Department of City Planning - Environmental Analysis Section

City Hall • 200 N. Spring Street, Room 750 • Los Angeles, CA 90012

Volume 3 of 9
Appendices F and G

DRAFT ENVIRONMENTAL IMPACT REPORT

WILSHIRE COMMUNITY PLAN AREA

Academy Museum of Motion Pictures Project

Case Number: ENV-2013-1531-EIR
State Clearinghouse Number: 2013051086

THIS DOCUMENT COMPRISES THE FIRST PART OF THE ENVIRONMENTAL IMPACT REPORT (EIR) FOR THE PROJECT DESCRIBED. THE FINAL EIR WILL COMPRISE THE SECOND AND FINAL PART.

Project Address: 6067 Wilshire Boulevard, Los Angeles, California 90036

Project Description: The proposed Academy Museum of Motion Pictures ("Project" or "Museum") would involve rehabilitation and adaptive reuse of the historically significant May Company Building, and construction of a New Wing, which would require demolition of a 1946 Addition to the May Company Building. The Project would retain important historic features of the Original Building constructed in 1939, including rehabilitation of its primary façades, while retrofitting the building interior to accommodate Museum uses. The New Wing would be constructed on the north side of the Original Building and include a Museum entrance, a 42,300-square foot Sphere housing a state-of-the-art Main Theater with seating for up to 1,000 persons, a 10,000-square foot enclosed View Deck within the Sphere, pedestrian bridges linking the Sphere to the Original Building, and an outdoor Piazza.

Council District: 4, Tom LaBonge

APPLICANT:

Homewood Foundation

PREPARED BY:
Environmental Review Section
Los Angeles City Planning Department

August 2014

F-1: Paleontological Resources Phase I Assessment

Paleontological Resources Phase I Assessment for the Academy Museum of Motion Pictures

Prepared for:

The City of Los Angeles

and

The Homewood Foundation

Prepared by:

ArchaeoPaleo Resource Management, Inc.

July 2014

Paleontological Resources Phase I Assessment for the Academy Museum of Motion Pictures

Prepared for:

The City of Los Angeles
Department of City Planning
200 North Spring Street, Room 750
Los Angeles, CA 90012

and

Homewood Foundation
8949 Wilshire Blvd.
Beverly Hills, CA 90211

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ArchaeoPaleo Resource Management Inc.
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310-823-2850

USGS 7.5-Minute Topographic Quadrangle: *Hollywood, CA* (1964, PR 1981)

Area: 2.2 acres

July 2014

This document contains sensitive information regarding the location of archaeological sites which should not be disclosed to the general public or other unauthorized persons.

Archaeological and other heritage resources can be damaged or destroyed through uncontrolled public disclosure of information regarding their location.

Therefore, information regarding the location, character, or ownership of archaeological or other heritage resources is exempt from the Freedom of Information Act pursuant to 16 USC 470w-3 (National Historic Preservation Act) and 16 USC Section 470(h) (Archaeological Resources Protections Act). This report and records that relate to archaeological sites information maintained by the Department of Parks and Recreation, the State Historical Resources Commission, or the State Lands Commission are exempt from the California Public Records Act (Government Code Section 6250 et seq., see Government Code Section 6254.19). In addition, Government Code Section 6254 explicitly authorizes public agencies to withhold information from the public relating to Native American graves, cemeteries, and sacred places maintained by the Native American Heritage Commission.

EXECUTIVE SUMMARY

ArchaeoPaleo Resources Management, Inc. (APRMI) conducted a Phase I Paleontological Resources Assessment for the proposed construction of the Academy Museum of Motion Pictures ("Museum" or "Project").

The Homewood Foundation is proposing to develop and operate the Museum at the original May Company Wilshire department store building ("May Company Building") on the grounds of the Los Angeles County Museum of Art Campus ("LACMA Campus") in the City of Los Angeles ("City"). Project elements that are foreseen to impact paleontological resources are those that require excavation of any kind. This report is limited to the analysis of impacts to paleontological resources. The Project entails re-use of the existing basement under the May Company Building with possible micropiles reaching a maximum depth of 40 feet beneath the building's basement (55 feet below the ground surface). Excavation for the foundations for the new theater (Sphere) will require an overall excavation reaching a depth of 7 feet below existing grade and drilling of augercast piles to support the foundation that will reach a maximum depth of 100 feet below existing grade. Excavation to a depth of approximately 10 to 15 feet and a width of approximately 10 feet will also be required for the underground utility corridor between the May Company Building and the Sphere.

The proposed 2.2-acre Project Site is located within the LACMA West Campus, which is bounded by 6th St., Wilshire Boulevard, Fairfax Avenue, and (vacated) Ogden Drive, in the City of Los Angeles, in Los Angeles County, California. It is west of the City's Greater Wilshire/Hancock Park neighborhood and is immediately west of the park named Hancock Park. The Project Site is depicted on the *Hollywood* United States Geological Survey (USGS 1994) 7.5-minute topographic quadrangle, in the southwest corner of Section 21 of Township 1S/Range 14W of the San Bernardino Base Meridian, just inside the Rancho La Brea land grant.

The Quaternary alluvial sediments within the Project Site are considered highly sensitive for the discovery of significant Pleistocene vertebrate, invertebrate, and plant fossil remains. The La Brea Tar Pits ("Tar Pits") and surrounding Pleistocene deposits within Hancock Park are listed in the California Register of Historical Resources as California Historic Landmark 170: "Hancock Park La Brea" and also make up the designated National Natural Landmark Site termed the "La Brea Fossil Site." "Hancock Park La Brea Tar Pits" has been evaluated for eligibility for listing in the National Register of Historical Places and "appears eligible" although it has not been nominated (Office of Historic Preservation 2011:620). The Tar Pits, plus newly discovered Pleistocene fossil remains that number in the millions, are located adjacent to the Project Site within the LACMA East Campus, Hancock Park, and the grounds of the George C. Page Museum of La Brea Discoveries ("Page Museum"), which are located within Hancock Park. At the depths to be encountered by the current Project, and given the Project Site's location adjacent to an area that has yielded numerous Pleistocene specimens and within 60 meters of other sites within Hancock Park, Project-related excavation at the Project Site has a high potential to result in the discovery of significant paleontological resources.

Project-related excavation without paleontological resources monitoring and full methodical, scientific excavation of fossil remains could result in in the permanent loss of—or loss of access to—paleontological resources. These paleontological resources are not only of regional and statewide significance, but of national and worldwide significance.

Complete avoidance of excavation of any kind is the preferred method for preserving these fossil specimens. If excavation cannot be avoided, full-time paleontological resource monitoring and scientific and methodological (not salvage) excavation, analysis, reporting, and curation at the Page Museum of any significant fossil remains—led by a Society of Vertebrate Paleontology-qualified paleontologist with at least five years of experience in paleontological excavations in the asphaltic deposits of Hancock Park—are recommended for any Project excavation, in order to mitigate impacts to possible fossil deposits. A technical report that records the monitoring and excavation, analysis, and curation methods is also recommended as a Project requirement. A Paleontological Resources Monitoring and Mitigation Program (PRMMP) with protocols for monitoring and data recovery protocols should be established prior to grading permitting and construction activities.

ACRONYM AND ABBREVIATION TABLE*

Acronym or Abbreviation	Term
1946 Addition*	1946 addition to May Company building
Academy	Academy of Motion Picture Arts and Sciences
APRMI	ArchaeoPaleo Resource Management, Inc.
amsl	above mean sea level
CEQA	California Environmental Quality Act
City	City of Los Angeles
County	County of Los Angeles
CRM	Cultural Resource Management
CSU	California State University
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
GIS	Geographic Information Systems
GPS	Global Positioning System
LACMIP	Section of Invertebrate Paleontology, Natural History Museum of Los Angeles County
LACMVP	Section of Vertebrate Paleontology, Natural History Museum of Los Angeles County
LACMA Campus*	Los Angeles County Museum of Art Campus
May Company Building*	May Company Wilshire department store building
Metro	Los Angeles County Metropolitan Transit Authority
MOU	Memorandum of Understanding
Museum*	Academy Museum of Motion Pictures
NALMA	North American Land Mammal Age
NHM	Natural History Museum of Los Angeles County, also abbreviated "LACM" in reference to fossil localities
Original Building*	1939 May Company building
Page Museum*	George C. Page Museum of La Brea Discoveries
PEAI	Paleo Environmental Associates, Inc.
PRC	Public Resources Code
PRMMP	Paleontological Resources Monitoring and Mitigation Plan
Project	Academy Museum of Motion Pictures
RPA	Register of Professional Archaeologists
Sphere*	Theatre
SVP	Society of Vertebrate Paleontology
USC	United States Code
U.S. DOT FTA	U.S. Department of Transportation Federal Transit Authority
USGS	United States Geological Survey
WEAP	Worker Environmental Awareness Plan
*Please see Environmental Impact Report (EIR) "Standard Terms & Definitions" for further explanation.	

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PURPOSE AND SCOPE OF STUDY

APRMI conducted a Phase I paleontological resources survey, study, and impact analysis for the proposed construction of the Academy Museum of Motion Pictures ("Museum" or "Project") within the western portion of the Los Angeles County Museum of Art Campus ("LACMA Campus"). The survey, study, and impact analysis, documented within this technical report, were conducted in order to:

- Identify and evaluate the existing paleontological resources of the Project Site;
- Determine if the Project would have any significant adverse impact on paleontological resources; and
- Determine appropriate mitigation measures to minimize adverse impacts to paleontological resources.

The study summarized in the present technical report includes:

- A pedestrian survey and inspection of the Project Site to examine geologic units, if visible;
- A review of the available geologic literature pertinent to the geologic units and fossils underlying the Project Site and vicinity, including paleontological localities;
- A review of the grading/excavation plan for the Project;
- A review of reports and records regarding resources encountered during recent construction projects at LACMA;
- A review of recent EIRs and Environmental Impact Statements ("EISs") in the vicinity, including the recent Los Angeles County Metropolitan Transit Authority ("Metro") Westside Subway Extension project, relative to impacts and approach to mitigation;
- Coordination with the Page Museum regarding conditions in the immediate area and extent of the Page Museum's involvement with recent construction projects;
- Data gathering of recommendations regarding the mitigation approach for paleontological resources;
- A paleontological resources records search by Natural History Museum of Los Angeles County ("NHM");
- Analysis of collected data to determine if the Project would have any significant adverse impact on paleontological resources; and
- Appropriate mitigation measures to minimize adverse impacts to paleontological resources.

PROJECT LOCATION AND DESCRIPTION

The Homewood Foundation, a supporting organization of the Academy Foundation, the charitable arm of the Academy of Motion Picture Arts and Sciences ("Academy"), is the applicant ("Applicant") for the proposed Museum, and the City of Los Angeles is the Lead Agency. The Project would be developed on a portion of the LACMA Campus in the City of Los Angeles ("City"). The LACMA Campus is comprised of LACMA West ("LACMA West") and LACMA East ("LACMA East") generally west and east of the vacated Ogden Drive. LACMA West encompasses approximately 8 acres and includes the 2.2-acre Project Site ("Project Site") at the northeast corner of Fairfax Avenue and Wilshire Boulevard, the Resnick North Lawn, as well as the Broad Contemporary Art Museum and the Resnick Exhibition Pavilion. LACMA East is located within the approximately 23-acre Hancock Park, along with the Page Museum/La Brea Tar Pits, on land owned by the County of Los Angeles ("County").

The Academy has secured a long-term lease from Museum Associates, the non-profit entity that administers LACMA, for the Project Site. The Project Site is currently developed with the original May Company building, constructed in 1939 ("Original Building"), and the 1946 building addition ("1946 Addition") constructed on the north side of the Original Building. The historically significant May Company Building ("May Company Building") was acquired by LACMA in 1994 and partially renovated for reuse. The May Company Building is currently used by LACMA for art storage and to temporarily house some Academy staff during renovation of the Academy's existing Beverly Hills headquarters. The remainder of the Project Site is developed with a loading dock, service driveways, and a gravel area north of the May Company Building, historically used for access and parking, and pedestrian walkways that provide access from Pritzker Garage and LACMA.

The Project would involve rehabilitation and adaptive reuse of the Original Building, and construction of a new wing ("New Wing") and an at-grade piazza ("Piazza"). The Museum would be dedicated to films and filmmaking and would include permanent and changing exhibition space; three theaters with a combined seating capacity of up to approximately 1,350; banquet and conference space with a maximum occupancy of approximately 1,200 persons; an approximately 4,000-square-foot café ("Museum Café") with seating for up to approximately 150 persons; an approximately 5,000-square-foot store ("Museum Store"); and ancillary spaces including administrative offices, educational spaces, exhibit preparation, a conservation laboratory, and maintenance and receiving areas. Parking would be provided through joint use of existing LACMA parking facilities and existing off-site parking facilities in the immediate vicinity.

The design concept would retain important historic features of the Original Building, including rehabilitation of its primary façades and seismic reinforcement, while retrofitting the building interior to accommodate Museum uses. Circulation elements, including escalators, elevators, and potentially stairs would be accommodated within the Original Building in the area along the north façade where the 1946 Addition would be removed. Removal of the 1946 Addition would allow construction of the approximately 42,300-square-foot New Wing and Piazza. The New Wing would include a Museum entrance; a spherical structure ("Sphere") housing a state-of-the-art theater with seating for up to 1,000 persons ("Main Theater"); an approximately 10,000-square-foot enclosed view deck ("View Deck") within the Sphere; and pedestrian bridges linking the Sphere to the Original Building. Total developed floor area ("Floor Area") on the Project Site at buildout would be up to approximately 208,000 square feet. The outdoor Piazza would be constructed to the north of the Original Building and the Museum's northern entrance, including areas beneath and surrounding the Sphere. The Piazza would provide public access to the Museum and LACMA Campus, Museum Café and other seating, and accommodate Museum and Academy programs and special events.

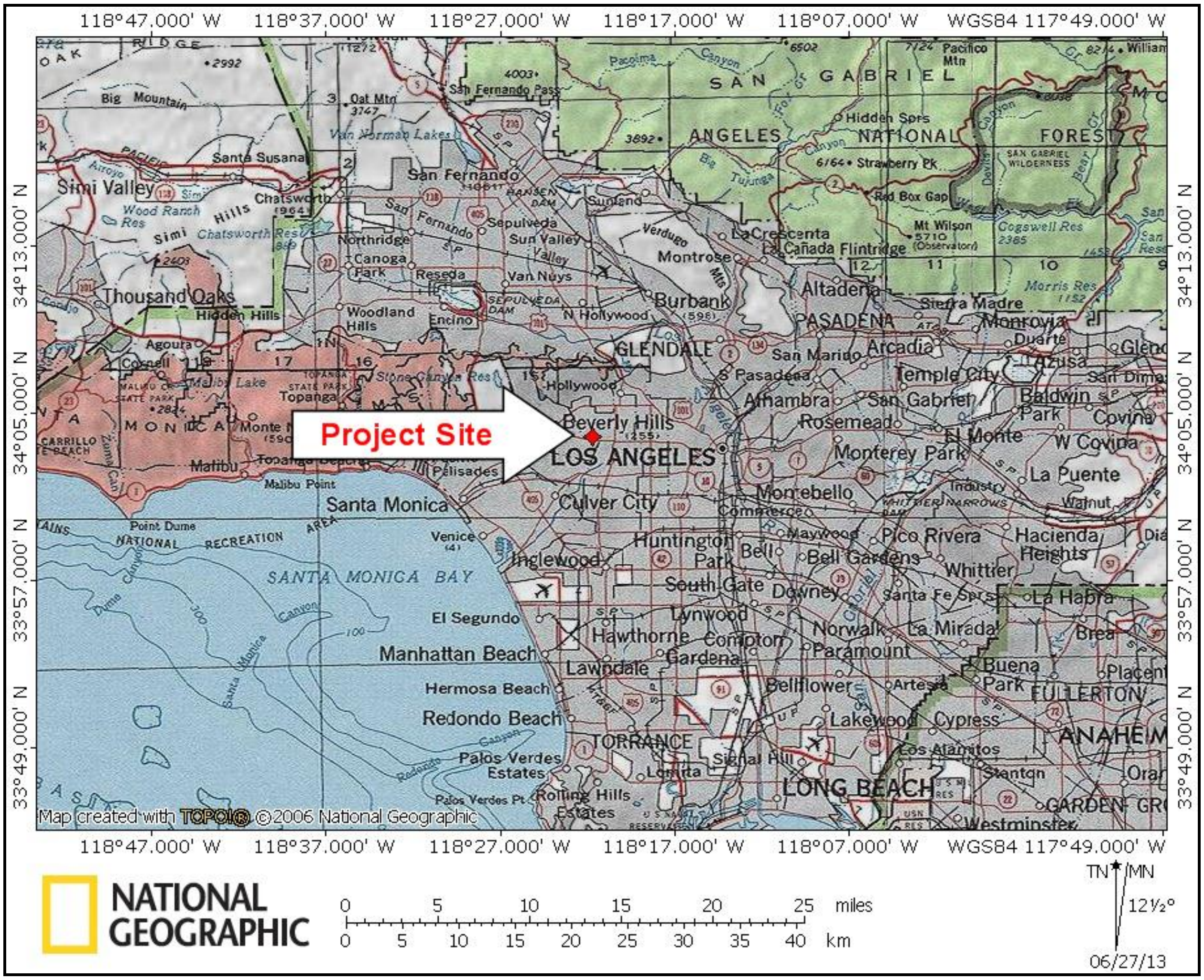

Figure 1. Project vicinity (base map from TOPO! [National Geographic 2006])

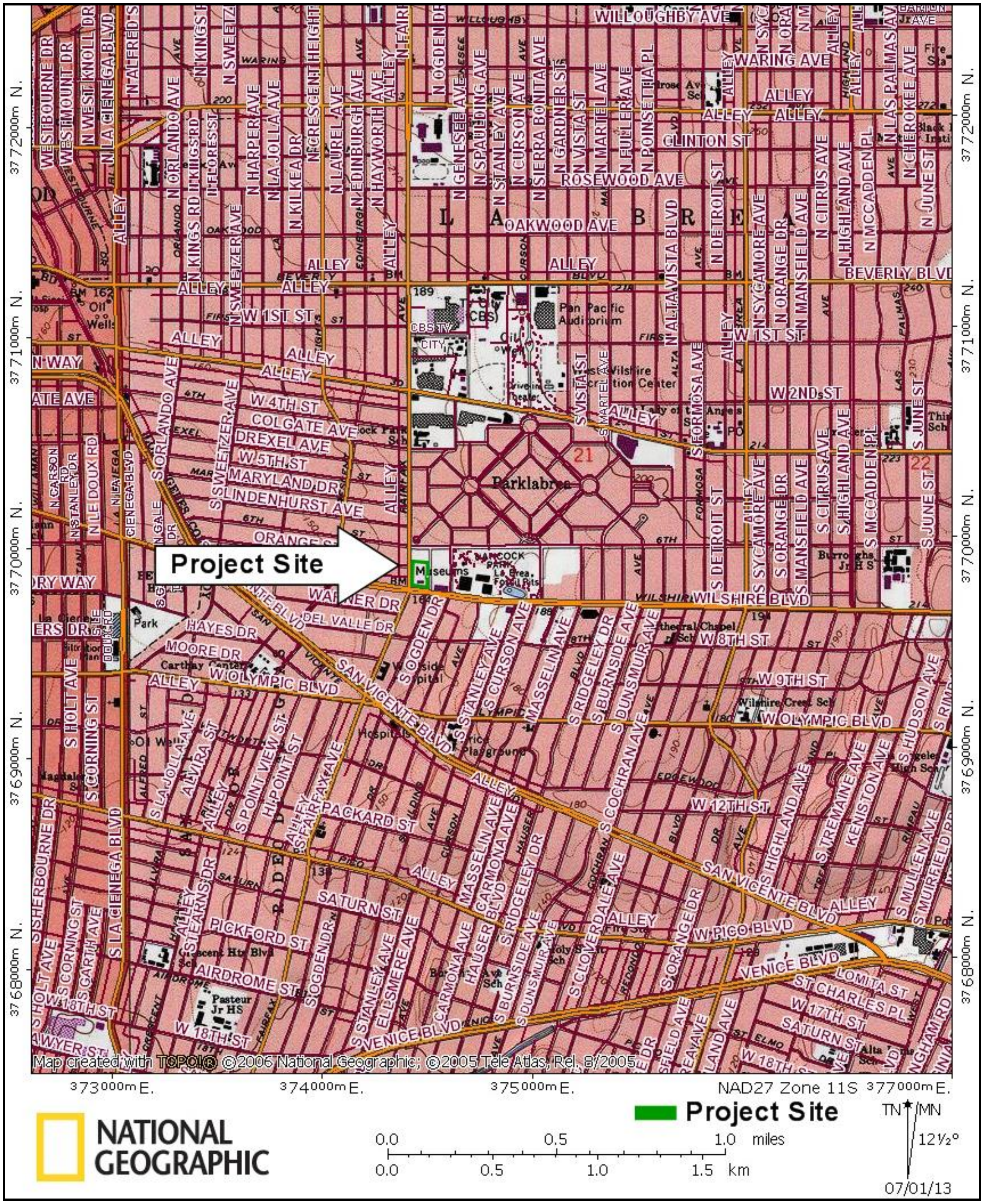

Figure 2. Project Site (base map from TOPO! [National Geographic 2006]; shape based on PCR Services Corporation, 2013: Figure A-2)

Project elements that are foreseen to impact paleontological resources are those that require excavation of any kind. This report is limited to the analysis of impacts to paleontological resources, according to Project elements presented in a project description entitled "Academy Museum of Motion Pictures Project" (PCR Services Corporation, 2013: Figures A-4 and A-5 and Buro Happold, 2013) and additional Project information provided by PCR Services Corporation in May 2014. Shannon & Wilson, Inc. (2014:3) state that the existing basement under the May Company Building will remain and be re-used, which might involve the installation of micropiles to support "proposed new shear walls and elevator pits." The Original Building's existing basement is approximately 15 feet below the ground surface, and the micropiles will reach a maximum depth of 40 feet below the basement, meaning they could reach a depth of 55 feet below surface grade. For the Sphere, excavation for the concrete mat slab foundation will reach a depth of 7 feet below existing grade, while augercast piles to support the foundation will reach a maximum depth of 100 feet below existing grade. Excavation to a depth of approximately 10 to 15 feet and a width of approximately 10 feet will also be required for the underground utility corridor between the May Company Building and the Sphere (Shannon & Wilson, Inc., 2014).

PROJECT PERSONNEL

Robin Turner, M.A. was the Project Manager and conducted the field work for this study. She is the President and Principal Investigator of APRMI and holds a Masters of Arts degree in Anthropology, with an emphasis in Public Archaeology, from California State University, Northridge and a Bachelor of Arts degree in Anthropology, from CSU Northridge. Ms. Turner has over 27 years of experience in the CRM and the paleontologic fields, including 27 years as a volunteer and employee or consultant to the Page Museum. The Page Museum is located within Hancock Park and maintains the fossil remains that have been recovered from Hancock Park for analysis, curation, and display. She has conducted major field and technical investigations throughout southern California.

Christopher A. Shaw, M.S. served as the Lead Paleontologist for this study and provided the majority of its geological and paleontological background. Some of the background is taken verbatim from Shaw (2007). Mr. Shaw contributed findings about the existing conditions of the Project Site and analyzed the impacts that the Project would have on paleontological resources. Mr. Shaw is a Senior Paleontologist for APRMI, and has over 40 years of paleontology experience. He holds a Bachelor of Science degree in Zoology (1974) and a Master of Science degree in Biology (1981) from California State University, Long Beach. For the past 35 years, he has been an integral part of the excavation projects in Hancock Park, including Pit 91 (LACM 6909) and Project 23 (deposits found recently by APRMI during excavations for the new subterranean parking at LACMA). His experience includes conducting hundreds of paleontological excavations, collection, preparation, and curation as well as lithological recording, stratigraphic interpretation, geologic documentation, museum exhibit engineering, and supervision and training of staff and volunteers for both museum- and excavation-related projects. He specializes in preparation and curation of fossil (Plio-Pleistocene) and modern collections of mammals in the western United States, and fossil analysis and identification. Before joining ArchaeoPaleo, he was the Fossil Collections Manager for the Page Museum.

Linda Akyüz, M.A., RPA was the primary technical writer of this report and documented the Project Site survey. She is a Registered Professional Archaeologist (RPA) and holds a Master of Arts degree in Anthropology from California State University (CSU) Fullerton (2011) with an emphasis in California and Great Basin archaeology and ethnography. She holds a Bachelor of Arts degree in Art Studio from UC Santa Barbara (1988), with an emphasis in Native American Art History and California and Mexican History and Prehistory. Ms. Akyüz has 28 years of experience as a California historian and ethnohistorian and 13 years of experience managing

California and Great Basin cultural resources, and is a qualified paleontological resources monitor per SVP (2010) guidelines. Ms. Akyüz taught California Natural History, Prehistory, and History in California public schools for 24 years. She has provided analysis for and has contributed to several PRMMPs and many paleontological resources technical reports.

Denise Ruzicka, M.A., M.S., RPA contributed several report summaries to the present study and incorporated the final edits to the report. Ms. Ruzicka is a Staff Archaeologist and Staff Paleontological Resources Monitor for APRMI. She holds a Master of Arts degree in Anthropology from the University of Nevada, Las Vegas (2010), a Master of Science degree in Astronomy from the Swinburne Institute of Technology (2009), and a Bachelor of Arts degree in Anthropology from the University of California, Los Angeles (2002). Ms. Ruzicka is a Registered Professional Archaeologist (RPA) with over nine years of experience in the field of paleontology, which includes three years as a paleontology laboratory and excavation volunteer at the Page Museum. Ms. Ruzicka has over eight years of experience in cultural resources management ("CRM"), which includes, but is not limited to, survey, excavation, site recordation, construction monitoring, laboratory processing and analysis, GIS mapping, and technical report writing. She satisfies the Secretary of the Interior's Professional Qualifications Standards as a professional archaeologist and is a qualified paleontological resources monitor per SVP (2010) guidelines.

REGULATORY SETTING

Paleontologic resources consist of fossilized remains and include fossils sites and fossil-bearing strata. This section of the report identifies state regulatory requirements that address paleontological resources.

SOCIETY OF VERTEBRATE PALEONTOLOGY POLICY AND ETHICS STATEMENTS

The Society of Vertebrate Paleontology ("SVP"), an international scientific organization of professional paleontologists, has issued guidelines and policy statements entitled *Assessment and mitigation of adverse impacts to nonrenewable paleontologic resources - standard guidelines* (SVP, 2013), *Conditions of receivership for paleontologic salvage collections* (SVP 1996), *Guidelines from the ethics education committee for collecting, documenting and curating fossils* (SVP, 2009a), and *Article 12: Member bylaw on ethics statement* (SVP 2009b). These statements outline acceptable professional practices in paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, specimen preparation, identification, analysis, and curation.

According to the SVP (2013: Line 189), significant nonrenewable paleontologic resources are "vertebrate fossils and their taphonomic and associated environmental indicators." While the SVP definition of nonrenewable paleontological resources "excludes invertebrate or paleobotanical fossils . . . certain invertebrate and plant fossils may be defined as significant by a project paleontologist, local paleontologist, specialists, or special interest groups, or by lead agencies or local governments." (SVP, 2013: Lines 190-194).

Fossil remains in general are not found unless exposed by natural forces or by human activity. A paleontologist cannot determine fossil quality or quantity until a rock unit is exposed/disturbed or until alluvial deposits are disturbed. Paleontologists make conclusions about sensitivity based upon what types of fossils have been found previously in the same type of rock unit or sediment type and based upon the likelihood that the depositional environment resulted in the burial and preservation of fossils (SVP, 2013). The SVP (2013: Lines 15-30) states

> The determination of a site's (or rock unit's) degree of paleontological potential is first founded on a review of pertinent geological and paleontological literature and on locality records of specimens deposited in institutions. This preliminary review may suggest particular areas of known high potential. If an area of high potential cannot be delimited from the literature search and specimen records, a surface survey will determine the fossiliferous potential and extent of the sedimentary units within a specific project. The field survey may extend outside the defined project to areas where rock units are better exposed. If an area is determined to have a high potential for containing paleontologic resources a program to mitigate impacts is developed. In areas of high sensitivity a pre-excavation survey prior to excavation is recommended to locate surface concentrations of fossils which might need special salvage methods. The sensitivity of rock units in which fossils occur may be divided into three operational categories.
>
> I. HIGH POTENTIAL. Rock units from which vertebrate or significant invertebrate fossils or significant suites of plant fossils have been recovered are

> considered to have a potential for containing significant non-renewable fossiliferous resources. These units include but are not limited to, sedimentary formations and some volcanic formations which contain significant nonrenewable paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Sensitivity comprises both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, ecologic, or stratigraphic data. Areas which contain potentially datable organic remains older than Recent, including deposits associated with nests or middens, and areas which may contain new vertebrate deposits, traces, or trackways are also classified as significant.
>
> II. UNDETERMINED POTENTIAL. Specific areas underlain by sedimentary rock units for which little information is available are considered to have undetermined fossiliferous potentials. Field surveys by a qualified vertebrate paleontologist to specifically determine the potentials of the rock units are required before programs of impact mitigation for such areas may be developed.
>
> III. LOW POTENTIAL. Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow determination that some areas or units have low potentials for yielding significant fossils. Such units will be poorly represented by specimens in institutional collections. These deposits generally will not require protection or salvage operations.

For example, the Project Site is located 200 meters west of the Rancho La Brea National Natural Landmark, “the site of the world-famous natural asphalt tar pits in which Pleistocene animals became entrapped in their quest for fresh water and food. It is recognized for having the largest and most diverse assemblage of extinct Ice Age plants and animals in the world” (National Park Service 2009:10). This fossil site contains numerous asphalt seeps that have yielded fossil remains, including Pit 91 (LACM 6909). In 2006, excavations for the LACMA Transformation Project yielded 23 fossil deposits and a mostly complete mammoth west of the Rancho La Brea National Natural Landmark and Hancock Park. The Rancho La Brea collections are housed at the Page Museum. The collections document the Rancho La Brea biota and include some 3.5 million specimens representing over 600 species of plants and animals (NHM 2013). This fossil site information is presented in this section as an example of what the SVP considers a significant nonrenewable paleontologic resource. More detailed information about the Tar Pits is presented later in this report, in the *Existing Conditions* section of this report. Since the naming of the Rancho La Brea National Natural Landmark, significant Pleistocene fossils were found west of the landmark, approximately 40 meters east of the Project Site, and may soon be evaluated as part of that landmark.

Fossils are seldom distributed uniformly within a rock unit or within an alluvial or fluvial deposit. Even if the majority of a rock unit or sediment deposit lacks fossil remains, the same rock unit or sediment deposit may contain concentrations of fossils in specific locations. In addition, within a fossiliferous portion of the rock unit, fossil remains may be present in varying densities. Because the presence or location of fossils within a rock unit cannot be discovered without exposure, SVP (2013) standard guidelines state that the entire rock unit possesses one level of sensitivity. Most fossil sites recorded during construction-impact mitigation studies have had no pre-project surface expression. Monitoring of construction-related excavation of a rock unit by an experienced paleontologist increases the probability that scientifically significant fossils will be discovered and preserved (SVP 2013).

According to SVP (2009a: Article 12.1-4) and SVP (2009b), vertebrate paleontologists must ensure that vertebrate fossils are collected in a professional manner, "which includes the detailed recording of pertinent contextual data, such as geographic, stratigraphic, sedimentologic and taphonomic information" (SVP, 2009a: Article 12.1). The ethics bylaw also states that fossil "vertebrate specimens should be prepared by, or under the supervision of, trained personnel" (SVP, 2009a: Article 12.3) and that "scientifically significant fossil vertebrate specimens, along with ancillary data, should be curated and accessioned in the collections of repositories charged in perpetuity with conserving fossil vertebrates for scientific study and education (e.g., accredited museums, universities, colleges and other educational institutions)" (SVP, 2009a: Article 12.4). The SVP (2013) standard guidelines state that vertebrate fossils are significant, nonrenewable paleontological resources and that the

> potential for destruction or degradation by construction impacts to paleontological resources on public lands (federal, state, county. or municipal) and land selected for development under the jurisdiction of various governmental planning agencies is recognized. Protection of paleontological resources includes: (a) assessment of the potential property to contain significant non-renewable paleontological resources which might be directly or indirectly impacted, damaged or destroyed by development, and (b) formulation and implementation of measures to mitigate adverse impacts, including permanent preservation of the site and/or permanent preservation of salvaged materials in established institutions (SVP, 2013: Lines 1-5).

Under the criteria stated above, all fossil remains may be considered *significant* by CEQA standards (discussed in the next section). *Significant* fossil remains may also be considered *scientifically significant* by the SVP. An individual fossil specimen is considered *scientifically significant* if it is:

- Identifiable
- Complete
- Well preserved
- Age diagnostic
- Useful in paleoenvironmental reconstruction
- A type or topotypic specimen
- A member of a rare species
- A species that is part of a diverse assemblage
- A skeletal element different from, or a specimen more complete than, those now available for that species (SVP 2013)

Both terrestrial and marine fossil remains are considered scientifically significant because they have the potential to indicate the geological age of the sedimentary unit, and its depositional environment. Additionally, vertebrate remains are comparatively rare in the fossil record. Fossil plants are also considered scientifically significant because they are sensitive indicators of their environment and help paleontologists reconstruct paleoenvironments.

