APPENDIX H

Paleontological Resources Inventory Report

Paleontological Resources Inventory Report
for the
Municipal Waterways Maintenance Plan
City of San Diego
San Diego County, California
PTS #616992

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Paleontological Resources Inventory Report for the Municipal Waterways Maintenance Plan

TABLE OF CONTENTS

Section **Page No.**

APPENDICES

FIGURES

TABLE OF CONTENTS (CONTINUED)

Page No.

TABLES

ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
CEQA	California Environmental Quality Act
City	City of San Diego
EIR	Environmental Impact Report
GEI	GEI Consultants Inc.
LDC	Land Development Code
MMP	Master Storm Water System Maintenance Program
MWMP	Municipal Waterways Maintenance Plan
PI	Principal Investigator
PRC	Public Resources Code
SDNHM	San Diego Natural History Museum
SVP	Society of Vertebrate Paleontology

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EXECUTIVE SUMMARY

The City of San Diego's (City) Transportation & Storm Water Department is preparing an Environmental Impact Report (EIR) to address the potential significant environmental effects resulting from the implementation of the proposed *Municipal Waterways Maintenance Plan* (MWMP). The proposed MWMP is intended to establish an effective and streamlined program that allows for waterway facilities (channels/ditches, basins, and structures) to be maintained, thus reducing flood risk while minimizing impacts and potential adverse effects of maintenance and repair activities. The City contracted Dudek to initiate the processing of an EIR. As a requirement of the EIR, this *Paleontological Resources Inventory Report* was completed for potential MWMP project facilities (69 facility groups). The MWMP study area for this analysis includes a 100-foot buffer around all potential MWMP project facilities, staging areas, and access routes.

Maintenance of the waterway facilities was governed by the Master Storm Water System Maintenance Program (MMP). In 2013, the City developed the MMP to govern channel operation and maintenance activities. The MWMP and this *Paleontological Resources Inventory Report* replaces the MMP and its governing cultural and paleontological resources analysis.

This report presents the results of a paleontological investigation performed by Dudek for the MWMP, located in the City of San Diego, San Diego County, California. The MWMP study area is located on the Del Mar, Escondido, Imperial Beach, La Jolla, La Mesa, Otay Mesa, Point Loma, Poway, and National City, California U.S. Geological Survey 7.5-minute topographic quadrangles. A total of 125 facilities were reviewed as part of this study. This report focuses on 95 of those facilities that require routine maintenance activities. The City is the lead agency for compliance with the state guidelines. In accordance with the City of San Diego's (2016) guidelines for compliance with the *California Environmental Quality Act: Significance Determination Thresholds,* the City of San Diego's Paleontology Guidelines (2002), County of San Diego's (2009) *Guidelines for Determining Significance, Paleontological Resources,* and state California Environmental Quality Act (CEQA) Guidelines, Dudek performed a paleontological study of the MWMP study area.

A paleontological records search was requested from the San Diego Natural History Museum (SDNHM), and a letter was received in response on April 21, 2017, indicating that there are 193 fossil localities within a quarter-mile radius of the MWMP. However, 16 of these localities occur in geological units that would not be impacted by the MWMP (Appendix A, Museum Records Search Results). Published geological maps and reports and unpublished reports were reviewed to identify geological units underlying the study area and their paleontological sensitivity or potential.

The regional geological mapping indicates that the geological units present within the study area are (listed in order from youngest to oldest): artificial fill, Quaternary alluvium, Bay Point Formation,

Lindavista Formation, San Diego Formation, Sweetwater Formation, Pomerado Conglomerate, Mission Valley Formation, Stadium Conglomerate, Friars Formation, Scripps Formation, Ardath Shale, Cretaceous Intrusive Igneous Rocks, Mesozoic Metasedimetary and Metavolcanic Rocks, Undivided, as confirmed by the museum record search results (Kennedy 1975; Kennedy and Tan 2007, 2008) (Appendix A and Appendix B, Geologic Mapping by Facility). The museum records search results indicate that the study area is underlain by geological units ranging from high to no paleontological potential (County of San Diego 2009; Appendix A).

