APPENDIX C.3

Paleontological Resources Technical Memorandum

November 7, 2017

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RE: Updated Paleontological Assessment for the Los Angeles County Metropolitan Transportation Authority (Metro) Division 20 Portal Project, Los Angeles, California

1.0 INTRODUCTION

Paleo Solutions, Inc. (Paleo Solutions), under contract to ICF, completed an updated paleontological assessment for the Los Angeles County Metropolitan Transportation Authority (Metro) Division 20 Portal Project (Project). The Metro Division 20 rail yard, located at 300 S. Santa Fe Avenue in Los Angeles, serves as a maintenance and operations facility for Metro's Red and Purple line trains. Metro is proposing facility improvements to accommodate future service increases on the Metro Red and Purple Lines. These improvements, which include widening the portal and new tracks and switches, will allow trains to perform faster turnarounds and increase overall service frequency.

This paleontological assessment serves as an update to the Cultural Resources Assessment for the Metro Red/Purple Line Core Capacity Improvements Project, Los Angeles, California (Beherec et al., 2017), which was prepared by AECOM in February 2017. This assessment includes portions of the Project area that were added to the Project since the completion of the February 2017 assessment. The study was conducted in compliance with provisions of the California Environmental Quality Act (CEQA), and all other applicable state and local regulations.

2.0 PROJECT LOCATION AND DESCRIPTION

The Project is located within and just north of the Arts District in downtown Los Angeles, south of the Santa Ana Freeway (US Route 101) along the Los Angeles River (Figures 1 and 2). On March 23, 2017, an Initial Study/Mitigated Negative Declaration (IS/MND) was adopted by the Metro Board of Directors (Beherec et al., 2017). Since then there have been refinements to the design of the Project that require additional environmental analysis. The proposed Project includes the following elements:

- Demolition of the existing MOW 61A building,
- Reconfiguration of trackwork,
- Extension of turnback tracks further south to existing tracks near 6th Street,

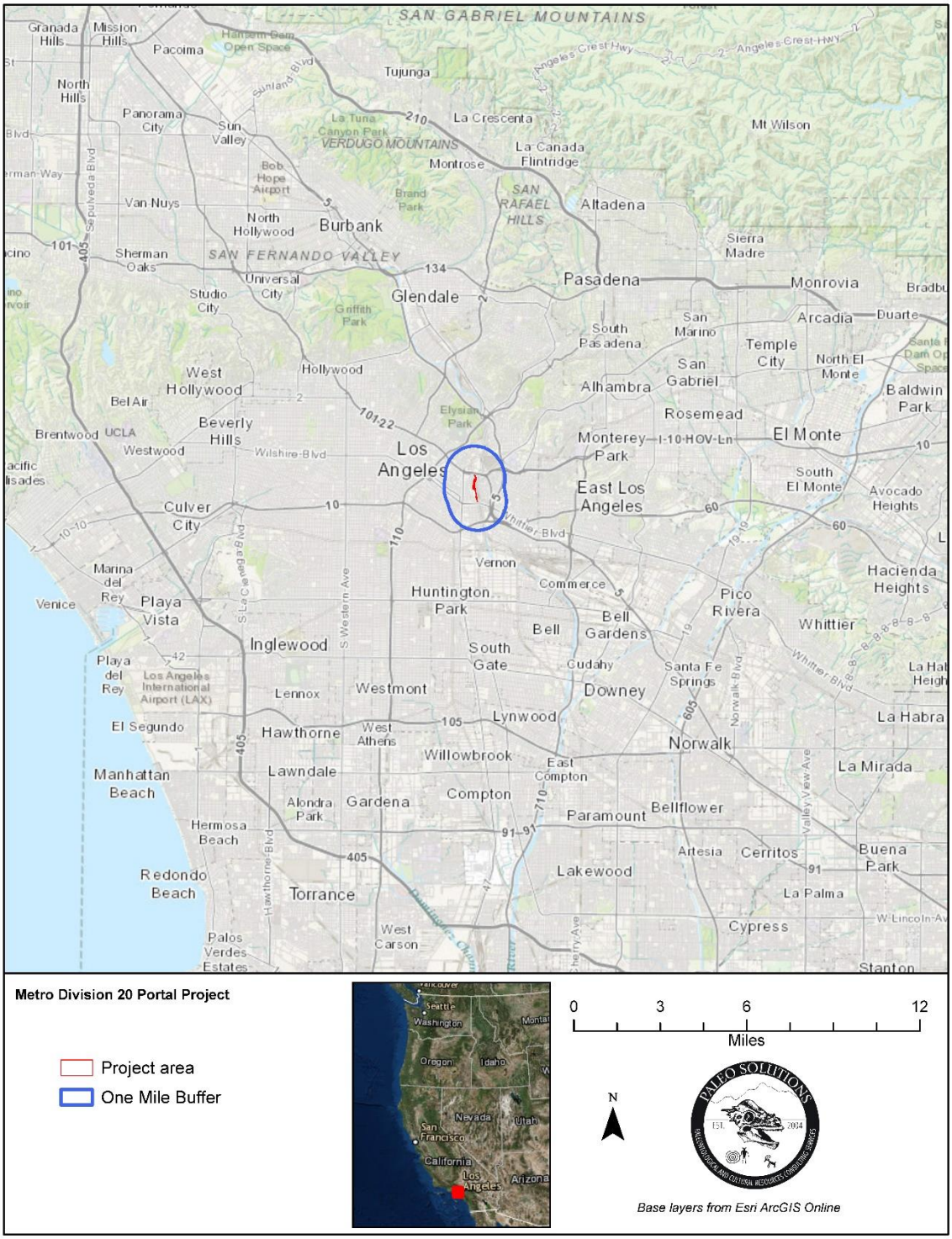

Figure 1. Project Location.

