for the high-speed train ridership in 2020. This same travel demand is assigned to the highways and airports and passenger rail described under the No-Project Alternative, and the additional improvements or expansion of facilities is assumed to meet the demand, regardless of funding potential and without high-speed train service as part of the system.

1.1.3 High Speed Train Alternative

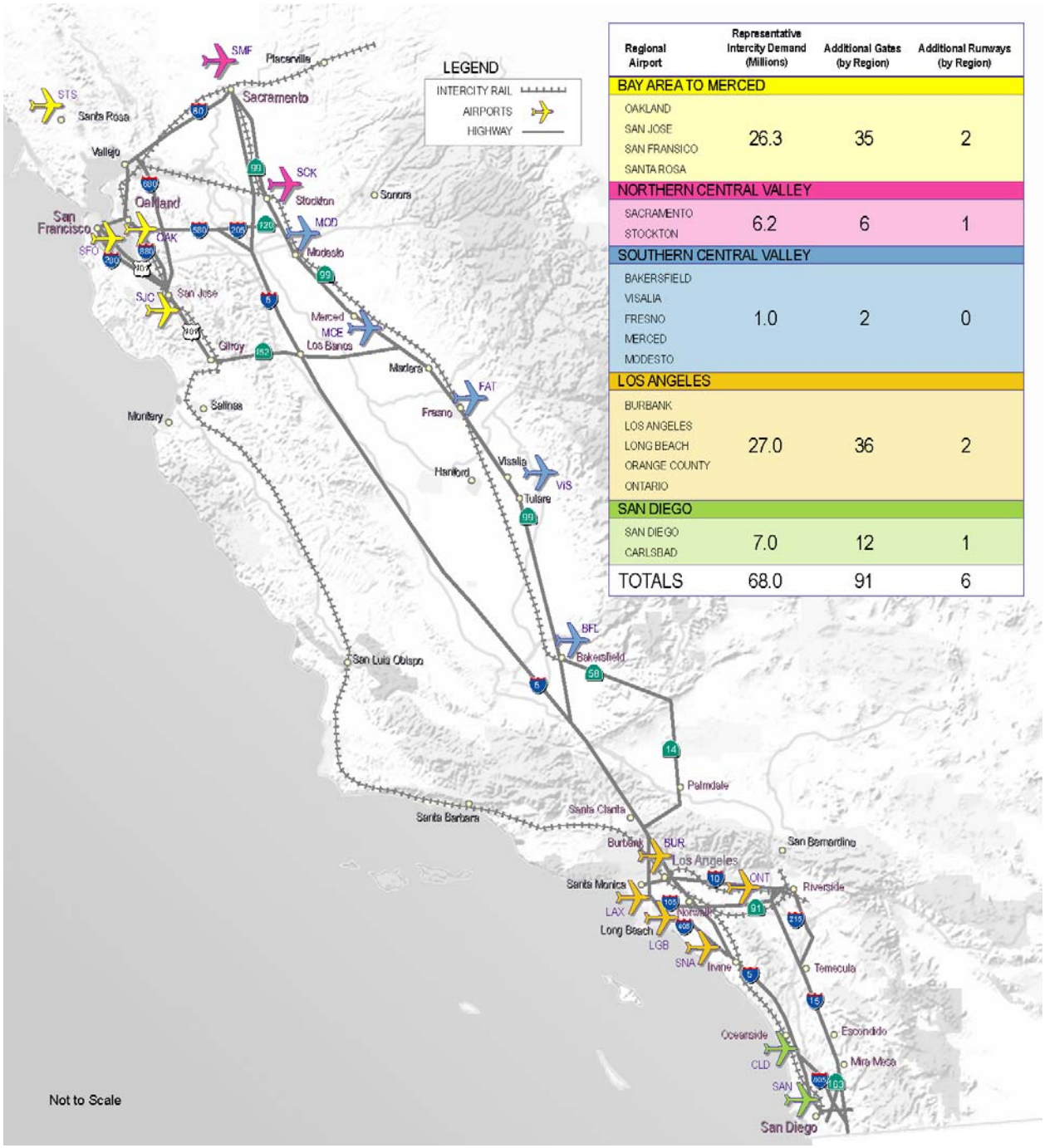
The Authority has defined a statewide high speed train (HST) system capable of speeds in excess of 200 miles per hour (mph) (320 kilometers per hour [km/h]) on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems. State of the art high-speed steel-wheel-on-steel-rail technology is being considered for the system that would serve the major metropolitan centers of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego (Figure 1.1-4).

The High-Speed Train Alternative includes several corridor and station options. A steel-wheel on steel-rail, electrified train, primarily on exclusive right-of-way with small portions of the route on shared track with other rail is planned. Conventional “non-electric” improvements are also being considered along the existing LOSSAN rail corridor from Los Angeles to San Diego. The train track would be either at-grade, in an open trench or tunnel, or on an elevated guideway, depending on terrain and physical constraints.

For purposes of comparative analysis, the HST corridors will be described from station-to-station within each region, except where a by-pass option is considered when the point of departure from the corridor will define the end of the corridor segment.

Figure 1.1-2
Modal Alternative - Highway Component

Figure 1.1-3
Modal Alternative - Aviation Component



Regional Airport	Representative Intercity Demand (Millions)	Additional Gates (by Region)	Additional Runways (by Region)
BAY AREA TO MERCED			
OAKLAND SAN JOSE SAN FRANSICO SANTA ROSA	26.3	35	2
NORTHERN CENTRAL VALLEY			
SACRAMENTO STOCKTON	6.2	6	1
SOUTHERN CENTRAL VALLEY			
BAKERSFIELD VISALIA FRESNO MERCED MODESTO	1.0	2	0
LOS ANGELES			
BURBANK LOS ANGELES LONG BEACH ORANGE COUNTY ONTARIO	27.0	36	2
SAN DIEGO			
SAN DIEGO CARLSBAD	7.0	12	1
TOTALS	68.0	91	6

Figure 1.1-4
High-Speed Train Alternative –
Corridors and
Stations for Continued Investigation

2.0 BASELINE/AFFECTED ENVIRONMENT

2.1 STUDY AREA (AREA OF POTENTIAL EFFECT) DEFINED

The study area for paleontologic resources is the Area of Potential Effect (APE) that was defined in consultation with the State Historic Preservation Officer (SHPO). At this programmatic Tier 1 level of analysis, the APE is the area within which information about the locations of paleontologic resource localities was obtained from the Regional Paleontologic Locality Inventory (RPLI) at the San Bernardino County Museum (SBCM), as well as from the Vertebrate Paleontology Section of the Natural History Museum of Los Angeles County (NHMLAC).

The APE for this undertaking is defined as 100 feet on each side of the centerline of proposed rail routes, both in non-urban and urban areas. The APE for freeway routes and around airports is defined as 100 feet beyond the existing freeway right-of-way and 100 feet beyond the existing airport property boundary. The reason for using 100 feet for urban rail corridors, freeways, and airports is that very little additional right-of-way would be affected in these areas. The 100 feet on each side of the railroad centerline in non-urban areas may require expansion to 500 feet on each side of the proposed project centerline if subsequent design features indicate that paleontologic resources beyond the presently defined APE might be affected.

Locations of easements and construction-related facilities, such as equipment staging areas, borrow and disposal areas, access roads, and utilities, have not been yet been identified. Locations for these will be identified as part of the construction design program for the alternatives selected for more detailed analysis in the next phase of the project. Thus, these items are not considered in the program level Tier-1 analysis, but this information will be available for Tier-2 site-specific EIR/EIS's. The APE will be modified to include these items as part of the Tier-2 analysis.

2.2 BRIEF GEOLOGIC AND PALEONTOLOGIC BACKGROUND OF REGION

A few of the rock units described above in the proposed project area are highly unlikely to contain significant vertebrate fossils. These include the Precambrian rocks, Mesozoic igneous rocks and metamorphic rocks, the Oligocene Vasquez Formation, especially the volcanic sections, north of Soledad Canyon along the Antelope Valley Freeway (Highway 14), and the Violin Breccia in the Ridge Basin along the Golden State Freeway (I-5). It would be extremely important, exciting even, if fossils were discovered in the massive sandstones of the Vasquez Formation, however. Shallow excavations that only extend into the uppermost layers of the surficial Quaternary Alluvium, widely distributed in the valleys and canyons in the proposed project area, are unlikely to produce significant fossil vertebrate remains. Deeper excavations below the Quaternary Alluvium into older Quaternary sediments or into bedrock in the proposed project areas, however, may well encounter significant vertebrate fossils. Excavations anywhere in the older Quaternary sediments have a good chance of uncovering "Ice Age" vertebrate fossils similar to those of the famous Rancho La Brea asphalt deposits in Los Angeles.