Geological units with low potential (e.g., Holocene alluvium) and no potential (e.g., artificial fill, Cretaceous Intrusive Igneous Rocks, and Mesozoic Metasedimentary and Metavolcanic Rocks) occur within the study area (County of San Diego 2009; Appendix A). This review suggests that earthen-bottom facilities developed in areas mapped as post-Pleistocene require evaluation; Holocene alluvium will not contain paleontological resources in a meaningful stratigraphic context, and therefore, will require no further action with regard to paleontological resources evaluation or application of Environmental Protocol (EP)-PAL-1 (Land Development Code (LDC) Section 142.0151, Paleontological Resources Requirements for Grading Activities [City of San Diego 2018]; Land Development Manual Appendix P, General Grading Guidelines for Paelontological Resources; and Appendix C of this report, Paleontological Review Matrix). Given the potential depth of proposed maintenance excavations and the no to low paleontological potential of the underlying geological units, no further mitigation is recommended at this time for facilities with underlying geologic units that have no or low paleontological potential.

Geologic units with high potential (e.g., old paralic deposits, correlative with the Bay Point Formation, San Diego Formation, Sweetwater Formation, Pomerado Conglomerate, Mission Valley Formation, Stadium Conglomerate, Friars Formation, Scripps Formation, and Ardath Shale), and moderate potential (e.g., very old paralic deposits, correlative with the Lindavista Formation) also occur in the study area (County of San Diego 2009; Appendix A). If thresholds of significance are exceeded in areas of moderate to high sensitivity, further paleontological resources evaluation would be required, and EP-PAL-1 would apply (LDC Section 142.0151; Land Development Manual Appendix P; and Appendix C of this report). In the event that significant paleontological resources are inadvertently uncovered, a City-qualified paleontologist should be retained to implement the paleontological mitigation program, which would be sufficient to reduce the impacts to less than significant. Under the City's (2016) thresholds for significance, monitoring is always required when grading on a fossil recovery site or near a fossil recovery site in the same geologic deposit/formation/rock unit as the project site, as indicated on the published geological mapping by Kennedy (1975), Kennedy and Peterson (1975), Kennedy and Tan (1977), and Kennedy and Tan (2008). Moreover, a paleontological resources review may be necessary where undisturbed formations may be impacted at depths less than 10 feet below the ground surface (City of San Diego 2016).

Paleontological Resources Inventory Report for the Municipal Waterways Maintenance Plan

1 INTRODUCTION

1.1 Project Description and Location

The City of San Diego's (City) Transportation & Storm Water Department is preparing an Environmental Impact Report (EIR) to address the potential significant environmental effects resulting from the implementation of the proposed *Municipal Waterways Maintenance Plan* (MWMP). The proposed MWMP is intended to establish an effective and streamlined program that allows for storm water facilities (including, but not limited to, a network of underground storm drain pipes, culverts, outlet/inlet structures [e.g., headwalls], detention basins, ditches, and channels) to be maintained, thus reducing flood risk, while minimizing impacts and potential adverse effects of maintenance and repair. The proposed MWMP outlines specific activities, maintenance methods, and procedures that will guide future maintenance and repair activities. The City contracted Dudek to initiate the processing of an EIR. As a requirement of the EIR, this paleontological resources inventory was conducted for the MWMP. This report describes the results of that inventory and analyzes the proposed MWMP maintenance and repair activities to determine their potential to impact paleontological resources. The potential of impact will determine the level of further paleontological review necessary before conducting future maintenance and repair activities.

Maintenance and repair of the waterway facilities was governed by the Master Storm Water System Maintenance Program (MMP). In 2013, the City developed the MMP to govern channel operation and maintenance activities in an efficient, economic, environmentally, and aesthetically acceptable manner to provide flood control for the protection of life and property. Dudek has included a screening matrix (see Appendix C) that will identify the maintenance activities that have the potential to cause impacts to paleontological resources and that would require additional identification, evaluation, and potential treatment measures. Appendix C also identifies those activities that would be considered exempt from additional paleontological review.

The City's municipal storm water system is distributed throughout the 342-square-mile metropolitan area (see Appendix B). The system conveys storm water runoff from natural and developed areas to receiving waters. Major drainage systems are (from north to south) Los Peñasquitos Canyon Creek, Rose Canyon Creek, San Diego River, Alvarado Canyon Creek, Chollas Creek, Otay River, Nestor Creek, and Tijuana River. City jurisdiction spans eight watersheds: San Dieguito River, Los Peñasquitos, Mission Bay, San Diego River, Pueblo San Diego, Sweetwater, Otay, and Tijuana River.