STATE LAW AND REGULATIONS

California Environmental Quality Act (Section 15064.5)

Paleontological resources are protected by Appendix G (Part V) of CEQA, which indicates that the destruction of unique, non-renewable paleontological resources is a significant impact on the environment that requires mitigation of the impact (State of California 2012). Construction excavation in paleontologically sensitive deposits that underlie a project area is a significant impact that can be mitigated via the salvage and identification of excavated fossils from the deposit.

California Administrative Code, Title 14, Sections 4307 and 4308

This code states that "no person shall destroy, disturb, mutilate, or remove earth, sand, gravel, oil, minerals, rocks, [or] paleontological features" on or from public lands. The code also states that "no person shall remove, injure, disfigure, deface, or destroy any object of archaeological or historical interest or value." Paleontological resources associated with the La Brea Tar Pits are considered of historical interest or value because of their listing in the California Register of Historical Resources as California Historic Landmark 170.

Public Resources Code Section 5097-5097.993: Native American Historic Resource Protection Act: Archaeological, Paleontological, and Historical Sites; Native American Historical, Cultural, and Sacred Sites

This act protects cultural resources on California public lands and was amended by Senate Bill 1034 in 2010. It states that a person shall not "knowingly and willfully excavate upon, or remove, destroy, injure, or deface, any . . . vertebrate paleontological site . . . or any other . . . paleontological . . . feature, situated on public lands, except with the express permission of the public agency having jurisdiction over the lands" (State of California 2010).

California Penal Code, Section 622

Section 6221.2 of this penal code states that every person, "not the owner thereof, who wilfully injures, disfigures, defaces, or destroys any object or thing of archeological or historical interest or value, whether situated on private lands or within any public park or place, is guilty of a misdemeanor."

LOCAL GUIDELINES

City of Los Angeles General Plan Conservation Element

The City's General Plan Conservation Element (City of Los Angeles 2001:II-5 to II-6) states that

> Los Angeles is rich in paleontological sites. Fossils have been found mostly in sedimentary rock that has been uplifted, eroded or otherwise exposed. Most of the sites are in local mountains. However, the best known and most abundant fossil

resource are La Brea Tar Pits, which are owned and operated by the County of Los Angeles. They are within and surround the 23-acre Hancock Park, which includes an art museum and the Page Museum (tar pit related displays and activities). The tar pits have provided an abundance of animal and plant fossils. Most are from the Pleistocene epoch (Ice Age) and date as far back as 40,000 years. Finds include mammoths, saber-tooth cats, insects and birds.

Site protection. Pursuant to CEQA, if a land development project is within a potentially significant paleontological area, the developer is required to contact a bona fide paleontologist to arrange for assessment of the potential impact and mitigation of potential disruption of or damage to the site. If significant paleontological resources are uncovered during project execution, authorities are to be notified and the designated paleontologist may order excavations stopped, within reasonable time limits, to enable assessment, removal or protection of the resources. For Los Angeles city and county, the Los Angeles County Museum of Natural History, including the George C. Page Museum, provides advice concerning paleontological resources.

Conclusion: The city has a primary responsibility in protecting significant archaeological and paleontological resources. Continuing issues: loss of or damage to archaeological and paleontological sites due to development, unauthorized removal and vandalism.

Archaeological and paleontological objective, policy and program:

Objective: protect the city's archaeological and paleontological resources for historical, cultural, research and/or educational purposes.

Policy: continue to identify and protect significant archaeological and paleontological sites and/or resources known to exist or that are identified during land development, demolition or property modification activities.

Program: permit processing, monitoring, enforcement and periodic revision of regulations and procedures.

Responsibility: departments of *Building and Safety, *City Planning and Cultural Affairs and/or the *lead agency responsible for project implementation.

Essentially, the Conservation Element of the General Plan protects endangered paleontologic sites by iterating CEQA mandates. It indicates that a paleontologist must assess a project’s potential impact to a paleontologic site and should determine the appropriate mitigation if a paleontologic site will be destroyed. If significant paleontologic resources are uncovered during a project’s execution, a designated paleontologist must be allowed to order assessment, removal, or protection of the resources.

City of Los Angeles CEQA Thresholds of Significance Guide

The City's CEQA Thresholds of Significance Guide (City of Los Angeles 2006: Section D) for paleontological resources states that the determination of significance of paleontological resources shall be made on a case-by-case basis, considering the following factors:

- Whether, or the degree to which, the project might result in the permanent loss of, or loss of access to, a paleontological resource; and
- Whether the paleontological resource is of regional or statewide significance.

The methodology to determine significance includes a description of the environmental setting that includes the following information (these are included in the present report):

- Description of the physical setting, paleontology, and geology of the project site and surrounding area;
- Summary of surveys and research for the project site; and
- Summary of requirements and/or policies for paleontological resources that apply to the project

Standard Specifications for Public Works Construction, Section 6-3.2 (Public Works Standards, Inc., 2009; City of Los Angeles, 2011)

The City follows standard specifications (Public Works Standards, Inc., 2009) that require grading, excavation, or other ground-disturbing activities for a public project to be halted in the area of a paleontological or archaeological find, until a resource expert can review the find, determine its significance, and if required, determine appropriate mitigation.

EXISTING CONDITIONS

Paleontologists consider the characteristics of an area prior to human occupation. The nature and age of geologic deposits are considered for their potential to contain paleontological material that may help scientists "reconstruct" pre-human biological settings. The previous recovery of paleontological material from a particular deposit or formation indicates that the same/similar deposit or formation has a high potential for the encounter of paleontological resources in the vicinity of, or even at a great distance from, the original find.

PHYSIOGRAPHY AND GEOGRAPHY

During the middle Miocene Epoch (about 15 million years ago ["mya"] to about 11 mya), the Los Angeles region was part of a deep submarine basin that included what is now part of the Ventura Basin, the Los Angeles Basin, and the San Fernando Valley, and extended to what is now Pomona. Deep, narrow, rapidly subsiding basins were formed when the tectonic blocks that make up today's Transverse Ranges rotated up to 90 degrees clockwise in response to a shear along the San Andreas Fault (Luyendyk, et al., 1985). The Transverse Ranges, which are now oriented west to east, include the San Gabriel Mountains, the Santa Ynez Mountains, the Santa Monica Mountains (approx. 4 km north of the Project Site), and the Channel Islands. As crustal blocks pivoted, they separated in places to create fault-bounded chasms. These steep-sided basins accumulated thick deposits of deep-water marine shales and sandstones, as well as deposits of siliceous shale and diatomite (formed from diatoms, or single-celled algae with cell walls made of silica) (Conrey, 1967; Crowell, 1981; Fritsche, et al., 2001; Luyendyk, et al., 1985; Schwartz and Colburn, 1987; Woodford, et al., 1954; Wright, 1991). Marine sediment over 6 miles deep accumulated in what is now downtown Los Angeles in only 6 million years (Luyendyk, et al., 1985).

Alluvial deposits accumulated on top of the earlier marine deposits of the Los Angeles Basin during the Quaternary period. The surface of the Project Site consists of later Quaternary Holocene/Pleistocene older surficial sediments (*Qae*), which are described as slightly elevated and dissected alluvium/alluvial fan sediments, clay, sand, and gravel (Dibblee and Ehrenspeck, 1991; Figure 3). Yerkes (1997) maps the deposit underlying the Project Site as *Qao*, or Pleistocene older alluvium. These Pleistocene deposits in the Project vicinity have often been found to contain mammals of Pleistocene age (discussion follows).

Numerous oil fields surround the Project Site, as hydrocarbon deposits are present in this part of the Los Angeles Basin among Miocene formations that underlie later deposits (see Quinn 2001; Dibblee and Ehrenspeck, 1991). The oil field located directly under the Project Site is designated as the "South Salt Lake Oil Field" by the State of California Department of Conservation: Division of Oil, Gas, and Geothermal Resources (n.d.) and the "southern part of the South Lake Oil Field" by Shannon & Wilson, Inc. (2014:20). Oil fields located in the immediate Project vicinity are the Salt Lake and Las Cienegas oil fields (Dibblee and Ehrenspeck 1991, see Figure 3). The San Vicente, Beverly Hills, and Cheviot Hills oil fields are located to the south and southwest (see Dibblee and Ehrenspeck, 1991 a; 1991b). The hydrocarbon deposits that have created these oil fields are the source of the seeps of the La Brea Tar Pits—or the Rancho La Brea Site as it is formally known—just east of the Project.

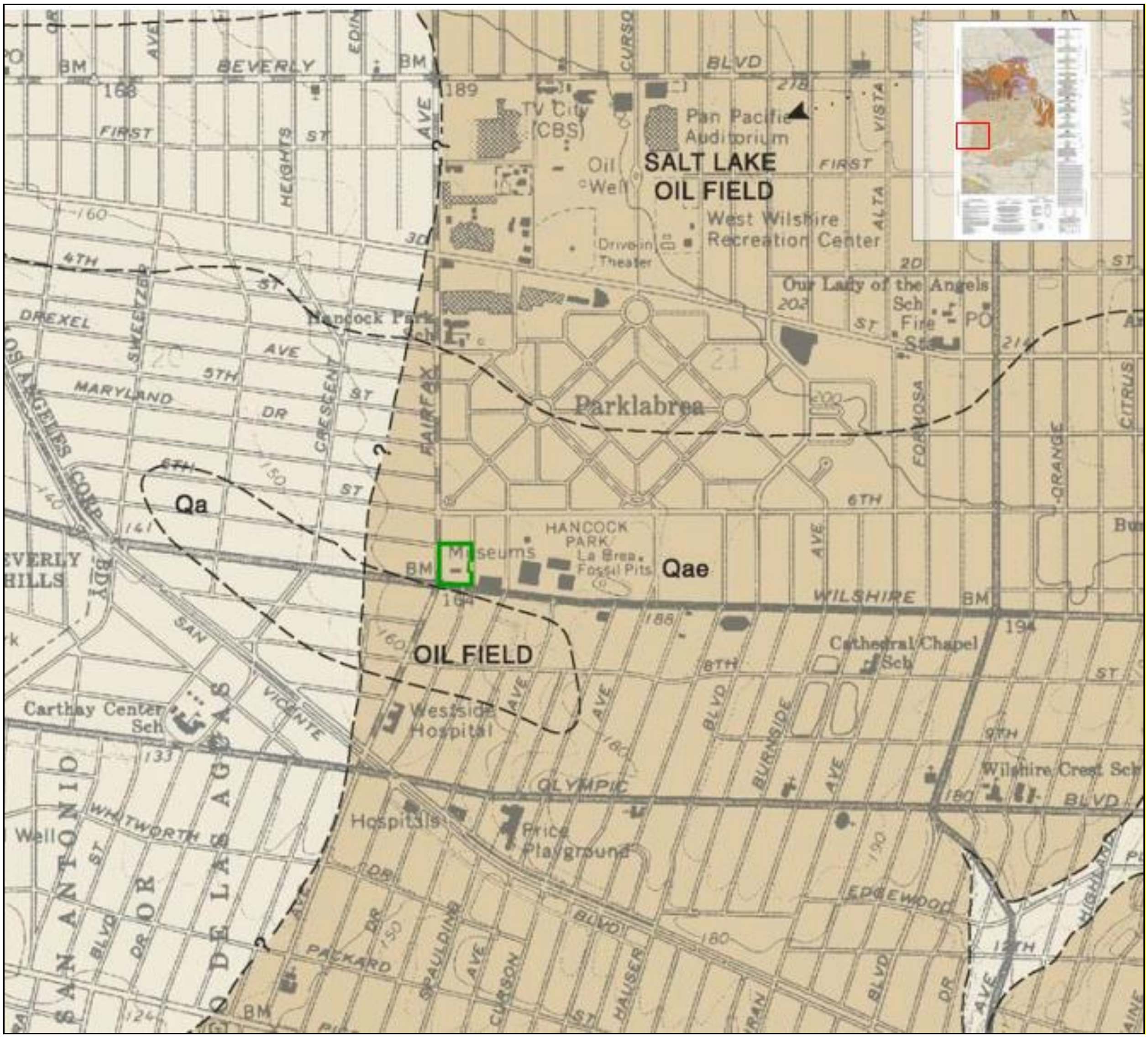

Figure 3. Geologic overview of area with Project Site marked (from Dibblee and Ehrenspeck 1991)

Father Juan Crespi described the tar seeps as “springs of pitch” upon their “discovery” during the expedition of Gaspar de Portolá in 1769-1770 (Heric, 1969). He pondered whether the earthquakes the group had experienced during the preceding day had some connection to the presence of these seeps.

For thousands of years, local Native Americans used asphalt as a sealant and an adhesive. The City of Los Angeles was established in 1781, approximately 7 miles east of the seeps. Spanish and Mexican settlers also had many uses for *la brea*. Rancho La Brea was originally a 4,400-acre Mexican Land Grant given to Antonio José Rocha in 1828. According to the City of Los Angeles (2010: 17):

> The brea was used to waterproof the roofing of Southern California adobes, and Rocha allowed access to it to all area inhabitants free of charge. Major Henry Hancock, a surveyor by trade, and his brother John, purchased the rancho from the Rocha heirs in 1870. Their title to the rancho was confirmed by the United

States government in 1870. The Hancocks owned the majority of the land, although others, including James Thompson and Senator Cornelius Cole, had acquired small portions. Major Hancock died in 1883, leaving his wife Ida with vast real estate holdings but little money. Their son George Allen assumed management of the ranch upon maturity, but it was a constant struggle to hold title and deal with squatters and claim jumpers.

In 1900, oil was struck in Los Angeles and a "boom" of mammoth proportions was begun. Many houses near downtown had oil derricks in their backyards. George Allan Hancock drilled wells in the La Brea/Wilshire/Fairfax area, and several proved productive. With the income from the wells and selective selling of some of their land, the Hancocks finally prospered.

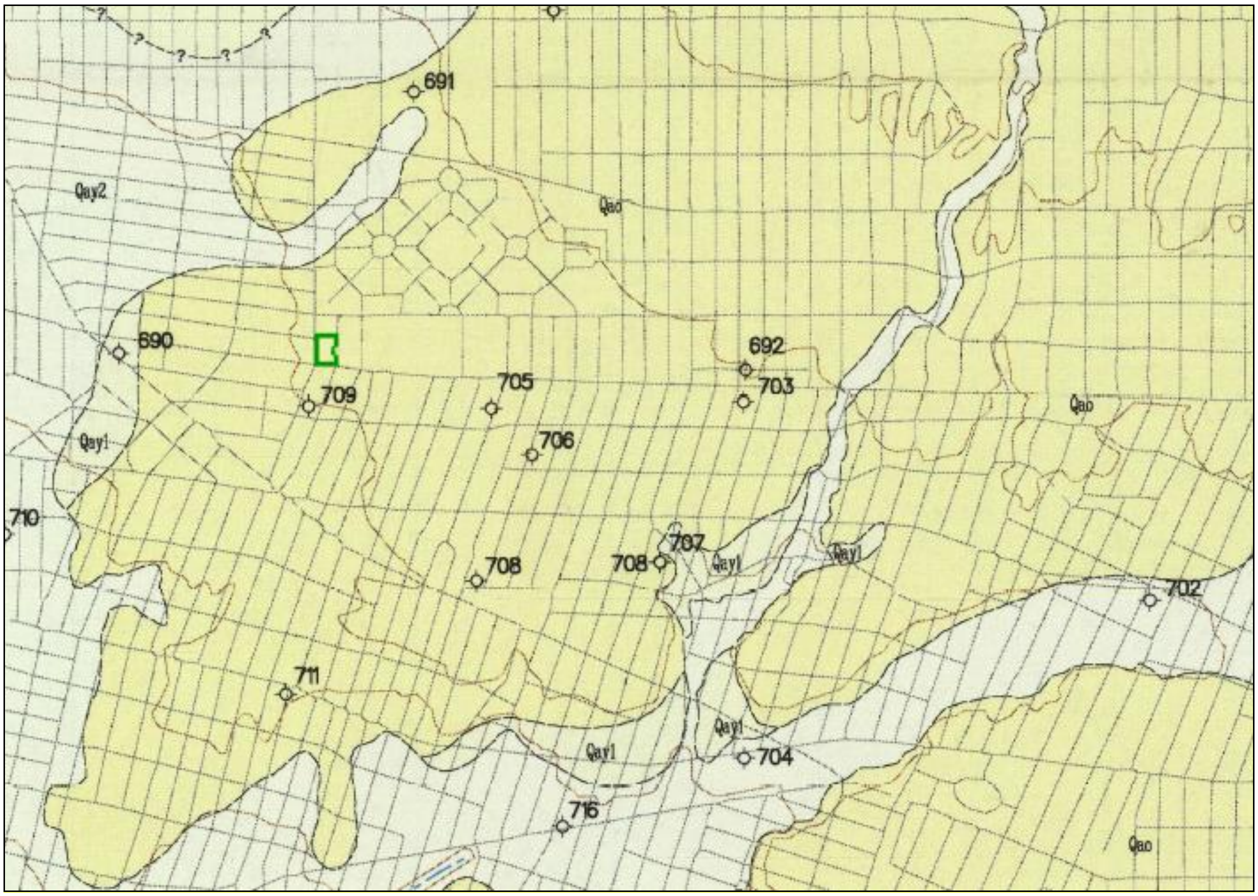

Figure 4. Geologic overview of area with Project Site marked (from Yerkes, 1997)

Hancock Park is located in the northwest Los Angeles Basin on the La Brea Plain, which is centered over a structural high between the probable fault-bounded Hollywood Basin and central trough of the Los Angeles Basin. It lies between the right-lateral Newport-Inglewood fault zone to the west and left-oblique Hollywood fault on the north (Fig. 4; Quinn, *et al*., 2000). Oil-industry subsurface exploration has illuminated a south-southwest facing monocline—or a step/shelf-like fold in the late Tertiary strata present, complicated by secondary folds and faults (Jacobson and Lindblom, 1977; Wright, 1991). This structural high has been postulated to be a result of folding above one or more active faults during the Quaternary (Hummon, *et al.***,** 1994). A complex sequence of Pleistocene marine and non-marine strata rest unconformably on folded and faulted late Miocene marine strata across the southwestern margin of the northern shelf monocline. In the vicinity of Hancock Park, a relatively thin Pleistocene section conceals the steeply dipping south limb of the northwest plunging Salt Lake anticline (Quinn, *et al.*, 1997). The Tertiary strata contain petroleum in structural traps, and asphalt (degraded petroleum) migrates to the surface as the result of up-dip leakage from oil sands (Wright, 1987) and/or along fractures and fissures within clayey siltstones (Quinn, *et al*., 1997).

Hancock Park is situated on approximately 150 feet (45m) of late Pleistocene strata that Woodard and Marcus (1973) divided into three lithologic units, informally designated Members A, B, and C. Member A, the stratigraphically lowest unit, consists of about 70 ft (21m) of asphalt-saturated mudstone that contains a fossil marine fauna. Member B is on the order of 40 feet (12m) thick and is composed of asphaltic fine- to medium-grained sandstone with lenses of mudstone and conglomerate. A marine fauna is present in the lower half of this member that is Sangamonian in age (Valentine and Lipps, 1970; Woodard and Marcus, 1973). An inferred transition between marine and non-marine conditions during deposition of Member B is documented by terrestrial vertebrates from the uppermost part of the unit. Woodard and Marcus (1973) subdivided the upper unit, Member C, into three distinct lithologic submembers a, b, and c in ascending stratigraphic order. The majority of non-marine fossil flora and fauna collected from Hancock Park occurred within 25 feet (7.6m) of the surface of Member C (Shaw and Quinn, 1986; Quinn, 1992).

The older alluvium mapped by Dibblee and Ehrenspeck (1991) and Yerkes (1997) is associated with Pleistocene Rancholabrean/North American Land Mammal Age (NALMA) fauna, such as that encountered at the Rancho La Brea fossil sites located at the Page Museum in Hancock Park just adjacent to the Project. This older alluvium is likely to contain remnants of Pleistocene fauna such as the American mastodon (*Mammut americanum*), the saber-toothed cat (*Smilodon fatalis*), yesterday's camel (*Camelops hesternus*), dire wolf (*Canis dirus*), Harlan's ground sloth (*Paramylodon harlani*), western horse (*Equus occidentalis*), and ancient bison (*Bison antiquus*) (Page Museum, 2013c).

Table 1. Divisions of Recent Geologic Time (after U.S. Geological Survey Geologic Names Committee, 2007; earlier eras not shown)

<table>
<tr><th>Era</th><th colspan="2">Period or Superiod</th><th>Series or Epoch</th></tr>
<tr><td rowspan="7">Cenozoic
65.5 mya to Present</td><td rowspan="2">Quaternary
1.5 million years ago (mya) to the Present</td><td rowspan="4">Neogene</td><td>Holocene
11,477 years ago (+/- 85 years) to the Present</td></tr>
<tr><td>Pleistocene ("The Great Ice Age")
1.5 million to approximately 11,477 (+/- 85 years) years ago</td></tr>
<tr><td rowspan="5">Tertiary
65.5 to 1.5 mya</td><td>Pliocene
5.3 to 1.5 mya</td></tr>
<tr><td>Miocene
23 to 5.3 mya</td></tr>
<tr><td rowspan="3">Paleogene</td><td>Oligocene
33.9 to 23.0 mya</td></tr>
<tr><td>Eocene
55.8 to 33.9 mya</td></tr>
<tr><td>Paleocene
65.5 to 58.8 mya</td></tr>
</table>

PALEONTOLOGICAL RESOURCES

Fossil Occurrence and Preservation

The liquid and gaseous hydrocarbons that migrate through the late Pleistocene strata ooze to the surface through vents or fissures as asphalt (a viscous liquid/semi-solid form of petroleum/hydrocarbon). “Stratiform” asphalt deposits develop around active vents and may produce rather sheet-like deposits. Local ponding occurs in depressions, but evidence for deep, extensive natural pools of liquid asphalt has not been found (Shaw and Quinn, 1986; Quinn, 1992). Asphalt exposed at the surface degrades through time to form a hard, resistant material called asphaltite (Quinn, 1992). Observed rates of asphalt extrusion through the Earth’s crust are variable. Some vents or fissures appear to be continuously active, but the amount of discharge is not uniform. Others are only intermittently active, producing copious amounts for several weeks or months, then becoming dormant.

Exposure to solar radiation and diurnal and seasonal temperature fluctuations at Rancho La Brea strongly affect the viscosity of asphalt. During the warmer summer months, discharged asphalt tends to flow a greater distance and thus penetrates porous sediments through which it flows more easily. Fallen leaves and wind-blown debris readily stick to the surface, and small animals that come in contact with the viscid liquid may become mired. Asphalt-saturated sands yield easily to pressure during the warmest part of the year and have the potential to mire very large animals. During the cooler months of fall, winter, and spring, the opposite is observed: asphalt flows neither as quickly nor as far; surface sheets typically congeal and are generally less adherent so that entrapment of large and small animals or debris is unlikely.

During the late Pleistocene, sediment that had eroded from the Santa Monica Mountains was carried by flood waters and deposited as alluvium. In the area of the seeps, the recently deposited alluvium was saturated with asphalt. Active seeps penetrated the surficial alluvial cover and asphaltic deposits developed. The congealed or oxidized asphaltite and asphalt saturated sediments were subsequently covered as alluvium aggraded in the area of Hancock Park. Again, active seeps penetrated the surficial cover and new asphaltic deposits developed. In this way, interstratified fluviatile sediments, asphalt saturated sediments, and asphaltite lenses were formed through time (Quinn, 1992).

The world-famous, dense accumulation of fossils at Rancho La Brea appears to have been mainly the result of entrapment and, to a lesser degree, fluviatile concentration. These accumulations typically occur in the general form of "chimneys" or "pipes" that often extend across stratigraphic facies. Faunal elements become disarticulated and often occur in tangled masses within these extraordinary asphaltic deposits. Therefore, only in rare instances had near-complete skeletons been recovered at Rancho La Brea. However, fossil deposits encountered during the recent LACMA Transformation Project are yielding many more near-complete skeletons that are being added to the Page Museum collection presently.

Entrapment at Rancho La Brea is analogous to either "fly-paper" or "quick-sand," depending upon the size of the animal entering the trap (Quinn, 1992). Large animals appear to be mired in and around asphalt vents in recently deposited, poorly consolidated sand which would exhibit high pore pressure and low weight-bearing strength near the seep. An animal that applied pressure to this surface would sink as if the surface were made of quick-sand. However, because the asphaltic sand has a high density, an animal would only partially sink into the mire. Once bogged, the animal would become entrapped because of the adhesive quality of the asphalt. Skeletal elements extending into the asphalt-saturated sediment tend to be more often preserved, while the remainder of the carcass is vulnerable to predation or decay (Marcus, 1960; Maloney, et al., 1974; Spencer, et al., 2003). Subsequent episodes of entrapment at the same location promote trampling of skeletal remains from previous bogging events, which could then be pushed deeper into the asphalt-saturated sediments due to being compacted, abraded, and broken. Plant and small animal remains that become stuck to the asphaltic surface as if it were "fly-paper" could also be forced deep into the subsurface during entrapment events.

The specimens found at the Tar Pits have been classified as being of Rancholabrean NALMA. The Rancholabrean NALMA is named for the mammal assemblage from the Rancho La Brea asphalt deposits, and "is characterized by the presence of the Eurasian immigrant genus Bison south of 55ºN latitude. Recent reviews suggest Bison arrived in the coterminous United States less than ~220 ka [220,000 years] before present, but estimates vary" (Scott et al., 2008).

Land mammal ages are defined in faunal terms, and faunas do not manifest themselves across the entirety of a continent in a geologic instant. The excellent preservation of most Rancholabrean NALMA fossils is attributable to their impregnation with asphalt. Bones, exoskeletons, and many plant parts that were not subject to extreme surface weathering are virtually unaltered chemically or physically, even though they may be over 40,000 years old. This unusual type of preservation has allowed the most delicate surface and internal structures of the fossils to survive for tens of thousands of years. Up to 80 percent of the original collagen protein remains in the bones (Ho, 1965), and even the collagen protein's microstructure is well preserved (Doberenz and Wyckoff, 1967). Materials rarely preserved elsewhere – auditory ossicles of mammals, tracheal rings of birds, the fleshy parts of leaves, and puparia of blow fly larvae – have been preserved at Rancho La Brea. However, flesh, hair, feathers, scales, and other soft organic tissues have not been found. Recent sampling of bacteria associated with the asphaltic sediments has revealed over 200 species, 80 percent of which are "new" species (J. S. Kim, personal communication with Christopher Shaw), and are likely responsible for the digestion of the organic tissues.

Paleoecology and Climatic Considerations

Fossils recovered from Rancho La Brea represent a diverse late Pleistocene terrestrial biota. Many of the plant and animal species found fossilized are still represented by living organisms. Plant remains are numerous and consist of tests, seeds, cones, fruits, leaves, and wood. The 142 identified species (at present) include 78 diatoms, one alga, eight gymnosperms and 64 angiosperms. Invertebrate animals are represented by over 200 species including snails, clam, crustaceans, and arthropods. Insects make up 77 percent of the known species diversity of invertebrates. Fossil remains of all groups of vertebrates (fish, amphibians, reptiles, birds, and mammals) have been recovered from the asphalt deposits of Rancho La Brea. Over 230 species have been identified (at present), including three fish, one salamander, five frogs and toads, one turtle and one tortoise, seven lizards, 12 snakes, over 140 birds, and 59 mammals. This total does not include the newly extracted specimens found at LACMA from 2006-2008, which are the fossil specimens known as Project 23.

Mammals constitute the most familiar and most well-known vertebrate group from Rancho La Brea (Stock and Harris, 1992). Ninety percent of the mammalian specimens larger than rabbits are carnivorans (Marcus, 1960). The most common carnivorans are the dire wolf, the coyote, and the saber-toothed cat; over 4,000 individuals are represented in the collections at the Page Museum, and more are being identified as a result of recent excavations for LACMA (see Turner 2006; Turner and Shaw 2008). Herbivores are also well represented and include mice and rats, rabbits and hares, pronghorns, camels, horses, bison, mastodons, and mammoths. Extinct bison and horse species far outnumber other species of large mammalian herbivores. Of the mammalian fauna, 21 of the species are extinct. The significant and extensive, well-preserved mammalian fauna forms the basis of the Rancholabrean Land Mammal Age/NALMA, the standard for all other North American late Pleistocene faunas (Savage, 1951; Savage, et al., 1954).

Changing flood plain microenvironments documented by the sedimentary deposits at Rancho La Brea suggest that the composition and distribution of the late Pleistocene flora also varied through time. Four plant associations are interpreted to have existed regionally (Shaw and Quinn, 1986; Templeton, 1964; Warter, 1976), primarily based upon botanic evidence obtained from Pit 91. These include coastal sage scrub, chaparral, deep canyon, and riparian associations. The composition and structure of these associations are based on analogy with modern plant associations.

A coastal sage scrub assemblage inhabited the La Brea Plain and was composed predominantly of small woody bushes. The spaces between the bushes allowed room for annual forbs. Dominant plants included coastal sage, sage, buckwheat, and California juniper. Juniper was very common locally. Groves of Bishop pine, Monterey pine, and Monterey cypress grew in the immediate vicinity of the asphalt seeps and other favorable site on the plain. However, the apparent absence of the gray squirrel at Rancho La Brea strongly indicates that extensive woodlands were not present near the asphalt vents. At higher elevations, the coastal sage scrub was punctuated by stands of valley oak. Grasses were undoubtedly present in this association but they do not appear to have been abundant. It is often assumed that horse and/or bison in fossil assemblages are indicative of extensive grassland habitats; however, the evidence from Rancho La Brea tends to contradict this common assumption.

Chaparral covered the slopes of the Santa Monica Mountains. This plant assemblage is composed of characteristically tall, usually densely packed, deeply rooted woody bushes. The dominant plants of this association included chamise, lilac, scrub oak, manzanita, walnut, elderberry, and poison oak. Digger pine and California juniper probably were scattered within the chaparral in open, drier areas. Groves of coast live oak are presumed to have been present on north-facing slopes of the deep canyons.

Coast redwood, bay, and dogwood grew in the deep canyons of the Santa Monica Mountains. This association integrated with coast live oak at higher elevations and with a riparian association in the canyon bottoms. In the deep canyon, riparian plants included alder, box elder, raspberry, and numerous herbs. Stream courses crossing the Santa Monica Plain were lined with sycamore, arroyo willow, red cedar, occasional coast live oak, elderberry, walnut, numerous herbs, and possibly Bishop pine.

In many respects, the composition of the late Pleistocene flora from Rancho La Brea was similar to that of the region today. By analogy, rainfall was strongly seasonal during the late Pleistocene; most precipitation occurred in the late fall, winter, and early spring months, whereas the summers were relatively dry. Many species of plants recorded from these deposits live today along the summer “fog belt” from San Luis Obispo north to Oregon and on the Channel Islands. Pit 91 is one of the older sites at Rancho La Brea, dating between 28,000 and 45,000 year BP (Marcus and Berger, 1984; unpublished dates), and the paleobotanical evidence from this site suggests that the late Pleistocene maritime climate during this time was cooler, more moist and equable (consistent) than it is today. However, tree ring and stable isotope analyses on plant remains from younger deposits indicate drier conditions prevailed between 15,000 and 18,000 years BP (Ward, et al., 2005).

Timeline of Excavations and Discoveries at the La Brea Tar Pits

The La Brea Tar Pits have been the subject of a number of excavations (Table 2). The bones found during historic mining for liquid asphalt were considered to be remains of unfortunate domesticated stock or other wild animals of the region (Gilbert, 1910; Merriam, 1911). More than a century later, William Denton (1875) reported the recovery of extinct species from the Rancho La Brea seeps, but this report went unnoticed by the scientific community. Finally in 1901, while investigating petroleum resources in the vicinity, William Orcutt noted that the bones found in the asphalt deposit represented remains of many extinct species. Orcutt, with fellow scientist F. M. Anderson, intermittently collected fossils until Anderson discovered a deposit that contained more bones than asphaltic matrix in 1905. Anderson contacted J. C. Merriam at the University of California (Berkeley) to investigate this unusually rich discovery (Heric, 1969).

Merriam recognized the significance of this discovery, but it wasn't until 1912 that he could generate funding for the first organized field collection of the site. The peak of excavation for fossil resources at Rancho La Brea was between 1905 and 1915. Local, national, and international institutions sent individuals or crews to the site to acquire fossil collections, large and small. Visiting amateurs were also known to take away many souvenirs. A large collection of fossil vertebrate specimens was recovered by J. Z. Gilbert, a teacher at Los Angeles High School, beginning in 1907; between 1910 and 1911 he generated local interest and monetary support through the Southern California Academy of Science and the Los Angeles County Board of Supervisors, and directed the excavation of the "Academy Pit." This was one of several early natural history collections that formed the basis for the establishment of what was to become the NHM. Between 1912 and 1913, the University of California recovered tens of thousands of fossils in less than one year of collecting. The then-owner of Rancho La Brea and owner of Rancho La Brea Oil Company, George Allen Hancock, feared that the collections would be scattered and taken from the community. In 1913, he gave exclusive rights to the NHM to excavate for two years. The largest and best-documented collections (approximately one million specimens) at that time were made by the NHM between 1913 and 1915. Hancock then donated the 23 acres of his property that appeared to contain the richest concentration of fossil deposits to the County of Los Angeles for a park, with the stipulation that the scientific features of the park be preserved and properly exhibited.