The other sedimentary rocks units encountered along the Golden State Freeway (I-5) and the Antelope Valley Freeway (Highway 14) routes in the proposed project area, including the terrestrial Pliocene and Pleistocene Saugus Formation, marine Late Miocene Towsley Formation, marine Pliocene Pico Formation, marine Late Miocene Castaic Formation, terrestrial Middle to Late Miocene Mint Canyon Formation, terrestrial Early Miocene Tick Canyon Formation, terrestrial Middle Miocene Punchbowl Formation, terrestrial Pliocene Harold Formation, and the marine brackish to terrestrial Late Miocene Ridge Basin Group containing the Peace Valley and Ridge Route Formations, the terrestrial Pliocene Hungry Valley Formation, the terrestrial Miocene Horned Toad Formation, the terrestrial Late Pleistocene Tehachapi Formation, the terrestrial Early Middle Miocene Kinnick Formation, the terrestrial Miocene Walker

Formation, the terrestrial and marine Bena Gravels, the terrestrial Pleistocene Kern River Formation, the marine Eocene Tejon Formation, and the terrestrial Early Miocene Tecuya Formation are all known to produce vertebrate fossils. Any portion of the proposed project area cutting through these sedimentary rock units should be considered of high paleontological sensitivity as they have a very good chance of discovering significant, and perhaps even rare, fossil vertebrates.

2.3 DATA SOURCES

Records searches were obtained from the Regional Paleontologic Locality Inventory (RPLI) at the SBCM, as well as from the Vertebrate Paleontology Section of the Natural History Museum of Los Angeles County (NHMLAC). A letter report with references was provided by the NHMLAC. Plotted locality data and computerized locality records are also available from the RPLI at the SBCM; these data were collated with the data received from the NHMLAC by the staff of the SBCM for this report.

2.4 PALEONTOLOGIC LOCALITIES

Paleontologic resource localities are those sites where the fossilized remains of extinct animals and/or plants have been preserved. Generally speaking, fossils are preserved remnants of past life. In rare cases, plant and animal body parts may become incorporated into the lithosphere. This procedure, known as fossilization, is extremely infrequent when measured in “normal” time, but over the course of geological time has resulted in the preservation of abundant remains of past organisms.

In California, the rich geologic record of the state has resulted in numerous rock units with high paleontologic sensitivity being exposed at the surface. For this reason, the fossil record of California is exceptionally prolific, with abundant fossils representing diverse organisms having been recovered from rocks dating from more than one billion years before present (ybp), during the later Proterozoic Era, to the end of the Pleistocene Epoch around 11,000 ybp. These fossils have provided key data for charting the course of the evolution and extinction of life on the planet, both locally and globally, as well as for determining paleoenvironmental conditions, sequences and timing of sedimentary deposition, and other details of past millennia.

As discussed above, numerous geologic formations with high paleontologic sensitivity occur along the proposed alignment within the APE. From Union Station in downtown Los Angeles north to the Ventura Freeway (Highway 134) the proposed project route and alternate follow the Los Angeles River (Los Angeles, Hollywood and Burbank quadrangles). Surficial deposits along this portion of the route consist of alluvial material from the Los Angeles River floodplain and are unlikely to contain significant vertebrate fossils in the uppermost layers. Just north of downtown Los Angeles in the hills above and west of the Golden State Freeway (I-5) between Broadway Avenue and the Glendale Freeway (Highway 2), there are bedrock deposits of the marine Late Miocene Monterey Formation (possibly referred to as the Modelo Formation or Puente Formation in this area). Additional bedrock deposits of the Monterey Formation occur in the hills west and above the Golden State Freeway in the Griffith Park area. The closest locality in the Monterey Formation near this portion of the proposed project route is LACM 4967 that is a general locality for the Elysian Park area just north of Dodger Stadium, bordered on the east by the Los Angeles River and the Golden State Freeway (I-5). LACM 4967 is the type locality for *Clupea tiejei*, a fossil herring, described by Lore Rose David in 1943. The next closest Monterey Formation locality is LACM 3882 in the Lincoln Heights hills directly east of Elysian Park. LACM 3882 is the type locality for *Mixocetus elysius*, a cetotheriid baleen whale, and one of the best-preserved cetothere skulls known, described by Remington Kellogg in 1934. Two other nearby Monterey Formation localities occur further east near the Pasadena Freeway (I-110): LACM 7017 near the Southwest Museum produced unidentified bony fish and LACM 6934 in the Mt. Washington area farther up the hills and west of LACM 7017 produced a fossil baleen whale (a specimen not yet prepared for identification).
From the Ventura Freeway (Highway 134) north to the Ronald Reagan Freeway (Highway 118) the

proposed project route and alternate along the Golden State Freeway and San Fernando Road courses through surficial deposits of Quaternary Alluvium (Burbank, Van Nuys and San Fernando quadrangles). Bedrock in the Verdugo Hills that come close or abut the Golden State Freeway (I-5) northeast of the Burbank Airport consists of igneous rocks that will be devoid of fossils. At depth in the portion of the proposed project route, however, there are older Quaternary deposits that may well contain significant vertebrate fossils. The closest locality in these older Quaternary deposits in this portion of the proposed project route is LACM 1146, very near San Fernando Road west of La Tuna Canyon in sands and gravels from a gravel pit. Late Pleistocene fossil specimens of mastodon, *Mammut americanum*, horse, *Equus occidentalis*, and camel, Camelidae, were recovered at approximately 160-170 feet below the surface at LACM 1146.

North of the Ronald Reagan Freeway (Highway 118) the proposed project route following San Fernando Road courses through surficial deposits entirely of Quaternary Alluvium north to the Foothill Freeway (I-210) (San Fernando quadrangle). On the alternate proposed project route following the Golden State Freeway (I-5), however, just south of the intersection with the San Diego Freeway (I-405) there are surficial deposits of older Quaternary sediments, the marine Late Miocene Monterey Formation, the terrestrial & marine Mio-Pliocene Towsley Formation, and the terrestrial Plio-Pleistocene Saugus Formation. The NHMLAC does not record any localities nearby to this portion of the proposed project route from the Monterey or Towsley Formations. The closest localities in the older Quaternary deposits or the Pleistocene portion of the Saugus Formation in the portion of the proposed project area are mostly clustered around the Van Norman Reservoir immediately west of the Golden State Freeway (I-5) and the San Diego Freeway (I-405). These localities include LACM 3397 that produced fossil bison, *Bison*, at a seventy-five foot depth, LACM 7152 that produced fossil mammoth, *Mammuthus*, and bison, *Bison*, in terrace deposits, and LACM 1733 that produced fossil horse, *Equus*, at unknown depth. North of San Fernando Road just east of the conjunctions of the Golden State Freeway (I-5), the Foothill Freeway (I-210) and San Fernando Road, an additional Quaternary locality, LACM 5745, contained fossil mastodon, *Mammut*, and horse, *Equus*, in fill dirt.