Maintenance and repairs are an important component of operating the storm water conveyance system and providing reliable flood risk reduction throughout the City. Many storm water facilities were originally designed to require ongoing maintenance and repair. For example, concrete-lined trapezoidal channels are often designed to convey the 100-year storm event. However, if sediment

accumulates in the channels, and vegetation establishes within the sediment, the conveyance capacity is often reduced, and adjacent developed properties are at greater risk of flooding. In other cases, storm water facilities damaged during large storm events require repair (e.g., replacement of broken concrete lining or dislodged riprap) to continue to provide safe storm water conveyance according to the original facility design. Finally, there are areas of the City where development or conditions have changed within the watershed, resulting in greater or faster storm water flows than predicted during the facility design, or the original design does not meet current standards. In these cases, a Capital Improvement Program project is often needed to address the potential flood risk that exists or erosion potential due a design that no longer meets the needs of the surrounding area; however, maintenance (removal of accumulated vegetation and sediment) may help alleviate the flood risk on an interim basis until a Capital Improvement Program project is designed and constructed.

The following are the primary objectives of the MWMP:

- Public safety and flood risk reduction
    - Protect life and property adjacent to, downstream, and upstream of affected channels from flooding and environmental degradation.
- Responsiveness to reduce flood risk
    - Provide for timely and consistent routine operations and maintenance in the affected channels and associated storm water conveyance infrastructure.
- Avoid, minimize, and/or mitigate potential effects to environmental resources
    - Avoid, minimize, and/or mitigate significant adverse environmental effects resulting from routine maintenance of storm water facilities.
    - Incorporate and adapt to water quality management strategies intended to protect water quality and address flooding impacts.
- Proactive and timely approval process
    - Provide project-level analysis upfront to expedite subsequent authorizations for routine and preventive maintenance activities within storm water facilities.
    - Identify a review-and-approval process to include additional storm water facilities and maintenance activities that follow the protocols and requirements of the MWMP.
    - Reduce the need to conduct emergency maintenance during significant storm events by implementing preventive maintenance activities.

As stated above, the objectives of the MWMP require the ability for the City's Transportation & Storm Water Department to be responsive to newly identified flood risks while also streamlining approvals for routine preventive maintenance that reduces flood risks. To accomplish this, the MWMP identifies the following:

1. A range of plan-wide activities that may occur throughout the storm water system where flood risks may arise and that would be conducted in accordance with a regulatory framework identified under the MWMP and associated permits.
2. A list of Facility Maintenance Plans (FMPs) that provide specific details and requirements for the majority of facilities that are likely to require routine maintenance and repair.

Together, these two components provide operational flexibility while also providing specific detailed analysis for the majority of anticipated maintenance and repair activities to streamline the review and approval process.

This technical report was drafted based on a facility evaluation list that includes 69 facility groups. Of those facility groups, the MWMP proposes FMPs for 66 facility groups. Therefore, this technical report provides a project-level analysis for those proposed FMPs. The conclusions of this project-level analysis may be used to analyze additional similar or related activities identified for a program-level analysis in the MWMP; however, such program-level analysis is not included in this technical report.

Figure 1a, Geologic Map – Index; Figure 1b, Geologic Map – Legend; and Figures 1-1 through 1-12, Geologic Map (see Appendix B) illustrate two groups of facilities: (1) those on the facility evaluation list and (2) additional facilities within storm water conveyance system:

1. Facility Evaluation List. These are facilities where routine maintenance is most likely to be needed (potential MWMP project facilities). All of these facilities were evaluated to determine if an FMP would be proposed under the MWMP. The Area of Potential Effect encompasses all of these facilities plus associated staging, access, loading, and stockpiling areas. These facilities are represented in the figures in Appendix B as follows:
    a. Project FMPs (identified in yellow)
    b. Project Facilities Evaluated (No FMP Proposed) (identified in blue with black outline)
2. Additional Facilities Subject to Limited Program-Level Activities. These are additional facilities monitored annually that are the most likely locations where additional programmatic activities may occur. These facilities are identified in blue in the figures in Appendix B. These facilities are not analyzed in this technical report, but the conclusions of this report may be used to develop a program-level analysis for similar or related activities.

In addition to the footprint of the potential MWMP project facilities, work staging areas and crew access routes were also inventoried. To ensure that all potentially impacted paleontological resources are identified, the current MWMP study area includes a 100-foot-wide buffer around all potential project facilities, staging areas, and access routes (see Appendix B).

This report documents the results of the MWMP paleontological resources inventory, which included a desktop review of published geological and paleontological literature and a museum records search. The goal of this inventory is to provide data to the City to aid in the development of the MWMP and determine which maintenance activities and facilities require further paleontological review.

This report presents the results of a paleontological investigation performed by Dudek for the study area, located in the City of San Diego, San Diego County, California. The study area is located on the Del Mar, Escondido, Imperial Beach, La Jolla, La Mesa, Otay Mesa, Point Loma, Poway, and National City, California U.S. Geological Survey 7.5-minute topographic quadrangles.