During the 55 years following the excavations by the NHM, paleontological excavation and data-gathering techniques had changed and improved, and paleontologists were able to extract additional knowledge from data and specimens neither noted nor collected by early excavators (Akersten, *et al*., 1983). These early excavators concentrated their efforts on the remains of larger plants and animals, and on the quest for "perfectly preserved" items, and rarely noticed or collected those of smaller organisms. In addition, important information pertaining to geology and taphonomy was not recorded (Shaw and Quinn, 1986). Reopened in 1969 to rectify these collecting biases, "Pit 91" was a major fossil-bearing asphalt deposit that had been partially excavated to a depth of 10 feet in 1915. New excavation techniques were developed in concurrence with established paleontological and archaeological methods to sample and record biologic and geologic data in a methodical manner in the renewed excavation (Shaw, 1982). The methodology has evolved and been refined over the past 38 years of excavation activity, and has created many avenues for research unavailable previous to the reopening of Pit 91 (*e.g.*, Lamb, 1989; Swift, 1989; LaDuke, 1991; Spencer, *et al*., 2003). The discovery of 23 major fossil deposits plus a mostly complete mammoth skeleton by APRMI during excavation for the LACMA subterranean parking structure under the Resnick Pavilion (for the LACMA Transformation Project) in 2006-2007 prompted "Project 23," which will be discussed in the next section.

Table 2. Timeline of La Brea Tar Pit Excavations

Date	Event
1769	First historic/recorded mention of Rancho La Brea (Heric, 1969)
1870-1890	Asphalt mining by the Hancock family, encountered fossils (Jefferson, 2001)
1875	First publication on fossil remains (Denton, 1875)
1901-1905	Recognition and fossil collecting by geologist William Orcutt and colleagues (Stock, 1930)
1905-1913	Fossil collecting by many institutions foreign and domestic including Occidental College, a Swedish natural history museum, and many amateur collectors (Page Museum archives)
1907-	Fossil collecting by J. Z. Gilbert for the Southern California Academy of Sciences (Gilbert, 1910)
1910-	Fossil collecting by J. Z. Gilbert for Los Angeles High School (Stock and Harris, 1992)
1909-1911	Exclusive right to excavate granted to the University of California, Berkeley (Mark, 2005)
1909-1911	Exclusive right to excavate granted to the University of California, Berkeley (Mark, 2005)
1911-13	Organized excavations and collecting by the University of California, Berkeley yielding tens of thousands of specimens (Stoner, 1913, Shaw, 2007)
1913	Exclusive rights to excavate granted to the Los Angeles Museum of History, Science and Art (NHM)
1913-1915	Organized excavation and collecting by the NHM yielding about one million specimens (Shaw 2007)
1915	Hancock Park (23 acres containing the richest fossil bearing surface asphalt deposits) donated to Los Angeles County, accepted by Los Angeles County in 1921 and put under jurisdiction of the LACM/NHM (Page Museum archives)
1929-1930	Organized excavation by Wesley Bliss to sample for small animal remains (Akersten *et al*., 1979)
1945	Series of borings to isolate subsurface fossil deposits (Page Museum archives)
1969-2007	Excavation and collecting from Pit 91, estimated to yield >2 million specimens (Romig, 1984)
2006-2007	Recovery (salvage), excavation and collecting of 16 deposits from the LACMA Transformation Project (APRMI)/Project 23, estimated to yield from one to three million specimens

Natural History Museum of Los Angeles County Records Search Methods and Results

On June 14, 2013, Robin Turner initiated a paleontological resources records search of the Project area from the NHM database. APRMI received the results on July 8, 2013. The NHM is the principal repository of paleontological data corresponding to Los Angeles County and therefore, maintains some data associated with the paleontological resources of Hancock Park. The NHM and the Page Museum are the sole repositories for paleontological specimens recovered from Hancock Park, and their associated data. Therefore, an online search or records search of other paleontological databases would not be appropriate for the present study.

Samuel A. McLeod, Ph.D., conducted a thorough vertebrate paleontology records search at NHM for locality and specimen data for the Project. The results of the records search are as follows (McLeod 2013, Appendix A):

> Surface sediments in the entire proposed project area consist of older Quaternary Alluvium, derived as alluvial fan deposits from the Santa Monica Mountains to

the north. These deposits usually do not contain significant vertebrate fossils in the uppermost layers, but at even shallow depth they may well contain significant vertebrate fossil remains. In addition, the proposed project area lies within an area of oil seepage that produced the adjacent renowned Rancho La Brea asphalt deposits. These asphaltic deposits can occur at, or very near, the surface and may contain a dense accumulation of vertebrate fossils. One vertebrate fossil locality, LACM 6345, may overlap the proposed Project area or be directly adjacent to it. Locality LACM 6345 is described as located at the May Company annex between Orange Grove Avenue and Ogden Drive and between Wilshire Boulevard and the [previous] May Company parking structure. In loose fill, locality LACM 6345 produced fossil specimens of undetermined bird, Aves, and horse, *Equus cf. E. occidentalis*. Immediately east of the proposed Project area, within Hancock Park bounded by Wilshire Boulevard, Ogden Drive, 6th Street, and Curson Avenue, a great number of vertebrate fossil localities from the world famous Rancho La Brea asphalt deposits, including LACM 1933, LACM 6909, and LACM 7297-7298 have been extracted. These deposits are perhaps the densest accumulation of vertebrate fossils in the world, and are unique . . . [because of] their occurrence in a major urban area and [their] still being productive after more than 100 years of excavation. In fact, one localized deposit designated as Pit 91 (locality LACM 6909) is still being actively excavated.

Asphaltic accumulations of fossils within the Hancock Park area are not uniformly distributed, but are rather localized. Over 100 separate fossil sites, called pits in this area, are documented. The pits were excavated based on the surface occurrence of asphaltic materials, but these deposits may also occur at depth with no indication at the surface of their presence. During excavations for the George C. Page Museum of La Brea Discoveries within Hancock Park in 1977, a large fossiliferous asphalt deposit was discovered: . . . localities LACM 7297-7298. From this deposit crews salvaged 33 plaster jackets of fossiliferous asphaltic matrix, each at least 2 cubic meters in size, including one of the rare articulated skeletons represented in the Rancho La Brea deposits. The Rancho La Brea asphalt deposits are also unusual in preserving a substantial portion of the total biota, including an extensive list of fossil plants, insects, and invertebrates in addition to the justly renowned vertebrate fauna (see vertebrate faunal list in the appendix [see Appendix A]). Over 200 species of fossil vertebrates are represented in these deposits, including extinct forms of bison, camel, horse, mammoth, mastodon, ground sloths, dire wolf, lion, condor, eagle, turkey, etc. One of the earliest human skeletal remains has also been recovered from these deposits. Numerous holotypes (name-bearing specimens for species new to science) have come from the Rancho La Brea deposits, including the holotype of the sabre-toothed tiger [cat], *Smilodon californicus* (= *Smilodon fatalis*), designated as the California state fossil. The Rancho La Brea paleobiota documents climatic change in the Los Angeles Basin during the latest Pleistocene and earliest Holocene, including the last “ice age.” It is so significant that this deposit served as the basis for designating the late Pleistocene as the North American Land Mammal Age called the Rancholabrean.

In addition to the extensive fossil vertebrate collections amassed from within Hancock Park, excavations in various areas surrounding the park have also uncovered fossil vertebrate remains, many from asphaltic sands and sometimes in dense accumulations. Our closest vertebrate fossil localities immediately outside of Hancock Park are LACM 1724, 4204, 4590, 5481, and 7247, which have all produced specimens similar to those from the Hancock Park localities. Whether the asphaltic matrix producing most of the vertebrate fossils from these localities occurs in the proposed project area is undetermined, but likely. Even surface grading or very shallow excavations in the proposed project area may well uncover significant fossil vertebrate remains. Deeper excavations at the proposed project site area also may well uncover significant vertebrate fossils in older Quaternary sediments, similar to specimens from the Rancho La Brea asphalt deposits to the east. Any substantial excavations in the proposed project area, therefore, should be closely monitored to quickly and professionally collect any specimens without impeding development. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Page Museum Data Search

On July 19, 2013, Ms. Turner and Ms. Akyüz met with several staff members of the Page Museum—Dr. John Harris, Chief Curator; Aisling Farrell, Collections Manager; Gary Takeuchi, Curatorial Assistant; and Shelley Cox, Laboratory and Volunteer Supervisor—in order to gather data about the paleontological sensitivity of the Project Site. The Page Museum staff stated unanimously that the Project Site's proximity to the Rancho La Brea Site and the recent discoveries at Project 23, just east of the Project Site, make it highly sensitive for the discovery of significant fossil remains, even at shallow depths. On June 25, 2013, APRMI received this statement written by Dr. John Harris (2013a):

> The La Brea Tar Pits are world-renowned for the abundance and diversity of the fossils that were trapped and fortuitously preserved in natural asphalt seeps emanating from the Salt Lake Oilfield. For tens of thousands of years, oil and natural asphalt have been extruded through cracks and fissures in the ground overlying the oil field. Shallow surface seeps trapped unwary animals and also the predators and scavengers attempting to exploit their carcasses. The process has resulted in one of the richest fossil assemblages yet known of Late Pleistocene time. The Page Museum's collections hold over three million fossils representing more than six hundred species of animals and plants ranging in size from millipedes to mammoths and from tiny seeds to entire tree trunks. The fossils also include one of the oldest human skeletons yet found in North America. The importance of this unique fossil locality resulted in its being designated a State Historic Landmark and a National Natural Landmark.

> Our understanding of the mechanisms by which these incredibly rich fossil assemblages were formed indicates that fossiliferous vents and seeps may occur at any terrestrial location that is underlain by an oil field. The Salt Lake Oilfield is a good example of this. Although the tar pit fossils were originally discovered in and below asphaltic seeps at ground surface, the processes of seepage, entrapment, and fossilization have taken place over many thousands of years during the emplacement and build-up of the coastal plain. As a result, unknown numbers of additional asphaltic fossil deposits lie hidden beneath the surface layers of alluvial sediment, as witnessed by the 16 new fossil deposits uncovered between depths of 10 and 25 feet during construction of the LACMA underground parking lot in 2006. Any construction taking place within a one thousand foot radius of the County's Hancock Park must therefore be prepared to mitigate the paleontological, archaeological, and historic material that may be encountered at depths up to 50 feet below the current ground surface. Such mitigation entails recovery and detailed documentation of any specimens and/or artifacts and should also include funding to support their preparation, curation, and storage in an appropriate permanent repository duly accredited by the American Association of Museums.

Dr. Harris (2013b) also wrote to the City and conveyed the paleontological sensitivity of the Project Site (Appendix B) and introduced the above quote with the following statement: "In addition to potential traffic, noise, view-shed, and light and shadow issues that we assume are going to be included in the scope of any environmental review, I would like to address the need for the scope to include consideration of the impact of the proposed project on paleontological resources."

Literature Review

APRMI referred to several previous local paleontological studies for their determinations of paleontological sensitivity and impacts to paleontological resources. Ms. Akyüz completed a records search of local EIRs and EISs at the Fairfax Branch of the City of Los Angeles Public Library system on July 9, 2013.

Local EIRs on file at the Fairfax Branch of the City of Los Angeles Public Library

Ten local EIRs were on file at the Fairfax Branch. Their findings of paleontological sensitivity and mitigation measures are found in Table 3. Additionally, particularly relevant projects are described after the table. One of the EIRs was conducted for the Metro's Westside Subway Extension. The Metro Project is very close to the current Project Site and its findings are directly relevant to the present Project. Therefore it is presented under a separate heading after the table.

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
1	Wilshire and LA Brea Project* (Draft and Final)	SCH 2007071053	Impact Sciences, 2008	Block bounded by Wilshire Blvd. and 8th St/La Brea Ave. and Sycamore Ave./ mixed-use development consisting of 562 residential units and approximately 45,000 square feet of ground-floor retail-commercial and restaurant uses. Excavation for subterranean parking to 60 feet.	1500 m east	“No unique paleontological resources or unique geologic features are known to occur on the project site; although, paleontological resources do exist throughout the City of Los Angeles. Excavation for the foundations and subterranean parking levels associated with the proposed project would cause new subsurface disturbance on the project site. As the project site has been subject to past subsurface disturbance associated with grading and foundations, it is unlikely that undisturbed paleontological resources or unique geologic features exist in the upper levels of subsurface soil. Soils underneath the project site consist of silty clay	“MM-CR-3: If paleontological resources are uncovered during excavation of the project site, the City of Los Angeles Department of Building and Safety must be notified immediately and work must stop within 100 feet of the find to allow a qualified paleontologist to appropriately remove the find.”

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
						with various amounts of silt. This soil type is not typically known to yield paleontological resources. However, unanticipated discovery of unique paleontological resources is possible. In the event of an unexpected disturbance, significant impacts to paleontological resources remains could occur. However, implementation of the recommended mitigation measure would reduce these impacts to a less than significant level."	
2	Metro Westside Subway Extension* (Final EIS/EIR)	SCH 2009031083	U.S. Department of Transportation Federal Transit Authority and Los Angeles County Metropolitan Transit Authority, 2012a, 2012b	Portion pertinent to current Project is the station along Wilshire Blvd. at Fairfax Ave. and within 2 miles of the station in any direction (2 mile radius/4-mile diameter)/subway line 50 to 70 feet beneath the ground surface	Adjacent, south	Area highly sensitive for the discovery of Rancholabrean NALMA fossils	Full-time paleontological resources monitoring and fossil recovery per Memorandum of Understanding (explained after table)

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
3	Wilshire Community Plan Area: The Wetherly Project*: Draft and Final	SCH 2007091074	Christopher A. Joseph and Associates, 2008a	Between Wetherly Drive and Almont Drive, north of Burton Way/Demolition of 84 existing apartment and condo units in 7 buildings and construct 132 condominium units in one 16-story, 208-foot tall building and 8 townhouse units in a 3-story building; subterranean lot.	2700 m northwest	No known paleontological resources at the project site; levels that would be excavated thought to be previously disturbed; probability of encountering paleontological resources considered unlikely but possible. No paleontological study done; referral to City's 1992 Vertebrate Paleontological Resources report only.	If paleontological materials encountered during project development, excavation is to be halted and the services of a paleontologist should be "secured by contacting Center for Public Paleontology – USC, UCLA, Cal State Los Angeles, Cal State Long Beach, of the Los Angeles County Natural History Museum to assess the resources and evaluate the impact. Copies of the paleontological survey, study or report shall be submitted to the Los Angeles County Natural History Museum. A covenant and agreement shall be recorded prior to obtaining a grading permit."

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
4	Wilshire Community Plan Area: Wilshire Crescent Heights*: Draft and Final	ENV -2008-0729-EIR	Christopher A. Joseph and Associates, 2008b	Along east side of Crescent Heights Blvd. between Orange Ave. and Wilshire Blvd. /demolition of bank and surface parking lot and construction of 21-story mixed-use commercial and residential tower and 4 townhouses, 2.5 stories of subterranean parking	300 m west	Records search conducted by NHM indicated that paleontological resources were likely below the surface: high potential for the encounter of significant	If paleontological materials encountered during project development, excavation is to be halted and the services of a paleontologist should be "secured by contacting Center for Public Paleontology – USC, UCLA, Cal State Los Angeles, Cal State Long Beach, of the Los Angeles County Natural History Museum to assess the resources and evaluate the impact. Copies of the paleontological survey, study or report shall be submitted to the Los Angeles County Natural History Museum."
5	Archstone Hollywood Mixed-Use Project*	ENV 2007-3810-EIR/SCH 2007101024	City of Los Angeles, 2008a	Area bounded by Santa Monica Blvd. and Lexington Ave./Mansfield Avenue and Orange Drive: 6911 and 6931 Santa Monica Boulevard, 1125 and 1155 Mansfield Avenue, 1120, 1130 and 1150 Orange Drive, Los	3.4 km north-northeast; however, quaternary soils below surface soils likely the same	"Grading or shallow excavations in the uppermost layers of soil and younger Quaternary deposits in the project area are unlikely to discover significant vertebrate fossils. Deeper	**IV.C-6** A qualified paleontologic monitor shall monitor excavation in areas identified as likely to contain paleontological resources (a qualified paleontologic monitor

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

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				Angeles/development of 348 apartment units, 40,654 square feet of office uses and 15,101 square feet of ground floor retail/restaurant space. Parking to be provided in one to 1.5 subterranean levels parking, and one level covered at grade.	deposits as the current Project area	excavations, however, may encounter significant remains of fossil vertebrates. Deeper excavated areas are defined as all areas within the Archstone Hollywood project area where planned excavation will exceed depths of 5 feet. In the instance of this project, up to one and one-half levels of subterranean parking levels will have a maximum depth of 20 feet. Thus, the paleontological sensitivity of the project site is considered to be high. The potential destruction of any unique fossil resources on the proposed project site would result in a significant impact under CEQA. Therefore, mitigation measures shall be implemented to ensure that potential impacts to any unique	has a Bachelor's degree in geology and is supervised by a member of the Society of Vertebrate Paleontology). These areas are defined as all areas within the Archstone Hollywood Mixed-Use project area where planned excavation will exceed depths of 5 feet. The qualified paleontologic monitor shall retain the option to reduce monitoring if, in their professional opinion, sediments being monitored are previously disturbed. Monitoring may also be reduced if the potentially fossiliferous units, previously described, are not found to be present or, if present, are determined by qualified paleontologic personnel to have low potential to contain fossil resources.

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
						paleontological resources that may be present will be reduced to a less than significant level."	**IV.C-7** The qualified monitor shall be equipped to salvage fossils and samples of sediments as they are unearthed to avoid construction delays, and shall be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens. **IV.C-8** Recovered specimens shall be prepared to a point of identification and permanent preservation, including washing of sediments to recover small invertebrates and vertebrates. **IV.C-9** Specimens shall be curated into a professional, accredited museum repository with permanent retrievable storage. **IV.C-10** A report of findings, with an appended itemized

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
							inventory of specimens, shall be prepared. The report and inventory, when submitted to the County, will signify completion of the program to mitigate impacts to paleontological resources. The paleontological sensitivity of the area including the project site is considered to be of high potential."
6	Cedars-Sinai Medical Center – West Tower Project Draft EIR and Final Supplemental EIR (Final SEIR)**	ENV 2008-0620-EIR/SCH 2008031040	City of Los Angeles, 2008b, 2009	Northwest corner of Gracie Allen Drive and George Burns Road/development of a new inpatient/medical support facility. The "West Tower" would occupy 200,000 square feet of floor area and be11 stories/185 feet high with an attached seven-level parking structure (three subterranean levels, one level at grade and three levels above grade)	2400 m northwest	No impacts determined	None provided

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

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7	(Survey report, not an EIR) Historical and Cultural Resources Survey, Miracle Mile Area, Part II: Apartment District, Part IV: Potential Individual Monuments	NA	Johnson Heumann Research Associates, 1988	Miracle Mile North (bounded by Beverly Blvd. and 3rd St./lots west of Gardner Ave. and alley between Detroit St. and La Brea Ave.); Miracle Mile South (bounded by Park La Brea/Hauser Ave., 3rd St., north of lots north of Wilshire Blvd., alley between Detroit St. and La Brea Ave.)/historical resources survey for future Historic Preservation Overlay Zone (HPOZ)	840 m east	Not evaluated/NA to project	N/A
8	(Historic resources report, not an EIR) Miracle Mile North HPOZ (Preservation Plan)*	NA	City of Los Angeles, 2010	Miracle Mile North (bounded by Beverly Blvd. and 3rd St./lots west of Gardner Ave. and alley between Detroit St. and La Brea Ave.) Preservation Plan/ HPOZ Built Environment	840 m east	Not evaluated/NA to project, but historic background of the Tar Pits was incorporated into the geologic background section of the present report.	N/A
9	Beverly & Fairfax Mixed-Use Project (Fairfax Theater) Draft and Final**	ENV-2009-2656-EIR/SCH 2010011044	Christopher A. Joseph and Associates, 2010, 2011	Foot print of Art Deco building at corner Fairfax Ave and Beverly Blvd/removal of the Beverly-Fairfax building (with the exception of the street-facing elevations). The Project Site would be developed with a six-story mixed-use building, containing 71 residential condominium units over 3 commercial condominium units (approximately 11,454	1300 m north	"The Project Site is underlain by Quaternary alluvium deposits. No paleontological resources are known to occur at the Project Site. However, significant paleontological resources have been found in the Project area, including one site to the east of the	"If any paleontological materials are encountered during the course of the Project development, the Project shall be halted. The services of a paleontologist shall be secured by contacting the Center City of Los Angeles April 2012

Table 3. EIRs/EISs on file at the Fairfax Branch of the City of Los Angeles Public Library

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				square feet of commercial/retail land uses, which could include a maximum of 5,000 square feet of restaurant use). The residential condominium units would include: 4 single, 42 1-bedroom, 4 1-bedroom-plus-study, and 21 2-bedroom units. Four levels of subterranean parking are proposed, providing 224 parking spaces.		Project Site, one site to the west, and the La Brea Tar Pits located approximately one mile to the southeast. Thus it is possible that unknown resources could be encountered during construction of the proposed Project. However, the Project Applicant would be required to implement the City's Standard Mitigation Measure listed below related to paleontological resources that would ensure no significant impacts would occur."	Beverly & Fairfax Mixed Use Project IV. Mitigation Monitoring and Reporting Plan Final Environmental Impact Report Page IV-3 for Public Paleontology – University of Southern California (USC), UCLA, Cal State Los Angeles, Cal State Long Beach, or the Los Angeles County Natural History Museum to assess the resources and evaluate the impact. Copies of the paleontological survey, study or report shall be submitted to the Los Angeles County Natural History Museum. A covenant and agreement shall be recorded prior to obtaining a grading permit."
10	La Cienega Eldercare Facility Project Draft and Final	ENV-2008-1994-EIR	Christopher A. Joseph and Associates, 2008c	1022 to 1054 South La Cienega Boulevard, Los Angeles/ construction of a four- to five-story,		"According to the Paleontology Records Check, surficial sediments in the	"Mitigation Measure CULT-3 Paleontological Resources

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Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
	EIR*			approximately 150,500 square-foot Eldercare Facility (Facility) over two levels of subterranean parking.		entire proposed Project area consist of younger Quaternary Alluvium deposits derived from the Santa Monica Mountains immediately to the north. These deposits usually do not contain significant vertebrate fossils, at least in the uppermost layers, but they are underlain by older Quaternary deposits at varying but relatively shallow depths that do contain significant vertebrate fossils. Vertebrate fossils found near the Project Site include the following: • A fossil specimen of mammoth (*Mammuthus*) was found approximately 13 feet below the surface east of the Project Site near the Olympic Boulevard/Alvira Street intersection • Fossil specimens	A qualified paleontologist, as determined by the Planning Department of the City of Los Angeles, shall monitor future ground-disturbing activities in native soil. In the event that paleontologic resources are discovered during grading and/or excavation, the monitor shall be empowered to temporarily halt or divert construction in the immediate vicinity of the discovery while it is evaluated for significance. Construction activities could continue in other areas. If any find were determined to be significant by the paleontologist, they shall be subject to scientific analysis, professional museum curation, and a report prepared according to current professional

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						of bison (*Bison*) and horse (*Equus*) were found at a depth approximately 16 feet below street level northeast of the Project area north of Olympic Boulevard and east of Schumacher Drive. • Fossil Specimens of ground sloth (*Zenarthra*), mammoth (*Mammuthus*), and bison (*Bison*) were found at approximately ten feet below the surface north of the Project area along Wilshire Boulevard, between La Cienega Boulevard and Sweetzer Avenue. • A variety of vertebrate fossils from the Rancho La Brea asphalt	standards."

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Reference No. for the Present Report	EIR Title	State Clearinghouse (SCH) and/or Case (ENV/EIR) Number	Author and Year	Location/Description	Distance and Direction from Current Project	Impacts to Paleontological Resources Predicted	Mitigation Measure Recommended
						deposits and environs further east of the Project area have been found within a few feet of the surface.	
	*Copy of EIR can be found online in its entirety; some portions not on file at the Fairfax Branch of the City of Los Angeles Library system						
	**Portions of EIR can be found online; some portions may not be on file at the Fairfax Branch of the City of Los Angeles Library system						

Of the ten reports on file, two (Numbers 7 and 8) did not involve excavation and thus did not address paleontological resources. Of the other eight, the sediments underlying four project footprints were found to have a high potential for containing paleontological resources and required full-time paleontological monitoring by a qualified paleontologist. One of these projects was the Metro Westside Subway Extension, which is just south of the Project Site and whose EIR/EIS contains very specific paleontological resources mitigation measures that are relevant and applicable to the current Project. The Metro Westside Subway Extension project is presented in this report after the LACMA Transformation Project/Project 23 because the LACMA Transformation Project/Project 23 provided the background for the Metro project. The LACMA Transformation Project did not have a corresponding EIR on file at the Fairfax Branch but is discussed here as a relevant local project. Project 23 is an ongoing paleontological excavation and analysis that is currently analyzing paleontological resources recovered during paleontological resources monitoring of the LACMA Transformation Project.

LACMA Transformation Project/Project 23

In 2006 and 2007, mechanical excavations for the subterranean parking under Resnick Pavilion (a project that began in 2005), approximately 30 m east of the current Project Site, unearthed countless fossil specimens. APRMI performed the archaeological resources and paleontological resources monitoring services for the construction excavation of the parking structure. APRMI recovered 23 trapezoidal/prismatic “landscape/tree boxes” of known intact and in context fossil deposits that contained an array of Pleistocene fossil remains from large terrestrial mammals to microfossils (Turner 2006). The base dimension of these boxes ranged from 5 feet by 5 feet to 12 feet by 16 feet, with the height of the boxes ranging from 2.5 feet to 12 feet. The total cubic volume collected in the boxes was 383 cubic meters, at a weight of 257,414 kg (Turner and Shaw 2008). These boxes were designed by Robin Turner for the efficient removal of entire fossil deposits as to not stop the construction work while keeping each deposit in context and integrity. Page Museum paleontologists are currently removing the fossil remains from the matrix in order to analyze, identify, catalog, and curate the newly discovered specimens for future scientific study and analysis. The fossil remains not found in entire deposits, such as individual animals, were jacketed for preservation, or smaller specimens were collected in 5-gallon buckets with their matrix intact. Specimens that were salvaged individually included a discrete Columbian mammoth, found in a location separate from the other deposits. Currently, several of the 23 crates/tree boxes are being excavated by the staff at the Page Museum. Pleistocene-age specimens recovered from the subterranean parking area at time of recovery had been identified as bison, dire wolf, mammoth, sloth, lynx, saber-toothed cat, horse, bird, turtle, trees, and plants (Turner and Shaw 2008). Current specimen counts and type counts are high. Figure 5 depicts the current Project Site location in relationship to the 2006-2007 findings.

Confidential Figure Removed

Figure 5. Results map from LACMA Transformation paleontological monitoring that yielded fossils of “Project 23” (Quinn 2006).

Metro Westside Subway Extension Final Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) and Memorandum of Understanding (MOU) for Paleontological Resources

The EIS/EIR and MOU for the Metro Westside Extension Project (the Purple Line) contains several stipulations for excavation within the vicinity of the Project area, specifically the Wilshire/Fairfax station and within two miles of it (U.S. Department of Transportation Federal Transit Authority [U.S. DOT FTA] and Metro 2012a). The EIS/EIR (U.S. DOT-FTA and Metro 2012b: Figures 4-39 and 4-40) found the Area of Potential Effect for the Wilshire/Fairfax station, which is just south of the current Project Site, to be underlain by *Qof*, older alluvial fan deposits. These deposits were found to be underlain by the Pleistocene-age Lakewood Formation, which in turn is underlain by the Pleistocene-age San Pedro Formation. The EIS/EIR (U.S. DOT-FTA and Metro 2012a: 4-301) emphasized the oil seeps of the vicinity, including the Rancho La Brea Tar Pits. The document stated that terrestrial fossils—from 11,000 to 50,000 years old (found in older alluvial fan deposits or trapped in asphaltic deposits)—and underlying marine fossils from 50,000 to 10 million years ago were highly likely to be encountered during subsurface excavations at the Wilshire/La Brea and Wilshire/Fairfax Stations. Excavations in other areas of the Westside Subway Extension were predicted to have the potential to encounter terrestrial fossils—from 11,000 to 50,000 years old (found in older alluvial fan deposits)—and underlying marine fossils from 50,000 to 10 million years ago were possible.

The MOU included the following provisions for the mitigation of adverse impacts to paleontological resources caused by The Project ground disturbance at the Wilshire/Fairfax station and within two miles of it:

1. The retention of a qualified paleontologist, approved by the Page Museum, to plan, implement, and supervise paleontological monitoring, preservation, fossil recovery, fossil preparation, fossil documentation and reporting of significant paleontological resources within paleontologically sensitive areas, which in the case of the present Project, is the entire Project excavation. Per Metro (U.S. DOT-FTA and Metro 2012b), a qualified paleontologist has a minimum of graduate degree, 10 years of experience as a principal paleontologist, and demonstrated expertise in vertebrate paleontology. Per SVP (SVP 2010), a qualified paleontologist has a graduate degree in paleontology or geology, and/or a publication record in peer-reviewed journals; demonstrated competence in field techniques, preparation, identification, curation, and reporting in the state or geologic province in which the project occurs; minimum two full years professional experience as assistant to a Project Paleontologist with administration and project management experience supported by a list of projects and referral contacts; proficiency in recognizing fossils in the field and determining their significance; and expertise in local geology, stratigraphy, and biostratigraphy; experience collecting vertebrate fossils in the field. The present study defers to SVP guidelines for the definition of a qualified paleontologist and to the Page Museum for approval of said qualified paleontologist.

2. The preparation of a PRMMP, subject to approval by the Page Museum and the Museum, to address the monitoring, recovery, preservation, and reporting of any paleontological resources.

3. The monitoring of all ground-disturbing activities by the principal paleontologist.

4. The temporary halting of all construction activities in an area of identified paleontological resources if paleontological resources are identified by the principal

paleontologist during ground disturbance.

5. The recovery of any paleontological resources, including asphaltic deposits containing fossils, will be recovered in accordance to the best practices outlined by the Page Museum (see below).

6. Sufficient designated and secure space for the storage, analysis, processing, and preparation of fossils and fossil deposits.

7. The recordation of all data and the excavation of boxed deposits and individual fossils, preparation of fossils, according to the best practices outlined by the Page Museum, by the principal paleontologist.

8. Periodic progress reports and all field notes provided to the Metro and the Page Museum by the principal paleontologist.

9. Funding for required fossil recovery, cleaning, preservation, identification, analysis, curation, and storage by the principal paleontologist and any other fossil-related activities performed by Page Museum staff (these may include fossil recovery, cleaning, preservation, identification, analysis, curation, and storage, also). A detailed cost agreement among the Metro, the Page Museum, and the firm associated with the principal paleontologist will be based on the estimated present costs of processing and storage of Project 23 materials. This agreement should include contribution to the cost of permanent storage facilities if significant quantities of fossils are recovered.

10. Page Museum oversight of all field and laboratory work.

11. The expeditious removal of paleontological resources, as monitored by principal paleontologist, to allow Project completion according to schedule but allowing complete resource recovery in compliance with Page Museum standards, as demonstrated with Project 23.

12. Responsibility for compliance with all archaeological mitigation measures, including all legal and regulatory provisions for reporting, preservation in place, and repatriation of Native American human remains and associated materials. The principal paleontologist shall not serve as the archaeologist, but shall comply with all archaeological mitigation measures and also, all protocols appropriate for the treatment of Native American human remains and associated materials.

13. Designation of the Page Museum as the sole source for the scientific description of fossils recovered from the Project.

14. Availability of Page Museum personnel to provide oversight for the principal paleontologist's PRMMP and to oversee all field and laboratory work.

15. Option for Page Museum to house boxed fossil deposits and to perform excavation and preparation "internally" for compensation comparable to that offered to the principal paleontologist/firm for similar services.

16. Page Museum provision of curation and management of the fossils recovered during Project excavation/ground disturbance in a secure and climate-controlled environment.

17. Donation of all paleontological resources to the Page Museum.

The Page Museum's "Attachment 1" to Appendix G (the MOU) of the EIS/EIR included is entitled *Paleontological methods for mitigation of fossils in the vicinity of Hancock Park*. Its contents are outlined below. The Page Museum's "Attachment 2" to Appendix G of the EIS/EIR included is entitled *Techniques for excavation, preparation and curation of fossils from the Project 23 salvage at Rancho La Brea: A Manual for the Research and Collections Staff of the George C. Page Museum.* Its contents are outlined after Attachment 1 below. The MOU also included a handbook for excavation contractors entitled *Wilshire/Fairfax Station Construction. Paleontological Resources Extraction* (Metro 2011). It provides contractor excavation support techniques for fossil recovery.

Paleontological Methods for Mitigation of Fossils in the Vicinity of Hancock Park (Page Museum 2011a/Appendix C)

Asphaltic fossil deposits take the form of inverted cone-shaped accumulations with a volume ranging from less than five cubic feet to more than twenty cubic feet. In areas where fossil deposits are likely to occur (asphaltic sands), sediment should be removed four to six inches at a time so that no fossils are inadvertently removed by the excavator bucket before they can be noticed. If a fossil or fossil deposit is uncovered, the paleontological monitor can halt excavation in the area and redirect construction activity to another, non-fossiliferous area.

While uncovered fossil deposits should be meticulously excavated in situ, if necessary, they can be removed intact and excavated later (see below). By removing the deposits intact, their stratigraphy is maintained, and the fossils can still be properly excavated while attaining as much information about the fossils, their position, and their environment as possible. The original conditions/positions at the time of discovery of the fossil deposits can be recreated if standard field collection techniques are used, which include determining a deposit's location and size accurately and precisely using GPS, mapping to scale and photographing the deposit, accurately recording the surrounding geology (i.e., formation, lithology, color using Munsell Soil Color Chart, and depositional environment), and documenting its removal (see Page Museum [2011a]/Appendix C for detailed recordation techniques).