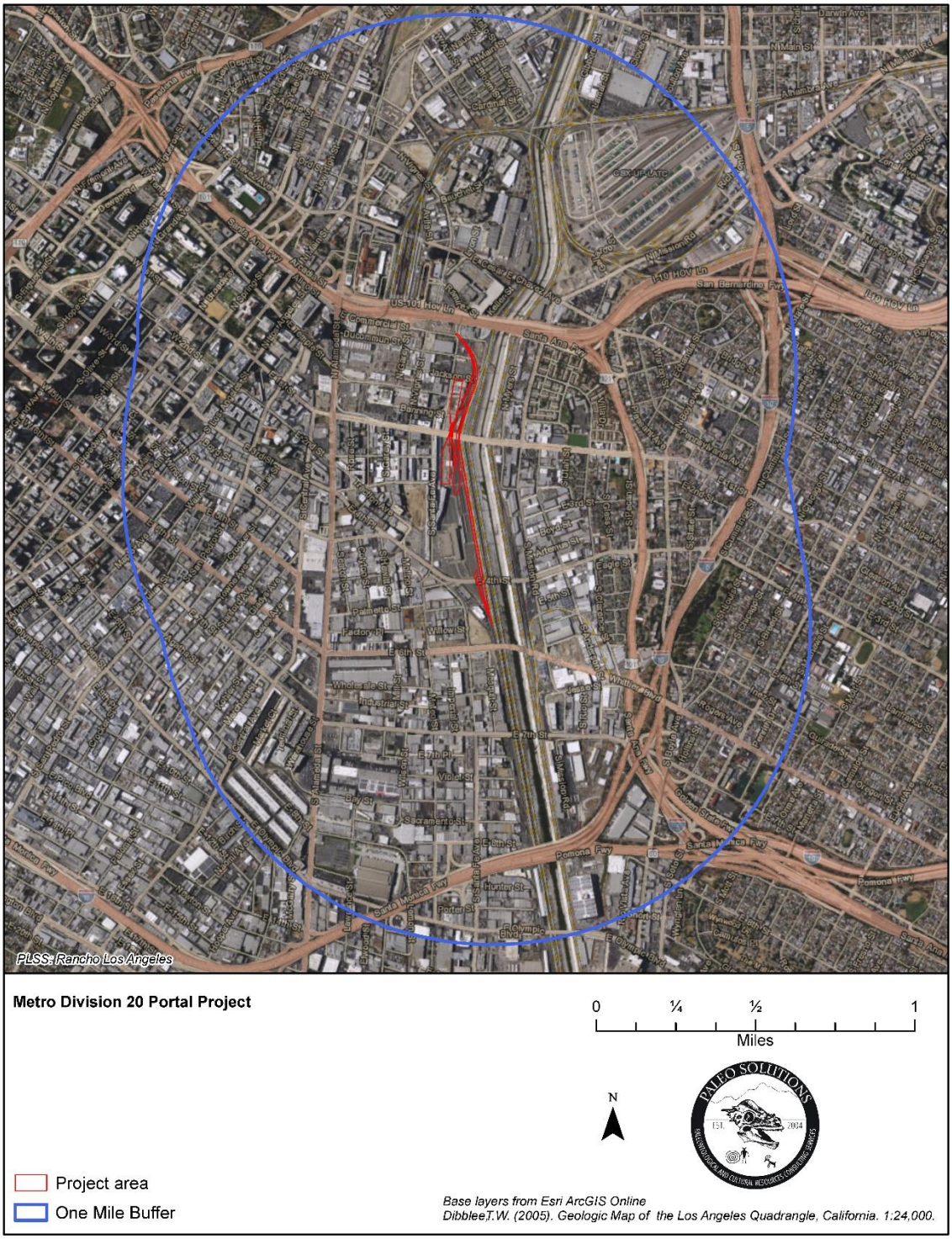

Figure 2. Project Area Overview.

- Acquisition and demolition of various properties located west of the current Division 20 railyard to provide additional storage tracks, and
- Modification of the 1st Street Bridge, including removal and modification of existing piers and superstructure.

This work may require grading and other ground-disturbing activities.

3.0 REGULATORY SETTING

This section of the report presents the regulatory requirements pertaining to paleontological resources that will apply to this project.

3.1 State Regulatory Setting

California Environmental Quality Act (CEQA)

The procedures, types of activities, persons, and public agencies required to comply with the California Environmental Quality Act (CEQA) are defined in the Guidelines for Implementation of CEQA (State CEQA Guidelines), as amended on March 18, 2010 (Title 14, Section 15000 et seq. of the California Code of Regulations) and further amended January 4th, 2013. One of the questions listed in the CEQA Environmental Checklist is: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" (State CEQA Guidelines Section 15064.5 and Appendix G, Section V, Part C).