1.2 Regulatory Context

1.2.1 Federal, State, and Local Regulations and Laws

The Paleontological Resources Preservation Act requires the secretaries of the Interior and Agriculture to manage and protect paleontological resources on federal land using scientific principles and expertise. The Omnibus Public Lands Act–Paleontological Resources Preservation (OPLA–PRP) includes specific provisions addressing management of these resources by the Bureau of Land Management, the National Park Service, the Bureau of Reclamation, the U.S. Fish and Wildlife Service, all of the Department of the Interior, and the Forest Service of the Department of Agriculture.

OPLA–PRP affirms the authority for many of the policies that the federal land-managing agencies already have in place for the management of paleontological resources, such as issuing permits for collecting paleontological resources, curation of paleontological resources, and confidentiality of locality data. The OPLA–PRP only applies to federal lands and does not affect private lands. It provides authority for the protection of paleontological resources on federal lands, including criminal and civil penalties for fossil theft and vandalism. As directed by the act, the federal agencies are in the process of developing regulations, establishing public awareness and education programs, and inventorying and monitoring federal lands.

The CEQA Guidelines require that all private and public activities not specifically exempted be evaluated against the potential for environmental damage, including effects to paleontological resources. Paleontological resources are recognized as part of the environment under these state guidelines.

Under the City's Paleontology Guidelines (2002) and in compliance with the *California Environmental Quality Act: Significance Determination Thresholds* for paleontology (City of San Diego 2016), specific policies have been created to reduce impacts to paleontological resources, as follows: "Monitoring is always required when grading on a fossil recovery site or near a fossil recovery site in the same geologic deposit/formation/ rock unit as the project site as indicated on the Kennedy Maps. Monitoring may be required for shallow grading (i.e., <10 feet) when a site has previously been graded and/or unweathered geologic deposits/formations/rock units are present at the surface. Monitoring is not required when grading documented or undocumented artificial fill" (City of San Diego 2016). The grading thresholds for required monitoring within areas underlain by high paleontological sensitivity geological units are earthwork greater than 1,000 cubic yards in quantity and 10 feet or more in depth. Grading thresholds for required monitoring within areas underlain by moderate paleontological sensitivity geological units are greater than 2,000 cubic yards in quantity and 10 feet or more in depth. Areas underlain by geological units with low or no paleontological sensitivity do not require monitoring, according to the City (City of San Diego 2016).

1.2.2 Paleontological Resources

Paleontological resources are limited, nonrenewable resources of scientific and educational value, which are afforded protection under state laws and regulations. This study satisfies MWMP requirements in accordance with state guidelines (13 PRC, 2100 et seq.) and Public Resources Code Section 5097.5 (Stats 1965, c 1136, p. 2792). This analysis also complies with guidelines and significance criteria specified by the Society of Vertebrate Paleontology (SVP 2010). Although not defined, the City ranks the paleontological potential of rock units using the following qualifiers: Zero, Low, Moderate, and High (City of San Diego 2016). Table 1 provides definitions for high, moderate, low, marginal, and no paleontological resource potential, or sensitivity, as set forth in and in agreement with the County of San Diego's (2009) *Guidelines for Determining Significance: Paleontological Resources,* which mirror the sensitivity ratings set forth by the City of San Diego (2016).

1.3 Report Format and Key Personnel

Following this Introduction (Chapter 1), Chapter 2 presents the overall geology of the study area. Chapter 3 outlines the methods used to conduct this study. Chapter 4 presents the results of the records search. Chapter 5 summarizes the study and provides management considerations. Chapter 6 lists the references cited in this report. Sarah A. Siren, M.S., served as Principal Investigator (PI), conducted the study and co-authored the report with Michael J. Williams, Ph.D. (Appendix D, Qualifications of Key Personnel).