When a fossil deposit is discovered, it must be given a field number and cordoned off so that no further excavation occurs in the area unless directed by a qualified paleontologist. Once the extent of the fossil deposit is determined, the surrounding sediment should be removed by hand or carefully by a small excavator, which must be directed and monitored constantly, in order to isolate or "pedestal" the deposit. The deposit should then be bound by metal bands in order to keep it together, and covered by a tarp or other form of strong plastic to keep it separated from the dirt that will surround it in the box. Using tree-boxing methods developed by APRMI for the LACMA Transformation Project/Project 23, a box should be constructed on-site around the fossil deposit to its specific size specifications and any empty spaces should be filled with polyurethane foam or soil/gravel that is distinctly different from the sediment/matrix of the deposit in order to maintain its integrity and avert deformation. The sides of the box should be nailed into place while metal bands are attached to the outside in order to secure the sides of the box. The sediment underneath the deposit should then be removed via tunneling and the box bottom is constructed and attached. Once the box is complete but before its removal, permanent marker or paint should be used to record on the outside of the box the deposit's field number and locality data, which includes orientation and depth below datum of the top and bottom of the deposit. The finished boxes should be removed using a crane, loaded onto a flatbed truck, and moved to a location where they can be stored properly and excavated.

Isolated fossils may also be uncovered in both asphaltic and non-asphaltic sediments. The same procedures used for recording and cordoning off deposits should be used for non-asphaltic sediments, including GPS positioning, mapping, and geologic recordation. However, instead of removing the fossil and its surrounding matrix intact via boxing, they should be excavated in situ using conventional paleontological field techniques. If the fossil is large and/or friable, it should be encased in a plaster jacket prior to removal with the field number, locality data, and orientation written on the jacket.

<u>Techniques for excavation, preparation and curation of fossils from the Project 23 salvage at Rancho La Brea: A Manual for the Research and Collections Staff of the George C. Page Museum (Appendix D)</u>

Each box/fossil deposit recovered from a project should be handled differently, based on the type of deposit, size of the box, and integrity of the sediments/matrix. A number of steps need to be taken prior to excavation. The first involves examining the field notes and documenting the nature of the box or deposit. If the box is taller than five feet, scaffolding must be erected in order for excavators to safely access the box. A safety railing extending upward from the sides of box may also be necessary to construct. The next step is to remove the metal bands from the top of box as well as the surrounding fill dirt, foam, and plastic. An electronic monitor should also be set up that documents the levels of dangerous gases such as carbon monoxide, hydrogen sulfide, and combustible gases.

The first step of excavation is to determine the original north side of the box using the field notes (and markings on the box) and setting up an excavation grid based on the deposit's original orientation. A datum should be placed near the top of the box in the original southeast corner and 1m x 1m units should be laid out based on the datum. The units should be named alphanumerically based on their direction from the SE corner (letters for north-south, numbers for east-west). The deposit/box is to be mapped with its grid lines and a north arrow and then excavated in 25-cm levels from the surface (which should have a known elevation). All or some of the box walls may be removed in order to excavate from the side (easier with smaller deposits). Dental picks and small screwdrivers should be used to uncover and remove fossils, and all fossils larger than a particular size should be measured in situ (using the metric system) and recorded within its grid prior to removal. The surrounding matrix is to be collected and stored in metal buckets with lids based on sediment type (asphaltic sand, brown silt, clay) that are marked with the box number, grid number, and level data. Thorough daily notes of the excavation should be taken and include such information as the excavators, grids being excavated, type of matrix, fossils and their positions/orientations, geologic and paleobiological data, etc. (see Page Museum 2011b). Photographic documentation of deposit excavation should occur at regular intervals daily.

In situ measurements of each fossil/bone should be taken using specific anatomical markers in order for its original orientation to be recreated. The northing (north from south grid line), westing (west from east grid line), and depth of each marker or point on the bone will be recorded. Large bones (greater than 2 cm in size) will be given three points if possible, but if they lack three distinct reference points, they will be given two points. Smaller bones (between 1 cm and 2 cm in size) should be given one point, while those smaller than one centimeter will be placed in bulk matrix bags for the grid that are separate from the matrix buckets. See Page Museum (2011b) for further detail on excavating fossils and recording data, including procedures used for excavating articulated skeletons, poorly preserved fossils, and non-osteological specimens (i.e. plant, shell, insect). The Page Museum (2011b) also details the techniques used for mapping the floors (plans) and walls (profiles) of deposits, the collection of geologic/soil samples, proper photographic documentation, and data entry of field notes.

When the collected fossils reach the laboratory, they should be sorted and stored by locality (deposit number), grid, and depth and then categorized by their significance, whether they are from a rare taxon, they are part of a previously excavated specimen, they are from the same organism as a previously excavated specimen, or they are unidentifiable. They should then be separated according to the most appropriate cleaning method. The cleaning methods are ultrasonic, pre-soaking, and hand preparation and are described in Page Museum (2011b). Each cleaning technique involves using an n-propyl bromide solvent to remove the asphalt. After bones are dry from cleaning, they can be polished using small amounts of solvent and a soft cloth. If bones fall apart during processing or individual bone fragments can be ascertained as once being connected to other bone fragments and can be pieced together, they should be put together using white glue, which can be removed with warm water. Matrix (both bulk and surrounding) is processed by soaking it in the solvent or water and then sifting it through a mesh screen (see Page Museum 2011b for further details). When the matrix is dry, it can be sorted for microfossils, which are then identified and placed in vials. Finished fossils along with their associated, sorted specimens are placed in envelopes that are marked with all of the original data (including provenience). The fossil should then be identified to the most precise taxon and skeletal element possible by a qualified expert and its scientific identification is put on the envelope. The proper techniques for identification and recordation, including terminology (anatomical codes, abbreviations, dental formulae, etc.), are detailed in Page Museum (2011b). After identification, the fossil specimens are curated, which involves cataloguing, database entry, and storage in the Page Museum's collections based on taxonomy (see Page Museum 2011b for more detail).

Local Paleontological Studies

Several paleontological studies for various local development projects have been conducted, but their associated EIRs were not on file at the Fairfax Branch library. Local projects that were not on file at the Fairfax Branch library—but of which APRMI staff is aware—are summarized in Table 4. Studies that were conducted by APRMI, or for which reports are on file at APRMI, are summarized after the table.

In addition to the EIRs, Jefferson (2002:53-58) lists over 200 significant Rancholabrean species recovered from Hancock Park and locations within one mile of it.

Table 4. Sample of Local Paleontological Resources Studies

Project Name	Project Description	Year	Location	Distance/ Direction from Current Project	Mitigation Measure	Monitoring Results
The Grove at Farmers Market*	Construction of retail and parking; borings to 60 feet for parking structure; excavation in other areas to 30 feet	2001	East (adjacent to) of Farmers Market	1000 m north	Full-time archaeological/ paleontological resources monitoring	Pleistocene gopher and plants; blue-green sandy silt
Farmers Market Renovation (also known as The Grove at Farmers Market Phases 2 and 3**)	Construction of retail and parking; no subterranean parking; utility	2001-2004	Farmers Market	1000 m north	Full-time archaeological/ paleontological resources monitoring	Pleistocene macrofauna, including mammals (mammoth, horse), microfauna, and flora; streambed soils, some asphaltic deposit stringers
Park La Brea Community Center*	Construction of community center	2004	Center of Park La Brea	650 m northeast	Full-time paleontological resources monitoring	No fossils; caliche soils
Palazzo West/Palazzo at Park La Brea*	Construction of multiple-unit residential complex	1999-2003	South side of 3rd Street between Ogden Dr. and Curson Ave.	700 m north	Full-time paleontological resources monitoring	Pleistocene macrofauna (horse, mammoth, bison, sloth) and other vertebrates (frog, bird, rabbit, snake, skunk, and rodent including gopher, kangaroo rat, deer mouse, packrat, vole), microfauna (clam, snail), and flora including tree; streambed soils (sandstone, siltstone, claystone), some asphaltic deposit stringers
Palazzo East/Palazzo at Park La Brea*	Construction of multiple-unit residential complex	1999-2003	South side of 3rd Street between Hauser Blvd. and Alta Vista Blvd.	1100 m northeast	Full-time paleontological resources monitoring	Pleistocene macrofauna, (horse, sloth, camel, bison, and proboscid/ elephant), microfauna (ostracod), and flora; fluvial alluvium (sandstone, siltstone, claystone)
The Villas at Park La Brea*	Construction of multiple-unit residential complex	1999-2003	North side of 6th Street between Burnside Ave. and Alta Vista Blvd.	1100 m east-northeast	Full-time paleontological resources monitoring	No fossils observed; silty clay, caliche

Table 4. Sample of Local Paleontological Resources Studies

Project Name	Project Description	Year	Location	Distance/ Direction from Current Project	Mitigation Measure	Monitoring Results
Median Improvements, Wilshire Boulevard from Fairfax Avenue to La Brea Avenue*	Median improvements	1996	Wilshire Blvd. median from Fairfax Ave. to La Brea Ave.	80 m south	Full-time archaeological and paleontological resources monitoring	Excavation to 4 feet; cultural deposits less than 50 years old at the time, no paleontological deposits.
Hancock Park Renovation**	Various construction	1989-2003	Hancock Park	Adjacent, east and north	Full-time paleontological resources monitoring	Pleistocene macrofauna, including mammals (various), microfauna, and flora; streambed soils, asphaltic deposits
Hancock Park Replacement Pipeline Discharge System*	Tar seep discharge line installation	2012	West of/adjacent to tar pit in southeast corner of Hancock Park	245 m east	Full-time paleontological resources monitoring	As-yet-unidentified mid-size terrestrial mammal, large bird, small bird, microfossils. Asphaltic deposits.
Luxe at 375*	Apartment construction with subterranean parking	2012	Parcel bounded by La Cienega Blvd., Rosewood Ave., and Westmount Dr.	2200 m northwest	Paleontological resources discovered during excavation; subsequent paleontological resources monitoring and salvage	Various Pleistocene specimens; see below.
*On file at APRMI, described below if paleontological remains encountered						
**personal communication, Robin Turner, July 10, 2013						

The Grove at Farmers Market (Lander, 2002)

Paleo Environmental Associates, Inc. ("PEAI") conducted paleontologic resource monitoring and data recovery for the development of the Phase 1 (eastern) portion of The Grove at Farmers Market parcel located at 6301 3rd Street in the Park La Brea district of the City of Los Angeles. Beneath the surface of the parcel lies older alluvium that is known to contain abundant and significant terrestrial paleontological resources (fauna and flora) from the late Pleistocene as it is the same geologic formation present at the Tar Pits at Rancho La Brea (Hancock Park) 0.4 km south of the project. One fossil locality was uncovered based on sample processing of soil recovered from augering for a parking structure footing that occurred on March 30, 2001. LACMVP 7478 consists of a fossilized tooth fragment from *Thomomys bottae* (Botta's pocket gopher) from a depth of approximately 46 feet below surface grade (144 ft above mean see level ["amsl"]). The tooth was determined to be older than 33,510 years (late Pleistocene) due to the radiocarbon dating of charcoal remnants from the degraded wood of a tree in the adjacent Parcel A of Park La Brea (see below).

Park La Brea Parcels A, B, and C. (Palazzo West, Palazzo East, and the Villas; Lander 2003)

PEAI conducted paleontologic resource monitoring and data recovery for the development of Park La Brea Parcels A, B, and C. Parcel A became the Palazzo West, Parcel B became the Palazzo East, and Parcel C became the Villas. The Palazzo West at Park La Brea is located between West 3rd Street on the north, Ogden Drive on the west, Genesee Avenue and Burnside Circle on the east, and Colgate and

Blackburn Avenues on the south. The Palazzo East at Park La Brea is west of Cochran Avenue and is located between West 3rd Street on the north, Hauser Blvd on the west-southwest, and Drexel Avenue on the south. The Villas at Park La Brea is west of Cochran Avenue and south of Maryland Drive and West 4th Street and is bordered by West 6th Street on the south and Burnside Avenue on the southwest. The entire project was monitored from May 1999 to April 2003. The three Park La Brea parcels are underlain by older alluvium that is well-documented for containing significant Pleistocene fossil remains, in particular at Hancock Park/Rancho La Brea located 0.3 miles south of Parcel A.

Twenty-six fossil deposits were recovered during the project: 13 from Parcel A and 13 from Parcel B. Only abraded mammal bone fragments were recovered from Parcel C; ultimately these were not curated. The fossil deposits were found in streambed soils that included sandstone, siltstone, and claystone. The fossil localities in Parcel A (Palazzo West) range in elevation from 140-185 feet amsl. Vertebrate fossils recovered from Parcel A included:

Anura (order) – indeterminate frog
Aves (class) – indeterminate bird
Bison antiquus - bison
Dipodomys sp. – kangaroo rat
Equus occidentalis – western horse
Glossotherium (Paramylodon) harlani – Harlan's ground sloth
Mammuthus columbi – Columbian mammoth
Microtus californicus – California vole
Neotoma sp. – packrat
Peromyscus sp. – deer mouse
Silvilagus audubonii – cottontail rabbit
Spilogale sp. – spotted skunk
cf. Thamnophis sp. – garter snake
Thomomys sp. – gopher
Proboscidea (order) – indeterminate proboscid ("elephant")
Rodentia (order) – indeterminate rodent
Mammalia (class) – indeterminate large herbivore, large mammal, and small mammal

Invertebrate fossils in Parcel A included eight freshwater genera and species of clam (class Bivalvia) and snail (class Gastropoda) from one locality (LACMIP 17576). The invertebrate fossils recovered from Parcel B included:

Anodonta californiensis – California floater
Pisidium sp. – pea clam

Amnicola longinqua – dusty snail
Fluminicola sp. – pebble snail
Gyraulus parvus – ash gyro
Lymnaea palustris – lymnaea snail
Physa sp. – physa snail
Valvata humeralis – glossy valvata

This locality also contained charcoal that yielded a C14 date of 33,510 +/- 400 years, fossilized spores from indeterminate fungi, and pollen from at least five genera and species of tracheophytes (vascular plants). The plants include Pinaceae (pine), Chenopodiaceae (goosefoot), Compositae (sunflower), *cf. Eriogonum* sp. (buckwheat), and *Liquidamber* sp. (sweetgum).

The fossil localities in Parcel B (Palazzo East) range in elevation from 172-192 feet amsl. Vertebrate fossils recovered from Parcel B included:

Bison antiquus - bison
Camelops hesternus – western camel
Equus occidentalis – western horse
Glossotherium (Paramylodon) harlani – Harlan's ground sloth
Proboscidea (order) – indeterminate proboscid (elephant)
Mammal (class) – indeterminate medium-sized herbivore, herbivore, large mammal, medium-sized mammal, and mammal

Invertebrate fossils found in Parcel B include five genera and species of freshwater ostracod (bivalved crustaceans) that were associated with the ground sloth in locality LACMVP 7517. The species were *Candona acuta*, *Cyclocypris ampula*, *Cypria palustera*, *Potamocypris granulosa*, and *Limnocythere staplini*.

While no fossil localities were attributed to Parcel C (the Villas), abraded bone fragments of small Pleistocene mammals were recovered there. However, because they were poorly preserved and unidentifiable, the fragments were discarded in the laboratory.

<u>Hancock Park Replacement Pipeline Discharge System Project (Ruzicka, 2013)</u>

The Hancock Park Replacement Pipeline Discharge System Project is located on the grounds of the George C. Page Museum of La Brea Discoveries at 5801 Wilshire Blvd within the Hancock Park museum complex in the City of Los Angeles. It is located in Rancho La Brea and the Quaternary alluvium where multiple significant paleontologic localities of late Pleistocene fossils have been discovered. The purpose of the project is to control the discharge of clarified water to the Municipal Storm Drain System by constructing a dedicated underground pipeline that serves as a permanent connection to the Bureau of Sanitation Sanitary Sewer System. It is a replacement of the previous temporary system that separated the oil from the water and then sent the asphalt, or oil, into the sanitary sewer system. The new, permanent pipeline discharges excess water from the lake pit so as to maintain its level at 174-foot elevation (amsl). The project was monitored by APRMI for paleontological and archaeological resources.

During the course of monitoring (August 2012- March 2013), fossil specimens were uncovered from five to twenty feet below the surface (160-175 feet amsl) in asphaltic sands. The fossil specimens recovered include a large terrestrial mammal proximal tibia, a large avian femur, bones from a small bird including a rib fragment and long bone fragments, indeterminate bone fragments, currently unidentified microfossils present in the matrix, and floral remains in the form of large samples of wood. Submission of fossil locality information and analysis of the fossil remains is in progress.

<u>Luxe@375 Paleontological Resources (Akyüz, et al., 2013)</u>

Luxe@375 is a mid-sized mixed-use building being built at 375 North La Cienega Boulevard in the City of Los Angeles, Los Angeles County, California. It consists of a five-story building containing 125 apartments, ground-level retail space, and two levels of subterranean parking. The Luxe@375 construction excavation exposed late Pleistocene alluvial/riparian sand, gravel, and silty clay deposits throughout the property. This older alluvium is associated with Pleistocene Rancholabrean fauna, such as what is encountered at the fossil sites located at the Page Museum in Hancock Park located approximately 2 km southeast of the Project.

During site excavation for the subterranean parking lot for the building, significant vertebrate paleontological resources were encountered near final grade (25 feet below ground surface). APRMI was contracted to recover the fossil remains in July and August of 2012. Nine distinct fossil deposits were uncovered during excavation. These deposits were determined to represent loci of one fossil locality, because they were encountered at the same elevation of approximately 144 feet amsl within the same type of soil, which reflected the same depositional environment. The paleontological resources encountered and recovered indicate that significant paleontological deposits are likely to be found at similar depths in the vicinity of the Project area within the same geologic designations.

Vertebrate remains recovered included the following specimens:
Osteichthyes (class) – indeterminate bony fish
Bufo sp. – True toad
Pseudacris sp. – Tree frog
Rana sp. – Pond frog
Anura (order) – indeterminate frog/toad
Actinemys marmorata – Western (Pacific) pond turtle
Crotalus sp. – Rattlesnake
Reptilia (class) – indeterminate reptile
Aves (class) – indeterminate bird
Microtus californicus – California vole
Thomomys bottae – Botta's pocket gopher
Sciuridae (family) – Squirrel
Rodentia (order) – indeterminate rodent
Camelops hesternus – Yesterday's (Western) camel
Equus occidentalis – Western horse
Lepus californicus – Black-tailed jackrabbit (American desert hare)
Mammut americanum – American mastodon
Paramylodon harlani – Harlan's ground sloth
Sylvilagus sp. – Cottontail (rabbit)
Mammalia (class) – indeterminate mammal
Vertebrata (subphylum) – indeterminate vertebrate

Invertebrate species recovered from Luxe@375 included:
Anodonta californiensis – California floater (mussel)
Pisidium sp. – Pea/pill clam
Bivalvia (class) – indeterminate freshwater clam/bivalve
Fluminicola sp. – Pebblesnail (freshwater)
Physa sp. – sinistral Bladder snail (freshwater pulmonate)
Planorbella trivolvis – Ramshorn snail (freshwater pulmonate)
Pupilla sp. – minute terrestrial pulmonate snail
Gastropoda (class) – indeterminate snail/gastropod
Ostracoda (class) – indeterminate seed/mussel shrimp

The only plant remains recovered were in the form of minute pieces of charcoal and, without further analysis, could only be identified as representing indeterminate vascular flora (Phylum Tracheophyta).

PALEONTOLOGICAL SURVEY METHODS AND RESULTS

On June 19, 2013, Robin Turner and Linda Akyüz visited the proposed Project Site. Field notes and photographs are on file at APRMI. The entire Project Site is paved or covered by the May Company Building (Original Building and 1946 Addition), and therefore geologic deposits and paleontological resources could not be assessed visually. However, the Project Site was determined to be approximately 15 meters west of the fossil localities at Project 23, and 300 meters west of the exposed Observation Pit located at the southeast corner of the LACMA Campus.

Figure 6. Project Site overview, view to south. Paved area with trailers and 1946 Addition in midground occupy the Project Site. Original Building visible behind tree and red-columned walkway. July 19, 2013: Photograph 2013-03-100_0043.

Figure 7. Northern half of Project Site in foreground and midground, view to east-southeast from Fairfax Avenue sidewalk. July 19, 2013: Photograph 2013-03-100_0051.

THRESHOLD OF SIGNIFICANCE AND IMPACT ANALYSIS

The Quaternary alluvial sediment types within the Project Site have a high potential for the discovery of Pleistocene fossil remains, especially at depths that would be reached by Project excavations. These fossil remains are considered significant by the SVP, the Page Museum, the NHM, and the City. The City's CEQA Thresholds of Significance Guide (City of Los Angeles 2006) states that the potential for the discovery of paleontological resources in Quaternary Alluvium is high, depending on depths reached by a project's excavation. At the depths to be encountered by the current Project, at a location adjacent to an area that has yielded numerous Pleistocene specimens and within 60 meters of other La Brea Tar Pits sites, the Project Site has a high potential for the discovery of significant paleontological resources.

According to the City's CEQA Guidelines (City of Los Angeles, 2006), the determination of significance of a paleontological resource shall be made on a case-by-case basis, considering:

- Whether, or the degree to which, the project might result in the permanent loss of, or loss of access to, a paleontological resource; and
- Whether the paleontological resource is of regional or statewide significance.

The Project, without paleontological resources monitoring and full methodical, scientific excavation of fossils, would result in the permanent loss of, or loss of access to, paleontological resources. These paleontological resources are not only of regional and statewide significance, but of national and worldwide significance.

Potential mitigation measures that the City accepts include the following:

- Revision of the proposed project to avoid excavation or grading in areas with known or potential surface exposures of fossils, or within rock units with a high potential for paleontological resources;
- Providing erosion protection (e.g., retaining walls, drainage channels) to protect surface resources;
- Restriction of or prevention of access to sensitive resource areas on site;
- Retaining a qualified paleontologist to monitor, and, if necessary, salvage scientifically significant fossil remains. Ensure scientific specimens become the property of a public, nonprofit educational institution, such as the Los Angeles County Museum of Natural History or similar institution;
- Protecting subsurface fossils in place, through covering with appropriate soil materials; and
- Diverting grading efforts in the area of an exposed fossil to allow evaluation and, if necessary, salvage of exposed fossils.

The above-mentioned mitigation measures can be applied separately or in various combinations, depending on the characteristics of the deposits and the relevant Project. Project-specific recommendations that incorporate these general mitigation measures are presented in the next chapter.

RECOMMENDATIONS

The Project Site is one of the most highly sensitive locations for the discovery of paleontological remains in the world. The type of alluvium present at the depths that may be reached by Project excavation is likely to yield significant paleontological resources. Excavation even at shallow depths has the potential to impact significant paleontological resources. The Project Site is adjacent to sites that have yielded fossils that have provided the basis for our knowledge of life in the Pleistocene age and that make up a National Natural Landmark that is known worldwide.

Complete avoidance of excavation of any kind is the best way to preserve these fossil specimens. If excavation cannot be avoided, full-time paleontological resource monitoring and scientific and methodological (not salvage) excavation, analysis, reporting, and curation at the Page Museum of any significant fossil remains, led by an SVP-qualified paleontologist, are recommended for any Project excavation, in order to reduce impacts to possible fossil deposits to a less-than-significant level. Similar mitigation measures were recommended for the other local projects discussed in U.S. DOT-FTA and Metro (2012b), City of Los Angeles (2008a), and Christopher A. Joseph and Associates (2008c). Similar mitigation measures were in place for the LACMA Transformation Project/Project 23, just east of the current Project. That mitigation measure allowed the recovery of millions of paleontological specimens.

A PRMMP with protocols for monitoring and data-recovery protocols will be established prior to construction activities and the issuance of grading permits. A technical report that records the monitoring and excavation, analysis, and curation methods will also be required.

The recommendations for the mitigation of Project impacts to paleontological resources are modeled after the MOU executed between the Metro and the NHM—including the Page Museum—for the preservation of paleontological and archaeological resources associated with the Wilshire/Fairfax Station and portions of the Westside Subway Extension Project within 2 miles of the Wilshire/Fairfax Station (U.S. DOT-FTA and Metro, 2012b). APRMI has adapted relevant portions of the MOU for the current Project.

These include:

1. The retention of a qualified paleontologist with a minimum of five years of experience in excavating in the asphaltic soils of Hancock Park. The paleontologist, who will be approved and supervised by the Page Museum, will plan, implement, and supervise paleontological monitoring, preservation, fossil recovery, fossil preparation (in the field), fossil documentation (in the field) and reporting of significant paleontological resources within paleontologically sensitive areas, which in the case of the present Project, is the entire Project excavation. The qualified paleontologist will monitor or supervise monitoring by a qualified paleontological monitor and will recover or supervise the recovery of any fossils. The qualified paleontologist, or a qualified paleontological monitor under the supervision of the qualified paleontologist, will document resource locations and stratigraphic context before the resources are conveyed to the Page Museum for preparation, curation, and study. Per SVP (SVP 2013), a qualified paleontologist has a graduate degree in paleontology or geology, and/or a publication record in peer-reviewed journals; demonstrated competence in field techniques, preparation, identification, curation, and reporting in the state or geologic province in which the project occurs; minimum two full years professional experience as

assistant to a Project Paleontologist with administration and project management experience supported by a list of projects and referral contacts; proficiency in recognizing fossils in the field and determining their significance; expertise in local geology, stratigraphy, and biostratigraphy; and experience collecting vertebrate fossils in the field. Per SVP (SVP 2013), a qualified paleontological monitor has a BS or BA in Geology or Paleontology and one year experience monitoring in the state or geologic province of the specific project. An associate degree and/or demonstrated experience showing ability to recognize fossils in a biostratigraphic context and recover vertebrate fossils in the field may be substituted for a degree. An undergraduate degree in geology or paleontology is preferable, but is less important than documented experience performing paleontological monitoring. Recovered fossils will be processed and cataloged by the Page Museum staff and will be curated at the Page Museum.

2. Prior to construction activities, a Paleontological Resources Monitoring and Mitigation Plan (PRMMP), shall be prepared by a qualified paleontologist, and subject to review and approval by the City, Page Museum, and the Academy. The PRMMP will describe the potential for encountering paleontological resources at the Project Site; known paleontological resources in the area; paleontological resources monitoring methodology that is generally consistent with Mitigation Measures 1 through 8 of the Metro Westside Subway Extension Final Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) and Memorandum of Understanding (MOU) for Paleontological Resources; procedures to follow if resources are discovered during any construction-related activities; and a regulatory framework that explains the laws and regulations that protect paleontological resources. The paleontological methods (Page Museum 2011a) and the techniques for excavation (Page Museum 2011b) should also be followed for all paleontological deposits and fossil specimen encountered.

3. Prior to construction activities, construction personnel who will be involved with construction-related, earth-moving activities will be informed that fossils may be encountered while working on the Project. The qualified paleontologist will design a Project-specific Worker Environmental Awareness Plan (WEAP) that will outline the procedure and protocols if fossil remains are uncovered. These procedures and protocols will include fossil recovery methods, notification procedures and protocols upon fossil discovery, and the laws and regulations protecting paleontological resources from theft and destruction. This plan could incorporate relevant elements from the Metro (2011) guidelines.

4. Funding for required fossil recovery, cleaning, preservation, identification, analysis, cataloging, curation, and temporary storage and any other fossil-related activities will be negotiated between the Academy and the Natural History Museum of Los Angeles County/Page Museum. A detailed cost agreement will be developed and mutually agreed upon between the Academy and the Page Museum, based on recovered fossils.

5. Page Museum consultation regarding field and laboratory methods.

6. The monitoring of all ground-disturbing activities, including drilling/augering of micropiles and augercast piles, by a qualified paleontologist experienced in working with the asphaltic soils of Hancock Park or a paleontological monitor who is experienced in working with the asphaltic soils of Hancock Park, approved by the

qualified paleontologist. One paleontological monitor per piece of operating mechanical equipment or hand-excavation crew will be required.

7. The temporary halting of all construction activities in an area of identified paleontological resources if paleontological resources are identified by the paleontologist or paleontological monitor during ground disturbance until the area is released by the paleontologist.

8. Any paleontological resources, including asphaltic deposits containing fossils, will be recovered in accordance to the best practices outlined by the Page Museum (see Appendix C). Microfossils will also be collected via the collection of up to 6,000 pounds of matrix per fossil locality per SVP guidelines as many significant vertebrate fossils and "non-vertebrate paleoenvironmental indicators" such as plant seeds and shell are "too small to be readily visible" and can only be recovered via bulk matrix sampling (SVP 2010: 7).

9. The expeditious removal of paleontological resources, monitored by qualified paleontologist or paleontological monitor, to allow Project completion according to schedule, but allowing complete resource recovery in compliance with Page Museum standards, as demonstrated with Project 23. The recordation of all data and the excavation of boxed deposits and/or individual fossils, preparation of fossils, according to the best practices outlined by the Page Museum (Appendix C, Appendix D), by the Paleontological Resources Extraction section of the Metro MOU (Appendix E), and in SVP guidelines, by the qualified paleontologist or paleontological technician.

10. Periodic (monthly, or per an interval to be determined in the PRMMP) progress reports and all field notes provided to the Museum and the Page Museum by the qualified paleontologist.

11. Donation of all paleontological resources to the Page Museum.

12. Page Museum accession, final curation, and management of the fossils recovered during Project excavation/ground disturbance in a secure and climate-controlled environment.

13. Upon completion of construction monitoring, a final report shall be prepared with preliminary/or summary findings to date for submittal to the City, the NHM, and the Page Museum. Because processing and analyzing large deposits and numerous specimens may be required and would take a substantial amount of time, an addendum to the final report shall be completed within a reasonable amount of time once all fossils have been analyzed. The final report and addendum shall be funded by the Academy.

CONCLUSION

The Project Site is in a paleontologically rich region that includes a National Natural Landmark that is internationally known for the quantity and diversity of its fossils.

The Project Site lies in sediment and terrain that is similar to other areas where dense and significant fossil localities, prehistoric archaeological sites, and historic archaeological sites have been documented. Excavation in the Project Site may directly or indirectly destroy a unique paleontological resource because sediments within the Project Site have a high potential to contain paleontological resources.

A PRMMP with protocols for monitoring and data recovery will be established, as outlined in the above Recommendations section. A WEAP that will outline the procedure and protocols if fossil remains are uncovered will also be established. Full-time paleontological resource monitoring with thorough excavation and analysis of fossil remains, led by an SVP-qualified paleontologist, should be employed for any Project excavation, in order to reduce impacts to fossil deposits to a less-than-significant level. Laboratory analysis of the excavated fossil remains will be conducted, after which remains will be curated at the Page Museum. A technical report that records the monitoring and excavation, analysis, and curation methods will also be required.

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APPENDIX A

Natural History Museum of Los Angeles County Records Search Results

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

tel 213.763.DINO
www.nhm.org

NATURAL HISTORY MUSEUM LOS ANGELES COUNTY

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

8 July 2013

ArchaeoPaleo Resource Management, Inc.
1531 Pontius Avenue, Suite 200
Los Angeles, CA 90025

Attn: Robin Turner, President

re: Paleontological resources for the proposed Academy at LACMA Project, APRM project # 2013-03, in the City of Los Angeles, Los Angeles County, project area

Dear Robin:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed Academy at LACMA Project, APRM project # 2013-03, in the City of Los Angeles, Los Angeles County, project area that you sent to me via e-mail on 14 June 2013. We have one vertebrate fossil locality that lies directly within or adjacent to the proposed project boundaries, and we have other localities nearby from the same sedimentary units that occur in the proposed project area.

Surface sediments in the entire proposed project area consist of older Quaternary Alluvium, derived as alluvial fan deposits from the Santa Monica Mountains to the north. These deposits usually do not contain significant vertebrate fossils in the uppermost layers, but at even shallow depth they may well contain significant vertebrate fossils. In addition, the proposed project area lies within an area of oil seepage that produced the adjacent renowned Rancho La Brea asphalt deposits. These asphaltic deposits can occur at or very near the surface and may contain a dense accumulation of vertebrate fossils. We have one vertebrate fossil locality, LACM 6345, that may overlap with the proposed project area or be adjacent to it. Locality LACM 6345 is described as being the May Company annex between Orange Grove Avenue and Ogden Drive and between Wilshire Boulevard and the May Company parking structure. In loose fill locality LACM 6345 produced fossil specimens of undetermined bird, Aves, and horse, *Equus cf. E. occidentalis*.

Immediately east of the proposed project area, within Hancock Park bounded by Wilshire Boulevard, Ogden Drive, 6th Street, and Curson Avenue, we have a great number of vertebrate fossil localities from the world famous Rancho La Brea asphalt deposits, including LACM 1933, 6909, and 7297-7298. These deposits are perhaps the densest accumulation of vertebrate fossils in the world, and are unique in their occurrence in a major urban area and still being productive after more than 100 years of excavation. In fact, one localized deposit designated as Pit 91 (locality LACM 6909) is still being actively excavated.

Asphaltic accumulations of fossils within the Hancock Park area are not uniformly distributed, but are rather localized. Over 100 separate fossil sites, called pits in this area, are documented. The pits were excavated based on the surface occurrence of asphaltic materials, but these deposits may also occur at depth with no indication at the surface of their presence. During excavations for the George C. Page Museum of La Brea Discoveries within Hancock Park in 1977, a large fossiliferous asphalt deposit was discovered, localities LACM 7297-7298. From this deposit crews salvaged 33 plaster jackets of fossiliferous asphaltic matrix, each at least 2 cubic meters in size, including one of the rare articulated skeletons represented in the Rancho La Brea deposits.