From the Foothill Freeway (I-210) north to the intersection of the Golden State Freeway (I-5) with the Antelope Valley Freeway (Highway 14), the proposed project route occurs primarily in areas containing surficial deposits of Quaternary Alluvium, deposits of the terrestrial Plio-Pleistocene Saugus Formation and rocks of the marine Late Miocene Towsley Formation (San Fernando and Oat Mountain quadrangles). The closest locality in the Towsley Formation is LACM 7421, from the roadcut on the east side of The Golden State Freeway (I-5) south of the intersection with the Antelope Valley Freeway (Highway 14), produced specimens of fossil baleen whale, Mysticeti. Additionally, locality SBCM 9.3.18, also from the Towsley Formation, yielded fossils of extinct large mammal. On the Antelope Valley Freeway (Highway 14) north from the intersection with the Golden State Freeway (I-5) the proposed project route crosses exposures of the marine Pliocene Pico Formation and a small exposure of the marine Late Miocene Towsley Formation, but mostly courses through exposures of the terrestrial Plio-Pleistocene Saugus Formation. In addition there is the typical surficial Quaternary Alluvium in the valleys and canyons, especially in the Newhall Creek area in this portion of the proposed project route. The closest locality in the Towsley Formation is described above; the closest localities in the Saugus Formation are described below in the discussion of the Golden State Freeway (I-5) route on the Oat Mountain quadrangle from the intersection with the Antelope Valley Freeway (Highway 14) north. In addition to these localities, SBCM 9.3.71 yielded fossil remains of pelecypods and gastropods from the Saugus Formation. The closest locality in the Pico Formation is LACM 5456, southwest of the proposed project area in Browns Canyon, that produced specimens of the fossil bonito shark, *Isurus planus*. Even farther away, locality LACM 1931, north of Santa Susana and west-southwest of this portion of the proposed project area, produced a specimen of a rare fossil right whale, Balaenidae. Localities SBCM 9.3.3 – 9.3.4 yielded a large clam and a fossil leaf from the Pico Formation.

On the area covered by the Mint Canyon quadrangle as the Antelope Valley Freeway (Highway 14)

courses north and east the proposed project area occurs initially in bedrock of the terrestrial Pliocene Saugus Formation but transverses exposures of the marine Late Miocene Castaic Formation north of Placerita Canyon. Just north of the intersection with Golden Valley Road the Antelope Valley Freeway (Highway 14) begins to traverse exposures of the terrestrial Middle to Late Miocene Mint Canyon Formation that occur on the ridges for the remainder of this quadrangle coverage. There are also extensive exposures of Quaternary Alluvium in the valleys and canyons, especially in Placerita Canyon and the Santa Clara River Valley, with older Quaternary deposits also exposed near the proposed project area. The closest localities in the Saugus Formation are LACM 6803-6804, northwest of this portion of the proposed project area near the Santa Clara River in Saugus, where fossil camel, Camelidae, and horse, *Equus*, specimens were recovered. The closest locality in the Castaic Formation is LACM (formerly California Institute of Technology [CIT]) 441, situated just south of the Antelope Valley Freeway (Highway 14) near Humphreys, that produced specimens of the fossil sea cow *Dusisiren jordani* published in the scientific literature by Domning (1978). Immediately south of Humphreys lies a new NHMLAC locality not yet entered that produced a rare nearly complete carapace of a fossil leatherback turtle, *Psephophorus*. Also from the Castaic Formation, locality LACM 5461, in Haskell Canyon northwest of this portion of the proposed project area, produced a rare specimen of fossil tapir, Tapiridae. There are numerous localities in the Mint Canyon Formation, but the closest to this portion of the proposed project area are LACM (CIT) 206, south of the Antelope Valley Freeway (Highway 14) at the mouth of Sand Canyon, that contained specimens of the fossil horse *Hypohippus*; LACM 4692, south of the Antelope Valley Freeway (Highway 14) west of Lang, that produced fossil specimens of a deer-like animal, Palaeomerycidae, camel, Camelidae, and rodents, Rodentia; LACM 4627, north of the Antelope Valley Freeway (Highway 14) and east of Sand Canyon, that contained a specimen of the fossil elephant-like Gomphotheriidae; and LACM (CIT) 98, south of the Antelope Valley Freeway (Highway 14) and farther south in Sand Canyon, that produced a specimen of the fossil peccary *Prosthennops* figured in the scientific literature by Maxson[2] (1930).

On the area covered by the Agua Dulce quadrangle the HST and Modal Alternatives diverge with the HST route following Soledad Canyon and the alternate following the Antelope Valley Freeway (Highway 14). In the Soledad Canyon area there are course gravels and conglomerate with occasional pockets of Quaternary Alluvium immediately along the stream course with igneous Precambrian rocks exposed extensively both north and south of the canyon but some Oligocene Vasquez Formation rocks also in the vicinity. The NHMLAC records no localities near Soledad Canyon and, given the rock units that occur there, it is highly unlikely that fossil vertebrates would be found in the area. Along the Modal route, as the Antelope Valley Freeway (Highway 14) courses east and north it initially occurs in outcrops of the Mint Canyon Formation but just west of Bee Canyon north of Lang the Antelope Valley Freeway (Highway 14) crosses exposures of the terrestrial Early Miocene Tick Canyon Formation. Just east of Agua Dulce Canyon the Antelope Valley Freeway (Highway 14) begins to traverse exposures of the terrestrial, and it part volcanic, Oligocene Vasquez Formation. From where the Antelope Valley Freeway (Highway 14) intersects Escondido Canyon Road east for the rest of this map coverage there are surficial deposits of Quaternary Alluvium. It is unclear whether NHMLAC localities in the area near this portion of the study area are from the Mint Canyon Formation or the Tick Canyon Formation, but the closest localities from these rock units are LACM (CIT) 434 and 482, near the power lines just west of Spring Canyon, that produced specimens of fossil horse, Equidae, and camel, Camelidae. Further west along the power lines west of Tick Canyon, locality LACM (CIT) 199 produced fossil specimens of horse, Equidae, camel, *Miolabis californicus*, and a paratype specimen of the primitive oreodont artiodactyl *Merychyus calaminthus* (Jahns, 1940). Somewhat farther to the northwest, just south of Davenport Road east of Mint Canyon, LACM (CIT) 480 contained fossil specimens of horse, Equidae, and carnivore, Carnivora. Of course, the volcanic rocks of the Vasquez Formation will contain no fossils, but the NHMLAC records no localities from the spectacular massive sandstones of the Vasquez Formation either.

[2] Maxson, J. H. 1930. A Tertiary mammalian fauna from the Mint Canyon Formation of southern California. *Carnegie Institution of Washington Publication* 404(7):77-112.

Where the Antelope Valley Freeway (Highway 14) courses north then turns east-southeast at the southern juncture of the Sleepy Valley and Ritter Ridge quadrangles, there are mostly exposures of Quaternary Alluvium and older Quaternary sediments. Some small exposures of Precambrian rocks are crossed by this portion of the study area, but they will not contain fossils. It is possible that the Antelope Valley Freeway (Highway 14) abuts exposures of the basal conglomerates of the terrestrial Oligocene Vasquez Formation, but those rocks are highly unlikely to contain significant fossils either.

On the Acton quadrangle as the Antelope Valley Freeway (Highway 14) courses east for the Modal route, there are mostly exposures of older Quaternary sediments with Quaternary alluvium in the canyons. Around Acton Canyon the Antelope Valley Freeway (Highway 14) crosses exposures of volcanic derived rocks of the Oligocene Vasquez Formation, which will almost certainly not contain significant fossils. Further eastward the Antelope Valley Freeway (Highway 14) crosses exposures of Mesozoic igneous rocks on the knolls and ridges, but those rocks will not contain fossils either. As the HST route follows Soledad Canyon east up to Soledad Pass (where the two alternative routes join) there are increasing exposures of older Quaternary sediments in addition to the Quaternary gravels and alluvium immediately along the stream bed. Bedrock in the hills around Soledad Canyon consists of Precambrian and Mesozoic igneous rocks and volcanic derived rocks of the Oligocene Vasquez Formation.

North of Soledad Pass the HST and Modal Alternative routes diverge again with the Modal route following the Antelope Valley Freeway (Highway 14) and the HST route following Sierra Highway. As the Antelope Valley Freeway (Highway 14) courses northeast on the very northwest corner of the Pacifico Mountain quadrangle and the southwest portion of the Palmdale quadrangle, it covers areas mostly containing surficial deposits of Quaternary Alluvium and older Quaternary sediments. As the Antelope Valley Freeway (Highway 14) turns north and then west on the Palmdale quadrangle, it crosses exposures of Mesozoic igneous rocks, which will be devoid of fossils, and terrestrial Oligocene Vasquez Formation, which are unlikely to contain significant fossils. At the canyon almost due west of the junction of the Sierra Highway and the Pearblossom Highway, the Antelope Valley Freeway (Highway 14) of the Modal Alternative route crosses exposures mapped as the terrestrial Middle Miocene Punchbowl Formation. The NHMLAC records several localities from this rock unit but they are all 15 or more miles to the southeast of these exposures.