State of California Public Resources Code

The State of California Public Resources Code (Chapter 1.7), Sections 5097 and 30244, includes additional state level requirements for the assessment and management of paleontological resources. These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, and define the excavation, destruction, or removal of paleontological "sites" or "features" from public lands without the express permission of the jurisdictional agency as a misdemeanor. As used in Section 5097, "state lands" refers to lands owned by, or under the jurisdiction of, the state or any state agency. "Public lands" is defined as lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

3.2 Local Regulatory Setting

Los Angeles County

The Conservation and Natural Resources Element of the County of Los Angeles General Plan (County of Los Angeles, 2015) recognizes paleontological resources as non-renewable and irreplaceable resources that an important part of the County's identity. The general plan includes four policies to protect paleontological resources (Goal C/NR 14):

- Policy C/NR 14.1: Mitigate all impacts from new development on or adjacent to historic, cultural, and paleontological resources to the greatest extent feasible;
- Policy C/NR 14.2: Support an inter-jurisdictional collaborative system that protects and enhances historic, cultural, and paleontological resources;
- Policy C/NR 14.5: Promote public awareness of historic, cultural, and paleontological resources; and

- Policy C/NR 14.6: Ensure proper notification and recovery processes are carried out for development on or near historic, cultural, and paleontological resources.

City of Los Angeles

The City of Los Angeles (City of Los Angeles, 2001), in Section 3 of the Conservation Element of the General Plan, requires that measures be taken to protect the City's archaeological and paleontological resources for historical, cultural, research and/or educational purposes. One policy and one program support this requirement. This policy requires that the City 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.

4.0 POTENTIAL FOSSIL YIELD CLASSIFICATION SYSTEM

The Potential Fossil Yield Classification (PFYC) system was developed by the Bureau of Land Management (BLM, 2007, 2016). The PFYC system is a predictive resource-management tool founded on two basic facts of paleontology: occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them, and the likelihood of the presence of fossils can be broadly predicted from the distribution of geologic units at or near the surface (Table 1). Therefore, geologic mapping, as the documentation of geologic unit distribution, is a reliable method for assessing the potential of geologic units to preserve fossils.

The PFYC system classifies geologic units on the relative abundance of scientifically significant vertebrate, invertebrate, or plant fossils and their sensitivity to adverse impacts, with a higher classification number indicating a higher potential for fossil occurrences. Among paleontologists, it is understood that this classification is preferably applied to the geologic formation, member, or other distinguishable unit at the most detailed mappable level. The PFYC is not intended to be applied to specific paleontological localities or small geographic areas within geologic units. Although significant localities may occasionally occur in a geologic unit, the existence of a few important fossils or localities widely scattered over a large area does not necessarily indicate a higher classification for the unit. The relative abundance of significant localities is intended to serve as the major determinant for the class assignment. The PFYC system is intended to provide baseline guidance for predicting, assessing, and mitigating impacts on paleontological resources.

Table 1. The PFYC, summarized from BLM IM 2016-124 (2016)

PFYC Designation	Assignment Criteria Guidelines and Management Summary
1 = Very Low Potential	Geologic units are not likely to contain recognizable fossil remains.
	Units are igneous or metamorphic, excluding reworked volcanic ash units.
	Units are Precambrian in age or older.
	Management concern is negligible, and impact mitigation is unnecessary except in rare circumstances.
2 = Low Potential	Sedimentary geologic units are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.
	Vertebrate or significant invertebrate or plant fossils are not present or are very rare.
	Units are generally younger than 10,000 years BP.
	Eolian deposition has occurred recently.
	Sediments exhibit significant physical and chemical changes (i.e., diagenetic alteration).
	Management concern is low, and impact mitigation is usually unnecessary except in rare circumstances.
3 = Moderate Potential	Fossiliferous sedimentary geologic units in which fossil content varies in significance, abundance, and predictable occurrence or sedimentary units of unknown fossil potential are present.
	Fossils are often marine in origin with sporadic known occurrences of vertebrate fossils.
	Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low

PFYC Designation	Assignment Criteria Guidelines and Management Summary
	Surface-disturbing activities require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action could affect the paleontological resources. Management options could include pre-disturbance surveys, monitoring, or avoidance. Opportunities may exist for hobby collecting.
4 = High Potential	Geologic units containing a high occurrence of significant fossils are present. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented but may vary in occurrence and predictability.
	Surface-disturbing activities may adversely affect paleontological resources in many cases.
	Management concern is moderate to high depending on the proposed action. A field survey by a qualified paleontologist is often needed to assess local conditions. On-site monitoring or spot-checking may be necessary during construction activities. Management prescriptions for resource preservation and conservation through controlled access or special management designation should be considered.
5 = Very high Potential	Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils are present and are at risk of human-caused adverse impacts or natural degradation.
	The probability for impacting significant fossils is high. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur.
	Management concern is high to very high. A field survey by a qualified paleontologist is usually necessary before surface disturbance or land tenure adjustments. Impact mitigation will often be necessary before and/or during these actions. Official designation of areas of avoidance, special interest, and concern may be appropriate
U= Unknown Potential	Unit is poorly studied and/or poorly documented; potential yield cannot be assigned without ground reconnaissance.
	Geologic units in this class may eventually be placed in another class after sufficient survey and research is performed.
	Management concern cannot be determined from existing data.

5.0 ANALYSIS OF EXISTING DATA

5.1 Geologic Map and Literature Review

The Project area is in the Los Angeles Basin, directly adjacent to the Los Angeles River. The Los Angeles Basin is a north-west trending alluviated lowland bounded on the north by the Santa Monica Mountains and the Elysian, Repetto, and Puente hills, and on the east and southeast by the Santa Ana Mountains and San Joaquin Hills, and by the Pacific Ocean on the west and south (Yerkes et al., 1965). According to geologic mapping by Dibblee (1989) (Figure 3), the Project area is entirely underlain by Holocene-aged surficial alluvium deposited by the Los Angeles River. However, mapping shows surface exposure of the Fernando Formation, an unnamed formation consisting of marine strata (potentially the Puente Formation), and older surficial sediments within a one-mile radius of the Project.