The Rancho La Brea asphalt deposits are also unusual in preserving a substantial portion of the total biota, including an extensive list of fossil plants, insects, and invertebrates in addition to the justly renowned vertebrate fauna (see vertebrate faunal list in the appendix). Over 200 species of fossil vertebrates are represented in these deposits, including extinct forms of bison, camel, horse, mammoth, mastodon, ground sloths, dire wolf, lion, condor, eagle, turkey, etc. One of the earliest human skeletal remains has also been recovered from these deposits. Numerous holotypes (name bearing specimens for species new to science) have come from the Rancho La Brea deposits, including the holotype of the sabre-toothed tiger, *Smilodon californicus* (= *Smilodon fatalis*), designated as the California state fossil. The Rancho La Brea paleobiota documents climatic change in the Los Angeles Basin during the latest Pleistocene and earliest Holocene, including the last "ice age". It is so significant that this deposit served as the basis for designating the late Pleistocene as the North American Land Mammal Age called the Rancholabrean.

In addition to the extensive fossil vertebrate collections amassed from within Hancock Park, excavations in various areas surrounding the park have also uncovered fossil vertebrate remains, many from asphaltic sands and sometimes in dense accumulations. Our closest vertebrate fossil localities immediately outside of Hancock Park are LACM 1724, 4204, 4590, 5481, and 7247, all producing specimens similar to those from the Hancock Park localities. Whether the asphaltic matrix producing most of the vertebrate fossils from these localities occurs in the proposed project area is undetermined, but likely.

Even surface grading or very shallow excavations in the proposed project area may well uncover significant fossil vertebrate remains. Deeper excavations at the proposed project site area also may well uncover significant vertebrate fossils in older Quaternary sediments, similar to specimens from the Rancho La Brea asphalt deposits to the east. Any substantial excavations in the proposed project area, therefore, should be closely monitored to quickly and professionally collect any specimens without impeding development. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,

Samuel A. McLeod

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosures: appendix, invoice

Rancho La Brea vertebrate fauna
(† = extinct, ¶ = Holocene record only, ‡ = represented by artifactual material)

OSTEICHTHYES
Salmoniformes
Salmonidae
Oncorhynchus mykiss - rainbow trout
Cypriniformes
Cyprinidae
Gila orcutti - arroyo chub
Gasterosteiformes
Gasterosteidae
Gasterosteus aculeatus - threespine stickleback

AMPHIBIA
Urodela
Plethodontidae
Aneides lugubris - arboreal salamander

Anura
Bufonidae - toads
Bufo nestor †
Bufo boreas
Bufo microscaphus
Hylidae
Hyla sp. - treefrog
Ranidae
Rana aurora - red-legged frog

REPTILIA
Chelonia
Emydidae
Clemmys marmorata - western pond turtle
Testudinidae
?*Geochelone* sp. - tortoise
Squamata
Anguidae - alligator lizards
Gerrhonotus multicarinatus
Anniella
Iguanidae - iguanid lizards
Phrynosoma coronatum
Sceloporus magister
Sceloporus occidentalis
Uta stansburiana

REPTILIA
Squamata
Scincidae
Eumeces skiltonianus - western skink
Teiidae
Cnemidophorus tigris - western whiptail lizard
Colubridae - colubrid snakes
Arizona elegans
Coluber constrictor
Coluber constrictor mormon
Diadophis punctatus
Hypsiglena torquata
Lampropeltis getulus
Lampropeltis sp.
Masticophis lateralis
Pituophis melanoleucus
Rhinocheilus lecontei
Tantilla sp.
Thamnophis cf. *T. couchi*
Thamnophis sirtalis
Viperidae
Crotalus viridis - western rattlesnake

AVES
Podicipediformes
Podicipedidae
Podilymbus podiceps - pied-billed grebe
Pelecaniformes
Phalacrocoracidae
Phalacrocorax sp. - cormorant
Ardeiformes
Ardeidae - egrets & herons
Ardea herodias
Botaurus lentiginosus
Butorides striatus
Casmerodius albus
Egretta thula
Egretta caerulea
Nycticorax nycticorax
Threskiornithidae (Plataleidae) - spoonbills & ibis
Ajaia ajaja
Plegadis chihi

AVES

Anseriformes

Anatidae - ducks

Anas platyrhynchos
Anas strepera
Anas crecca
Anas cyanoptera
Anas clypeata
Anser albifrons
Aythya valisineria
Anabernicula gracilenta †
Branta canadensis
Branta cf. *B. bernicla*
Chen caerulescens
Chen rossi
Cygnus columbianus

Ciconiiformes

Ciconiidae - storks

Ciconia maltha †
Mycteria wetmorei †

Teratornithidae - teratorns

Cathartornis gracilis †
Teratornis merriami †

Vulturidae (Cathartidae) - vultures

Breagyps clarki †
Coragyps occidentalis †
Cathartes aura
Gymnogyps amplus †

Accipitriformes

Accipitridae - hawks & eagles

Accipiter gentilis
Accipiter striatus velox
Accipiter cooperii
Aquila chrysaetos
Buteo jamaicensis
Buteo swainsoni
Buteo lagopus
Buteo regalis
Buteogallus fragilis †
Circus cyaneus
Elanus caeruleus
Haliaeetus leucocephalus
Amplibuteo woodwardi †
Wetmoregyps daggetti †
Spizaetus grinnelli †
Neogyps errans †
Neophrontops americanus †

AVES

Accipitriformes

Falconidae - falcons

Falco columbarius
Falco mexicanus
Falco peregrinus
Falco sparverius
Polyborus plancus

Galliformes

Phasianidae - pheasants & turkeys

Meleagris californica †
Callipepla californica

Gruiformes

Rallidae

Fulica americana - American coot

Gruidae - cranes

Grus canadensis
Grus americana
Grus pagei †

Charadriiformes

Charadriidae - plovers & killdeer

Charadrius vociferus
Pluvialis squatarola

Recurvirostridae

Recurvirostra americana - American avocet

Scolopacidae - sandpipers & phalaropes

Calidris alba
Calidris alpina
Catoptrophorus semipalmatus
Gallinago gallinago delicata
Limnodromus griseus
Limosa fedoa
Numenius americanus
Numenius phaeopus hudsonicus
Tringa melanoleuca
Phalaropus fulicarius

Laridae - gulls

Larus canus ¶
Rissa tridactyla ¶

Columbiformes

Columbidae - pigeons & doves

Columba fasciata
Ectopistes migratorius †
Zenaida macroura

AVES

- Cuculiformes
  - Cuculidae
    - *Geococcyx californianus* - California roadrunner
- Strigiformes
  - Tytonidae
    - *Tyto alba* - barn owl
  - Strigidae - owls
    - Aegolius acadicus
    - *Asio flammeus*
    - *Athene cunicularia*
    - *Bubo virginianus*
    - Glaucidium gnoma
    - *Otus asio*
    - *Strix brea* †
- Caprimulgiformes
  - Caprimulgidae
    - *Phalaenoptilus nuttallii* - common poorwill
- Piciformes
  - Picidae - woodpeckers & flickers
    - *Colaptes auratus cafer*
    - *Dryocopus pileatus*
    - *Melanerpes lewisi*
    - *Picoides* sp.
    - *Sphyrapicus* sp.
- Passeriformes
  - Tyrannidae
    - *Tyrannus vociferans* - Cassin's kingbird
  - Alaudidae
    - *Ermophila alpestris* - horned lark
  - Corvidae - crows
    - *Aphelocoma coerulescens*
    - *Aphelocoma coerulescens californica*
    - *Corvus corax*
    - *Corvus cryptoleucus*
    - *Corvus brachyrhynchos*
    - *Corvus caurinus*
    - *Cyanocitta stelleri*
    - *Nucifraga columbiana*
    - *Pica nuttalli*
  - Paridae
    - *Parus* sp. cf. *P. gambeli* - mountain chickadee
  - Muscicapidae - bluebirds & robins
    - *Sialia* sp. cf. *S. mexicana*
    - *Turdus migratorius*

AVES

Passeriformes

Mimidae - mockingbirds & thrashers

Oreoscoptes montanus

Toxostoma redivivum

Bombycillidae

Bombycilla cedrorum - cedar waxwing

Laniidae

Lanius ludovicianus - loggerhead shrike

Emberizidae - sparrows & towhees

Parulinae gen. sp. indet.

Pheucticus melanocephalus

Amphispiza bilineata

Ahphispiza belli

Chondestes grammacus

Melospiza melodia

Passerella iliaca

Pipilo erythrophthalamus

Pipilo fuscus

Pipilo angelensis †

Pooecetes gramineus

Spizella passerina

Zonotrichia leucophrys

Agelaius sp. cf. *A. phoeniceus californicus* (?)

Euphagus magnirostris †

Icterus spp.

Molothrus ater

Sturnella neglecta

Xanthocephalus sp.

Pandanaris convexa †

Fringillidae - finches

Carduelis pinus

*Carduelis tristi*s

Coccothraustes vespertinus

MAMMALIA	
Insectivora	
Soricidae	- shrews
Sorex ornatus	
Notiosorex crawfordi	
Talpidae	
Scapanus latimanus	- broad-footed mole
Primates	
Hominidae	
Homo sapiens ¶	- humans
Chiroptera	
Vespertilionidae	- vesper bats
Lasiurus cinereus	
Antrozous pallidus	
Edentata	
Megalonychidae	- Jefferson's ground sloth
Megalonyx jeffersonii †	
Megatheridae	
Nothrotheriops shastensis †	- Shasta ground sloth
Mylodontidae	
Glossotherium harlani †	- Harlan’s ground sloth
Lagomorpha	
Leporidae	- rabbits
Sylvilagus audubonii	
Sylvilagus bachmani	
Lepus californicus	
Rodentia	
Sciuridae	- squirrels
Spermophilus (Otospermophilus) beecheyi	
Tamias cf. *T. merriami*	
Geomyidae	- pocket gophers
Thomomys bottae	
Heteromyidae	- kangaroo rats & pocket mice
Dipodomys agilis	
Perognathus californicus	
Cricetidae	- deer mice & wood rats
Reithrodontomys megalotus	
Peromyscus imperfectus †	
Onychomys torridus	
Neotoma fuscipes	
Microtus californicus	

MAMMALIA	
Carnivora	
Mustelidae	- skunks, badgers & weasels
Mustela frenata	
Taxidea taxus	
Spilogale putorius	
Mephitis mephitis	
Canidae	- dogs
Canis latrans	
Canis lupus	
Canis familiaris	
Canis dirus †	
Urocyon cinereoargenteus	
Procyonidae	- raccoons
Procyon lotor	
Bassariscus astutus	
Ursidae	- bears
Arctodus simus †	
Ursus americanus	
Ursus arctos horribilis ¶	
Felidae	- cats
Smilodon fatalis †	
Smilodon fatalis brevipes †	
Homotherium serum †	
Panthera atrox †	
Panthera onca agusta †	
Felis concolor †	
Lynx rufus	
Proboscidea	
Mammutidae	
Mammut americanum †	- American mastodon
Elephantidae	
Mammuthus columbi †	- Columbian mammoth
Perissodactyla	
Equidae	- horses
Equus cf. *E. occidentalis* †	
Equus conversidens †	
Tapiridae	
Tapirus californicus †	- California tapir

MAMMALIA

Artiodactyla

Tayassuidae	
Platygonus cf. *P. compressus* †	- peccary
Camelidae	- camels & llamas
Camelops hesternus †	
Hemiauchenia macrocephala †	
Cervidae	- deer
Odocoileus cf. *O. hemionus*	
Cervus cf. *C. elaphus* ¶ ‡	
Antilocapridae	- pronghorn antelopes
Capromeryx minor †	
Antilocapra americana	
Bovidae	- cattle, sheep & goats
Euceratherium sp. cf. *E. collinum* †	
Bison latifrons †	
Bison antiquus †	
Ovis aries ¶	

APPENDIX B

John Harris, Ph. D, Letter to Michael J. Logrande, Director of Planning, and Luciralia Ibarra, Environmental Analysis Section City of Los Angeles Department

Michael J. Logrande, Director of Planning, and
Luciralia Ibarra, Environmental Analysis Section
Department of City Planning
200 N. Spring Street, Room 750
Los Angeles, California 90012

Dear Sir and Madam,

ENV-2013-1531-EIR

This letter is in response to your request for comment regarding the Academy of Motion Pictures Project for 6067 Wilshire Boulevard. It is, however, also pertinent to the Museum Square Office Building Project ENV-2013-194-EIR at 5757 West Wilshire Boulevard.

In addition to potential traffic, noise, view-shed, and light and shadow issues that we assume are going to be included in the scope of any environmental review, I would like to address the need for the scope to include consideration of the impact of the proposed project on paleontological resources.

The La Brea Tar Pits in Hancock Park are world-renowned for the abundance and diversity of the fossils that were trapped and fortuitously preserved in natural asphalt seeps emanating from the Salt Lake Oilfield that underlies this area. For tens of thousands of years, oil and natural asphalt have been extruded through cracks and fissures in the ground overlying the oil field. Shallow surface seeps trapped unwary animals and also the predators and scavengers attempting to exploit their carcasses. The process has resulted in one of the richest fossil assemblages yet known of Late Pleistocene time. The Page Museum's collections hold over three million fossils representing more than six hundred species of animals and plants ranging in size from millipedes to mammoths and from tiny seeds to entire tree trunks. The fossils also include one of the oldest human skeletons yet found in North America. The importance of this unique fossil locality resulted in its being designated a State Historic Landmark and a National Natural Landmark. For scientists it has the additional recognition of being designated the type locality of the Rancholabrean North American Land Mammal Age—i.e. it is the paleontological standard against which all North American continental fossil assemblages dating between 10,000 and 250,000 years old are compared.

Our understanding of the mechanisms by which these incredibly rich fossil assemblages were formed in Hancock Park indicates that fossiliferous vents and seeps may occur at any terrestrial location that is underlain by an oil field. The Salt Lake Oilfield is a good example of this. Although the tar pit fossils were originally discovered in and below asphaltic seeps at ground surface, the processes of seepage, entrapment, and fossilization have taken place over many thousands of years during the emplacement and build-up of the coastal plain. As a result, unknown numbers of additional asphaltic fossil deposits lie hidden beneath the surface layers of alluvial sediment, as witnessed by the 16 new fossil deposits uncovered between depths of 10 and 25 feet during construction of the LACMA underground parking lot in 2006.

Any construction taking place within a one thousand five hundred foot radius of the County's Hancock Park must therefore be prepared to mitigate the paleontological, archaeological, and historic material that may be encountered at depths up to 50 feet below the current ground surface. Such mitigation entails the discovery, recovery and detailed documentation of any specimens and/or artifacts and should also include funding to support their preparation, curation, and storage in an appropriate permanent repository duly accredited by the American Association of Museums.

Respectfully submitted,

John M. Harris, Ph.D.
Chief Curator, George C. Page Museum
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Los Angeles, CA 90036
(323) 857-6300 xt 131
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Luciralia Ibarra
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APPENDIX C

Paleontological methods for the mitigation of fossils in the vicinity of Hancock Park

Paleontological methods for mitigation of fossils in the vicinity of Hancock Park.

Images courtesy of ArchaeoPaleo Resource Management, Inc.

2011

TABLE OF CONTENTS

Introduction

Rancho La Brea is the world's richest Ice Age fossil locality, yielding well over 3 million fossils and representing more than 600 species of animals and plants that lived in the Los Angeles Basin between 11,000 and 50,000 years ago. The asphaltic fossil deposits generally occur in randomly distributed inverted cone-shaped masses between 10 to 35 feet in depth. The sizes of the accumulations vary considerably from less than 5 cubic feet to more than 20 cubic feet. Flat tabular deposits such as that recovered during the construction of the Page Museum are rare. Ideally, the fossil accumulations should be carefully excavated as they are discovered. The fall back position is to remove the deposit intact, preserving it for excavation at a later date. This methodology, developed during the mitigation of the LACMA underground parking structure, preserves stratigraphic integrity, permits less hurried excavation under more optimum conditions, maximizes fossil and information retrieval, and enhances opportunities for major discoveries and new scientific contributions. All data pertaining to the location and condition of newly discovered fossil deposits must be recorded and photographed as outlined later in this document.

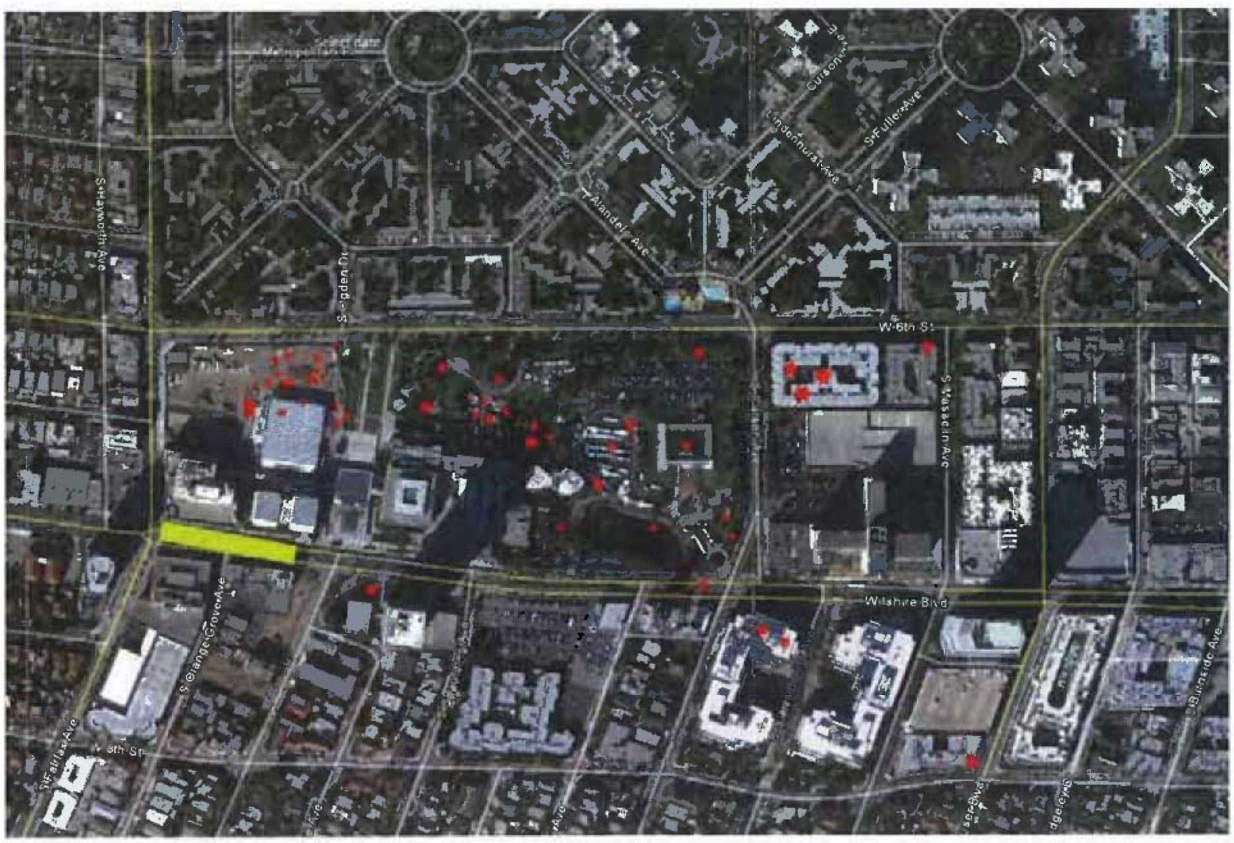

Fig 1: Map of Hancock Park and vicinity with known asphalt preserved fossil localities (red stars) and the approximate location of the proposed MTA subway station (yellow rectangle)

Fig 2: Monitoring

All excavation activity must be carefully monitored. In areas of asphaltic sediment or other areas where fossils have been discovered, sediment should be removed in 4-6" levels while paleontologists monitor closely. The monitors are empowered to halt the process as soon as fossils are located.

Fig 3: Fossils are discovered

After a fossil deposit has been located the surrounding area must be roped off so that paleontologists can determine the extent of the deposit or if it is an isolated fossil. In the case of an accumulation deposit this may range from 5 feet to 20 or more feet across. Construction work in the immediate vicinity of the fossil deposit must be halted temporarily but may proceed normally elsewhere in the construction site. Asphalt saturated conical shaped deposits and isolated fossil mitigation are described separately below.

Taking Field notes

Whether an accumulation of fossils are discovered or an isolated fossil is found, detailed field notes must be taken. The precise locality of each fossil deposit must be recorded with a resource-grade GPS device, its extent clearly described, mapped, and photographed on site using conventional field data collection methods, and its context including represented lithologies and depositional environments must be described. Types of geologic information to be collected should include: the nature of bounding contacts (erosional, sharp, gradational), thickness, geometry, grain size, shape, and sorting, color (fresh and weathered, use a color chart), sedimentary structures (physical and biogenic), cement type, pedogenic features (rooting, nodules, slickensides, etc.), halos, mineral crusts, microstructures around bio-clasts, and other fossils. Types of taphonomic information to be collected should include: taxonomic representation, skeletal articulation and association, scale and geometry of assemblage, density, and orientation of bones. Bone modification information to be collected should include: weathering, polishing, abrasion, scratch/tooth marks, root traces, borings, fragmentation/breakage, and distortion. Each isolated fossil and each individual fossil deposit must be given an individual field number. This number should be written in permanent ink on individual fossils and clearly marked in permanent marker or paint on the box containing a deposit.

Asphalt saturated conical shaped deposits

Fig 4: Pedestal a deposit

Once the extent of the fossil accumulation has been determined, the sediment surrounding the fossiliferous deposit is carefully removed, isolating the accumulation on a pedestal. It may be necessary for monitors to wear a SCBA, as in this image, because of the high concentrations of hydrogen sulfide.

Fig 5: View of east end of LACMA construction site

It is possible that there will be a number of fossil deposits within the construction site. Work may continue at non-fossiliferous locations while the deposits are being salvaged.

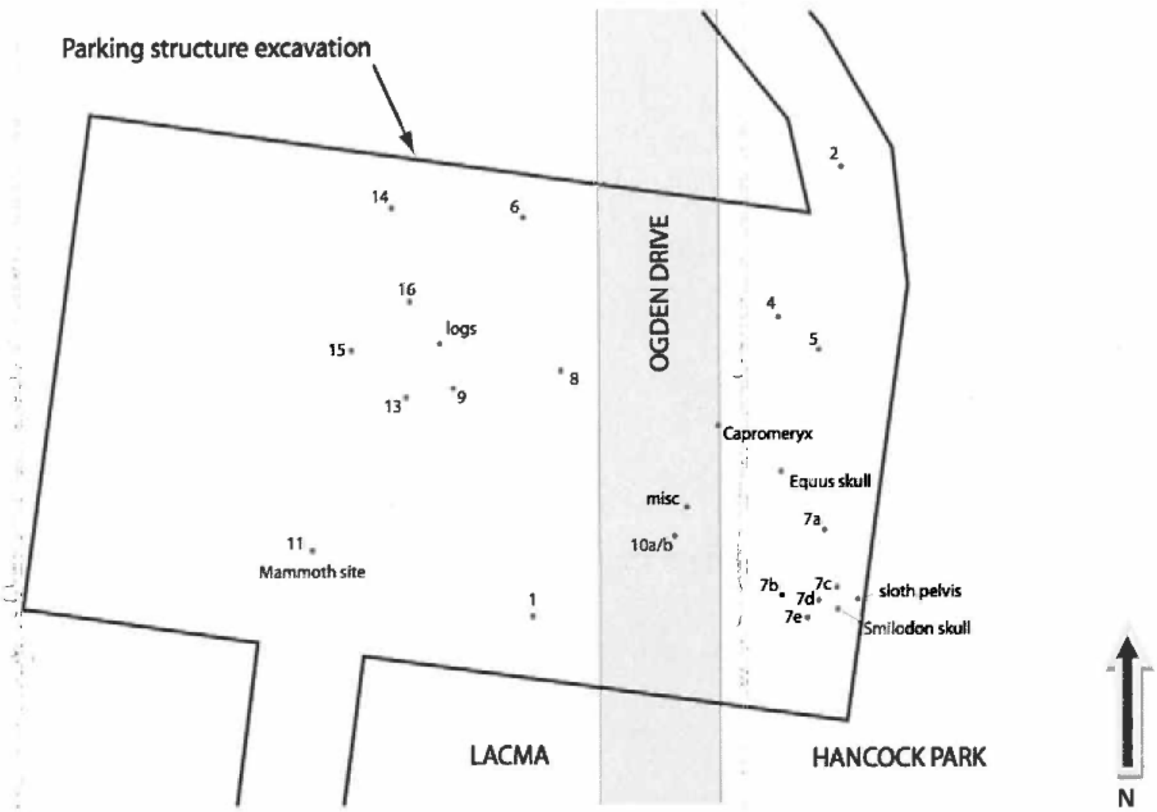

Fig 6: Map of fossil localities from LACMA parking garage

These were mostly asphaltic fossiliferous masses but included some occurrences of isolated bones, trees, and other fossils.

Fig 7: Fossil accumulation pedestals before tree box

After the deposit has been isolated it will be surrounded by metal bands to conserve its integrity before the box is built and a brightly colored strong plastic or a tarp to keep the deposit dirt separated from the 'fill' dirt.

Fig 8: Building a tree box around a fossil deposit

A custom sized box is then built around each deposit by a 'tree boxing' company. Valley Crest was used on the LACMA project. Any space between the plastic-wrapped deposit and the edge of the box must be filled with polyurethane foam, distinctly different sediment or gravel to preserve the integrity of the deposit and to prevent its deformation during subsequent transportation and storage. It is important that the 'fill' sediment be easily recognizable from the matrix during later excavation of the deposit.

Fig 9: Secure the tree box with metal bands

After the sides of the box are nailed into place, metal bands are added to secure and strengthen the sides of the box.

Fig 10: Tunnel under the tree box

After the sides of the box are secured and banded, the sediment beneath the box is removed by tunneling so that the box floor can be constructed. The field number and locality data must be clearly written on the outside of the box in permanent marker or paint. The orientation of the box and the depth below datum of the top and bottom of the deposit must also be clearly and permanently marked on the box, as well as added to the field notes for that deposit.

Figs 11, 12 & 13: Relocating the tree boxes by crane and truck

A crane is used to lift the completed boxes, load them onto a flat bed truck, and to relocate them to the place where their excavation will take place.

Isolated fossils

In addition to conical and flat tabular asphaltic accumulations, construction activities may encounter isolated fossils in non-asphaltic or asphaltic sediments such as the trees, mammoth skeleton, and bison and horse skulls that were discovered during the recent construction of the LACMA's underground parking structure. Similar procedures pertain. The area must be roped off in order for the monitors to determine the extent of the fossil occurrence, which may then be removed using conventional paleontological field techniques. Large or fragile bones must be pedestaled (with sediments immediately surrounding the fossil) and covered in a plaster and burlap jacket. The type of plaster used determines the time it takes to dry. Once the plaster is dry, it is flipped over and the other side is covered with plaster and burlap and left to dry completely. In the meantime paleontologists need to determine the extent of other isolated fossils in the area looking in particular for other elements of the skeleton of the jacketed specimen or sediments in which microfossils such as rodent, bird and reptile remains may occur.

It is crucial; that all isolated fossil occurrences be given a field number, their location recorded with a resource-grade GPS device, and these data entered into the field notes together with a map and description of the fossil, its orientation and its locality including description of the lithology in which the fossil was preserved. Standard guides such as Munsell Soil Color Charts should be used. The field number should be clearly and permanently affixed to the fossil and written on its container or jacket as appropriate. Maps must have a legend and scale to the show the orientation and depths of each fossil as well as a datum point. In addition to the field number, plaster jackets should also be marked "field side up" on the appropriate surface.

Fig 14: Excavating isolated fossils

Paleontologists need to excavate around large bones with hand tools before covering them with a protective plaster jacket for later removal and transport.

Fig 15: Mammoth discovered

This image show the mammoth locality in the context of the construction site during the LACMA underground parking garage.

APPENDIX D

Techniques for excavation, preparation and curation of fossils from the Project 23 salvage at Rancho La Brea: A Manual for the Research and Collections Staff of the George C. Page Museum.

Techniques for excavation, preparation and curation of fossils from the Project 23 salvage at Rancho La Brea.

A MANUAL FOR THE RESEARCH AND COLLECTIONS STAFF OF THE GEORGE C. PAGE MUSEUM

2011

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Introduction

This document was compiled mid project to record and codify best practices for excavation, preparation and curation of specimens from Project 23 and other Rancho La Brea localities that are housed in the George C. Page Museum. Some of the techniques are similar to Pit 91 excavations that were reported by Shaw (1982) and others that are unique to Project 23 because of the nature of the salvage. This provides guidelines for possible future salvage efforts. Documents discussing the nature of the mitigation are available elsewhere.

Excavation Techniques for Project 23

Excavation of Project 23 deposits began in August, 2008.. The measuring techniques used to determine and record data for *in situ* specimens follow those of Shaw (1982) for Pit 91 with some modifications described here (for instance, the imperial measurement system was used prior to Project 23). New excavation procedures have also been devised as a result of the removal of the deposits from their original location due to construction.

In Project 23, a custom-sized wooden box was built around each isolated plastic-wrapped deposit by a 'tree boxing' company (Valley Crest was used for this particular project). Any space between the deposit and the edge of the box was filled with either polyurethane foam or sediment to preserve the integrity of the deposit and to prevent its deformation during subsequent transportation and storage.

Because the deposits are no longer *in situ*, all excavation grids are oriented with respect to the deposits' original north orientation. Where feasible, box walls may be removed in part or in their entirety to allow excavation from the side of the deposit rather than from the top. Each "tree box" from Project 23 is treated differently depending on the type of deposit, size of the box and integrity of the sediments in the box. Refer to paleo mitigation protocol and ArchaeoPaleo report documents for descriptions on how the 'tree boxes' were constructed.

Preparing a tree box for excavation

First read all the field notes pertinent to that particular deposit. In a field notebook or deposit logbook document the nature of the "box" size, construction, fill, plastic, etc. If the box is taller than 5 feet, erect scaffolding for excavators to safely access the box. Depending on the size of the tree box it may be necessary to construct a safety railing extending upward from the sides of the box. After the top of the box is safe to access, remove the metal bands that are strapped across the top of box. Use specific snips if recommended by the tree boxing company. Remove supportive fill dirt, foam and plastic to reveal deposit surface, taking care to maintain an appropriate area for excavators to work safely.

Depending on box stability and size, board walls or portions of board walls may be removed to enable excavation from the side of the deposit. Smaller boxes containing deposits with cohesive sediments may allow the removal of all sidewalls. For larger boxes, removal of one wall or a small "window" cut into a sidewall may be feasible.

Before any asphaltic sediment is removed, set up a gas monitor close to where work will be conducted. The Solaris Multigas Detector is an economical, 4-gas instrument providing simultaneous detection of CO, O2, H2S and combustible gas and costs ~$600 from Safety Tek Industries.

Grid layout

Determine the deposit's north side from field data and data written on the box.

Establish a datum point near the top of the box and record it based on field data. The datum point should not be removed during excavation.

Lay out grids into 1m x 1m squares with origin in the SE corner of the box using an alphanumeric system (N/S = A-Z; W/E = 1, 2, 3). Gridlines can be marked with string, spray paint or chalk and need to be refurbished and maintained periodically. A map of the box showing the grid lines and a north arrow should be drawn for reference.

Excavation and Documentation

After grids are established, clean surface to remove fill dirt, to determine sediment type and to locate fossils if exposed. Note nature and location of fossils (bones, shells, plant remains, etc.)

Excavate grids in 25 cm spits (i.e. Level 1=0cm-25cm, L2=25cm-50cm, etc). If multiple grids are worked on at the same time, ensure that this doesn't compromise the mapping of each spit wall and floor. If a deposit has been exposed from the side, the spits in any one grid may be excavated sequentially from the top to the base of the deposit.

Depending on degree of consolidation, use small hand tools (hammers, chisels, and screwdrivers as required) on non-fossiliferous areas. Pneumatic or electric hammers can be used on areas with hard matrix where there are no fossils. Use dental picks and small screwdrivers to expose and extract fossils. Hard asphaltic matrix can be softened with clamp lamps or loosened with a small amount of solvent. Measure exposed fossils *in situ* (see below) within each grid and record their data in field notes before extracting them.

Note: Clamp lamps should be placed at least 8" away from the specimens and always monitored. Never leave lamps unattended. If the sediments start to smoke immediately turn off the lamp. 150 watt incandescent unfrosted bulbs should be used.

Save all of the surrounding sediments but separate them based on sediment type into 5 gallon metal buckets with lids. The pre-designated sediment types are A= asphaltic sand, B=brown silts and C=clay. Mark each bucket with box #, grid and level data as well as the sediment type (A, B or C). Note the number of buckets of each sediment type from each grid on an inventory list kept by the lead excavator. This is important because it determines how each bucket is processed later (see matrix processing section).