On the Ritter Ridge quadrangle as the Antelope Valley Freeway (Highway 14) of the Modal Alternative proposed project route courses north through Palmdale towards Lancaster, the surficial deposits are almost exclusively composed of Quaternary Alluvium. On the north side of the San Andreas Fault, north of the intersection with Avenue S, the Antelope Valley Freeway (Highway 14) crosses exposures of the terrestrial Pliocene Harold Formation (possibly also known as the Anaverde Formation). Likewise, the Sierra Highway of the HST route crosses the Harold Formation on the north side of the San Andreas Fault on the northeast side of Lake Palmdale. The closest localities in the Harold Formation are LACM (CIT) 399, 451 and 589 as well as LACM 5761, all southeast of this portion of the proposed project area. LACM (CIT) 399 and 451 lie in the San Andreas Rift Zone on the north side of Palmdale Ditch southeast of Barrel Springs. LACM (CIT) 589 and LACM 5761 lie southwest of Barrel Springs. All these localities have produced fossil specimens of mastodont, *Mammut*, and horse, *Equus*. The more general locality of LACM (CIT) 589 has produced a more diverse fauna with birds, carnivorans, rabbits identified as both *Lepus* and *Sylvilagus*, and rodents of the genera *Reithrodontomys*, *Peromyscus* and *Neotoma*.

As both the Modal and HST routes along the Antelope Valley Freeway (Highway 14) and the Sierra Highway course north to Rosamond through the areas covered by the Lancaster West and Rosamond quadrangles, the surficial deposits are composed exclusively of Quaternary Alluvium. Although some miles to the east of the southern part of this portion of the proposed project route, along Avenue S from Little Rock east localities LACM 5942-5953 from pipeline excavations in the Quaternary Alluvium and older Quaternary sediments produced a fauna of small vertebrates including gopher snake, *Pituophis*, kingsnake, *Lampropeltis*, leopard lizard, *Gambelia wislizenii*, cottontail rabbit, *Sylvilagus*, pocket mouse, *Chaetodipus*, kangaroo rat, *Dipodomys*, and pocket gopher, *Thomomys*.

Just north of Rosamond on the Soledad Mountain quadrangle the proposed routes cross some low hills with small exposures of various igneous rocks along with the terrestrial Miocene Bena Gravels and some terrestrial Quaternary sediments. The igneous rocks, of course, will not contain fossils, but there are no recorded localities anywhere nearby from the same or similar sedimentary deposits either. From those low hills northward to Mojave on the Mojave quadrangle, the surficial exposures crossed by the proposed project routes are exclusively of Quaternary Alluvium.

Between Soledad Mountain and Mojave the HST alignment splits off in a northwest direction to join up with the Modal Alternative on the Bakersfield - Tehachapi Highway (Highway 58) at the Tehachapi Pass, whereas the Modal Alternative follows the Sierra Highway north until it turns west at about Cache Creek to follow the Bakersfield - Tehachapi Highway (Highway 58) through the Tehachapi Pass (Mojave and Monolith quadrangles). For both routes the surficial sediments are composed entirely of Quaternary Alluvium up to the Horned Toad Hills northwest of the Los Angeles Aqueduct. In the Tehachapi Pass there are Quaternary sediments in the lower-lying areas around Cache Creek, but mostly igneous and Mesozoic metasedimentary rocks in the hills above the Pass. On the eastern side of the Horned Toad Hills, however, there are exposures of the terrestrial Miocene Horned Toad Formation that would be crossed by the HST route and possibly by the Modal route right around the area between the Los Angeles Aqueduct and Cache Creek. The NHMLAC records one locality here from the Horned Toad Formation, LACM 1552, approximately in the middle of the triangle formed by the two routes, that produced a specimen of the gomphothere *Cuvieronius edensis*.

From the Tehachapi Pass westward the Modal Alternative follows the Bakersfield - Tehachapi Highway (Highway 58) through the Tehachapi Valley while the HST route takes a cutoff in a direct northwest direction (Monolith, Tehachapi South and Tehachapi North quadrangles). Most of the central part of the Tehachapi Valley has surficial Quaternary Alluvium but is more or less ringed with exposures of older Quaternary deposits including some terrace deposits and even the terrestrial Late Pleistocene Tehachapi Formation along the Bakersfield - Tehachapi Highway (Highway 58) directly north of the town of Tehachapi. These older Quaternary deposits may well underlie the Quaternary Alluvium in most of the Tehachapi Valley. In fact, locality LACM 3722, discovered in a sewer excavation in the town of Tehachapi at shallow but unknown depth, produced a fossil specimen of the horse, *Equus*. Igneous and metamorphic rocks compose the bedrock in most of the hills surrounding the Tehachapi Valley.

Leading out of the Tehachapi Valley the HST and Modal Alternative routes track the Bakersfield - Tehachapi Highway (Highway 58) and Tehachapi Creek northwestward through the ravine towards Caliente (Tehachapi North, Keene and Oiler Peak quadrangles). Except for localized Quaternary Alluvium, almost all of the bedrock in this portion of the proposed project area is composed of igneous and metamorphic rocks. Nonetheless, locality LACM 6471, from just north of the Bakersfield - Tehachapi Highway (Highway 58) east-northeast of Black Mountain and southeast of Marcel, produced a specimen of the fossil dog, *Tephrocyon*, published by L. Dingus in 1990 as being from the terrestrial Early Middle Miocene Kinnick Formation.

As the alternative routes emerge from the Tehachapi Mountains and follow the Bakersfield - Tehachapi Highway (Highway 58) west-northwestward to Bakersfield they initially cross a complex of rocks in the El Tejon region up to Caliente Creek including granitics on the east and south, older Quaternary sediments on the west and terrestrial and marine Miocene rocks of the Walker Formation and the Bena Gravels in the middle of this portion of the study area (Bena and Edison quadrangles). Just north of Caliente Creek and east of Bena north of this portion of the study area, locality LACM 5777 from the Walker Formation produced a fossil specimen of an undetermined mammal (innominate). Northwest of Bena, locality LACM 6115 produced an extensive marine vertebrate fauna, including sharks, bony fishes, marine birds, baleen whales, and a sperm whale, *Aulophyseter morricei*, from the Bena Gravels.

Quaternary Alluvium, fan deposits and terrace deposits comprise the surface deposits around Caliente

Creek and in the city of Bakersfield proper, but the route following the Bakersfield - Tehachapi Highway (Highway 58) west-northwestward into Bakersfield mostly crosses surficial deposits of older Quaternary sediments, with terrestrial Pleistocene Kern River Formation deposits exposed on both sides of Caliente Creek and generally north of the Bakersfield - Tehachapi Highway (Highway 58) (Edison, Lamont, and Gosford quadrangles). No localities are recorded from the older Quaternary sediments, but the NHMLAC possesses an extensive collection of specimens from the Kern River Formation in localities from north of the Kern River north of this portion of the proposed project area. The most prominent locality in the Kern River Formation, LACM (CIT) 49, situated northwest of the study area north of the Kern River, produced an extensive terrestrial fauna (and a couple of marine specimens) including the holotypes [name bearing specimens] of a fossil vulture, *Vultur kernensis* (Miller 1931[3]), a fossil mustelid carnivore, *Brachypsalis angustidens* (Hall 1930[4]), a fossil mouse, *Peromyscus pliocenicus* (Wilson 1937[5]), and a fossil peccary, *Prosthennops kernensis* (Colbert 1938[6]).