Artificial fill (Holocene)

Artificial fill or previously disturbed sediments consist of surface materials that have been disturbed by human activity. These deposits comprise materials that have been impacted and/or imported. Scientifically significant fossils are generally not known from these units, since any discovered resource would lack stratigraphic context. Artificial fill is not mapped in the Project area; however, these deposits were observed in aerial photographs of the Project area, particularly in areas where previous construction has occurred. These deposits have a low paleontological potential (PFYC 2).

Alluvial Gravel (Holocene), Gravel and Sand (Holocene)

Alluvial Gravel (Qa) and Gravel and Sand (Qg) are young surficial sediments composed of clay, sand, and gravel deposited by rivers and in floodplains, (Dibblee, 1989). These deposits do not typically produce fossils due to their young age, and therefore these deposits are assigned a low paleontological potential (PFYC 2), but they may overlie older, more sensitive geologic units.

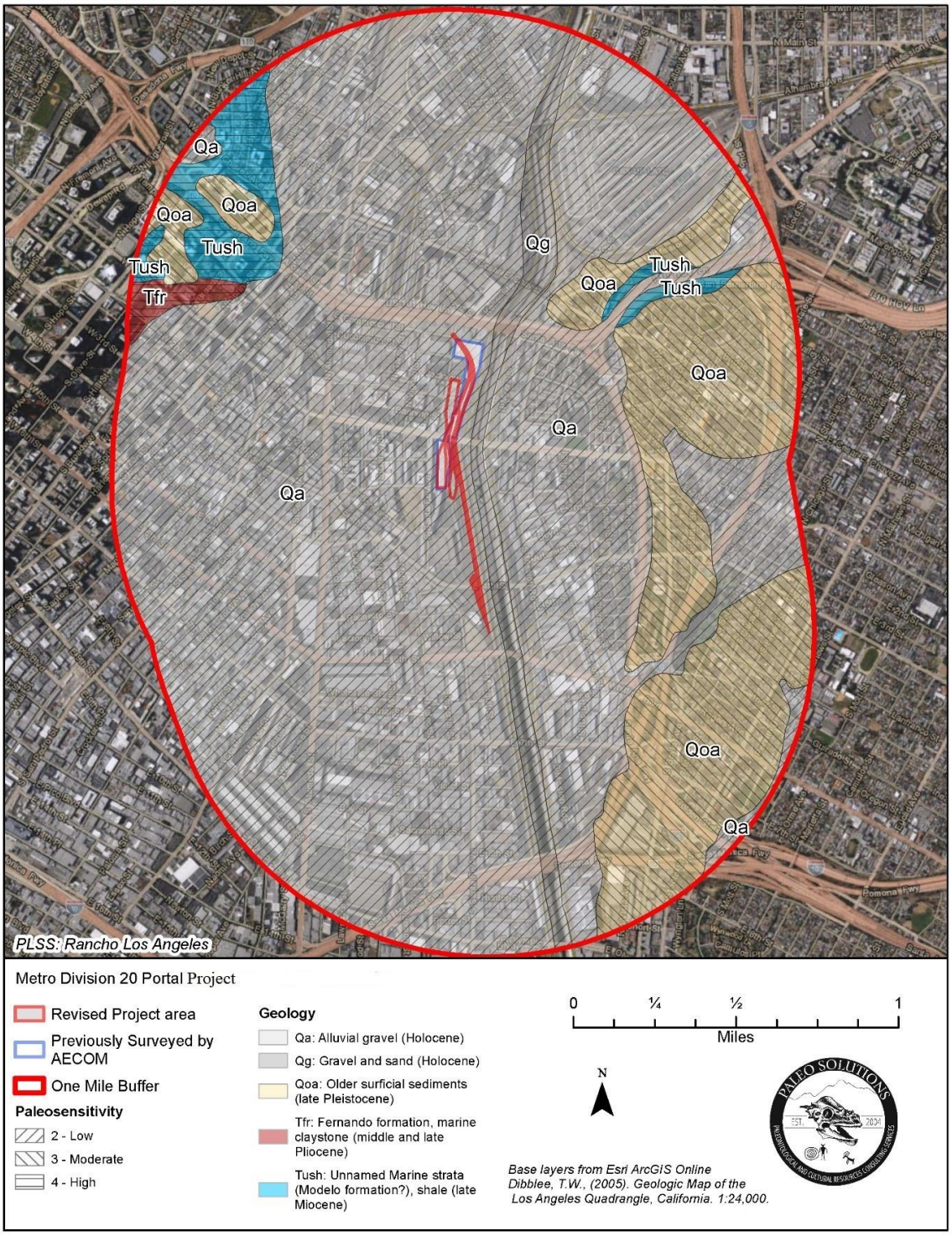

Figure 3. Geology within One Mile of Project Area.

Older Surficial Sediments (Pleistocene)
Older Surficial Sediments (Qoa) are Pleistocene-aged (11,000 to 1.1 million years old) remnants of older weakly consolidated alluvial deposits of gravel, sand, and silt (Dibblee, 1989). Taxonomically diverse and locally abundant Pleistocene fossil animals and plants have been collected from older alluvial deposits throughout southern California and include mammoth, mastodon, camel, horse, bison, giant ground sloth, peccary, cheetah, lion, saber-tooth cat, capybara, dire wolf, and numerous taxa of smaller mammals (Jahns, 1954; Jefferson, 1991). Some Pleistocene-aged alluvial deposits are composed of coarse-grained material, which is not typically conducive to the preservation of fossils. However, finer grained alluvial sediments may contain significant paleontological resources. These deposits are assigned a moderate paleontological potential (PFYC 3).