Keep daily documentation in field notes of who is excavating, a list of the grid or grids being excavated and describe the type of matrix being removed, what is being found within each grid, and any challenges encountered with the excavation. Geologic and paleobiological data should be recorded in field notes for later use to constrain and further refine taphonomic, paleoenvironmental, and paleobiological interpretations. A description of each lithology (soil type) should include color (fresh and weathered), lithologic composition, grain size, sorting and shape, sedimentary structures, induration, type of cement, fossil content, and pedogenic features (rooting, nodules, slickensides, etc.). As excavation proceeds note unit thickness, nature of the bounding contacts (erosional, sharp, gradational), and inferred depositional setting. Note nature and location of fossils (bones, shells, plant remains, etc.). Any visible modifications to the bones (weathering, polish, abrasion, scratch/tooth marks, root traces, borings, pitwear, breakage, distortion) and gross orientation should be recorded. Features of the matrix surrounding the bones, such as alteration halos, mineral crusts, micro-structures, fine root traces (small burrows or borings), and localized invertebrate bioturbation should be noted. The degree and nature of articulated, semi-articulated, associated, and dissociated skeletal elements should be described. Notes should also be taken on the general geometry of the fossil deposit (vertical pipe, tabular, etc.) drawings and/or photographs should be taken when appropriate.

Measurement system

The most common types of macrofossils recovered from asphaltic deposits are isolated bones. The following measurement system has been devised for capturing data for individual bones.

See the Special Cases section for the treatment of associated skeletons, dermal ossicles, plant masses, etc.

In situ measurements are taken from specific anatomical points on each bone (see Table 1 and 2 Appendix A) to define its spatial orientation with reference to its depth below an established datum point (BD), its distance north (N) of the southern grid line and its distance west (W) of the east grid line using the metric system (see Fig 1. of Shaw (1982) but note this uses the imperial measurement system). Recording this data at the time of excavation will facilitate studies of stream current energy and direction, deposition, and taphonomy.

All identifiable bones from 1 cm to 2 cm in size should be measured *in situ* as a 1-point measurement before being excavated. Each Standard Measurement (BD, N, W) is taken to the center point of the longest dimension (Fig. 3)

Bones larger than 2cm in minimum length or diameter should be measured as either a 2-point or a 3-point measurement. The 3-point measurement is used on all bones in which three predetermined identifiable anatomical points are visible. The 2-point measurement is used if the bone lacks three distinct reference points and records the orientation of the long axis of the specimen (proximal-distal, anterior-posterior, medial-lateral, etc.). Detailed instructions for measuring out specimens are provided by Shaw (1982), which also lists the elements that generally fall into each of these categories.

All the data pertinent to the specimen should be recorded in the field notebook and should also accompany the specimen until its preparation and curation have been completed. One method of doing this is to duplicate the field notebook entries onto a 3" x 5" card using carbon paper (Fig 1, 2 and 3 below). This card then accompanies the specimen throughout its preparation, curation, and final cataloging. Only when the data have been recorded in the catalog are they separated.

In addition to measurements on individual bones, the dip of all limb bones and skulls should be recorded with a Brunton compass. Recording these data at the time of excavation will assist with interpretation of stream current energy and direction, and taphonomy which may include possible vertical movement in a vent, trampling, etc.

The soil type surrounding each measured bone should also be noted on the 3" x 5" card by a letter using a pre-designated lettering system. The pre-designated sediment types are A= asphaltic sand, B=brown silts and C=clay.

After a bone has been measured *in situ*, it is placed in an appropriate sized clear plastic bag. The 3" x 5" data card is placed in its own small clear plastic bag for safety and then placed in the bag with the bone.

Fig 1: Example of excavation data for a 3-point measurement in a field notebook and transcribed onto a 3" x 5" card template.

P23-14 B3/L4

	GT	Px	Dt
BD =	58cm	53cm	64cm
N =	31cm	35cm	31cm
W =	13cm	10cm	90cm

Canis dirus femur

Soil type= A
Dip=30°SW
Excavator initials and date

P23-14 = Project 23-Box 14
B3/L4 = grid B3/level 75cm-100cm

GT = Greater Trochanter is 58cm below datum, 31cm from the south grid axis and 13cm for the east axis
Px = Proximal end is 53cm below datum, 35cm from the south grid axis and 10cm from the east axis
Dt = Distal end is 64cm below datum, 31cm from the south axis and 90cm from the east axis

Soil type A= asphaltic sand

Fig 2: Excavation data for a 2-point measurement in a field notebook and transcribed onto a 3" x 5" card template.

P23-1 B1/L2

	Px	Dt
BD =	53cm	64cm
N =	35cm	31cm
W =	10cm	90cm

Canid juv. radius

Soil type= B
Dip=1°SW
Excavator initials and date

P23-1 = Project 23-Box 1
B1/L2 = grid B1/level 25cm-50cm

Px = Proximal end is 53cm below datum, 35cm from the south grid axis and 10cm from the east axis
Dt = Distal end is 64cm below datum, 31cm from the south axis and 90cm from the east axis

Soil type B= brown silt

Fig 3: Excavation data for a 1-point measurement in a field notebook and transcribed onto a 3" x 5" card template.

P23-5B D3/L7

BD = 20 cm
N = 10cm
W = 15cm

Rodent tooth

Soil type=C
Excavator initials and date

P23-5B = Project 23-Box 5B
D3/L7 = grid D3/level 150cm-175cm

20cm below datum
10cm from south gridline
15cm from east gridline

Soil type=clay

Specimens smaller than 1 cm, fragments, or unidentifiable smaller bones are placed into "bulk matrix bags" together with field data cards (P23-deposit # and grid/level information, excavator initials and date). Because they are known to contain fossils, the bulk matrix bags will be processed before the rest of the matrix samples. Keep associated fragments together in capsules or envelopes within the bag. Be sure to always place delicate bones into snap cap vials first and then into a clear plastic bag with their data. If a fossil is not in place, identify it and label it "not *in situ*"

Special cases

Each special case requires consultation by lab and collections staff to assess the best way of documenting each potentially unique occurrence.

- An articulated or associated skeleton should be extensively photographed. If, after consultation with Lab and collection staff this is removed as a small block, be sure to place a white pin in the top surface along the northern middle portion of the block so that it can be oriented later. Draw and annotate a diagram of the block and the elements that are visible on each surface before it is removed. Measure out the block as a 2-point measurement. Elements within the block that can be identified and measured without compromising the specimens should be also noted and can be measured using the 1 or 2-point measurement system but should not be removed from the block. Labeled copies of all photographs should be placed in the bag with the specimen. This is additional to downloading the photographs to the archive computer (see photography section). Articulated or semi-articulated specimens should be extracted in articulation and the sediments around the specimens stabilized to conserve the maximum amount of information derivable from the specimen.

- Bone masses with poorly preserved specimens (fragmented and/or less asphalt-impregnated) are more difficult to measure out individually. Measure out the extent of the mass with the 2-point system rather than the constituent bones. Place a white pin in the top surface along the northern middle portion of the block so that it can be oriented later. Photograph in situ specimens, print and label images and place them in the bag with the specimens.

- As instructed by Lab and collections staff, and depending on their nature and frequency, dermal ossicles and pockets of plant, shell or insect material should either be measured out as a small block with a 2-point measurement (same as above) or placed in pre-labeled bags with locality information for a specific 10cm square within the 1m x 1m grid.

Geologic Samples

Collect 15 cm by 15 cm soil samples of each sediment type from each grid and level for geologic analysis of composition, weathering, and grain size at a later date. Document each sample in your notebook and measure each one *in situ* as a block using the 2-point measurement system used for fossils and described above. Each sample should have a white pin placed on the upper surface in the northern middle portion of the sample so that later the sample can be oriented. Transcribe all data onto a 3" x 5" card and place in a clear plastic bag with the soil sample. A list of soil samples taken should be kept by the lead excavator for each grid and deposit.

When spits are completed, photograph and map each exposed wall and the floor.

Floor and Wall mapping

When mapping a wall or floor (Fig. 4, 5 and 6)

- Draw maps on graph paper with a scale of 3 squares = 10 cm.
- Keep the origin point (0, 0) in the southeast corner.
- Mark north arrow.
- Draw in empty spaces and the edge of the box when present.
- Mark asphalt and sediment contacts.
- Use standardized symbols for lithologies and other known sedimentary features. Also
- Indicate where fossils, cobbles, bone, shells and plants masses are located (Fig 4).

Figure 4: Standard symbols used in mapping each grid's floor and wall

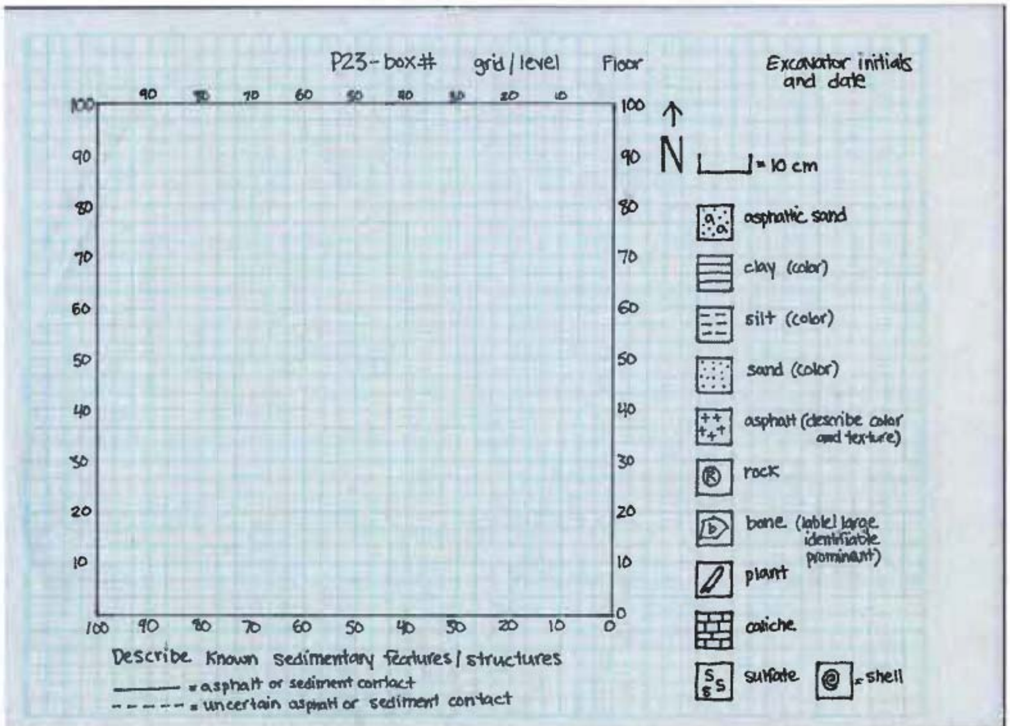


Figure 5: Sample drawing of the floor of grid C3/L3 of box 14

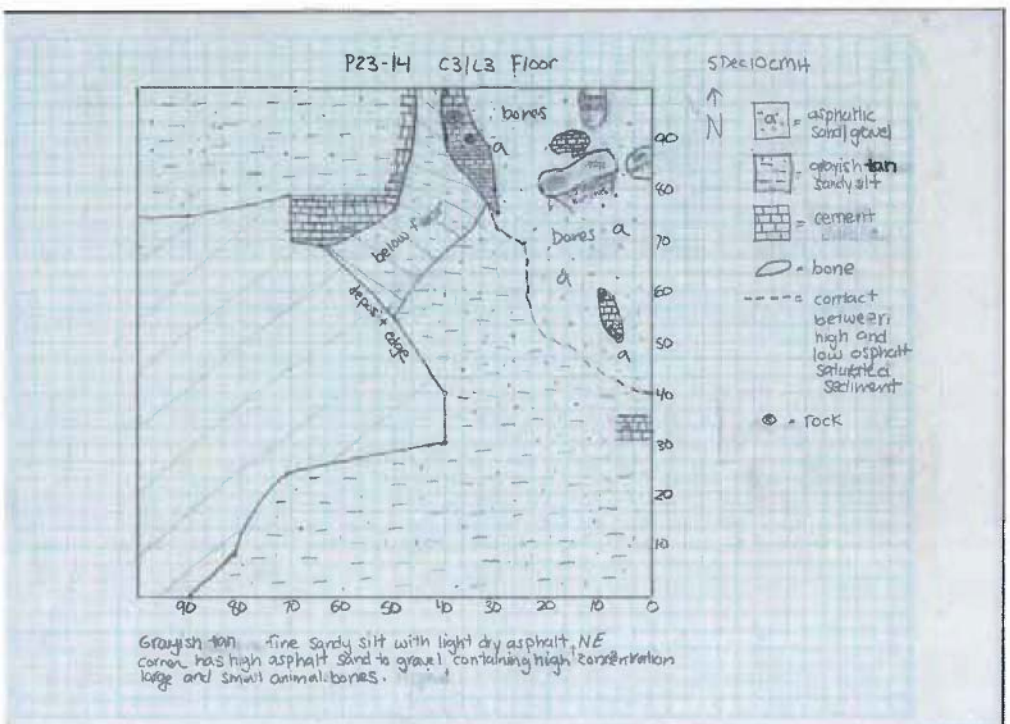
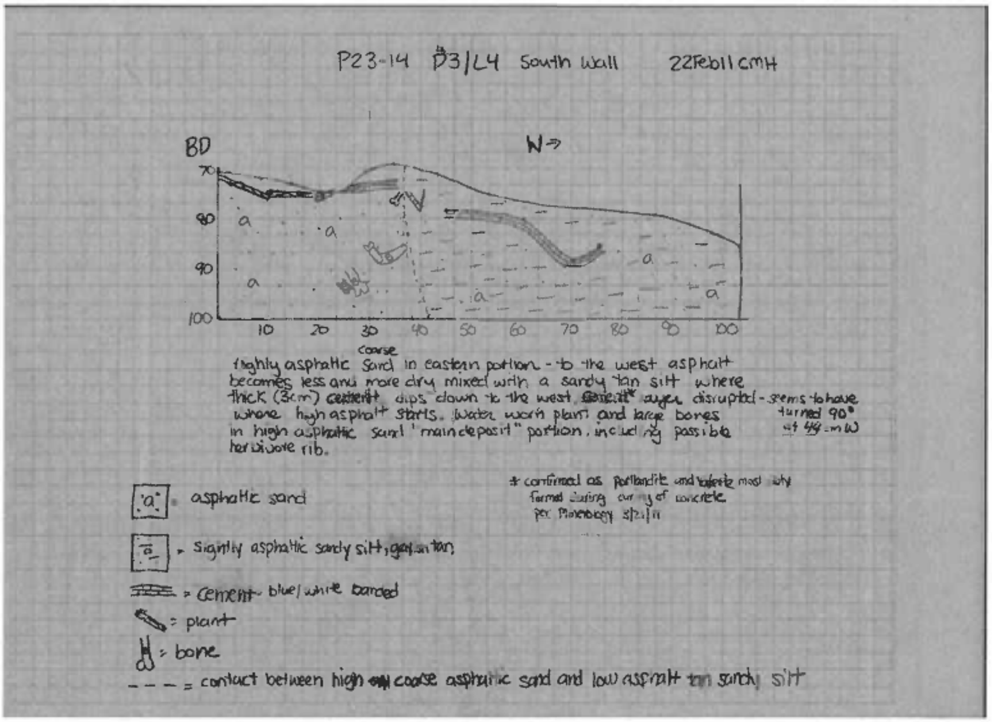


Figure 6: sample drawing of the south wall of grid D3/L4 of box 14



Photography

Photo documentation and the labeling of downloaded images are very important. In the field photo logbook provided, record all the images that you take. This is shared by everyone and has columns for name of photographer, date, box #, grid and level, orientation of image, file number and special notes. Take a photograph whenever it might be useful for lab staff and researchers to see how a specimen was oriented in the ground, broken in a certain way or for any other unusual circumstance. Always photograph the floor and each wall of a grid before starting a new one.

<u>When photographing a specimen:</u>

Write the project name, box #, grid and level #'s, orientation, description of what you are photographing, the date and excavator initials on a 3"x 5" card with a black sharpie and place next to the object you are photographing.

For example:

P23-14 C3/L3
Skull , ventral view ↑
N
Excavator initials and date

Print the photo as soon as possible and place it in the bag with the specimen. This may not be necessary for all the images of *in situ* specimens, so make a judgment call here.

When photographing a floor or wall:

- Write the project name, box #, grid and level #'s, orientation, the date and excavator initials on a 3"x 5" card with a black sharpie.

For example:

P23-14 C3/L3
South Wall ↑
Excavator initials and date N

- Place meter sticks in north and west orientation.
- Take a picture of each exposed wall and floor with the card and meter sticks in frame so as not to cover up any significant features and so the information on the card can be used to tag the photograph in the database.

Download all photographic images to the archive computer and place in the folder "to be sorted" under My Pictures\Project23 under the project 23 login. Rename your files appropriately so that they can be retrieved, tagged in Adobe Bridge and added to the EMu database. This is where the photo logbook will be useful. Each image should be named with the following conventions in order to be searchable in the database:

1. If it is a photo of a grid and a level then name it P23-1 B1 L2 where P23-1 refers to the Box number, B1 refers to the grid and L2 refers to the level. Notice a space between P23-1 and B1 and also between B1 and L2. This is on purpose and helps the database find the files. If there is no level just enter the information that you have.
2. If it is just an image of several grids just name it with the box number e.g. P23-14.

3. If it is a photo of a possible associated skeleton or a specimen in the ground include some more information such as what it might be e.g. P23-1 B1 L2 bird skeleton

Data entry of field notes

Write field notes in pre-bound notebooks. For each day compile a daily journal that includes notes on the weather, who was working, general work done that day, grids being worked on, etc. as well as geological information on open grids and specimen measurements. On a weekly basis all excavation notes, photographs and grid drawings will be captured electronically.

- Type journal entries into word documents with each day saved as a new file. The naming convention of the file should be "project yearmonthday initials" (e.g. P23 20090201 ABF). Within the word doc file at the top of the page type the initials of the excavator and the date. This serves as a search tool for the database. Save these to the flash drive that is provided. The Collections Manager will import these data into the database.
- Type specimen measurement data into a pre-prepared Excel spreadsheet and save to the flash drive provided. The Collections Manager will import these data into the database.
- The floor and wall drawings and photographs for each grid must be scanned and downloaded onto the archive computer at the Page Museum.

Matrix processing

There are two different ways that matrix from the excavation is processed. All asphaltic matrix from or adjacent to asphaltic bone concentrations needs to be processed with solvent in a vapor degreaser in order to release small bones and other plant, insect, invertebrate and vertebrate remains from the asphalt. After degreasing, the matrix is dried and dry screened to remove the clay-to-silt fraction. The remaining concentrate is sorted for microfossils under a microscope.

Samples of other (apparently non-fossiliferous) non-asphaltic sediments are screen-washed in water on 20 mesh screens and the concentrates are sorted for microfossils under a microscope. If there is no evidence of microfossils in the sample, the remaining material from that facies of that grid may be discarded (except for the 15 cm archival cube that was collected during excavation of the grid).

Laboratory Protocols

All material sent to the Lab for cleaning is triaged to resolve appropriate methodology, account for the skill level of available lab workers, and for research and collection priorities. An n-propyl bromide solvent is used to remove asphalt from the bones. Trade names for this solvent include Lenium, GenTech and EcoMax. Elmers white glue is used to repair broken bones and Acryloid (Paraloid) B-72 (Ethyl methacrylate copolymer) is occasionally used to consolidate dry bones.

Prioritize new specimens

1. For cleaning method
    - Sort and store by locality, grid, depth.
    - Sub-sort by best cleaning method: ultrasonic, soaking, or hand prep.
2. For significance
    - Rareness of taxon
    - Incomplete section of previously excavated specimen
    - New element of known individual skeleton from that locality
    - Unrecognizable to element or taxon.

Ultrasonic cleaning

Ultrasonic cleaning can be used for the following types of specimens:

- Complete or sturdy bones measured in individually (examples include *Smilodon* or *Canis dirus* carpals, tarsals, phalanges)
- Complete or mostly intact avian bones. The feasibility of processing other fragile bones, including broken small bones, should be assessed by the person who will be re-assembling them.
- Shells, insects, and concentrations of mollusks or insects from within known locality with measurements.

Steps to be followed

1. Place each specimen or sample in a baby food-sized jar with all contents of envelope.
2. With pencil, number the envelope and the <u>top</u> of the jar (on masking tape).
3. Prepare six jars as above.
4. Fill with solvent to an equal level in all jars.
5. Place in ultrasonic tank and fill with water up to the level of solvent in jars.
6. Buzz for fifteen minutes.
7. Strain contents of jar through 20 mesh screen on top of pitcher.
8. Rinse with clean solvent.
9. Check specimen or sample for matrix, detail with brush or skewer as needed.
10. Place each specimen or sample on separate paper tray, with flipped out matrix, data, and masking tape number from jar top.
11. Let dry over night, polish, and sort matrix.
12. Solvent that was strained into pitcher can be reused for setting up next batch of six jars if not too dirty.

Pre-soaking

- Large bone masses: If there is no single identifiable bone, put it in a large jar or a bucket with more solvent than volume of mass. Mass may require a second rinse if solvent becomes too thick with asphalt.
- Unusually hard matrix: Put all of the specimen and loose matrix in jar with data taped to lid.
- Broken *in situ* specimens: If matrix is in internal structure of bone, soak and rinse.

Hand preparation

- Individual specimens with positional data include vertebrae, ribs, long bones, etc. that are relatively complete.

Steps to be followed

1. Rubber stamp, date, and write the signature of preparator on back of data card.
2. Empty all contents of plastic bag or envelope into stainless steel pan.
3. Wet specimen with solvent from squirt bottle.
4. Scrub with tooth brush, dipped in small jar of solvent (n-propyl bromide)
5. DISOLVE MATRIX, DO NOT PUSH OFF WITH BRUSH OR OTHER TOOL.
6. Wood skewers or sticks can be used to loosen or nudge matrix off (If the stick breaks, the matrix is not soft enough yet)
7. When specimens appear clean, rinse thoroughly with solvent and immediately hold in front of vent for quick dry. Matrix still adhering to specimen will be black or darker than bone.
8. DENTAL TOOLS ARE TO BE USED FOR THE REMOVAL OF VISIBLE ROCKS ONLY!
9. When the entire matrix has been removed, place specimen, data card and jarred contents of metal pan matrix on paper tray lined with paper towels to dry.
10. DO NOT GLUE UNTIL ALL MATRIX IS SORTED.

- Multiple pieces of one specimen.
  1. Should be prepared by one person but treated as separate projects.
  2. Finished elements held until all parts are done.
  3. If glued, the part that goes with which data should be recorded in pencil on back of data card.
- Possibly associated elements of one individual
  1. Treat as above but can be cleaned by multiple preparators.
  2. Label for possible association with a known skeleton or a single other element. [more specific].

- Skulls

  1. External surfaces should be freed of larger associated specimens and gross matrix clumps using toothbrushes and solvent.
  2. DO NOT POKE IN EARS, NOSE OR BRAIN CASE.
  3. At the end of session, immerse in solvent in sealable bucket with copy of data on lid.
  4. Soak for two or three days.
  5. Hold skull over bucket and flush with clean solvent to remove loose matrix.
  6. Working in metal tray, nudge with skewers to loosen softened matrix and rinse off.
  7. Add removed matrix back into bucket.
  8. Replace skull in bucket at end of session.
  9. If the tympanic bulla is intact, nudge and rinse ear region over metal pan and process matrix separately for ear ossicles.
  10. When brain case and nasal region are mostly free of matrix, skull will not need to continue to soak and can dry between sessions.
  11. Strain contents of bucket.

Polishing

- When specimen has dried overnight, go over small sections of solid bone with a dampened **soft cloth**, then go over the same space with a dry cloth. Exposed cancellous tissue should be <u>blotted</u> with a damp rag. Not rubbed!
- If there are small spaces that cannot be reached with a rag use a pipe cleaner or Q-tip. Dip it in solvent and blot off some liquid before applying. IF THE SPECIMEN GETS DARKER OR BEGINS TO LEAK ASPHALT, IT IS TOO WET. Put aside for a day and begin again.

Processing Matrix from Individual specimens

- Processing sediment that has been soaked in solvent. (most common situation)

1. Pour contents through 20 mesh screen sitting on funnel into carboy.
2. Rinse with clean solvent.
3. With one motion, flip contents onto paper toweling on a paper tray.
4. Make sure everything is out of jar and out of screen.
5. Place tray near vent to dry.
6. When completely dry, sift and put in appropriate sized jar for later sorting.
7. If matrix appears clumpy after sifting, re-soak in solvent.
8. If matrix appears dirty with clay or silt after sifting, soak in hot water with a small amount (1 tsp) of detergent)

- Processing soaked in water sediment.
    1. Pour contents of jar through 20 mesh screen in a basin in the sink.
    2. Agitate the screen in clean warm water.
    3. Flip contents onto newspaper and leave screen on top to thoroughly dry.

Microfossil sorting

When the matrix from an individual specimen is clean and dry it is ready for microfossil sorting.

Take the entire project (specimen, data and matrix) to a sorting station.

Do not pour out more matrix than you have time to sort. Only 1½ to 2 Tbs. may take several hours.

1. Sifting
    - Always sift matrix before sorting even if it was sifted before putting in a jar.
    - Sift through a designated 20 mesh screen with 2 inch sides.
    - Shake back and forth, (not up and down) over a paper towel.

- Empty contents of screen onto a clean piece of white sorting paper and shape matrix into a pile.
- Discard the fine soil that went through the sifter.

2. Sorting

   - Examine matrix, several grains at a time, by moving it across the paper with a fine paintbrush.
   - Create a "discard pile" for sediment and oxidized asphalt.
   - Move bone, plant, shell and insect fossils into distinct piles on one side of the paper.
   - Create a "questions" pile for indeterminate fossils.
   - When the entire matrix has been categorized, review fossils and "discard pile".
   - Have a staff person double check sorting.
   - It may be necessary to examine some specimens under the microscope.

3. Temporary packaging of categories

   a. <u>If all of the matrix of a individual project is sorted</u>

      - Review bone and separate into three categories:
      - 1. Broken pieces of the main bone (put aside for possible gluing);
      - 2. Identifiable bones (put into individual capsules or plastic containers);
      - 3. Unidentifiable bone fragments (put into one capsule or larger container).
      - Review plant material (separate seeds and put into capsule) and put into glass vial.
      - Review insect and put into one capsule.
      - Review shell and put into one capsule.

   b. <u>If only a portion of the matrix is sorted</u>

      - Place complete identifiable bones in capsules.
      - Place all bone fragments, plant, insect and shell into their own labeled containers.

When a large project is complete, all of the bone fragments must be reviewed and sorted to the above categories. It will be necessary to look at the small bone fragments under the microscope to determine the final number of Identifiable bones.

Gluing

DO NOT GLUE UNTIL ALL MATRIX REMOVAL, POLISHING AND MATRIX SORTING IS DONE.

Use white glue for reconstructing most bones because it is reversible with warm water.

If a specimen is shattered, first reconstruct it holding the pieces together with masking tape. Do not glue until all of the fragments have been tested in available holes. Determine where all the major fragments go first and then glue from one direction. Have small strips of masking tape cut before the glue is applied. Apply glue with stick or dental pick in small amounts to the broken edges. Tape glued pieces in place and/or balance in sandbox for drying. Allow large pieces to dry overnight.

Envelopes for finished projects

A copy of the original data must be made for every identifiable bone and one copy each for vial containing plant, insect, shell and unidentifiable bone. A rubber stamp template for "Found in assoc. w/" data is stamped on the face of a #5 ½ coin envelope. An exact copy of the original is then filled in. Note: Do not change the tentative field identification that is part of the original data even if it is wrong. The back of the envelope is stamped with a template for the scientific identification. If an "assoc. w/ bone "or the plant fragment is too large to fit inside an envelope, it should be put in a small plastic bag with an envelope. The envelopes are stapled shut and the entire project is put in one large plastic bag.

The finished bag should include the main bone, fragments of the main bone that could not be glued on, the original data and all the "associated with" specimens.

Pre-Curation

After the specimens have been cleaned, the microfossils sorted and put into individual capsules and individual envelopes have been made for each specimen with all of the provenance data written on each envelope (see laboratory procedures) they are sent to the curation station. Identification of all of the fossils takes place near the comparative collection in the lab in order to facilitate identification. The principal measured out specimen with its original 3"x 5" field data card is identified first. The card is stamped on the back with a custom stamp with Scientific Name, Element, Identifier, and Notes. The specimen is identified as much as possible but identifications necessarily range from class identification such as Aves to genus and species. The identifier also describes the element according to an established list of bone terminology. Then each of the microfossils associated with that main bone are also identified in the same manner. After all of the microfossils that accompany that main specimen are identified, they are placed in a clear plastic bag with a twist tie and sent to the cataloging station. Below are detailed step-by-step instructions on how to identify specimens.

For each specimen follow the steps below in the order given.

1. Choose a specimen from the 'to be identified' box. If several envelopes are fastened together you must keep them together and complete the work on all of them.

2. Check the bone to see if it is clean and that all broken pieces have been glued if possible. If the bone is not clean then do not proceed with that one and send it back to the lab

3. Identify the bone using the reference collection and write the identification on the back of the envelope or card in pencil. Only use paperclips to join envelopes together.

4. Check to see if the main identified bone is in the original envelope or with the original 3" x 5" card.

5. Send identified specimen to be cataloged

- Always put the comparative bone back in the box it came from!

- if you find a 'found in association with' envelope which is not still with its original envelope, find the original envelope and fasten them together

- put all tools away and empty bags and containers

Associated groups

If there is more than one specimen in an envelope the principal bone for which the measurements were recorded should remain in the original envelope. The other specimens should be treated as follows;

- all plants in one envelope
- all insects in one envelope
- all shells in one envelope
- each identifiable bone in a separate envelope, along with any of its broken pieces
- all unidentifiable bone in one envelope
- all difficult to identify bones in one envelope

Use envelopes stamped "Found in Association with" and make a complete copy of the information from the original envelope on each one.

Identifiable and Unidentifiable Specimens

Identifiable bone characteristics:

- presence of an articular surface
- cross-sectional shape
- foramina
- distinctive curves
- relative size combined with other features

Bones are rated in three different grades of how easy they are to identify

- identifiable
- difficult to identify
- unidentifiable

Double check all identifications

Identification of Specimens

The back of each envelope is marked with a custom stamp (stamp in bold below). Identifications are printed in pencil. An example below

- **Scientific name:** *Smilodon* (use both genus and species if more than one species)
- **Element:** prox. rt. tibia
- **Special Notes:** Pathology
- **Identifier:** ABF

1. Avoid using terms such as "frag" or "portion". Use prox. or dist. if appropriate.
2. You must not abbreviate scientific names but you may use abbreviations for the elements as long as they are the ones listed in this manual.
3. When identifying skulls and mandibles always list the teeth that are present and if they are erupting, fully erupted or worn.
4. The format of the identification is very important. Do not invert the word sequence e.g. prox. rt. rib is correct but rib, rt. prox. is not.
5. For incomplete bones name both the bone e.g. XIII thoracic vert and either the represented part e.g. centrum or the missing portion, e.g., w/o right transverse process. Make sure that the identity of the bone and its qualifier are both listed.
6. Be specific about the identity of any represented epiphysis, e.g., proximal or distal epiphysis of a limb bone, or head epiph of lt femur or ant cent epiph of thoracic vert.

7. Ordinal numbers of ribs, vertebrae, metapodials and digits are written in Roman numerals e.g. rt. II rib or XII thoracic vert

8. Number of phalanges and teeth are written in Arabic numerals e.g. 2nd phalanx or rt. M1. Note that abbreviations for upper molars are written in upper case letters (I, C, P, M) whereas those for lower teeth are written in lower case (i, c, p, m). For clarity of handwritten entries, put a line below the number for upper teeth (e.g. P4/) and a line above the number for lower teeth (e.g. m/1).

9. The side, either left or right comes before a number e.g. rt. II metatarsal

10. There are two special cases:

    - Phalanges that can be precisely named include sloth phalanges, carnivore 'thumb' phalanges and bird carpal phalanges e.g. rt. 1st carpal phalanx, digit I

    - Teeth which can be specifically named e.g. lt. p2

11. Skull fragments: if the facial or cranial region of the skull is mostly intact this can be recorded as 'ant' or 'post' skull. However if there are only a few fragments the individual bones are named e.g. basisphenoid, occipital and rt. temporal or indicate if some parts are missing, e.g. post. skull w/o rt. occipital.

12. Juvenile specimens: it is important to note if an epiphysis is missing as the order of ephiphyseal fusion is used to detect the age of an animal. Also mark "juv." in the special notes section of the identification.

Abbreviations chart for elements

Left: lt.	Posterior: post.	With: w/
Right: rt.	Ventral: vent.	Without: w/o
Proximal: prox.	Dorsal: dors.	Juvenile: juv.
Distal: dist.	Medial: med.	Pathological: path.
Anterior: ant.	Lateral: lat.	Unidentifiable: unid.

Difficult to identify: diff.

Zygomatic: zygo.

Epiphysis: epiph.

Diaphysis: diaph.

Tuberosity: tub.

Trochanter: troch.

Articular: artic.

Vertebra: vert.

Transverse: trans.

Process: proc.

Centrum: cent.

Prezygapophysis: prezyg.

Postzygapophysis: postzyg.

Incisor: I (upper) or i (lower)

Canine: C (upper) or c (lower)

Premolar: P (upper) or p (lower)

Molar: M (upper) or m (lower)

Deciduous: D

Dental formulae for Rancho La Brea fauna

Dental formulae are a short hand way of indicating the number and kind of teeth that are present. The upper jaw is indicated first and the teeth are in order: incisor, canine, premolar, molar.