After the Golden State Freeway (I-5) splits from the Antelope Valley Freeway (Highway 14) and courses northward on the area covered on the Oat Mountain quadrangle, it crosses exposures of the marine Pliocene Towsley Formation, the marine Pliocene Pico Formation, and the marine and terrestrial Pliocene and Pleistocene Saugus Formation. In the valleys and canyons, especially in Gavin Canyon in the northern part of this portion of the project area, there are the typical surficial deposits of Quaternary Alluvium. The closest NHMLAC localities in the Towsley and Pico Formations are discussed above in the beginning of the report. The closest localities in the Saugus Formation to this portion of the study area are LACM 6145-6146, in the road cuts on the west side of the Golden State Freeway (I-5) just north of the mouth of Towsley Canyon. A suite of marine sharks and fishes, including eagle ray, *Myliobatis*, guitar fish, *Rhinobatos*, bull shark, *Carcharhinus*, basking shark, *Cetorhinus*, and sheepshead, *Semicossyphus*, were recovered from localities LACM 6145-6146. From the terrestrial facies of the Saugus Formation the closest locality is LACM 6601, directly south of the study area north of California Highway 118 and west of the San Fernando Reservoir, that produced specimens of fossil deer, Cervidae, as well as a specimen of a fossil tapir, *Tapirus merriami*, figured in the literature by Jefferson (1989[7]).

In the area covered by the western half of the Newhall quadrangle, the Golden State Freeway (I-5) courses north through terrestrial Pliocene and Pleistocene Saugus Formation exposures and a large expanse of terrestrial older Quaternary sediments. Most of this portion of the study area, however, has surficial sediments of Quaternary Alluvium, particularly in the Pico Canyon, Santa Clara River valley and Castaic Creek valley areas. The closest localities in this portion of the study area from the Saugus Formation are LACM 6062 that produced fossil lizard, *Gerrhonotus*, and pocket gopher, *Thomomys*, and LACM 6063 that produced fossil horse, *Equus*. LACM 6871, between Castaic Creek and San Francisquito Canyon east of Wayside Honor Rancho and east of the Golden State Freeway (I-5) produced fossil horse, *Equus*, and dog, Canidae, specimens. Further southeast in Saugus south of the Santa Clara River, localities LACM 6803-6804, also mentioned above, yielded fossil camel, Camelidae, and horse, *Equus*.

In the area covered by the Whitaker Peak quadrangle, as the Golden State Freeway (I-5) courses northwest initially the exposures are of the marine and terrestrial Late Miocene Castaic Formation. On the ridge between Violin Canyon and Marple Canyon the Golden State Freeway (I-5) begins to course northwestward through exposures of the Peace Valley Formation, the Ridge Route Formation and the Violin Breccia of the marine brackish to terrestrial Late Miocene Ridge Basin Group. In the valleys and canyons, of course, there are surficial deposits of Quaternary Alluvium, especially in the Castaic Creek

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3 Miller, L. H. 1931. Bird remains from the Kern River Pliocene of California. *Condor* 33(2):70-72.

4 Hall, E. R. 1930. A bassarisk and a new mustelid from the later Tertiary of California. *Journal of Mammalogy* 11(1):23-26.

5 Wilson, Robert W. 1937. New Middle Pliocene rodent and lagomorph faunas from Oregon and California. *Carnegie Institution of Washington Publication* 487(1):1-19.

6 Colbert Edwin H. 1938. Pliocene peccaries from the Pacific Coast region of North America. *Carnegie Institution of Washington Publication* 487(6):241-269.

7 Jefferson, G. T. 1989. Late Cenozoic Tapirs (Mammalia: Perissodactyla) of Western North America. *Contributions in Science, Natural History Museum of Los Angeles County* 406:1-21.

and Big Oak Flat areas. Localities recorded by the NHMLAC in the Castaic Formation have been listed above in the discussion of the Mint Canyon quadrangle. In addition to these localities, the RPLI at the SBCM lists localities SBCM 9.3.65 through 9.3.70; these localities yielded fossil remains of pelecypods, gastropods, and fish from the Castaic Formation. No localities are recorded from the Violin Breccia and it is unlikely to produce significant vertebrate fossils. In road cuts on the east side of the Golden State Freeway (I-5) at Canton Canyon, localities LACM 6151 and 6159 from the Peace Valley Formation produced fossil specimens of killfishes, Cyprinodontidae, as well as fossil plant material. On the ridge forming the west border of Canton Canyon but north of the Golden State Freeway (I-5), localities LACM 6153-6154 also produced fossil specimens of killfishes, Cyprinodontidae, and additionally fossil plant material. In a road cut on the west side of Threemile Grade road west of the Golden State Freeway (I-5) northwest of Big Oak Flat, the locality LACM 4498 produced a specimen of fossil rhinoceros, Rhinocerotidae, from the Ridge Route Formation. Locality LACM (CIT) 389, along Threemile Grade Road in Osito Canyon near Frenchmans Flat west of the Golden State Freeway (I-5), produced fossil specimens of the stickleback fish *Gasterosteus aculeatus* published in the scientific literature by M. A. Bell[8] (1973) as well as the holotype specimen of the fossil stickleback fish *Pungitius haynesi* (David 1945[9]).

In the area covered by the Liebre Mountain quadrangle (very southwest corner only), as the Golden State Freeway (I-5) courses northwest the exposures are alternately of the Ridge Route Formation and of the Peace Valley Formation of the marine brackish to terrestrial Late Miocene Ridge Basin Group. Directly east of the southernmost part of this portion of the study area along the Old Ridge Route road east of the Golden State Freeway (I-5) and Osito Canyon, locality LACM 4492 in the Ridge Route Formation produced fossil specimens of bony fish, Osteichthyes. Further north along the Old Ridge Route road above the terminus of Osito Canyon are located Ridge Route Formation localities LACM 4488, which produced a specimen of a fossil horse, *Merychippus* and LACM 6155, which produced fossil specimens of plants and mollusks as well as stickleback fish, *Gasterosteus*. Further north along the Old Ridge Route road but south of Posey Canyon, localities LACM 4485 produced fossil ground sloth, Megalonychidae, while localities LACM 4493-4494 produced fossil specimens of bony fish, Teleostei, from the Ridge Route Formation. Directly east of those previously listed localities and east of the power lines, locality LACM 6147 from the Ridge Route Formation produced fossil specimens of the killfish *Empetrichthys erdisi*, stickleback fish, *Gasterosteus*, lizard, Lacertilia, snake, Serpentes, and the pocket gopher, *Parapliosaccomys*. The closest localities to this portion of the study area in the Peace Valley Formation are LACM 6161, just east of the power lines above the terminus of Osito Canyon, that produced specimens of the fossil killfish *Empetrichthys erdisi*, and LACM 6158, also east of those power lines but further north, that produced specimens of fossil bony fish, Teleostei.

In the area covered by the Black Mountain and Lebec quadrangles, as the Golden State Freeway (I-5) courses northwest then north to the junction with the Lancaster Road (Highway 138), the exposures are initially of the Peace Valley Formation then mostly of the Ridge Route Formation of the marine brackish to terrestrial Late Miocene Ridge Basin Group. Substantial sections of this portion of the study area have surficial deposits of Quaternary Alluvium, particularly in the Peace Valley area. Based on the geologic mapping of the area, it appears that fossil localities, especially the older ones, do not distinguish between the Peace Valley Formation, the Ridge Route Formation, and the terrestrial Pliocene Hungry Valley Formation very well. Therefore they will be treated together as part of the Ridge Basin Group undifferentiated. Many of the taxa from these localities were published by Miller and Downs[10] (1974) in their description of a new species of pronghorn antelope, *Ottoceros peacevalleyensis*, from locality LACM 1092. In the following account taxa may be listed as (Figured) or (Published) indicating they were figured or published in the Miller and Downs paper.

8…Bell, M. A. 1973. The Pliocene stickleback, *Pungitius haynesi*, a junior synonym of *Gasterosteus aculeatus*. *Copeia* 1973(3):588-590.

9 David, L. R. 1945. A Neogene stickleback from the Ridge Formation of California. *Journal of Paleontology* 19(3):315-318.

10 Miller, W. E. and T. Downs. 1974. A Hemphillian local fauna containing a new genus of antilocaprid from southern California. Contributions in Science, *Natural History Museum of Los Angeles County* 258:1-36.