Fernando Formation (Pliocene to Pleistocene)
The Pliocene to Pleistocene (3 to 1.8 million years old) is present in the eastern Puente Hills and much of the northeastern Los Angeles Basin. The formation has been divided into two members which are separated by an erosional unconformity. The lower member generally consists of a light grayish-brown to olive-brown siltstone, is massive to poorly bedded, and micaceous. Several thin lenticular pebble conglomerate beds are interbedded with the fine-grained strata and form prominent outcrops. The presence of this coarse-grained sediment within generally fine-grained strata suggests that the coarse basin margin sediments were transported to the deeper basin center by turbidity currents. While microfossils (foraminifers) are abundant, megafossils are comparatively rare in this member and consist primarily of gastropods, pelecypods, and brachiopods (Durham and Yerkes, 1964).

The upper member is composed of light gray sandstone, pebbly sandstone, and interbedded sandy conglomerate consisting of sub-rounded to well-rounded pebbles of igneous and metamorphic rocks. The well-cemented matrix of the conglomerate is composed of white to yellowish-brown coarse sandstone. The sandstone lithologies are poorly consolidated, fine- to coarse-grained, rarely well bedded, and sometimes graded, and they weather to yellowish-brown or reddish-brown. Numerous fossil localities have been documented within this member and consist of mollusks such as gastropods, bivalves, and scaphopods (Durham and Yerkes, 1964).

Multiple marine specimens of pinnipeds (e.g., *Pontolis magnus*) and dolphins, as well as gastropods (e.g., *Calicantharus humerosus*) and pelecypods (e.g., *Chlamys beringianus*) have also been published from the Fernando Formation (Kellogg, 1925; Yerkes, 1972). Terrestrial vertebrates include ground sloth (*Paramylodon*); mastodon (*Mammut*); mammoth (*Mammuthus*); horses (*Plesippus* and *Equus*); camel (*Camelops*); the pronghorn antelope (*Antilocapra Americana*); and turkey (*Meleagris californica*) (Koch et al., 2004). Due to the presence of many significant vertebrate macrofossils, the Fernando Formation has high paleontological potential (PFYC 4).

Unnamed Marine Strata (Puente Formation) (Miocene)
This unit is mapped by Dibblee (1989) as "unnamed shale," however, it is attributed to the Miocene Puente Formation by other geologic map authors (Lamar, 1970; and Schoellhamer et al., 1965; Webber, 1980 [cited in Dibblee, 1989]); therefore, it will be referred to as Puente Formation throughout this report. As mapped by Dibblee (1989) the formation consists of gray to light brown, thinly bedded silty clay shale that locally contains calcareous nodules, fine-grained sandstone interbeds, and lenses of semi-siliceous or diatomaceous shale.

The Puente Formation was first described in detail by G.H. Eldridge and R. Arnold (1907). The formation typically consists of shale, siltstone, sandstone, and pebble to cobble conglomerate and has an unknown maximum thickness of more than 13,000 feet (Eldridge and Arnold, 1907). The Puente Formation is known to be locally equivalent to the Monterey Formation (Cooper, 1981; Critelli et al., 1995). The formation is generally subdivided into four distinct members, but in the central Los

Angeles Basin where the Project is located, the Puente Formation is too uniform to be divided by visible lithology.

The Puente Formation was deposited when the ocean still covered much of southern California. Rapid uplift of landward sediments due to the geologically rapid convergence of the Pacific and Farallon Plates caused the production of large amounts of terrestrially derived sediments. At that time, submarine canyons along the coast shed two main "megasequences" of turbidites (comparable to oceanic landslides) off the continental shelf and into the ocean basin, where they were interbedded with slower accumulating silts and clays (Critelli et al., 1995). This resulted in the beds of sandstone, siltstone, shale, and clay present near the Project area.

Fossils found in upper sections of the Puente Formation include benthic and pelagic foraminifera, which indicate ocean depths of greater than 2,000 feet (Cooper, 1981; Morton and Miller, 2006). Deep marine fish are also present in these units that are today only found in water below 3,300 feet-below the photic zone. Species include anglerfish (*Lophiiformes*), deep-sea smelts (Bathyalgidae), hatchetfish (*Argyropelecus* sp.), and lanternfish (*Myctophidae*). Lower in the Puente Formation foraminifera, fragments of fossilized wood, mollusks, bony fish, shark teeth, and whale have been reported (Cooper, 1981; Critelli et al., 1995). In addition, the Puente Formation recently produced numerous specimens of well-preserved fossil fish of late Miocene age during excavations for a housing development project in Diamond Bar. These fossils were discovered during monitoring in early 2016 and included scientifically significant specimens from seven different taxa: round herring (*Estringus scintillans*), cod (*Eclipes* sp.), ray-finned fish (Teleostei undet.), mackerel/tuna family (Scombridae), herring/shad family (Clupeidae), shad (*Ganolytes cameo*), and a unique eel (Anguilliformes) (Aron et al., 2016). A recovered fossil eel specimen with 74 small articulated vertebrae is of particular importance since similar eel fossils are only known from small isolated vertebrae in the Capistrano Formation and a few other formations in southern California (Aron et al., 2016). Due to the presence of many significant vertebrate fossils, the Unnamed Marine Strata (Puente Formation) has high paleontological potential (PFYC 4).