Ruminant artiodactyls

0,0,3,3 / 3,1,3,3

(Antilocapra, Bison, Capromeryx, Odocoileus)

Camelids

Camelops: 1,1,2,3 / 3,1,1,3

Hemiauchenia: 1,1,2,3 / 3,1,1-3,3

Peccaries

Platygonus: 3,1,4,3 / 3,1,4,3

Horses

Equus: 3,1,3,3 / 3,1,3,3

Tapirs

Tapirus: 3,1,4,3 / 3,1,4,3

Dogs and bears

3,1,4,2 / 3,1,4,3

(Arctodus, Canis dirus, Canis latrans, Urocyon, Ursus)

Cats

3,1,3,1 / 3,1,2,1

(Felis atrox: Felis concolor: Lynx)

Sabertoothed cats

Smilodon: 3,1,2,1 / 3,1,1,1

Skunks, weasels, & badgers

3,1,3,1 / 3,1,3,2

- Tympanic bulla
- Vomer

Auditory ossicles

- Malleus
- Incus
- Stapes

Mandible

- Angular process
- Articular condyle
- Coronoid
- Symphysis

Hyoid

- Basihyal
- Ceratohyal
- Epihyal
- Stylohyal
- Thyrohyal

Teeth

- Permanent upper and lower. Upper denoted by upper case abbreviation and lower by lower case abbreviation.
    - Incisor – I (upper) or i (lower)
    - Canine – C (upper) or c (lower
    - Premolar – P (upper) or p (lower)
    - Molar – M (upper) or m (lower)
- Deciduous upper and lower. Upper denoted by upper case abbreviation and lower by lower case abbreviation.
    - Incisor – DI (upper) or di (lower)
    - Canine – DC (upper or dc (lower)
    - Premolar –DP (upper) or dp (lower)

Vertebra (e)

- Atlas
- Lumbar
- Sacral
- Axis
- Neural spine
- Sacrum
- Caudal
- Odontoid process
- Thoracic
- Centrum
- Postzygapophysis
- Transverse process
- Cervical
- Prezygapohysis
- Wing

Ribs

- Capitulum
- Shaft
- Tuberculum

Sternum

- Manubrium
- Sternebra
- Xiphisternum

Scapula

- Acromium process
- Glenoid fossa
- Spine
- Coracoid process
- Metacromion
- Vertebral border

Humerus

- Deltoid tuberosity
- Entepicondylar foramen
- Greater tuberosity
- Head
- Lateral condyle
- Lateral epicondyle
- Lesser tuberosity
- Medial condyle
- Medial epicondyle

Radius

- Styloid process
- Radial tuberosity

Ulna

- Coronoid process
- Olecranon
- Semilunar notch
- Styloid process
- Radial notch

Carpals

- Cuneiform
- Trapezium
- Lunar
- Magnum
- Trapezoid
- Central
- Pisiform
- Unciform
- Radial sesamoid
- Scapholunar
- Scaphoid

Metacarpal

- Plantar tubercle

Sesamoids

- Proximal sesamoid
- Distal sesamoid

Phalanges

- 1st, 2nd, 3rd, 4th, 5th
- Carpal
- Tarsal

Inominate

- Acetabulum
- Iliac crest
- Ilium

- Ischial tuberosity
- Ischium
- Pubic symphysis
- Pubis

Fabella

- Lateral
- Medial

Femur

- Greater trochanter
- Head
- Lateral condyle
- Lateral epicondyle
- Lesser trochanter
- Medial condyle
- Medial epicondyle
- Neck
- Patellar track
- Third trochanter

Patella

Tibia

- Lateral condyle
- Medial condyle
- Medial malleolus
- Tibial tuberosity

Fibula

- Head
- Lateral malleolus
- Distal fibula (herbivore)

Tarsals

- Astragalus
- Calcaneum
- Cuboid
- Ectocuneiform
- Entocuneiform
- Mesocuneiform
- Navicular
- Sustentaculum
- Naviculocuboid

- Mesoectocuneiform

Metatarsal

- Plantar tubercle

Non-articulating bones

- Baculum (male)
- Dermal ossicle (sloth)
- Sclerotic ossicles (birds and lizards)
- Falciform (sloth)
- Tracheal ring (birds)
- Dermal scale (lizard)

Variations for juveniles

- Diaphysis – shaft of juvenile long bone
- Epiphysis – the unfused articular surfaces of juvenile bone

Numbers

- Ribs – roman numerals
- Metapodials – roman numerals
- Digits – roman numerals
- Phalanges – Arabic numerals—1st, 2nd, 3rd, 4th, 5th, terminal

Curation

In order to curate specimens into the collections of the George C. Page Museum, all of the above-mentioned steps for excavation, preparation, and identification must be followed. The field number, orientation measurements, and pertinent field notes and photographs are all integral parts of the specimen information and must be readily available. Each specimen will receive an individual catalog number that is first recorded in an archival catalog book and then entered into the electronic database EMu, which is stored on the Natural History Museum's server. Once cataloged, each specimen is stored taxonomically in the collections. Specimens are housed in metal or wooden drawers within standard metal Lane cabinets. On average each drawer holds about seventy five specimens and each cabinet contains nine drawers.

Based on a typical deposit for Project 23, a 1m X 1m x 25cm grid yields approximately 1000 macro-vertebrate specimens per one (1) cubic meter. Additionally each cubic meter can have up to 2000 micro-vertebrate fossils. A typical conical shaped deposit can be up to 30 cubic meters.

Appendix A

Table 1. Anatomical codes used for orienting specimens in the 2- and 3-point measurement system.

A -- Anterior	Px -- Proximal
P -- Posterior	Dt -- Distal
M -- Medial	Lt -- Left
L -- Lateral	Rt -- Right
D -- Dorsal	R -- Root
V -- Ventral	C -- Crown

Table 2. Anatomical codes of osteologic points used for orienting specimens in the 3-point measurement system.

MAMMALS

Skull:
- AP - Anterior Premaxillae
- OC - Occipital Condyles
- POP- Postorbital Process (Rt or Lt)

Mandible:
- A - Anterior
- CP - Coronoid Process
- P - Posterior

Vertebra:
- AC - Anterior Centrum
- ANS- Anterior Neural Spine
- NS - Neural Spine
- PC - Posterior Centrum
- TP - Transverse Process (Rt and Lt)

Rib:
- Dt - Distal
- GC - Greatest Curve
- Px - Proximal
- Tub- Tuberculum

Scapula:
- AP - Acromion Process
- CP - Coracoid Process
- D - Dorsal
- PA - Posterior Angle
- V - Ventral

Humerus:
- Dt - Distal
- LEP- Lateral Epicondyle
- MEP- Medial Epicondyle
- Px - Proximal

Radius:
- Dt - Distal
- Px - Proximal
- RT - Radial Tuberosity

Ulna:
- CP - Coronoid Process
- Dt - Distal
- Px - Proximal

Innominate:
- IC - Iliac Crest
- IS - Ischial Tuberosity
- PU - Anterior Pubic Symphysis

Femur:
- Dt - Distal
- FC - Fovea Capitis
- Px - Proximal

Tibia:
- Dt - Distal
- Px - Proximal
- TT - Tibial Tuberosity

Fibula:
- Dt - Distal
- LM - Lateral Malleolus
- Px - Proximal

Calcaneus:
- Dt - Distal
- Px - Proximal
- S - Sustentaculum

Metapodial:
- Dt - Distal
- PT - Plantar Tubercle
- Px - Proximal

BIRDS

Skull:
- Same as Mammals

Mandible:
- Same as Mammals

Vertebra:
- NS - Neural Spine
- TP - Transverse Process (Rt and Lt)

Sternum:
- A - Anterior
- CA - Carinal Apex
- P - Posterior

APPENDIX E

***Wilshire/Fairfax Station Construction, Paleontological Resources Extraction* from Metro Westside Subway Extension Memorandum of Understanding (MOU) for Paleontological Resources**

WESTSIDE SUBWAY EXTENSION PROJECT

Wilshire/Fairfax Station Construction. Paleontological Resources Extraction.

Metro

December 2011

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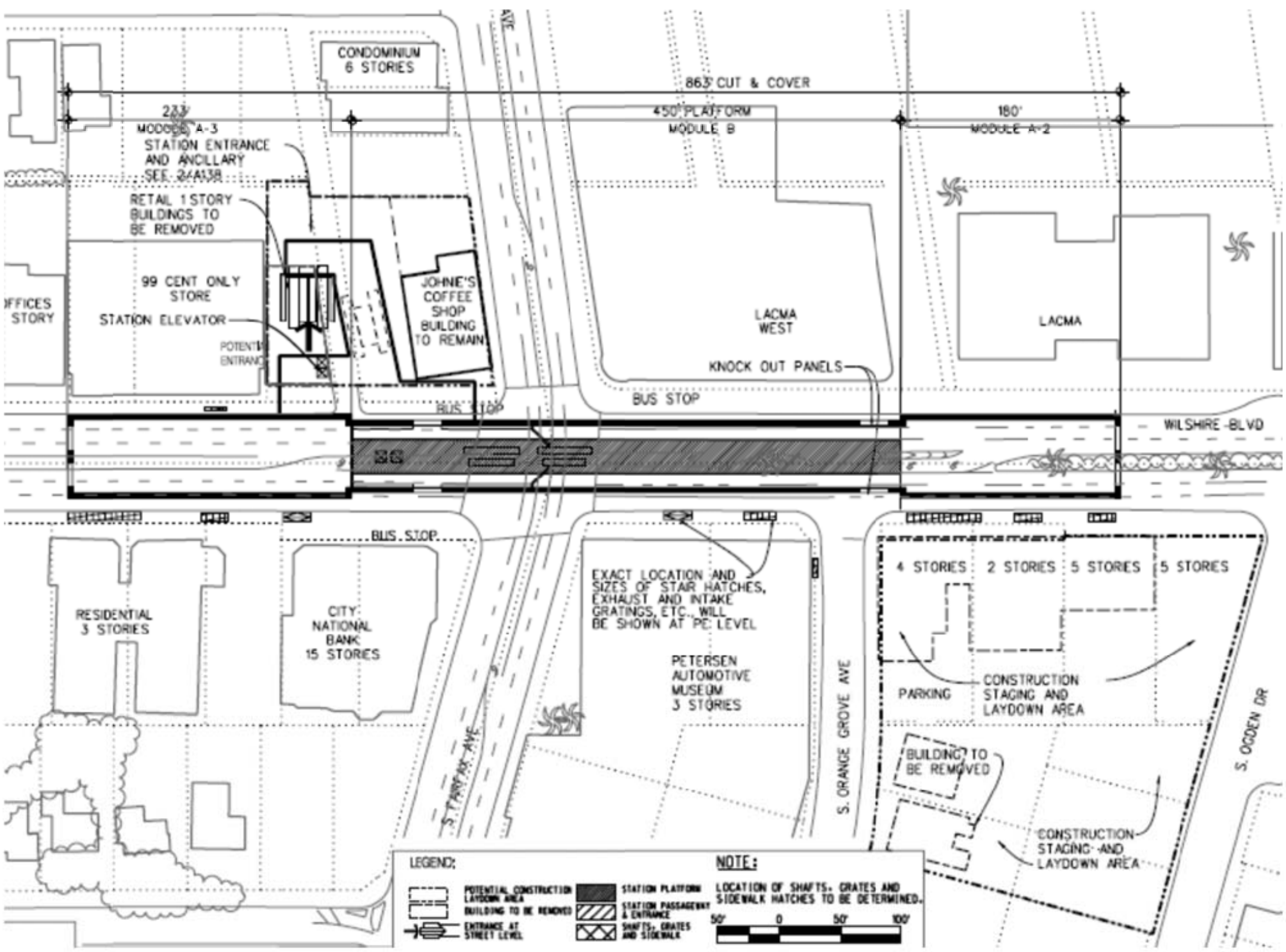
Appendix

1.0 BACKGROUND

The Wilshire/Fairfax station box excavation will be approximately 860-ft long, 70-ft wide, and 60 to 70-ft below street level. The station extends beneath the intersection of Wilshire Boulevard and Fairfax Avenue - see Figure 1-1. The station entrance is planned to be located near the northwest corner of Wilshire and Fairfax between the 99 Cent Only Store and Johnie's Coffee Shop. Two alternative entrances under consideration; the south side of Wilshire between South Orange Grove Avenue and South Ogden Drive and; within the LACMA building at the north east corner of Fairfax Avenue and Wilshire Boulevard (May Company). A construction staging and materials laydown area is planned for the south side of Wilshire between South Orange Grove Avenue and South Ogden drive. Side access shafts will be located at the construction staging and materials laydown area and at the location selected for the station portal. The side access shafts will be excavated to the full depth of the station. The station box will be excavated by the cut and cover method and most probably use a temporary shoring system to support the excavation and decking system during construction, though a permanent shoring system that would be integrated into the permanent station structure could also be used. The side access shafts will be excavated by the open cut method and would most probably use the same type of shoring system that is used on the station box.

Figure 1-1: Wilshire/Fairfax Station Box



2.0 GEOLOGIC CONDITIONS

The geologic conditions in this region consist of soft alluvium deposits of sands, silty sand, clayey sand, gravely sand, silty clay, clayey silt, shell fragments, soil saturated with crude oil, and asphaltic (tar) sands. Several borings were taken within the station area; see Figure 2-1 through Figure 2-4. Core G-118 (Figure 2-1) was taken east of the station box between La Brea and Fairfax, the sample at 82-ft below ground surface (bgs) consists of silty clay/clayey silt with traces of crude oil. The portion of ring sample G-123 shown in Figure 2-2 is located just east of Fairfax at 60-ft bgs and consists of predominantly fine grained soil with channels of medium grained sand saturated with crude oil. Heavy tar was reported in G-123 from 38 – 110-ft bgs. Core sample G-124 (Figure 2-3 and Figure 2-4) was obtained just west of Fairfax by the Standard Penetration Test (SPT). The sample pictured was taken from 80-ft bgs and consists of medium to coarse grained sand saturated with tar. Heavy tar was reported in G-124 from 45 – 105-ft bgs. The consistency of tar in this region ranges from dry and hard to wet and oozing. This reach is also known to contain pockets of pressurized gases and dissolved gases in groundwater. The groundwater conditions are measured to have a water table depth of 74-ft bgs, and zones of perched water between 10 – 50-ft bgs. Since the station box invert depth will be located between 60 – 70-ft bgs, perched water can be anticipated during excavation.

Figure 2-1: Core Sample G-118

Figure 2-2: Core Sample G-123

Figure 2-3: Core Sample G-124 (1 of 2)

Figure 2-4: Core Sample G-124 (2 of 2)

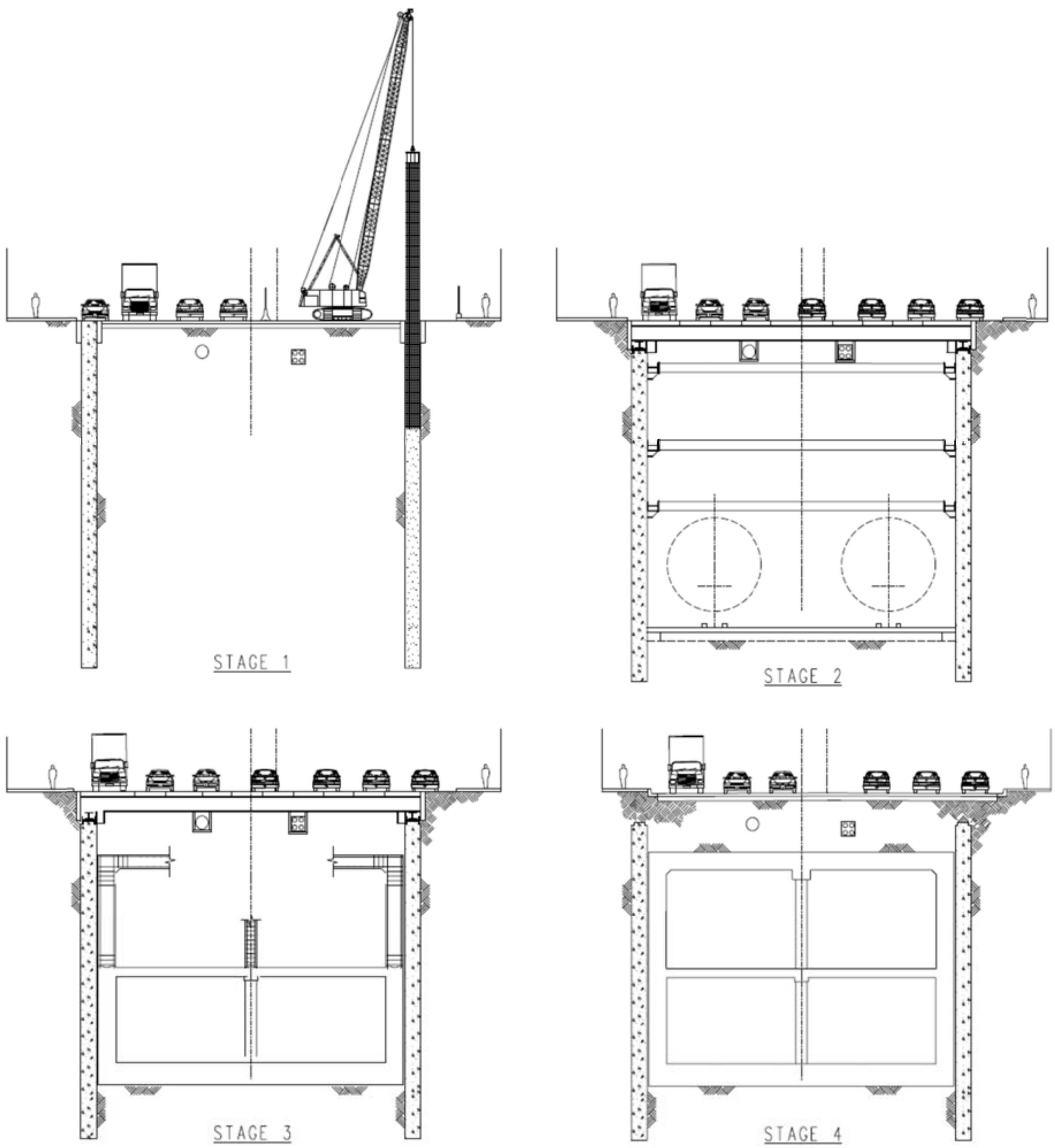
2.1 Gassy Ground Conditions

The gases present in the soils of this region are methane (CH_4) and hydrogen sulfide (H_2S). They are likely to occur in pressurized pockets as well as in a dissolved state in groundwater. These gases can seep into tunnels and other excavations through soil and also through discontinuities (fractures, faults, etc.) in bedrock. CH_4 and H_2S are considered hazardous gases due to their explosive properties. H_2S is also highly toxic. Being heavier than air, it tends to accumulate at the bottom of poorly ventilated spaces. Although very pungent at first, it quickly deadens the sense of smell, so potential victims may be unaware of its presence. CH_4 is extremely flammable and may form explosive mixtures with air. It is odorless and lighter than air, and it dissipates quickly once at the surface causing no threat of explosion. However, in 1985 an explosion occurred at the Ross Dress-for-Less in the Fairfax area which resulted in injuries requiring hospital treatment of twenty-three people. The explosion took place in a poorly ventilated ancillary room of the building where CH_4 gas had accumulated. There was no gas detection equipment at this location.

3.0 EXCAVATION SUPPORT TECHNIQUES

Cut and cover excavation is the preferred technique to excavate the station box structure, although cut and cover still leads to lengthy occupation of streets with noise disturbances and interrupted access (see Figure 3-1). Traffic interruptions can be mitigated by performing most excavation below a temporary decking system constructed at an early stage (See Figure 3-2 through Figure 3-6).

Figure 3-1: Open Cut Excavation



Shoring the excavation walls and providing structural support beneath the decking system can be accomplished through a variety of excavation support techniques. The following sections describe several excavation support methods, including: soldier pile and lagging, slurry walls, tangent piles, secant piles, and deep soil mix walls.

Figure 3-2: Initial Excavation at Soto Station

Figure 3-3: Precast Concrete Decking

Figure 3-4: Installation of Decking (1 of 2)

Figure 3-5: Installation of Decking (2 of 2)

Figure 3-6: Roadway Operations Restored on Temporary Decking System

3.1 Soldier Piles and Lagging

Soldier pile and lagging walls are a type of shoring system typically constructed along the perimeter of excavation areas to hold back the soil around the excavation. This support system consists of installing soldier piles (vertical structural steel members) at regular intervals and placing lagging in between the piles to form the retaining structure. Pre-augering is necessary for installation of the soldier piles. Pre-augering involves drilling holes for each pile from the street surface to eliminate the need for pile driving equipment and thereby reduces project noise and vibration levels that would otherwise occur while pile driving. Pre-augering also provides better accuracy of location than pile driving. The lagging, which spans and retains the soil between the piles, is typically timber or shotcrete (sprayed-on concrete) and is installed in a continuous downward operation taking place concurrently with excavation. The installation of soldier piles and lagging is a relatively clean process. The majority of construction materials, such as, drilled earth spoils, concrete, backfill, and H-piles are easy to contain within the construction site. The soldier piles and deck beams are installed first with excavation and lagging installation taking place from beneath the street decking. A soldier piles and lagging earth retention system is shown in Figure 3-7 through Figure 3-9. The equipment required for installation of the soldier piles includes drill rigs, concrete trucks, cranes, and dump trucks.

Soldier piles and lagging are generally used where groundwater inflow is not a consideration, or where grouting, or lowering of the groundwater level (dewatering) can be used to mitigate water leakage between piles. Based on findings from core samples, the geologic conditions in this area consist of soils containing deposits of oil and tar. Where these deposits occur along the excavation perimeter, oil or tar may tend to seep between the joints in the lagging. This is not considered to be a hazard to workers, although some cleanup may be necessary. Alternatives to soldier pile and lagging walls being considered for this station include tangent pile or secant pile walls, slurry walls, and deep soil mix walls (see next sections below).

Figure 3-7: Pre-augering for Soldier Pile

Figure 3-8: Cut and Cover with Soldier Pile and Lagging

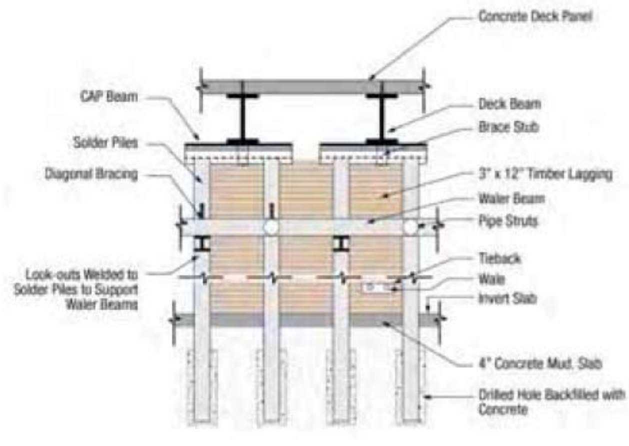
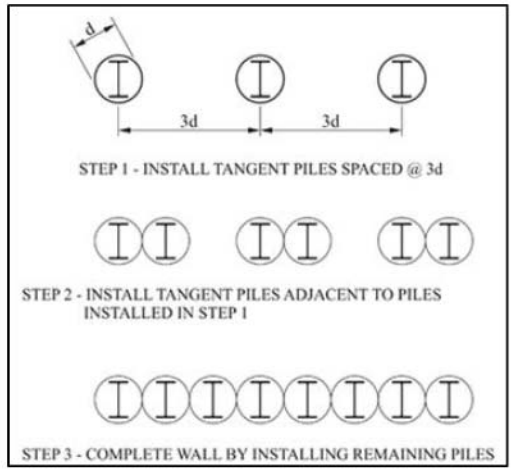


Figure 3-9: Soldier Pile and Lagging

3.2 Tangent Pile or Secant Pile Walls

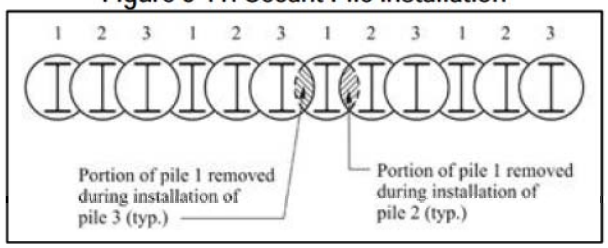
Tangent pile walls consist of contiguous cast-in-drilled-hole (CIDH) reinforced concrete piles – see Figure 3-10. The contiguous wall generally provides a better groundwater seal than the soldier pile and lagging system, but some grouting or dewatering could still be needed to control leakage between piles.

Figure 3-10: Tangent Pile Installation



A secant pile wall system is similar to the tangent pile wall but the piles have some overlap, facilitating better water tightness and rigidity - see Figure 3-11. This method consists of boring and concreting the primary piles at centers slightly less than twice the pile diameter. Secondary piles are then bored in between the primary piles, prior to the concrete achieving much of its strength.

Figure 3-11: Secant Pile Installation



In terms of relative cleanliness, tangent pile and secant pile walls are comparable to one another and both are more difficult to contain than soldier piles and lagging due to the greater amount of pumped concrete and the expected larger diameter of drilled holes. The completed secant pile wall for the Barnsdall Shaft in Hollywood for the Metro Red Line project is shown on Figure 3-12. Secant and Tangent pile shoring systems are slower to construct that soldier pile and lagging and therefore have the disadvantage of requiring longer lane closures on Wilshire while they are being constructed. Furthermore, because of the close spacing of tangent piles, utilities crossing the wall often require relocation whereas a soldier pile system can often be built around the existing utilities. The equipment required for installation of the tangent pile or secant pile walls includes drill rigs, concrete trucks, cranes, and dump trucks.

Figure 3-12: Secant Pile Wall at Barnsdall Shaft on Metro Red Line

3.3 Diaphragm/Slurry Walls

Diaphragm walls (commonly known as slurry walls) are structural elements used for retention systems and permanent foundation walls. Use of slurry wall construction can provide a nearly watertight excavation, eliminating the need to dewater. Slurry walls are constructed using deep trenches or panels which are kept open by filling them with a thick bentonite slurry mixture. After the slurry filled trench is excavated to the required depth, structural elements (typically a steel reinforcement cage - see Figure 3-13) are lowered into the trench and concrete is pumped from the bottom of the trench, displacing the slurry. Figure 3-14 and Figure 3-15 illustrate slurry wall excavation equipment.

Tremie concrete is placed in one continuous operation through one or more pipes that extend to the bottom of the trench. The concrete placement pipes are extracted as the concrete fills the trench. Once all the concrete is placed and cured, the result is a structural concrete panel. Grout pipes can be placed within slurry wall panels to be used later in the event that leakage through wall sections, particularly at panel joints, is observed. The slurry that is displaced by the concrete is saved and reused for subsequent panel excavations.

Figure 3-13: Steel Reinforcement Cage for Slurry Wall

Slurry wall construction advances in discontinuous sections such that no two adjacent panels are constructed simultaneously. Stop-end steel members are placed vertically at each end of the primary panel to form joints and guides for adjacent secondary panels. In some cases, these members are withdrawn as the concrete sets. Secondary panels are constructed between the primary panels to create a continuous wall. Panels are usually to full depth and 8 – 20-ft long and vary from 2 – 5-ft wide.

Figure 3-14: Slurry Wall Construction Equipment

Figure 3-15: Clamshell Digger for Slurry Wall Construction

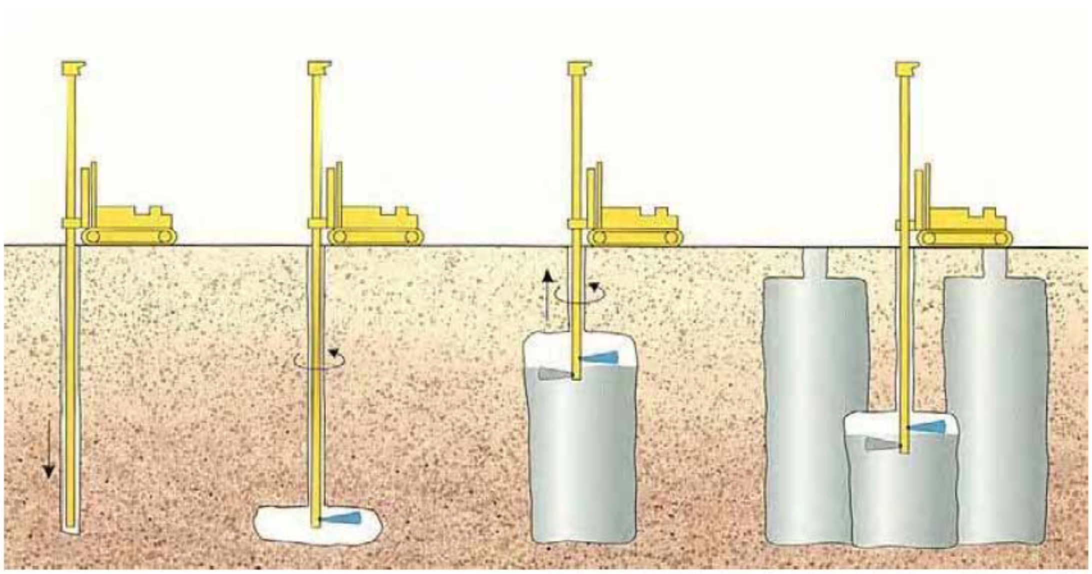
Similar to other shoring systems, slurry wall construction would occur in stages, working on one side of the street at a time. These walls have been constructed in virtually all soil types to provide a watertight support system in addition to greater wall stiffness to control ground movement. Because slurry walls are thicker and more rigid than many other shoring methods, the walls may in some cases be used as the permanent structural wall, although this application is not anticipated for this project. Where slurry walls are used, the thickness of the permanent structural walls can sometimes be reduced, i.e. when compared to wall thicknesses used with a conventional soldier pile and lagging system after removal of internal bracing.

Slurry wall construction materials are the most difficult to contain within the construction site of all the shoring types being considered due to the inherent messy nature of bentonite slurry combined with the operational characteristics of the clamshell digger which will likely be used to excavate large volumes of soil from the wall trench. Slurry walls are generally not adaptable to utility crossings and all utilities crossed by the wall would require temporary or permanent relocation. The equipment required for installation of the slurry walls includes clamshell or rotary head excavators, concrete trucks, slurry mixing equipment, cranes, slurry treatment plant, and dump trucks. The bentonite slurry would require disposal after a number of re-use cycles. Slurry walls are also slow to construct and will be very disruptive to traffic on Wilshire Boulevard.

3.4 Deep Soil Mix Walls

Deep soil mix walls are another type of temporary or permanent shoring system for deep excavation. Mechanical soil mixing is performed using single or multiple shafts of augers and mixing paddles. See Figure 3-16. The auger is rotated into the ground and slurry is pumped through the hollow shaft feeding out at the tip of the auger as the auger advances. Mixing paddles blend the slurry and soil along the shaft above the auger to form a soilcrete mixture with high shear strength, low compressibility, and low permeability. Spoils come to the surface comprised of cement slurry and soil with similar consistency to what remains in the ground. Steel beams are typically inserted in the fresh mix to provide structural reinforcement. A continuous soil mix wall is constructed by overlapping adjacent soil mix elements. Similar to secant pile walls, soil mix elements are constructed in alternating sequence; primary elements are formed first and secondary elements follow once the first have gained sufficient strength.

Figure 3-16: Deep Soil Mix Construction



Deep soil mix wall construction materials are also difficult to contain. Most of the construction process is performed by a single piece of equipment which mixes cement and soil in situ. Cement and soil mixture can be expected to escape beyond the confines of the drilling operation creating problems for traffic and pedestrians. The equipment required for installation of deep soil mix walls includes multi-shaft drill rigs, concrete trucks, cranes, and dump trucks.

3.5 Comparison of Excavation Support Techniques

Due to the speed of construction, and the ability to work around utilities, soldier piles and lagging is preferred unless site conditions dictate the use of other methods. See Table 3-1 for a comparison of excavation support methods. Soldier piles and lagging is the predominant shoring system used in the Los Angeles area and has been used successfully by Metro on construction of both Red and Gold Line stations. Experience at the LACMA parking garage excavation suggests that soil off-gasses immediately after being exposed but with a short period of time, the off gassing slows to levels acceptable for work. This suggest that the relatively impervious seal achieved by slurry walls, secant piles, and deep soil mix walls may only provide very short term benefits and that gas entering the station box excavation through a soldier pile and lagging system could be controlled with a well designed ventilation system.

Since it is anticipated that gassy soils will be encountered regardless of shoring system type, various methods of providing a safe and hazard free workplace will be implemented in all situations. No matter which type of temporary shoring system is selected; other measures such as, partially open decking, ventilation, gas detection, and Personal Protective Equipment (PPE), will be in use to protect workers from gases that may enter the excavation site.

Table 3-1: Comparison of Excavation Support Types

Shoring Method	Permeability	Installation Duration	Containment Impacts	Noise / Vibration Impacts	Traffic Impacts	Utility Impacts	Business Impacts
Soldier Pile & Lagging	High	concurrent w. excavation	Low	Moderate	Moderate	Moderate	Moderate
Slurry Wall	Low	3 Months	High	Moderate	High	High	High
Secant Pile	Low	3 Months	Moderate	Moderate	High	High	High
Tangent Pile	Moderate	3 Months	Moderate	Moderate	High	High	High
Deep Soil Mix	Low	3 Months	Moderate	Moderate	High	High	High

3.6 Construction Staging

For all types of shoring, the contractor would first occupy one side of the street to install one line of excavation support piles or wall panels. The installation will require extended closures of 2 – 3 traffic lanes on the side of the street where the equipment would be staged. After installation of piles or walls on both sides of the street at the station excavations, piles or walls would then be installed across the street at the station ends. This operation would also require lane closures, and is often done during night-time or weekend periods. The contractor would then proceed with installation of deck beams, installation of the deck panels and excavation and bracing. Deck panels (decking) allow continued traffic and pedestrian circulation since they will typically be installed flush with the existing street or sidewalk levels though raised decking, which requires less excavation during installation is being discussed with the traffic authority. Raised decking does have particular advantages at Wilshire / Fairfax Station as less excavation during the weekend closures while installing the decking makes it less likely that fossils will be encountered during the decking operation.