The closest localities east of the Golden State Freeway (I-5) are LACM (CIT) 487-488, west of the northern part of Apple Canyon, that produced fossil specimens of snails, Gastropoda, birds, Aves, and horse, *Pliohippus* (Published). Further east between Liebre Gulch and West Fork Liebre Gulch are localities LACM 6152, which produced fossil specimens of plants, Plantae, clams, Bivalvia, and stickleback fish, Gasterosteidae, and localities LACM 6156-6157 and 6160, which produced fossil specimens of stickleback fish, *Gasterosteus*. On the west side of the Golden State Freeway (I-5) in and around Pyramid Lake, localities LACM 3215 and 6960 produced fossil specimens of plant, Plantae, killfish, Cyprinodontidae, and stickleback fish, *Gasterosteus.* West of the Golden State Freeway (I-5) and west of Pyramid Lake up Piru Creek, locality LACM 6149 produced fossil specimens of killfish, Cyprinodontidae, and bird, Aves. West of the Golden State Freeway (I-5) and south of Coyote Canyon, locality LACM 1092 produced the holotype (name bearing specimen) and referred specimens of the fossil pronghorn antelope *Ottoceros peacevalleyensis*. West of the Golden State Freeway (I-5) between Coyote Canyon and Cañada de los Alamos, localities LACM (CIT) 444, 471 and LACM 1169 produced fossil specimens of pond turtle, *Clemmys*, rabbit, Lagomorpha, elephant, Proboscidea (Published), mastodon, Mammutidae, tapir, *Tapirus* (Published), horse, *Pliohippus* (Figured), and camels, *Tanupolama* (Published) and *Megatylopus* (Published). West of the Golden State Freeway (I-5) just north of Cañada de los Alamos localities LACM (CIT) 452-453, 486, LACM 4233, 7049-7050, and 7248 produced a composite fossil fauna of specimens of pond turtle, *Clemmys marmorata* (Published), tortoise, *Geochelone* (Published), elephant, Proboscidea (Published), cat, Felidae (Figured), horse, *Pliohippus leardi* (Figured), pronghorn antelope, Antilocapridae, and camels, *Tanupolama* (Figured) and *Megatylopus* (Figured). West of the Golden State Freeway (I-5) in Mystic Canyon, localities LACM (CIT) 468-469 produced fossil specimens of horse, *Pliohippus* (Published), and camel, Camelidae. West of the Golden State Freeway (I-5) between Mystic Canyon and Quail Canyon, LACM (CIT) 466-467 produced fossil specimens of tortoise, *Geochelone* (Published), horse, *Pliohippus* (Published), and camel, *Tanupolama* (Published). West of the Golden State Freeway (I-5) just north of Quail Canyon locality LACM (CIT) 459 produced fossil specimens of pond turtle, *Clemmys marmorata* (Published), horse, *Pliohippus* (Published), and camel, *Tanupolama* (Published). The general locality LACM 4234 in this vicinity west of the Golden State Freeway (I-5) is notable in producing a fossil specimen of rhinoceros, *Aphelops* (Published), in addition to horse, Equidae.

Although the HST and Modal Alternative routes diverge near Tejon Lake (formerly Castac Lake) and the junction of the Golden State Freeway (I-5) and the Lancaster Road (Highway 138), with the Modal Alternative route following the Golden State Freeway (I-5) and the HST route further east, the hills through which both proposed routes course northward to Grapevine (Lebec, Frazier Mountain and Grapevine quadrangles) are composed of Mesozoic granitic rocks and therefore will not contain vertebrate fossils. Around the Lancaster Road (Highway 138) Quaternary Alluvium deposits occupy the drainage basin that contains Castac Lake and there is a complex of rocks around the San Andreas fault. No fossil vertebrate localities are recorded from any of these rock units nearby.

Where the Golden State Freeway (I-5) exits the Grapevine into the San Joaquin Valley (Grapevine quadrangle), there are some outcrops of marine Eocene Tejon Formation, terrestrial Early Miocene Tecuya Formation, and marine Middle Miocene Monterey Formation. Although localities exist from elsewhere from the Tejon and Monterey Formations, no localities are recorded from those deposits near this portion of the proposed project area. West of the Golden State Freeway (I-5) in the Tecuya Formation in Tecuya Canyon, however, locality LACM (CIT) 116 produced the holotypes (name bearing specimens) of the oreodont artiodactyl *Promerycochoerus erythroceps* and the amphicyonid carnivore *Daphoenus ruber*, both named by Stock in 1932 [Schultz and Falkenbach 1950[11], renamed the former *Hypsiops erythroceps*].

With the possible exception of encountering terrestrial Pleistocene deposits on the very eastern edge of Wheeler Ridge where the Golden State Freeway (I-5) and California Highway 99 split, the HST and Modal

11 Schultz, C.B. and C. H. Falkenbach 1950. Phenacocoelinae, A New Subfamily of Oreodonts. *Bulletin of the American Museum of Natural History* 95(3):87-150.

Alternative proposed routes cover San Joaquin Valley deposits of Quaternary Alluvium, sand, or fan deposits for the remainder of the proposed project area northward into Bakersfield (Mettler, Weed Patch, Conner, Gosford, and Lamont quadrangles). There are no recorded localities nearby from these deposits.

3.0 METHODS FOR PALEONTOLOGIC RESOURCES ANALYSIS

The paleontologic resources analysis for this program-level EIR/EIS is focused on a broad comparison of potential impacts to significant nonrenewable paleontologic resources along corridors for each of the alternatives (No-Project, Modal and High-Speed Train Alternatives) and around stations. The potential impacts for each of these alternatives are compared with the No-Project Alternative.

3.1 DATA COLLECTION

An Area of Potential Effect (APE), or study area, was defined for the project. The APE for paleontologic resource localities was defined as 100 feet on each side of the centerline of proposed rail routes. The APE for freeway routes and around airports was defined as 100 feet beyond the existing freeway right-of-way and 100 feet beyond the existing airport property boundary. In non-urban areas, the APE may require expansion to 500 feet on each side of the proposed project centerline if subsequent design features indicate that paleontologic resources beyond the presently defined APE might be affected.

Records searches were obtained from the RPLI at the SBCM, as well as from the NHMLAC, as described above. The records searches provided the locations of known paleontologic localities within the APE. The number of paleontologic resource localities within the APE for each alternative was compared to assess the relative degree of potential impacts or effects for each alternative.

3.2 LEGAL CITATIONS REGARDING THE PROTECTION AND PRESERVATION OF PALEONTOLOGIC RESOURCES

3.2.1 Federal Regulations

Statutes of the United States of America that incorporate provisions for the protection of paleontologic resources include:

Federal Antiquities Act of 1906 (P.L. 59-209, 32 Stat. 225).

> Forbids and establishes criminal sanctions for disturbance of any object of antiquity on Federal land without a permit issued by an authorizing authority.

National Environmental Policy Act of 1969

(P.L. 91-190, 83 Stat. 852, 42 USC 4321-4327). Mandates policies to “preserve important historic, cultural and natural aspects of our national heritage” (Section 101.b4).

3.2.2 State of California -- Requirements

Fossil remains are a limited, nonrenewable, highly sensitive, scientific resource. In California, these resources are afforded protection against adverse impacts under the authority of the following State of California legislation (California Office of Historic Preservation 1983):

California Environmental Quality Act of 1970

(13 Public Resources Code, 21000 et seq). Requires public agencies and private interests to identify the potential adverse impacts and/or environmental consequences of their proposed project(s) to any object or site scientific to the scientific annals of California (Division 1, Public Resources Code: 5020.1 [b]).

Guidelines for the Implementation of CEQA (as amended 1 January 1999)

(CEQA Guidelines Sec. 15064.5). Provides protection for paleontologic resources by requiring that they be identified and mitigated as historical resources under CEQA. The CEQA Guidelines define historical resources broadly to include any object, site, area or place that a lead agency determines to be historically significant. The regulation goes on to provide that generally, a resource shall be considered "historically significant" if it has yielded or may be likely to yield information important in prehistory. Paleontologic resources fall within this broad category, and additionally are included in the CEQA checklist under "Cultural Resources."

Warren-Alquist Act

(PRC 25000 et seq.). Requires the California Energy Commission to evaluate energy facility siting in unique areas of scientific concern (section 25527).

Public Resources Code, Section 5097.5

(Stats 1965, c. 1136, p. 2792). Prohibits excavation or removal of any "...vertebrate paleontological site...or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands." Public lands are defined to include lands owned by or under the jurisdiction of the State of California or any city, county, district, authority or public corporation, or any agency thereof. Defines any unauthorized disturbance or removal of paleontologic, archaeologic and/or historic materials or sites located on public lands as a misdemeanor.