5.2 Paleontological Records Search

On August 15, 2017, Paleo Solutions requested a paleontological records search from the Natural History Museum of Los Angeles County (LACM), intended to determine if there are any previously recorded paleontological localities within the boundaries of, or in the vicinity of, the Project area.

Based on the LACM records search, there are no known fossil localities within the Project area, nor within a one-mile radius of the Project area. However, the LACM reported two vertebrate fossil localities in the vicinity of the Project in Older Surficial Sediments, one at a depth of 43 feet below the street, and the other at a depth of 20-35 feet below the surface (LACM 1755 & 2032). Additionally, they report a nearby locality in the Older Surficial Sediments uncovered during storm drain excavation (LACM 1023) (McLeod, 2017; Table 2; Appendix A). Although shallow excavations in younger alluvium are unlikely to uncover significant vertebrate fossil remains, any substantial excavations in the Project area may impact older Pleistocene sediments which have the potential to produce vertebrate fossils (McLeod, 2017).

Table 2. Previously Recorded Fossil Localities in nearby Older Surficial Sediments

Locality Number	Data Provided By	Data Collected By	Fossils	Depth below surface	Formation
1755	LACM	Data not provided	Horse, *Equus*	43 feet	Older Surficial Sediments

Locality Number	Data Provided By	Data Collected By	Fossils	Depth below surface	Formation
2032	LACM	Data not provided	pond turtle, *Clemmys mamorata*; ground sloth, *Paramylodon harlani*; mastodon, *Mammut americanum*; mammoth, *Mammuthus imperator*; horse, *Equus*; and camel, *Camelops*	20-35 feet	Older Surficial Sediments
1023	LACM	Data not provided	turkey, *Meleagris californicus*; sabre-toothed cat, *Smilodon fatalis*; horse, *Equus*; and deer, *Odocoileus*	Unstated	Older Surficial Sediments

5.3 Geotechnical Records

A review of geotechnical boring logs completed for previous Metro projects in the vicinity of this project provides an excellent basis for estimation of the geology in the subsurface of the Project area. Particularly, geotechnical analysis performed for the First Street Viaduct over the Los Angeles River Project (Gallagher et al., 1994) and the Regional Connector Transit Corridor Project (Hansmire, 2015) provided useful logs nearby the Project area.

The closest available geotechnical boring log to the Project area was taken at the intersection of First Street and Santa Fe Avenue, which is near the center of the Project area (see Figure 2). This log records 15 feet of artificial fill material, underlain by 8 feet of light brown sand, followed by 52 feet of light tan sand with gravel (Gallagher et al., 1994). The log ends upon drill rig refusal at 75 feet below the surface due to boulders at depth.

Slightly to the northwest, a log was recorded at the intersection of Temple Street and Alameda Street, near the current Little Tokyo/Arts District Station, approximately a quarter mile west of the northern end of the Project area (Figure 2). This log records approximately 8 feet of artificial fill, followed by 12 feet of younger alluvial material, then 25 feet of older alluvial material, then Fernando Formation until the end of the log at 60 feet below the surface (Hansmire, 2015). This log indicates the existence of older alluvial material at approximately 20 feet below the ground surface, and an inferred cross section created from this and other logs in the associated report estimates that the depth to older alluvium becomes shallower closer to the Los Angeles River.

These logs indicate that Older Surficial Sediments will be impacted by any excavation greater than 20 feet below the ground surface, and potentially at more shallow depths within the Project area. Puente Formation did not appear in any boring logs near the Project area, and the Fernando Formation was encountered at approximately 50 feet below the ground surface in boring logs along Alameda Street, approximately a quarter mile west of the Project area, and likely exists at this depth under the Project area.

6.0 IMPACT ANALYSIS

Impacts on paleontological resources can generally be classified as either direct, indirect or cumulative. Direct adverse impacts on surface or subsurface paleontological resources are the result of destruction by breakage and crushing as the result of surface disturbing actions including construction excavations. In areas that contain paleontologically sensitive geologic units, ground disturbance has the potential to adversely impact surface and subsurface paleontological resources of scientific importance. Without mitigation, these fossils and the paleontological data they could provide if properly recovered and documented, could be adversely impacted (damaged or destroyed), rendering them permanently unavailable to science and society.

Indirect impacts typically include those effects which result from the continuing implementation of management decisions and resulting activities, including normal ongoing operations of facilities constructed within a given project area. They also occur as the result of the construction of new

roads and trails in areas that were previously less accessible. This increases public access and therefore increases the likelihood of the loss of paleontological resources through vandalism and unlawful collecting. Human activities that increase erosion also cause indirect impacts to surface and subsurface fossils as the result of exposure, transport, weathering, and reburial.

Cumulative impacts can result from incrementally minor but collectively significant actions taking place over a period of time. The incremental loss of paleontological resources over time as a result construction-related surface disturbance or vandalism and unlawful collection would represent a significant cumulative adverse impact because it would result in the destruction of non-renewable paleontological resources and the associated irretrievable loss of scientific information.

There are no documented paleontological localities within the boundaries of the Project area, and the native sediment immediately beneath the Project area is mapped as younger alluvium (Dibblee, 1989). However, geotechnical logs indicate that Older Surficial Sediments will be present at least 20 feet below the ground surface, and potentially at shallower depths within the Project area. Any earthmoving work in native sediments beneath the surficial fill and alluvium may potentially result in significant impact on paleontological resources if native Pleistocene or older sediments are encountered. Current planned excavations for the Project extend approximately 25 feet below the ground surface, and are not expected to impact the Puente or Fernando formations.

No indirect or cumulative impacts on paleontological resources are anticipated at any of the work areas.