Table 1
Paleontological Resource Sensitivity Criteria

Resource Sensitivity/ Potential	Definition
High	High resource potential and high sensitivity are assigned to geologic formations known to contain paleontological localities with rare, well preserved, critical fossil materials for stratigraphic or paleoenvironmental interpretation, and fossils providing important information about the paleoclimatic, paleobiological and/or evolutionary history (phylogeny) of animal and plant groups. In general, formations with high resource potential are considered to have the highest potential to produce unique invertebrate fossil assemblages or unique vertebrate fossil remains and are, therefore, highly sensitive.
Moderate	Moderate resource potential and moderate sensitivity are assigned to geologic formations known to contain paleontological localities. These geologic formations are judged to have a strong, but often unproven, potential for producing unique fossil remains (Deméré and Walsh 1993).
Low	Low resource potential and low sensitivity are assigned to geologic formations that, based on their relatively young age and/or high-energy depositional history, are judged unlikely to produce unique fossil remains. Low resource potential formations rarely produce fossil remains of scientific significance and are considered to have low sensitivity. However, when fossils are found in these formations, they are often very significant additions to our geologic understanding of the area.
Marginal	Marginal resource potential and marginal sensitivity are assigned to geologic formations that are composed either of volcaniclastic (derived from volcanic sources) or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain formations at localized outcrops. Volcaniclastic rock can contain organisms that were fossilized by being covered by ash, dust, mud, or other debris from volcanoes. Sedimentary rocks that have been metamorphosed by heat and/or pressure caused by volcanoes or plutons are called metasedimentary. If the sedimentary rocks had paleontological resources within them, those resources may have survived the metamorphism and still be identifiable within the metasedimentary rock, but since the probability of this occurring is so limited, these formations are considered marginally sensitive.
No Potential	No resource potential is assigned to geologic formations that are composed entirely of volcanic or plutonic igneous rock, such as basalt or granite, and therefore do not have any potential for producing fossil remains. These formations have no paleontological resource potential, i.e., they are not sensitive.

Source: County of San Diego 2009.

2 PROJECT BACKGROUND

2.1 Geological Setting

The MWMP study area lies within the western portion of the Peninsular Ranges Geomorphic Province, where older, generally plutonic and metamorphic bedrock geological units are overlain by younger, Cenozoic sedimentary deposits (Walawender 2000). The Peninsular Ranges were formed by uplift of plutonic igneous rock resulting from the subduction of the Pacific Plate underneath the North American Plate during the latter portion of the Mesozoic era (approximately 125 to 90 million years old; Abbott 1999; USGS 2007).

The California Geological Survey (Kennedy 1975) maps geological units at a scale of 1:24,000 as artificial fill (Qaf); Holocene age alluvium (Qal), slope wash deposits (Qsw), and undifferentiated alluvium and slope wash deposits (Qal + Qsw); Pleistocene age Bay Point Formation (Qbp); middle to early Pleistocene-age Lindavista Formation (Qln, Qlb); Pliocene and Pleistocene San Diego Formation (Tsd, Tsdss); late Eocene Sweetwater Formation (Tsw), Pomerado Conglomerate (Tp), Mission Valley Formation (Tmv), and Stadium Conglomerate (Tst); middle Eocene Friars Formation (Tf), Scripps Formation (Tsc), and Ardath Shale (Ta); Cretaceous intrusive igneous rocks (Kg); and Mesozoic Metasedimentary and Metavolcanic Rocks, Undivided (Mzu) (Appendix B). Geological descriptions and paleontological sensitivities of mapped units are detailed below and summarized in Table 2. Generalized stratigraphic relationships of geological units in northwestern San Diego County are presented in Figures 1 and 2, below.

Artificial Fill (Qaf)

The thickness of the artificial fill (map unit Qaf) mapped throughout the study area is variable. Due to the young (recent), human-caused nature of these deposits, artificial fill has no potential to produce scientifically significant paleontological resources because any recovered fossils are not in their original geographic, stratigraphic, and temporal context (City of San Diego 2016; County of San Diego 2009).

Alluvium, Slope Wash Deposits, and Undifferentiated Alluvium and Slope Wash Deposits (Qal, Qsw, and Qal + Qsw)

The Holocene (less than approximately 11,000 years old) alluvium (map unit Qal), slope wash deposits (map unit Qsw), and undifferentiated alluvium and slope wash deposits (map unit Qal + Qsw) mapped throughout the study area along drainages and lower elevations are described by Kennedy (1975) as follows:

> Alluvium in the area consists primarily of poorly consolidated stream deposits of silt, sand, and cobble-sized particles derived from bedrock sources that lie within and to the east of the study area. The alluvium is intertongued with Holocene slope wash

that generally mantles the lower valley slopes throughout the area. For this reason, alluvium and slope wash have not been differentiated in most areas.

Three-quarters of the total number of facilities are underlain by Holocene-age deposits (Appendix A). Due to the young (recent) nature of these deposits, Holocene-age alluvium and slope wash has low potential to produce scientifically significant paleontological resources (City of San Diego 2016; County of San Diego 2009; Appendix A).