Public Resources Code, Section 30244.

Requires reasonable mitigation of adverse impacts to paleontological resources from development on public land.

3.3 INTERPRETING PALEONTOLOGIC SENSITIVITY

Under both state and federal guidelines for cultural resources (including paleontologic resources), impacts are potentially significant only if the resource being impacted has been determined to be significant. Section V(c) of Appendix G of CEQA makes reference to "unique paleontological resource(s) or site(s) or unique geological feature(s)". No definition of what constitutes a "unique" resource or site is provided. Some interpretation is therefore necessary to provide proper resource protection.

3.3.1 Paleontologic Resources

Paleontologic resources are the fossilized evidence of past life found in the geologic record. Despite the tremendous volume of sedimentary rock deposits preserved worldwide, and the enormous number of organisms that have lived through time, preservation of plant or animal remains as fossils is an extremely rare occurrence. Because of the infrequency of fossil preservation, fossils -- particularly vertebrate fossils -- are considered to be nonrenewable resources. Because of their rarity, and because of the scientific

information they can provide, fossils are highly significant records of ancient life. They can provide information about the interrelationships of living organisms, their ancestry, their development and change through time, and their former distribution. Progressive morphologic changes observed in fossil lineages may provide critical information on the evolutionary process itself -- that is, the ways in which new species arise and adapt to changing environmental circumstances. Fossils can also serve as important guides to the ages of the rocks and sediments in which they are contained, and may prove useful in determining the temporal relationships of rock deposits from one area to another and the timing of geologic events. Time scales established by fossils provide chronologic frameworks for geologic studies of all kinds.

3.3.2 Defining Paleontologic Significance

Because of the infrequency of fossil preservation, fossils are considered to be nonrenewable resources. Because of their rarity, and because of the scientific information they provide, fossils can be highly significant records of ancient life. Given this, fossils can be considered to be of significant scientific interest if one or more of the following criteria apply:

1.) The fossils provide data on the evolutionary relationships and developmental trends among organisms, both living and 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; and/or

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 paleontologic resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, uncommon, diagnostically or stratigraphically important, and/or those that add to an existing body of knowledge in specific areas—stratigraphically, taxonomically, and/or regionally. They can include fossil remains of large to very small aquatic and terrestrial vertebrates, remains of plants and animals previously not represented in certain portions of the stratigraphy, and fossils that might aid stratigraphic correlations, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, paleoclimatology, and the relationships of aquatic and terrestrial species.

Determinations of the significance of paleontologic resources can only be made by qualified, trained paleontologists familiar with the fossils under consideration. Such determinations are best advanced in the light of a well-conceived and clearly defined treatment plan. With an efficient sampling plan based upon such a treatment program in effect, the ability of the paleontologists to recognize, recover and preserve significant paleontologic resources is greatly enhanced.

3.4 DETERMINATIONS OF ROCK UNIT SENSITIVITY

Sedimentary units which are paleontologically sensitive are those units with a high potential for containing significant paleontologic resources -- that is, rock units within which vertebrate fossils or significant invertebrate fossils have been determined by previous studies to be present or likely to be

present. These units include, but are not limited to, sedimentary formations that contain significant paleontologic resources anywhere within their geographical extent, as well as sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Determinations of paleontologic sensitivity must therefore consider not only the potential for yielding abundant vertebrate fossils but also the potential for production of a few significant fossils, large or small, vertebrate or invertebrate, which may provide new and significant taxonomic, phylogenetic, and/or stratigraphic data. Areas that may contain datable organic remains older than Recent and areas that may contain unique new vertebrate deposits, traces, and/or trackways must also be considered paleontologically sensitive.

3.4.1 Invertebrate Fossils

Generally, invertebrate fossils recovered from marine sediments are often widely distributed throughout a given outcrop or formation, are found in predictable locations, and are both abundant and well preserved. In fact, many invertebrate fossils—particularly marine invertebrate fossils—can sometimes number in the millions, and can be exposed over miles of outcrop. Some invertebrate fossils are so prolific that they constitute major rock material, such as diatomaceous clay.

Given these general observations, it is clear that sedimentary exposures containing abundant, well-preserved, and extensively-distributed invertebrates -- but lacking vertebrate fossils (see below)—are less paleontologically sensitive than limited exposures containing few fossils from a restricted depositional zone—for example, a narrow near-shore environment. In the first case, paleontologically significant data lost to adverse impacts (be such impacts development-related or otherwise) could very likely be easily recovered from any other exposures of the impacted formation that contained similar fossil density and species diversity. However, in the second instance (that of the limited exposures from restricted depositional environments), adverse impacts to paleontologic resources might not be ameliorated by fossil salvage elsewhere in the formation, since the fossil abundance and species representation would likely be very different. In this second case, the sediments under consideration would be determined to have higher paleontological sensitivity.

3.4.2 Vertebrate Fossils

Vertebrate fossils—fossils representing animals with backbones, including mammals, birds, reptiles, amphibians and fish—are much more rare than invertebrate fossils and are often more poorly preserved. In marine rock units, significant vertebrate fossils are generally much less common than invertebrate fossils. Paleontologic resource localities yielding vertebrate fossils are also frequently recovered from terrestrial (= non-marine) deposits; these continental deposits are generally less depositionally uniform than marine deposits, and fossilization is consequently even more infrequent. Further, in life vertebrates are often far less abundant than invertebrates (picture the difference between a herd of hundreds or even thousands of bison versus marine beds containing *hundreds of millions* of bivalves); the infrequency of fossilization and the vicissitudes of the many taphonomic factors involved result in vertebrate fossils being extremely rare relative to their original numbers in life. For these reasons, vertebrate fossil resources are considered to have very high paleontologic significance; geologic formations that have the potential to yield vertebrate fossil remains are therefore considered to have the greatest paleontologic significance—and, it follows, the highest paleontologic sensitivity.

3.4.3 Definitions

Literature research and institutional records searches have resulted in the designation of areas within the APE as having high, low, or undetermined paleontologic sensitivity. Provisions for mitigation of adverse impacts to significant nonrenewable paleontologic resources present within the boundaries of the APE were based upon these determinations of potential paleontologic sensitivity. The terms “high sensitivity,” “low sensitivity,” and “undetermined sensitivity” are described below.

High Sensitivity: Sedimentary units with a high potential for containing significant nonrenewable paleontologic resources are determined to have high paleontologic sensitivity. In these cases the sedimentary rock unit contains a high density of recorded vertebrate fossil sites, has produced vertebrate fossil remains within the APE and/or the vicinity, and is very likely to yield additional remains within the APE.

Low Sensitivity: The rock unit contains no or very low density of recorded resource localities, has produced little or no fossil remains within the APE and/or the vicinity, and is not likely to yield any remains within the APE. [Note: elsewhere in southern California, sedimentary exposures with few or no prior recorded sites have recently proven abundantly fossiliferous during paleontologic mitigation activities for other construction projects. For example, the Diamond Valley Lake in Hemet, Riverside County, California was originally determined to have "low to moderate" sensitivity, but subsequently has yielded thousands of well-preserved fossils of terrestrial Pleistocene Epoch vertebrates (Springer and Scott 1994[12]; Scott 1997[13]; Springer et al. 1998[14], 1999[15]) and plants (Anderson et al. 2002[16])].

Undetermined Sensitivity: The rock unit has limited exposure(s) in the APE, is poorly studied, and contains no recorded paleontologic resource localities. However, in other areas, the same or a similar rock unit contains sufficient paleontologic resource localities to suggest that exposures of the unit within the ROW have potential for yielding fossil remains.

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4.0 PALEONTOLOGIC IMPACTS

Table 4.0 lists each segment of the Bakersfield to Los Angeles for the No-Project, Modal, High Speed Train and Conventional Rail alternatives. The number of rock units having high paleontologic sensitivity and the number of paleontologic resource localities recorded within each APE were assessed in order to provide an accurate interpretation of the overall ranking of high, low, or undetermined potential to impact significant nonrenewable paleontologic resources. This final evaluation is reached using both the raw data in the table below and incorporating professional assessments by the paleontologic staff regarding the significance of recovered resources from exposed rock units, and the likelihood of these rock units to contain additional paleontologic resources. Brief discussions of the rationale behind these judgments are presented following the table in paragraphs discussing each segment and its evaluation.