7.0 SUMMARY AND RECOMMENDATIONS

The new area encompassed by the refinements to the Project is completely underlain by surficial alluvium and previously disturbed sediments. However, Project activities have the potential to penetrate older Pleistocene alluvium below the surface and therefore the original paleontological mitigation recommendations of the Beherec et al. (2017) assessment are applicable to the entire refined area. To avoid inadvertent impacts to subsurface paleontological resources, Mitigation Measures CR-2, CR-3, and CR-4, as described in the Final IS/MND for the Project (AECOM, 2017) shall be implemented with the minor modifications presented below:

> *Mitigation Measure CR-2.* The Project is expected to occur in previously disturbed soils. However a qualified paleontological monitor shall be retained to monitor project-related excavation activities on a full-time basis in previously undisturbed Pleistocene deposits, if encountered. Project-related excavation activities of less than ten feet depth shall be monitored on a part-time basis to ensure that underlying paleontologically sensitive sediments are not being impacted. In addition, the monitor shall ensure the proper differentiation between paleontological and archaeological resources.
>
> *Mitigation Measure CR-3.* The Project is expected to occur in previously disturbed soils. A Paleontological Monitoring and Mitigation Plan will be developed prior to the start of ground disturbing activities by a qualified professional paleontologist. A qualified professional paleontologist shall be retained to supervise the monitoring of construction. Paleontological resource monitoring shall include inspection of exposed geologic units during active excavations within sensitive geologic sediments, as defined by the PMMP and as needed. The monitor shall have authority to temporarily divert grading away from exposed fossils in order to efficiently recover the fossil specimens and collect associated data. The qualified paleontologist shall prepare monthly progress reports to be filed with Metro. At each fossil locality, field data forms shall be used to record pertinent geologic data,

stratigraphic sections shall be measured, and appropriate sediment samples shall be collected and submitted for analysis. Matrix sampling shall be conducted to test for the presence of microfossils.

Mitigation Measure CR-4. Recovered fossils shall be prepared to the point of curation, identified by qualified experts, listed in a database to facilitate analysis, and deposited in a designated paleontological curation facility. The most likely repository would be the Natural History Museum of Los Angeles County.

Thank you for the opportunity to assist you with this project. If you have any questions concerning the results of this study, please contact Courtney Richards at crichards@paleosolutions.com.

Sincerely,

Nathan Dickey, M.S.
Paleontologist & GIS Specialist

Courtney Richards, M.S.
Principal Paleontologist

8.0 REFERENCES

AECOM. 2017. Final Initial Study/Mitigated Negative Declaration (IS/MND) for Metro Red/Purple Line Core Capacity Improvements Project. Prepared for the Los Angeles County Metropolitan Transportation Authority, Los Angeles, California.

Aron, G.L., C.D. Richards, J.T. Raum, and J.C. Kelly. 2016. Final Paleontological Monitoring Report: Techachapi Renewable Transmission Project Segment 8: Los Angeles and San Bernardino Counties, California. Report No. CA1

Beherec, M.A., A. Hill, C. Miller, J. Hollins. 2017. Cultural Resources Assessment for the Metro Red/Purple Line Core capacity Improvements Project, Los Angeles, California. Prepared for the Los Angeles County Metropolitan Transportation Authority.

Bureau of Land Management (BLM). 2007. Potential Fossil Yield Classification system: BLM Instruction Memorandum No. 2008-009 (PFYC revised from USFS, 1996).

Bureau of Land Management (BLM). 2016. Potential Fossil Yield Classification system: BLM Instruction Memorandum No. 2016-124 (PFYC revised from USFS, 2008).

City of Los Angeles. 2001. City of Los Angeles Conservation Element of the General Plan, available at: http://planning.lacity.org/cwd/gnlpln/ConsvElt.pdf

Cooper, J.D. 1981. Geology of the eastern Puente Hills: in M.S. Woyski (ed) Tour and Field Guide, National Association of Geology Teachers, Far Western Section. Chevron Oil Field Research Co., Fullerton CA, p. 35-54.

County of Los Angeles. 2015. Los Angeles County General Plan, available at: http://planning.lacounty.gov/ generalplan/generalplan

Critelli, S., P.E. Rumelhart, and R.V. Ingersoll. 1995. Petrofacies and Provenance of the Puente Formation (middle to upper Miocene), Los Angeles Basin, Southern California; implications for rapid uplift and accumulation rates. Journal of Sedimentary Research.65, p. 656 – 667.

Dibblee, T.W. 1989. Geologic Map of the Los Angeles Quadrangle, Los Angeles County, California.

Durham, D.L., and R.F. Yerkes. 1964. Geology and oil resources of the eastern Puente Hills area, southern California: U. S. Geological Survey Professional Paper 420-B, p. B1-B62.

Eldridge, G.H, and R. Arnold. 1907. The Santa Clara Valley, Puente Hills and Los Angeles Oil Districts, Southern California. USGS Bulletin 309.

Gallagher, R.J., C.J. Zadoorian, and P.J. Michalski. 1994. First Street Viaduct Over the Los Angeles River – Supplemental Report. City of Los Angeles Department of Public Works Bureau of Engineering.

Hansmire, W.H. 2015. Revised Geotechnical Baseline Report, Regional Connector Transit Corridor Project, Los Angeles, California.

Jahns, R.H. 1954. Geology of Southern California. State of California, Department of Natural Resources, Bulletin 170, Volume 1.