Bay Point Formation (Qbp)

The Pleistocene Bay Point Formation (approximately 0.08 to 0.13 million years old [Ma]; Valentine 1959; Kennedy 1973; USGS 2007; GEI 2017; Appendix A) (map unit Qbp) consists of shallow marine and nonmarine deposits that are correlative with terrace deposits (map units Qt_{1-3} of Tan and Kennedy 1996; map units Qop_{6-7}, and Qop_{2-4} of Kennedy and Tan 2007). Named for deposits near Crown Point (formerly Bay Point), the formation is composed of poorly consolidated, pale brown fine- to medium-grained sandstones (Valentine 1959; Tan and Kennedy 1996, 1975).

The Bay Point Formation has produced important invertebrate and vertebrate fossil localities along coastal San Diego (Stephens 1929; Hertlein and Grant 1939; Valentine 1959; Deméré 1981) and has high paleontological sensitivity (City of San Diego 2016; County of San Diego 2009; Appendix A).

Lindavista Formation (Qln and Qlb)

The Pleistocene Lindavista Formation (approximately 0.7 to 1.5 million years old [Ma]) (GEI 2017; Kennedy 1973; USGS 2007) (map units Qln and Qlb), represents nearshore marine, beach, and nonmarine depositional environments and is present throughout the study area, either mapped at the surface or underlying artificial fill or surficial alluvial deposits. The Lindavista Formation is correlative with the Qt_4 and $Qvop_{13}$ terrace deposits of Tan and Kennedy (1996) and Kennedy and Tan (2007), respectively. These deposits are primarily sandstone and conglomerates and vary from moderate- to well-indurated. According to Deméré and Wagner (2001), "Typical exposures of the formation consist of rust-red, coarse-grained, pebbly sandstones and pebble conglomerates with locally common deposits of green claystone."

The Lindavista Formation is considered to have high paleontological sensitivity in Tierrasanta and Mira Mesa and moderate paleontological sensitivity in all other areas of its geographic extent. Within the study area, the Lindavista Formation has moderate chance to produce scientifically significant paleontological resources (City of San Diego 2016; County of San Diego 2009; Appendix A).

San Diego Formation (Tsd and Tsdss)

The Pliocene and Pleistocene (approximately 1.5–3 Ma) San Diego Formation (map units Tsd and Tsdss) consists of marine and nonmarine strata, and is named for deposits in the South Bay area of San Diego (Arnold 1906; Deméré 1983; GEI 2017). This unit has been further subdivided into two informal members, the lower and the upper members (Deméré 1983). The San Diego Formation consists of yellowish-gray to yellowish-brown, weakly consolidated, fine-grained sandstones, poorly sorted gravels, pebble conglomerates, and bedded claystones (Kennedy 1975; Deméré and Walsh 1993).

The San Diego Formation has produced numerous fossil traces, plants, invertebrates, and vertebrates and has high potential to produce scientifically significant paleontological resources (City of San Diego 2016; County of San Diego 2009; Appendix A).

Sweetwater Formation (Tsw)

The late Eocene (approximately 37–42 Ma) Sweetwater Formation (map unit Tsw) is a terrestrial sedimentary unit found along coastal San Diego (Deméré and Walsh 1993; GEI 2017). Part of the Poway Group, it is named for fluvial channel and floodplain strata and consists of gravelly gritstone and sandstone grading upward to reddish mudstones and interstratified gritstones (Deméré and Walsh 1993).

The Sweetwater Formation has yielded remains of opossums, insectivores, and rodents, and has high potential to produce scientifically significant paleontological resources (Deméré and Walsh 1993; Walsh 1996; City of San Diego 2016; County of San Diego 2009; Appendix A).

Pomerado Conglomerate (Tp)

The middle Eocene (approximately 42 Ma) Pomerado Conglomerate (map unit Tp) is a fluvial to nearshore marine sedimentary unit found along coastal San Diego (Deméré and Walsh 1993; GEI 2017; Kennedy and Peterson 1975; Kennedy and Tan 2007; Tan and Kennedy 1996; Walsh 1996). This formation has been revised by Walsh (1996), at least in part, to be a portion of the conglomerate tongue of the Friars Formation, and forms the uppermost strata of the Poway Group. This formation was originally named by Peterson and Kennedy (1974) for the cobble conglomerate that overlies the Mission Valley Formation, as seen on the published geological maps for the Poway and La Mesa quadrangles.