Deck installation will require successive full road closures on weekends with traffic detours. The decking would be installed in stages, commensurate with the amount of decking that can be installed during a weekend closure. Typical decking installation rates range from 50 -100 ft / weekend for an installation crew. Multiple crews will be used wherever possible to reduce the number of full road closures

3.7 General Approach to Handling Utilities

Prior to beginning construction of shoring and decking, it will be necessary to relocate, modify or protect in place all utilities and underground structures that would conflict with excavations. The contractor will verify locations through potholing methods and where feasible, the utility will be relocated so as to stay out of station or other surface structure excavation. Where the utility cannot be relocated outside the excavation footprint, it will be exposed and hung from the supporting structure (deck beams) for the roadway decking over the cut-and-cover structure. See Figure 3-17 and Figure 3-18.

Figure 3-17: Utilities Hung from Deck Beams

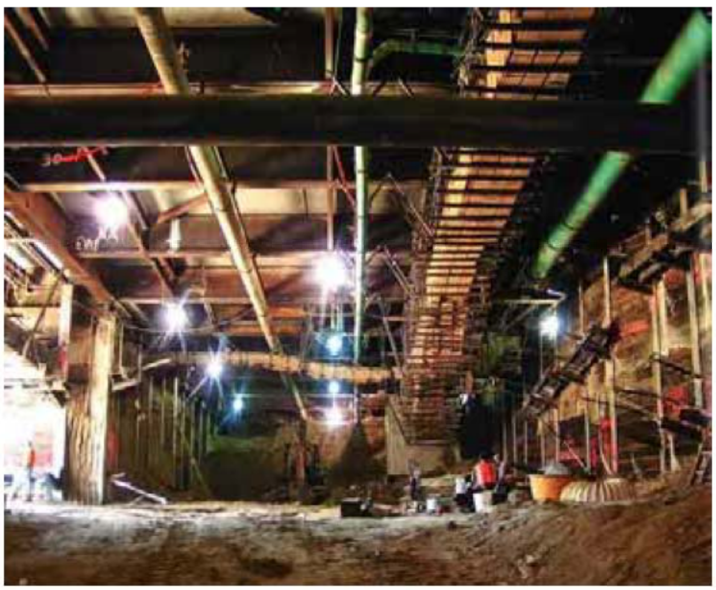


Figure 3-18: Utilities Hung from Deck Beams (Close Up)

Shallow utilities, such as maintenance holes or pull boxes, which would interfere with excavation work, will require relocation. The utilities alignments will be modified and moved away from the proposed facilities. Utility relocation takes place ahead of station and other underground structure excavation. During this time, it will be necessary to close traffic lanes.

It is possible that in some instances, block-long sections of streets would be closed temporarily for utility relocation and related construction operations. Pedestrian access (sidewalks) would remain open and vehicular traffic would be re-routed. Temporary night sidewalk closures may be necessary in some locations for the delivery of oversized materials. Special facilities, such as handrails, fences, and walkways will be provided for the safety of pedestrians.

Minor cross streets and alleyways may also be temporarily closed but access to adjacent properties will be maintained. Major cross streets would require partial closure, half of the street at a time, while relocating utilities.

Figure 3-19: Backfilling Utilities in Final Location beneath Road Surface

Utilities, such as high-pressure water mains and gas lines, which could represent a potential hazard during cut-and-cover and open-cut station construction and that are not to be permanently relocated away from the work site, would be removed from the cut-and-cover or open-cut area temporarily to prevent accidental damage to the utilities, to construction personnel and to the adjoining community. These utilities would be relocated temporarily by the contractor at the early stages of the operations and reset in essentially their original locations during the final backfilling above the constructed station. See Figure 3-19

4.0 PALEONTOLOGICAL ISSUES

The Wilshire/Fairfax Station is situated within the vicinity of the Hancock Park Rancho La Brea Tar Pits. The San Pedro Sand layer exists beneath the older and younger alluvium deposits near the surface in this region. This formation has a high likelihood for producing significant paleontological resources. The existing La Brea Tar Pits immediately adjoining the Wilshire/Fairfax Station site is the largest collection of fossils of extinct mammals in the entire world. Because of the high likelihood of fossil discovery while excavating the Wilshire/Fairfax station box, station construction at Wilshire/Fairfax will be given the maximum time available within the overall project schedule, so that excavation can proceed slowly and carefully and fossils located and removed without schedule pressures.

Before fossil recovery can begin, utility relocation and shoring for the station excavation using one or more of the shoring methods outlined above must occur. Utility relocations, by their nature (narrow trenches beneath paved streets) will make recovery of fossils during this phase of the work unlikely. Then, any fossils that lie within the footprint of the shoring will necessarily be destroyed when the shoring is constructed, as there is no way to remove them in advance of the shoring. However, shoring will at worst occupy less than 10% of the footprint of the station excavation, leaving 90% of the footprint unaffected and suitable for fossil recovery.

The plan for fossil removal has been based on the methods used by the Page Museum for the removal of fossils from the nearby LACMA parking garage excavation, referred to from here-on by the Page Museum name, Project 23. The ground will be excavated in shallow lifts, with museum staff on land to inspect the excavated surfaces as earth is removed and to mark the locations of fossils when discovered. It is assumed that the fossils will occur in a manner similar to that at Project 23, i.e. concentrated in vertical tar “pipes” which, once located, can be boxed in place and then removed from the site for further analysis. As with Project 23, fossils can also be found away from the tar pipes so all excavated surfaces must be inspected, and the contractor’s team must be alerted to the possibility of finding fossils anywhere with the excavation. The Project 23 site was an open excavation, not constrained by a deck at ground level. This made boxing and removal of the fossil boxes a good deal more straight-forward than will be the case at Wilshire/Fairfax. Figure 4-1 shows fossils in a pit at the Page Museum, and Figure 4-2 a boxed “pipe” containing fossils being prepared at the Project 23 site. Figure 4-3 and Figure 4-4 show examples of fossils recovered from Project 23 after processing.

Figure 4-1: Tar Deposit Containing Fossils

Figure 4-2: Fossil Box Construction at Project 23

Figure 4-3: Smilodon (Sabre Tooth Cat) Pelvic Bone

Figure 4-4: Smilodon Skull in Fossil Box

4.1 Minimize Excavation Done Before Decking Installation

Although the Project 23 experience suggests that fossils will mainly be 10 ft or more below street level, fossils must be anticipated anywhere within undisturbed ground. Using the cut and cover excavation technique, deck beams which support the deck panels are installed in the road bed after the piles or shoring walls are complete. The top of the deck beams sit just below the roadway surface so that the decking is flush with the roadway. The deck beams are approximately 6-ft tall and joined together with cross bracing so a minimum of 7-ft of excavation is required for their installation. On Red line and Gold Line stations, contractors have normally excavated 10 ft deep when installing the deck beams to provide clear space beneath the beams for better access when commencing to dig out from beneath the decking and to expose utilities immediately below the deck beams.

Because the street decking requires a full street closure to install, only limited times are available in which to close the street. Full street closures, especially along Wilshire Boulevard will be limited to approximately 52 hours duration on week-ends, and this will not provide time to carefully remove soil in layers to expose fossils nor to box and remove any fossils found in this initial excavation. Therefore, opportunities for fossil recovery from the initial excavation for the street decking will be limited. It therefore requires a construction approach to try and reduce the depth of the initial excavation. Two strategies are being pursued in this regard. One approach is to use raised decking so that the bottoms of the deck beams can be raised up by the same height that the station decking is installed above street level. Metro is in discussions with traffic authorities regarding the acceptability of using raised decking at Fairfax. See Appendix A for details of raised decking. The other approach is to use shallower deck beams, either for a flush deck system or in conjunction with a raised decking approach. Shallower beams will almost certainly require installing the deck beams at closer centers, probably 7 ft centers instead of the usual 14 ft centers but the shallow beams will reduce the likelihood of finding fossils during decking.

It should be noted that many utilities in the street are much deeper than the bottom of the deck beams, and any fossils would have been destroyed during the construction of such utilities. Utilities already have disturbed a significant percentage of the station excavation footprint, and this will increase with the relocations required prior to the installation of the shoring and decking. Nevertheless, there will remain areas of undisturbed soil within the 10 ft immediately below street level and fossils therefore could be found in these locations. These areas can be mapped in advance so that they can be excavated carefully.

4.2 Excavation of the topmost layers beneath the street decking

Once the street decking has been installed, excavation beneath the decking will commence. The side access shaft(s) from the contractor's laydown area (see Figure 4-5) and from the station portal site will be excavated in shallow lifts, using methods similar to those of Project 23. Any fossils found will be removed. Once the side access shafts are deep enough to allow equipment to commence digging beneath the street decking, equipment will be lowered into then shaft to commence digging. One scenario will be for the contractor to dig the initial lift by scraping down the face, using low headroom equipment such as a Gradall (see Figure 4-6) or other equipment acceptable to Metro and to the Page Museum. The working face would be inclined at probably a 2:1 slope and would be accessible for inspection (see Figure 4-7). The excavation would proceed in this manner until the first lift was completely removed. The height of the first lift will be determined by the head room needed by the equipment needed for the subsequent lifts, but probably of the order of 12-14 ft. depending on the equipment selected, subsequent lifts could continue to be inclined or horizontal. Fossils and tar pipes containing fossils would be removed under the supervision of Page Museum staff, probably using the boxing techniques developed for Project 23. Because the Fairfax Station will be decked, handling large boxes beneath the decking will be very difficult. Boxes of not more than 500 cubic ft (approximately 30 tons) are proposed as an upper limit, and smaller boxes for the first lift below the decking may be necessary so that low headroom equipment will be able to carry the boxes back to the side access shaft. Actual box sizes can be determined in the field by the contractor and paleontologists. Figure 4-7 and Figure 4-8 show the proposed excavation sequence.

Figure 4-5: Open Cut Excavation of Side Access Shaft

Figure 4-6: Gradall Excavator - East Side Access Project NYC

Figure 4-7: Cross Section Showing Excavation Procedure of Shallow Lifts at 2:1 (Approx) Slope Beginning from the Side Access Shaft

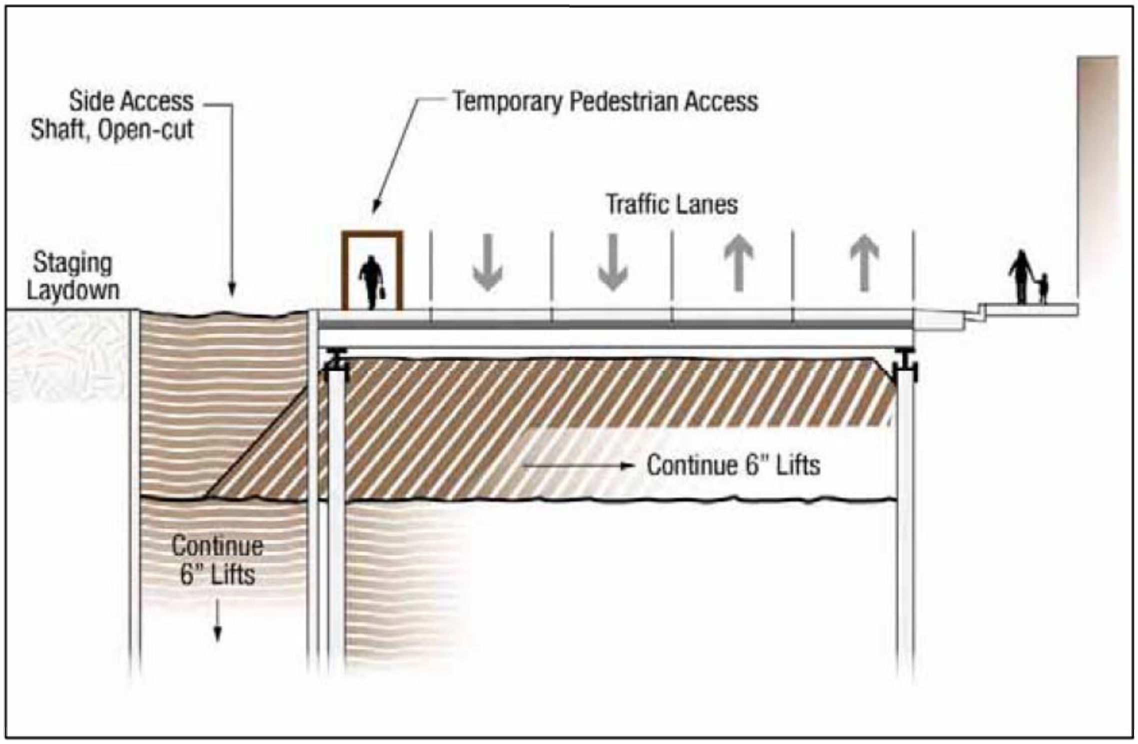
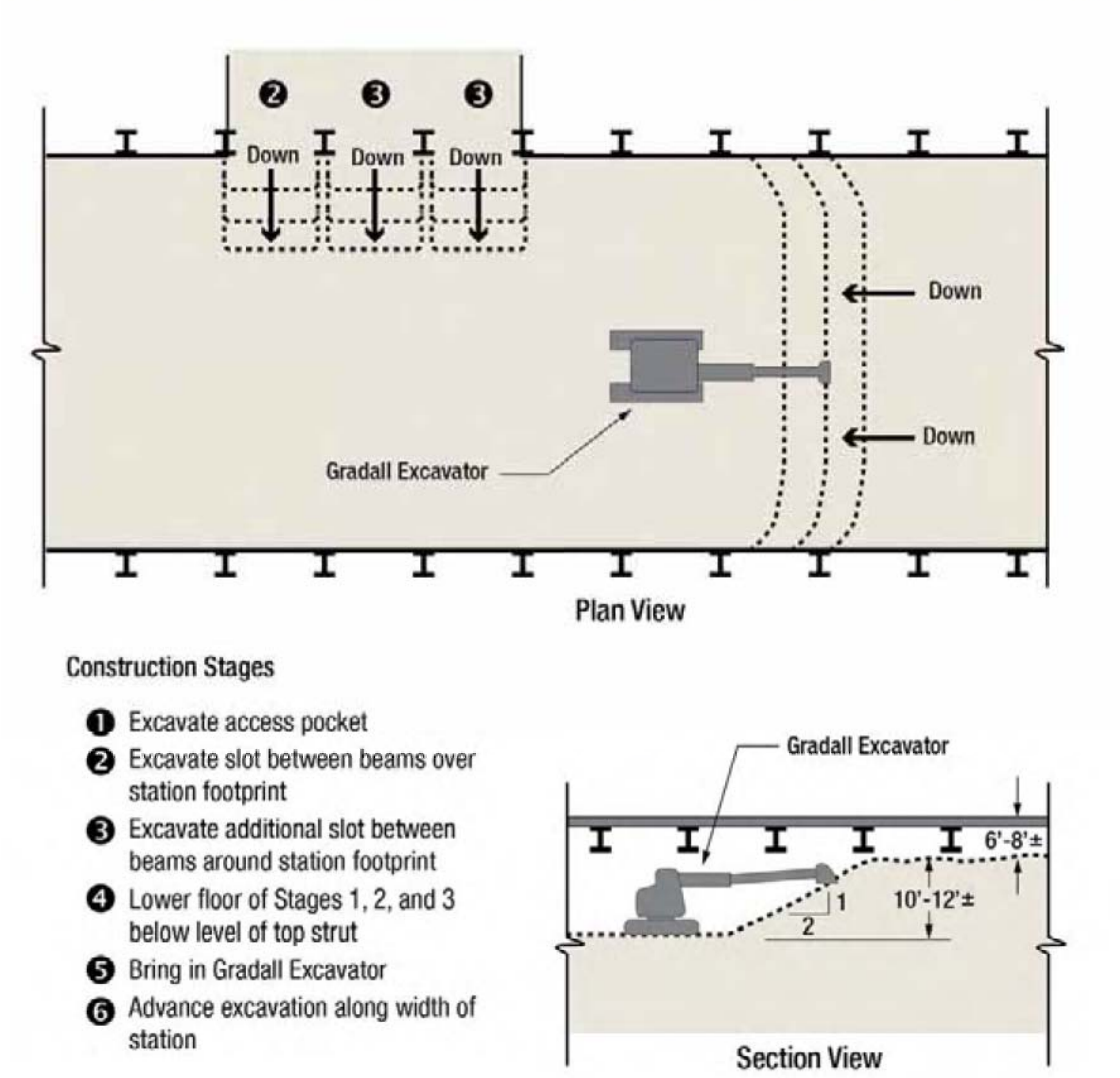


Figure 4-8: Plan Showing Excavation Procedure of Shallow Lifts with Low-Profile Gradall Excavator



4.3 Excavate in Layers

The station box and side access shafts will be excavated in shallow lifts to carefully expose and locate fossils. The Page Museum is suggesting 6" lifts based on experience at the Los Angeles County Museum of Art (LACMA) parking garage. As with Project 23, fossils can also be found away from the tar pipes so all excavated surfaces must be inspected, and the contractor's team must be alerted to the possibility of finding fossils anywhere with the excavation.

Compact track loaders and compact excavators (see Figure 4-9 and Figure 4-10) are likely necessary for initial soil removal directly beneath the deck beams due to their low vertical clearance, and relatively small bucket size capable of excavating precise lifts. Continuous tracks improve vehicle traction on soft and sticky terrain and reduce the amount of pressure exerted on the soil below. A pressurized although this may not be an option due to tight clearances and proper ventilation will still be needed regardless. If soil conditions permit, a rubber tire vehicle like skid steer loaders or equipment fitted with floatation tires may be used instead of compact track loaders. Gradalls operate a bucket at the end of a telescopic arm in a linear motion. The linear shoveling motion enhances depth control improving the ability to cut in precise shallow lifts. These will be considered considered as well. Track loaders, wheeled dozers and hydraulic excavators would be employed to remove the bulk of the soils in order to maintain efficiency in excavating (see Figure 4-11 through Figure 4-13. Excavation with these tools will require careful observation to identify the location of tar deposits. When tar deposits are located, smaller equipment should step in to avoid damaging fossil resources with heavier machines.

Figure 4-9: Compact Track Loader

Figure 4-10: Compact Excavator – 6.75'-Tall/12'-Long/6.5'-Wide

It is possible that the discovery and removal of fossils could lead to schedule delays and the station box structure would not be completed in time to precede the TBM breakthrough. As long as station box excavation has not breached a reasonable depth above where the top of the tunnel liner will be so that it would compromise the operation of the TBM, then the TBM drive should continue through the station box location and station excavation would work its way down and eventually break through the tunnel liner.

Figure 4-11: Tracked Loader Removing Muck from Beneath Struts

Figure 4-12: Hydraulic Excavator between Struts

Figure 4-13: Track Loader beneath Struts

It may be possible to use an imaging technique to locate fossils ahead of excavating operations thus allowing the pace of excavation to accelerate beyond the recommended 6" lift limit. If the imaging technique produces a reliable indication, the boxing of fossils can be pre-planned. Some techniques of scanning for objects below the surface that should be considered are Ground Penetrating Radar (GPR), HAARP Detection using ELF and VLF radio waves, electrical resistivity imaging, and geophysical diffraction tomography.

If an Early Work Authorization is obtained, construction can begin on an exploratory shaft to test the effectiveness of the anticipated geophysical methods. The shaft could be located within the limits of a side access shaft and would ideally reach full station depth in order to learn as much as possible from this process. The length and width of the shaft should be a minimum size to allow a variety of the equipment under consideration to perform excavation operations during the exploration process. Construction methods will be tested to determine the best techniques and tools for station box excavation. Shoring types will be tested to determine the effectiveness of the planned shoring in the soils present in the area. Gas levels will be measured to gauge the specifics of the ventilation scheme.

4.4 Fossil Box Size

As layers of soil are removed, tar-laden sand deposits containing fossils are likely to be uncovered. When this happens, work is halted within proximity of the fossil to allow the paleontologists on site to assess the discovery and begin preparations for boxing and removal of the deposit. The technique of boxing and removing fossil deposits to an off-site facility for additional paleontological work is an efficient process that was first implemented at the La Brea Tar Pits in 1915 and more recently during the construction of Project 23. A photo of the 1915 boxing method is contained on Page 8 of Rancho La Brea, Death Trap and Treasure Trove, Edited by John M. Harris, June 2001.

Figure 4-14: Fossil Boxes at Project 23

The box construction technique used on Project 23 is similar to that which is used for boxing palm trees for transport. See Figure 4-14. First, the paleontologist defines the location of the fossil deposit. Next, trenches are dug around the sides and excavation continues by removing sterile soil from around the fossil zone with heavy equipment leaving an island where the deposit sits. The bottom of the box is most challenging. After the box is supported by blocks and shims at each of the four corners, workers must crawl beneath the box and dig by hand while inserting the timber boards which make up the base of the box (Figure 4-15). An alternative approach to creating the bottom of the box which would improve worker safety and expedite the excavation process would require an auger to drill holes in the island beneath the fossil deposit. Timbers would be inserted through the auger holes, thus beginning to form the base of the box. The auger would then remove the balance of soil between the timbers allowing completion of the box and freeing the deposit from the soil below. See Figure 4-16. During the excavation of Project 23, sixteen tar deposits were discovered. From the sixteen deposits, twenty-three boxes were recovered, thus giving the parking garage project its name. The boxes range in size from 5x5x5-ft (weighing 3 tons) to 12x15x10-ft (weighing 56 tons).

Figure 4-15: Fossil Relocation Process. (From Page Museum Whiteboard)

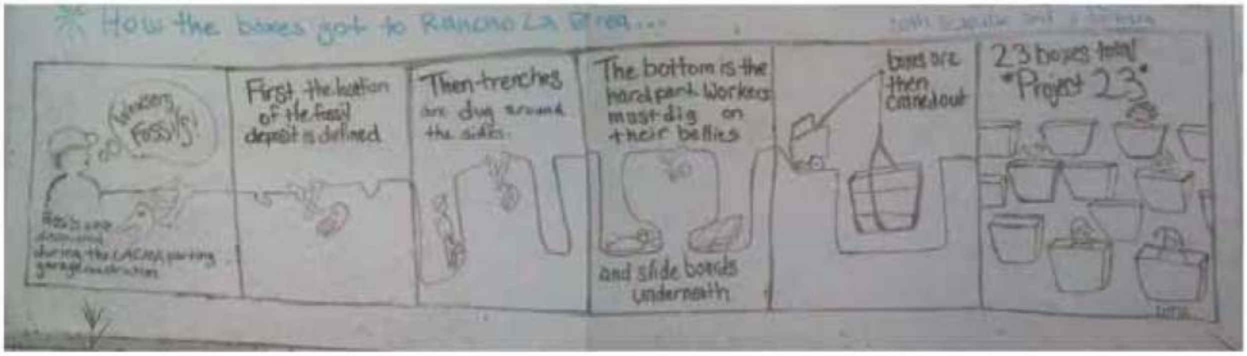
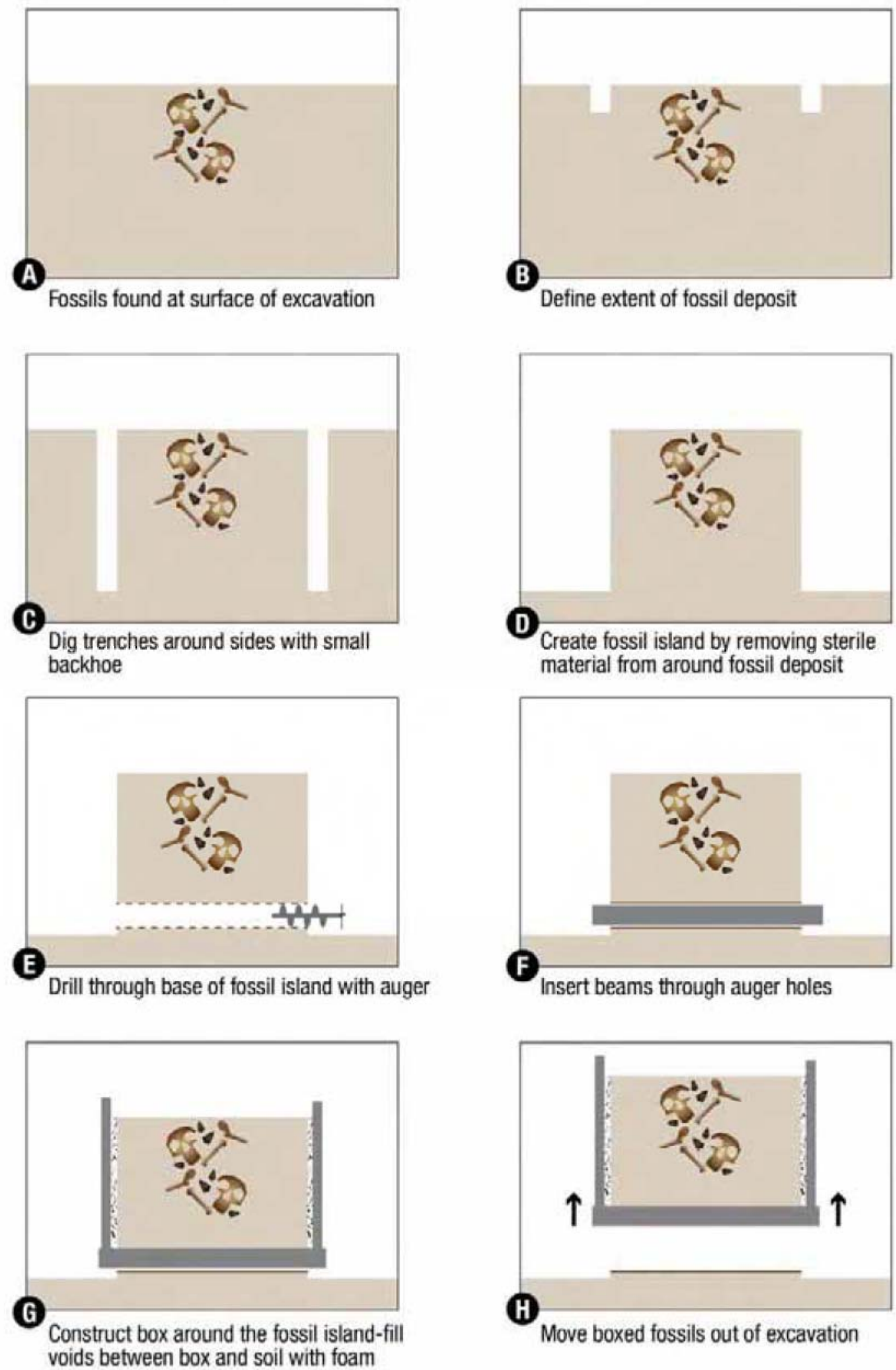


Figure 4-16: Proposed Alternative Boxing Technique Using Auger for Floor Construction



Depending on the size and weight of each box, fossils located beneath deck panels may be lifted in place by crane through temporary openings in the decking. However, this may prove to be impossible if street closure is not possible or the crane cannot be positioned on the street decking in a way to perform the lift. It is proposed to limit the size of fossil boxes to about 30 tons, i.e. 500 cubic feet which will make boxes easier to lift or to move around below the decking with low headroom equipment or with a system of skids and temporary tracks constructed within the station box. Once positioned adjacent to the side access shaft, fossil boxes can be lifted by mobile cranes positioned on "terra firma". The crane would lift the box out through the access shaft and load it on a truck which will transport the tar and fossils either to the Page Museum site where paleontologists can continue their work or to the contractor's laydown area at South Orange Grove/ Ogden for storage and processing. Offsite processing is preferred as there is less potential for damage by heavy equipment that will be operating at the South Orange Grove/Ogden laydown area.

4.5 Construction Issues in Tar-Laden Soils

The asphaltic sands have unique properties and the engineering characteristics are not as well documented as compared to other soils. However, contrary to common expectations, it is proven that these sands possess shear strength. Design parameters for excavation support systems in asphaltic sands will need to consider some additional pressure due to the makeup of these soils. There are numerous cases of successful experience in construction of deep basements and underground parking structures in the Wilshire/Fairfax area soils, such as construction of underground structures at LACMA (see Figure 4-17). Similar design elements, construction techniques and operating methods and procedures can be applied to the planned excavations.

Figure 4-17: Aerial View of Project 23 Excavation with Dark Tar Seeps

4.6 Potential Impacts to Construction Methods from Anticipated Tar-Laden Soils

When excavating in tar-laden soil, efforts will be undertaken to avoid excessive disturbance. Excavation methods will be closely controlled to minimize over-excavation or vibrations. When grade is achieved within these soils, a mud slab could be applied to minimize disturbance. In some cases, a layer of gravel may be placed over the asphaltic sands to increase traction and reduce the amount of soil compaction caused by construction traffic. The contractor can also apply various other materials on top of the tar such as cement, lime, or other additives to prevent it from fouling the tracked equipment. Wide tracked machinery can be used to reduce the pressure exerted on the soils below. Timber mats can make a sturdy foundation to drive equipment on. Rubber tire vehicles are considerably lighter than their tracked counterparts and could be operated with floatation tires specifically designed to minimize the amount of soil compaction caused by heavy equipment. Because the tar is rather sticky or tacky in some areas, it is anticipated that the equipment's tracks, axles, or buckets could become fouled and would require occasional cleaning. Steam cleaners would handle the task well, by heating the tar to a less viscous consistency.

4.7 Handling Gas Intrusions during Construction Operations

Previous projects in the Methane Risk Zone have been successfully and safely excavated. Multiple underground parking garages have been constructed in this area. For example, LACMA built a two-level subterranean parking structure in the Methane Risk Zone, previously referred to as Project 23. During the excavation, H2S (above safe working levels) was encountered on several occasions. Workers donned PPE to protect against exposure during these events (se Figure 4-18). Further investigation of operating underground structures will be undertaken during future design phases to assess effectiveness of barrier systems and detection equipment used.

Figure 4-18: Fossil Boxes with Worker Donning Oxygen Respirator at Project 23

Since the majority of gas is expected to enter the excavation through the excavation surface, the release of gases may be constricted by applying a ground cover to all areas except the area where current excavation operations are taking place. An impervious membrane of Visqueen plastic sheeting or geotextile fabric may serve this purpose.

In areas of potential H2S exposure, there are a number of techniques that can be used to lower the risk of H2S release or exposure. Because station excavations are less confined than tunnels, gas exposure issues are anticipated to be less significant. Although pre-treatment of the ground water prior to excavation, with additives such as hydrogen peroxide or copper-zinc, is an option, it is not expected to be required. If released, H2S will not naturally dissipate because it is heavier than air, hence it would build up around the bottom of the excavation. The first line of defense is dewatering since H2S occurs in a dissolved state in ground water. Dewatering will remove any contaminated water from the excavation area. At the surface, a sealed tank would capture the water and treat the air for H2S off-gassing before discharging it to the surrounding environment. Additionally, a ventilation system will be used to introduce fresh air in the workspace. Fans will be used to circulate the air while a gas detection system monitors levels of hazardous gas. A suction system fitted with scrubbers may be required to collect H2S from the bottom of the excavation and treat the air before discharging clean air at the street surface.

CH4 is a hazard in confined spaces. As such, it is essential that workers be sufficiently protected, and thus detection and monitoring equipment would be required. Fans similar to those used to dilute H2S concentrations would also dilute CH4 concentrations in the station box. Once above-ground, CH4 dissipates rapidly in the atmosphere and would not be a health hazard.

4.8 Ventilation Schemes

Ventilation is required to combat harmful or dangerous gasses when present in underground construction. Cal OSHA classifies subterranean work areas as “gassy”, “potentially gassy”, “non-gassy”, or “extra hazardous”. Excavation equipment in “gassy” spaces must be manufactured to resist accidental sparks and either be sealed or of explosion proof design.

Since CH4 and H2S gases are expected to be encountered during the excavation of Wilshire/Fairfax station, adequate ventilation and continuous air quality monitoring will be in use throughout construction. In addition to maintaining acceptable levels of CH4 and H2S in the air supply, the ventilation system must maintain a certain level airflow for workers present in the work space (see Figure 4-19) . The size of the system is dependent on the number of persons and the size of diesel equipment underground. The air supply shall not be less than 200 CFM (cubic feet per minute) per person underground, plus 100 CFM per diesel horse brake power.

Use of perforated deck panels, either perforated steel or concrete integrated with steel could be used in place of concrete only deck panels to allow the free flow of air between the excavation area and the surface, especially if full decking is required across the entire station box.

Figure 4-19: Underground Ventilation Ducts

5.0 CONCLUSIONS AND RECOMMENDATIONS

The project is committed to recover fossils and to work closely with the Page Museum to minimize the loss of fossils due to the construction of a station at Wilshire/Fairfax.

The project plans to use the same recovery methods that have been proven at Project 23, and with the cooperation of Page Museum staff, will seek to customize and improve on these methods to tailor them for the site conditions at Wilshire/Fairfax.

Further studies are on-going to find ways to raise the height of the beams used for street decking, which in turn, will leave more soil beneath the beams for controlled excavation and fossil recovery.

The fastest and lowest cost shoring method is preferred. This means that a soldier pile and lagging system will be employed provided that continuing geotechnical investigation do not find ground conditions that preclude this system. Soldier pile and lagging shoring has the added advantage of disturbing less of the station excavation footprint than other methods, minimizing the loss of fossils in this phase.

Gases will be controlled by installing adequate ventilation within the excavation, and by designing the street decking system with gaps for natural ventilation and elimination of pockets where gases could accumulate.