Table 4.0
Detailed Analysis/Comparison table:
Impacts to Paleontologic Resources, Bakersfield to Los Angeles Region

	Formations with High Fossil Sensitivity	Formations with Low Fossil Sensitivity	Formations with Undetermined Fossil Sensitivity	Fossil Resource Localities	Overall Rank
NO-PROJECT ALTERNATIVE					
NO-PROJECT	N/A	N/A	N/A	N/A	N/A
MODAL ALTERNATIVE					
Highways					
I-5: SR-99 to SR-14	8	4	0	1	HIGH
I-5: SR-14 to I-405	3	1	0	0	HIGH
I-5: I-405 to Burbank	3	1	0	0	HIGH
I-5: Burbank to LA Union Station	4	1	0	0	HIGH
SR-58/14: SR-99 to Palmdale	5	3	0	7	HIGH
SR 14: Palmdale to I-5	7	1	0	0	HIGH
Airports					
Burbank Airport Expansion	0	1	0	0	LOW
HST CORRIDORS AND STATION OPTIONS					
Alignments					
Wheeler Ridge Corridor	2	4	0	0	HIGH
Union Avenue Corridor	0	4	0	0	LOW
I-5: Tehachapi Crossing	8	2	0	0	HIGH
SR-58 Corridor	6	1	0	0	HIGH
Antelope Valley Corridor	0	1	0	0	LOW
Soledad Canyon Corridor	6	1	0	0	HIGH
Metrolink/UPRR: Sylmar Station to Burbank Airport	1	1	0	0	HIGH
Burbank Airport to Downtown Burbank	1	1	0	0	HIGH

	Formations with High Fossil Sensitivity	Formations with Low Fossil Sensitivity	Formations with Undetermined Fossil Sensitivity	Fossil Resource Localities	Overall Rank
Metrolink/UPRR: Downtown Burbank to LAUS (Over I-5 and SR 110 Variant)	1	1	0	0	HIGH
Metrolink/UPRR: Downtown Burbank to LAUS (Under I-5 and SR 110 Variant)	1	1	0	0	HIGH
I-5: Downtown Burbank to LAUS (Aerial at Silverlake)	0	1	0	0	LOW
I-5: Downtown Burbank to LAUS (Cut and Cover Option at Silverlake)	0	1	0	0	LOW
East Bank North	0	1	0	0	LOW
East Connection	2	0	0	0	HIGH
South Connection	0	1	0	0	LOW
Stations					
Palmdale Station	1	1	0	0	HIGH
Sylmar Station	1	1	0	0	HIGH
Burbank Airport Station	0	1	0	0	LOW
Burbank Downtown Station	0	1	0	0	LOW
LAUS Existing Siding	0	1	0	0	LOW
LAUS East Bank Siding	0	1	0	0	LOW
LAUS South Siding	0	1	0	0	LOW
Maintenance yard	0	1	0	0	LOW

4.1 NO-PROJECT ALTERNATIVE

The No-Project Alternative includes the implementation of programmed improvements to highways and existing transportation corridors by the year 2020. The only major improvement planned for implementation within the study area is a widening of SR-14 within the existing disturbed right-of-way in Antelope Valley. This improvement should have little or no impact on paleontologic resources. Other minor improvements are also being planned. Environmental studies are being implemented independently for these improvements, and so they do not constitute part of this Project. No additional impacts to paleontologic resources are expected to occur beyond those impacts addressed in the appropriate environmental documents for those projects.

4.2 MODAL ALTERNATIVE

4.2.1 Highways

A. I-5: SR-99 TO SR-14

One paleontologic resource locality and eight (8) geologic formations with high paleontologic sensitivity are recorded by the SBCM and/or the NHMLAC within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

B. I-5: SR-14 TO INTERSTATE 405

Three (3) geologic formations with high paleontologic sensitivity are mapped within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

C. I-5: I-405 TO BURBANK

Three (3) geologic formations with high paleontologic sensitivity are mapped within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

D. I-5: BURBANK TO LOS ANGELES UNION STATION

Four (4) geologic formations with high paleontologic sensitivity are mapped within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

E. SR58/14: SR-99 TO PALMDALE

Seven (7) paleontologic resource localities and five (5) geologic formations with high paleontologic sensitivity are recorded by the SBCM and/or the NHMLAC within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

F. SR-14: PALMDALE TO INTERSTATE 5

Seven (7) geologic formations with high paleontologic sensitivity are mapped within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

4.2.2 Airports

A. BURBANK AIRPORT EXPANSION

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

4.3 HIGH SPEED TRAIN ALTERNATIVE

4.3.1 Alignments

A. WHEELER RIDGE CORRIDOR

Two (2) geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

B. UNION AVENUE CORRIDOR

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

C. I-5: TEHACHAPI CROSSING

Eight (8) geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

D. SR-58 CORRIDOR

Six (6) geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

E. ANTELOPE VALLEY CORRIDOR

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

F. SOLEDAD CANYON CORRIDOR

Six (6) geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

G. METROLINK / UPRR: SYLMAR STATION TO BURBANK AIRPORT

One geologic formation with high paleontologic sensitivity is recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

H. BURBANK AIRPORT TO DOWNTOWN BURBANK

One geologic formation with high paleontologic sensitivity is recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

I. METROLINK / UPRR: DOWNTOWN BURBANK TO L.A. UNION STATION (OVER I-5 AND SR 110 VARIANT)

One geologic formation with high paleontologic sensitivity is recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

J. DOWNTOWN BURBANK TO L.A. UNION STATION (UNDER I-5 AND SR 110 VARIANT)

One geologic formation with high paleontologic sensitivity is recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

K. I-5: DOWNTOWN BURBANK TO LAUS (AERIAL AT SILVERLAKE)

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

L. I-5: DOWNTOWN BURBANK TO LAUS (CUT AND COVER OPTION AT SILVERLAKE)

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

M. EAST BANK NORTH

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity;

this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

N. EAST CONNECTION

Two (2) geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

O. SOUTH CONNECTION

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

4.3.2 Stations

A. PALMDALE STATION

One geologic formation with high paleontologic sensitivity is recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

B. SYLMAR STATION

One geologic formation with high paleontologic sensitivity is recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

C. BURBANK AIRPORT STATION

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

D. BURBANK DOWNTOWN STATION

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

E. LAUS EXISTING SIDING

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

F. LAUS EAST BANK SIDING

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

G. LAUS SOUTH SIDING

No paleontologic resource localities or geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned low paleontologic sensitivity. However, some subsurface rock units may have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

H. MAINTENANCE YARD

Two (2) geologic formations with high paleontologic sensitivity are recorded within the APE along this segment. For this reason, this portion of the APE is assigned high paleontologic sensitivity. Additionally, some subsurface rock units may also have high sensitivity; this potential for paleontologically sensitive sediments to be present in the subsurface must be considered and incorporated during subsequent analyses.

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6.0 PREPARERS

Eric Scott Curator of Paleontology	**Master of Arts** (1990), Anthropology (Biological): University of California, Los Angeles, California. 18 years of experience as a professional vertebrate paleontologist. • Data collation and report writing
Kathleen Springer Senior Curator of Geological Sciences	**Master of Science** (1989), Geology: University of California, Riverside, California. 19 years of experience as a professional geologist and paleontologist. • Data collation and project supervision
Craig Manker Paleontologic Field and Laboratory Technician	Undergraduate studies in Biology, Vertebrate Morphology and Geology, Mount San Antonio College, Walnut, California. 5 years of experience as a paleontologic field and laboratory technician. • Data collation and project assistance
Gregory Maxwell Collections Assistant	**Associate of Science** (2000), Geology: Crafton Hills Community College, Crafton Hills, California. 2½ years of experience as a museum professional. • Data collation and project assistance
Stephanie Fluitt Project Assistant	**Bachelor of Arts** (1998), Social Sciences: Bethany College, Scotts Valley, California. 2½ years of experience as a museum professional. • Project assistance