The Pomerado Conglomerate has produced extinct terrestrial mammals and marine mollusks and has high potential to produce scientifically significant paleontological resources within the Scripps Ranch and Tierrasanta areas of San Diego, and moderate paleontological sensitivity in all other

areas of its geographic extent (Deméré and Walsh 1993; Walsh 1996; City of San Diego 2016; County of San Diego 2009; Appendix A).

Mission Valley Formation (Tmv)

The middle Eocene (approximately 42 Ma) Mission Valley Formation (map unit Tmv) is a marine sedimentary unit found along coastal San Diego (GEI 2017; Kennedy and Peterson 1975; Kennedy and Tan 1977; Tan and Kennedy 1996). Part of the Poway Group, it is named for strata located within Mission Valley where it is characterized by light gray, fine- to very fine-grained marine sandstones (Kennedy and Moore 1971; Deméré and Walsh 1993). These strata grade to the east and south into fluvially-derived sandstones and mudstones.

The Mission Valley Formation has produced numerous terrestrial vertebrates and marine invertebrates and vertebrates and has high potential to produce scientifically significant paleontological resources (Deméré and Walsh 1993; Walsh 1996; City of San Diego 2016; County of San Diego 2009; Appendix A).

Stadium Conglomerate (Tst)

The middle Eocene (approximately 42–44 Ma) Stadium Conglomerate is a terrestrial sedimentary unit found along coastal San Diego (GEI 2017; Kennedy and Peterson 1975; Kennedy and Tan 1977; Tan and Kennedy 1996). The bottommost unit of the Poway Group, the Stadium Conglomerate, has been divided into lithologically distinct upper and lower units (Deméré and Walsh 1993; Appendix A). The lower unit was described by Deméré and Walsh (1993) as poorly sorted, light gray and pale greenish-gray cobble conglomerate with muddy to sandy matrix and intermittent greenish and bluish-gray siltstone and mudstone that contains fossil vertebrates (Walsh 1996). The upper unit is composed of better-sorted, light rusty brown coarse-grained, cobble conglomerate with lenses of cross-bedded sandstones (Deméré and Walsh 1993). In addition, the upper unit contains sporadic, thin lenses of reddish-brown and greenish mudstones that have yielded fossil vertebrates (Deméré and Walsh 1993; Walsh 1996).

The Stadium Conglomerate has yielded significant fossils throughout its geographic extent in San Diego County and has moderate to high potential to produce scientifically significant paleontological resources in the upper member and high potential to yield scientifically significant paleontological resources in the lower member (County of San Diego 2009; Appendix A). The City of San Diego (2016) assigns the Stadium Conglomerate high paleontological sensitivity.

Friars Formation (Tf)

The middle Eocene (approximately 44–47 Ma) Friars Formation (map unit Tf) is a terrestrial sedimentary unit found along coastal San Diego. The formation is named for strata located along the north side of Mission Valley, near Friars Road. According to the City of San Diego (2016):

> The Friars Formation consists mainly of sandstones, mudstones, and cobble conglomerate. It is rich in vertebrate fossils, especially terrestrial mammals such as primates, rodents, artiodactyls, and perissodactyls. Well-preserved remains of marine microfossils and macroinvertebrates, and remains of fossils leaves have been recovered from the Friars Formation.

The Friars Formation has high potential to produce scientifically significant paleontological resources (City of San Diego 2016; County of San Diego 2009; Appendix A).

Scripps Formation (Tsc)

The middle Eocene (approximately 44–47 Ma) Scripps Formation (map unit Tsc) is a marine sedimentary unit found along coastal San Diego. Part of the La Jolla Group, it is named for strata located north of the Scripps Institute of Oceanography pier on the north of Black's Canyon (GEI 2017; Geolex 2017; Kennedy and Moore 1971). Sediments consist of interstratified layers of claystones, siltstones, and sandstones and minor cobble conglomerate (Deméré and Walsh 1993).

The Scripps Formation has produced trace, plant, marine invertebrate, marine vertebrate fossil remains and has high potential to produce scientifically significant paleontological resources (City of San Diego 2016; County of San Diego 2009; Appendix A).

Ardath Shale (Ta)

The middle Eocene (approximately 45–49 Ma) Ardath Shale is a marine sedimentary unit found along coastal San Diego. Part of the La Jolla Group, it is named for strata located on the east side of Rose Canyon, south of the intersection of Interstate 5 with Ardath Shale (GEI 2017; Geolex 2017; Kennedy and Moore 1971). In this area of San Diego, the Ardath Shale includes interbedded claystones and fine-grained sandstones, with occasional concretionary beds. This formation has yielded plant, invertebrate, and vertebrate fossilized remains (Bukry and Kennedy 1969; Gibson 1971; Hanna 1926; Givens and Kennedy 1979).