Jefferson, G.T. 1991. A Catalogue of late Quaternary Vertebrates from California: Part two, Mammals. Natural History Museum of Los Angeles, Technical Report #7

Kellogg, R., 1925. Additions to the Tertiary History of the Pelagic mammals on the Pacific Coast of North America V. Structure of the flipper of a Pliocene Pinniped from San Diego County, California. Carnegie Institution of Washington 348:97-116.

Koch, A.L., V.L. Santucci, and T.R. Weasma. 2004. Santa Monica Mountains National Recreation Area Paleontological Survey: National Park Service, Geologic Resources Division, Technical Report NPS/NRGRD/GRDTR-04/01.

Lamar, D.L. 1970. Geology of Elysian Park-Repetto Hills area, Los Angeles County, California. California Division of Mines and Geology Special Report 101. 1:24,000.

McLeod, S.A. 2016. Paleontological resources for the proposed Metro Division 20 Portal Widening / Turnback Facility Project. On file with Paleo Solutions, Inc. Monrovia.

Morton, D.M. and F.K. Miller. 2006. Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: U.S. Geological Survey, Open-File Report 2006-1217, scale 1:100,000

Schoellhamer, J.E., J.G. Vedder, J.G., and R.F. Yerkes. 1965. Geology of the Los Angeles Basin in Geology of the Los Angeles Basin, California: An Introduction. California Division of Mines Bulletin 170, pt II, ch. 5. 1:100,000.

Weber, F.H. 1980. Preliminary geologic map of the north central Los Angeles area, Los Angeles County, California, showing features relating to character and recency of faulting. California Division of Miles and Geology Open File Report 80-10 LA. 1:24,000.

Yerkes, R.F. 1972. Geology and Oil Resources of the Western Puente Hills Area, Southern California; Geology of the Eastern Los Angeles Basin, Southern California. United States Geological Survey Professional Paper 420-C.

Yerkes, R., T. McCulloch, J. Schoellhamer, J. Vedder. 1965. Geology of the Los Angeles Basin, California- An Introduction. Geological Professional Survey Paper: A1-A55.

APPENDIX A: MUSEUM RECORD SEARCH RESULTS

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of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
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NATURAL HISTORY MUSEUM
LOS ANGELES COUNTY

Vertebrate Paleontology Section
Telephone: (213) 763-3325

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1 September 2017

Paleo Solutions, Inc.
911 South Primrose Avenue, Unit N
Monrovia, CA 91016

Attn: Barbara Webster, GIS Specialist & Archaeologist

re: Paleontological resources for the proposed Metro Division 20 Portal Widening / Turnback Facility Project, in the City of Los Angeles, Los Angeles County, project area

Dear Barbara:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed Metro Division 20 Portal Widening / Turnback Facility Project, in the City of Los Angeles, Los Angeles County, project area as outlined on the portion of the Los Angeles USGS topographic quadrangle map that you sent to me via e-mail on 15 August 2017. We do not have any vertebrate fossil localities that lie directly within the proposed project area boundaries, but we do have localities nearby from the same sedimentary deposits that occur subsurface in the proposed project area.

The entire proposed project site area has surficial deposits of younger Quaternary Alluvium, derived as fluvial deposits from the flood plain of the Los Angeles River that currently flows in a concrete channel immediately to the east. These younger Quaternary deposits usually do not contain significant fossil vertebrates, at least in the uppermost layers, but the underlying older Quaternary deposits found at varying depths may well contain significant vertebrate fossils.

Our closest vertebrate fossil locality from the older Quaternary deposits is LACM 1755, due west of the southern-most portion of the proposed project area near the intersection of Hill Street and 12th Street, that produced a fossil specimen of horse, *Equus*, at a depth of 43 feet below the street. Our next closest vertebrate fossil locality from older Quaternary deposits

beneath the younger Quaternary Alluvium is LACM 2032, northeast of the northern-most portion of the proposed project area near the intersection of Mission Road and Daly Street around the Golden State Freeway (I-5), that produced fossil specimens of pond turtle, *Clemmys mamorata*, ground sloth, *Paramylodon harlani*, mastodon, *Mammut americanum*, mammoth, *Mammuthus imperator*, horse, *Equus*, and camel, *Camelops*, at a depth of 20-35 feet below the surface. The pond turtle specimens from locality LACM 2032 were figured in the scientific literature by B.H. Brattstrom and A. Sturn (1959. A new species of fossil turtle from the Pliocene of Oregon, with notes on other fossil *Clemmys* from western North America. Bulletin of the Southern California Academy of Sciences, 58(2):65-71). At our locality LACM 1023, just north of locality LACM 2032 near the intersection of Workman Street and Alhambra Avenue, excavations in these deposits for a storm drain recovered fossil specimens of turkey, *Meleagris californicus,* sabre-toothed cat, *Smilodon fatalis*, horse, *Equus*, and deer, *Odocoileus*, at unstated depth. A specimen of the turkey, *Meleagris*, from this locality was published in the scientific literatus by D. W. Steadman (1980. A Review of the Osteology and Paleontology of Turkeys (Aves: Meleagridinae). Contributions in Science, Natural History Museum of Los Angeles County, 330:131-207).

Shallow excavations in the younger Quaternary Alluvium exposed throughout the proposed project area are unlikely to uncover significant fossil vertebrate remains. Deeper excavations in the proposed project area that extend down into the older Quaternary sediments, however, may well encounter significant vertebrate fossils. Any substantial excavations in the proposed project area, therefore, should be closely monitored to quickly and professionally recover any potential vertebrate fossils without impeding development. Also, sediment samples should be collected and processed to determine the small fossil potential in the proposed project area. 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

enclosure: invoice