The Ardath Shale has high potential to produce scientifically significant paleontological resources (City of San Diego 2016; County of San Diego 2009; Appendix A).

Intrusive Igneous Rocks (Kg, Kgu, Kt)

Cretaceous-age (approximately >66 Ma) igneous bedrock in this area is mid-Cretaceous in age and described by Kennedy (1975) as granitic rocks of the southern California Batholith (map unit Kg) (USGS 2007). Citing geological mapping of Kennedy and Tan (2007, 2008), the SDNHM (2017) described the Cretaceous plutonic rocks as granodiorite and tonalite, undivided (map unit Kgu), and tonalite, undivided (map unit Kt) and part of the northern portion of the Peninsular Ranges Batholith. These rocks crop out within the northern most geology of the study area (Appendix B).

Igneous rocks have no paleontological resource potential (County of San Diego 2009; Appendix A).

Mesozoic Metasedimentary and Metavolcanic Rocks, Undivided (Mzu, Jsp)

The Mesozoic metasedimentary and metavolcanic bedrock (map unit Mzu) mapped by Kennedy and Tan (2007) are late Jurassic to early Cetaceous (approximately 125–145 Ma) in age and are the oldest geological unit within the study area. These rocks are located in the northern portion of the study area. According to older, but more detailed mapping by Kennedy (1975), this unit is equivalent to the Undifferentiated Santiago Peak Volcanics (map unit Jsp). According to Kennedy and Tan (2007), this unit consists of a "wide variety of unmetamorphosed and low- to high-metamorphic grade volcanic and sedimentary rocks."

Metasedimentary deposits mapped as the Santiago Peak Volcanics within San Diego County have marginal sensitivity due to the minor fossil potential within these specific rock types (County of San Diego 2009; Appendix A).

Table 2
Geological Units, Paleontological Sensitivities, and SDNHM Localities within One-Quarter Mile of the Study Area

Geological Unit	Epoch, Period, or Era	Geological Age (Millions of Years)	Paleontological Sensitivity	No. of SDNHM Localities within Quarter-Mile of Program Area
Artificial Fill (Qaf)	N/A	N/A	None	N/A
Alluvium, Slope Wash, and Undifferentiated Alluvium and Slope Wash (Qal, Qsw, and Qal + Qsw)	Holocene	<0.120	Low	N/A
Bay Point Formation (Qbp)	Late Pleistocene	~0.08–0.13	High	33

Table 2
Geological Units, Paleontological Sensitivities, and SDNHM Localities within One-Quarter Mile of the Study Area

Geological Unit	Epoch, Period, or Era	Geological Age (Millions of Years)	Paleontological Sensitivity	No. of SDNHM Localities within Quarter-Mile of Program Area
Lindavista Formation (Qln)	Early to Middle Pleistocene	~0.5–1.5	Moderate – High*	0
San Diego Formation (Tsd and Tsdss)	Pliocene to Pleistocene	~3–1.5	High	48
Sweetwater Formation (Tsw)	Late Eocene	~42–37	High	1
Pomerado Conglomerate (Tp)	Middle Eocene	~42	Moderate – High**	0
Mission Valley Formation (Tmv)	Middle Eocene	~42	High	2
Stadium Conglomerate (Tst)	Middle Eocene	~42–44	High	0
Friars Formation (Tf)	Middle Eocene	~46–47	High	18
Scripps Formation (Tsc)	Middle Eocene	~47	High	15
Ardath Shale (Ta)	Middle Eocene	~47–48	High	11
Intrusive Igneous Rocks (Kg, Kgu, Kt)	Cretaceous	> ~66	Low	0
Mesozoic Metasedimentary and Metavolcanic Rocks, Undivided	Early Cretaceous	~145–125	Marginal to Moderate***	0

* The Lindavista Formation is considered to have high paleontological sensitivity in Tierrasanta and Mira Mesa and moderate paleontological sensitivity in all other areas of its geographic extent.

** The Pomerado Conglomerate is considered to have high paleontological sensitivity in Scripps Ranch and Tierrasanta and moderate paleontological sensitivity in all other areas of its geographic extent.

*** The metavolcanic rocks are assigned marginal sensitivity and the metasedimentary rocks are assigned moderate sensitivity; however, due to lack of localities near the program area, the SDNHM (2017) assigned low sensitivity rating to the geological unit.

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Figure 1. Generalized Stratigraphy for Northwestern San Diego County

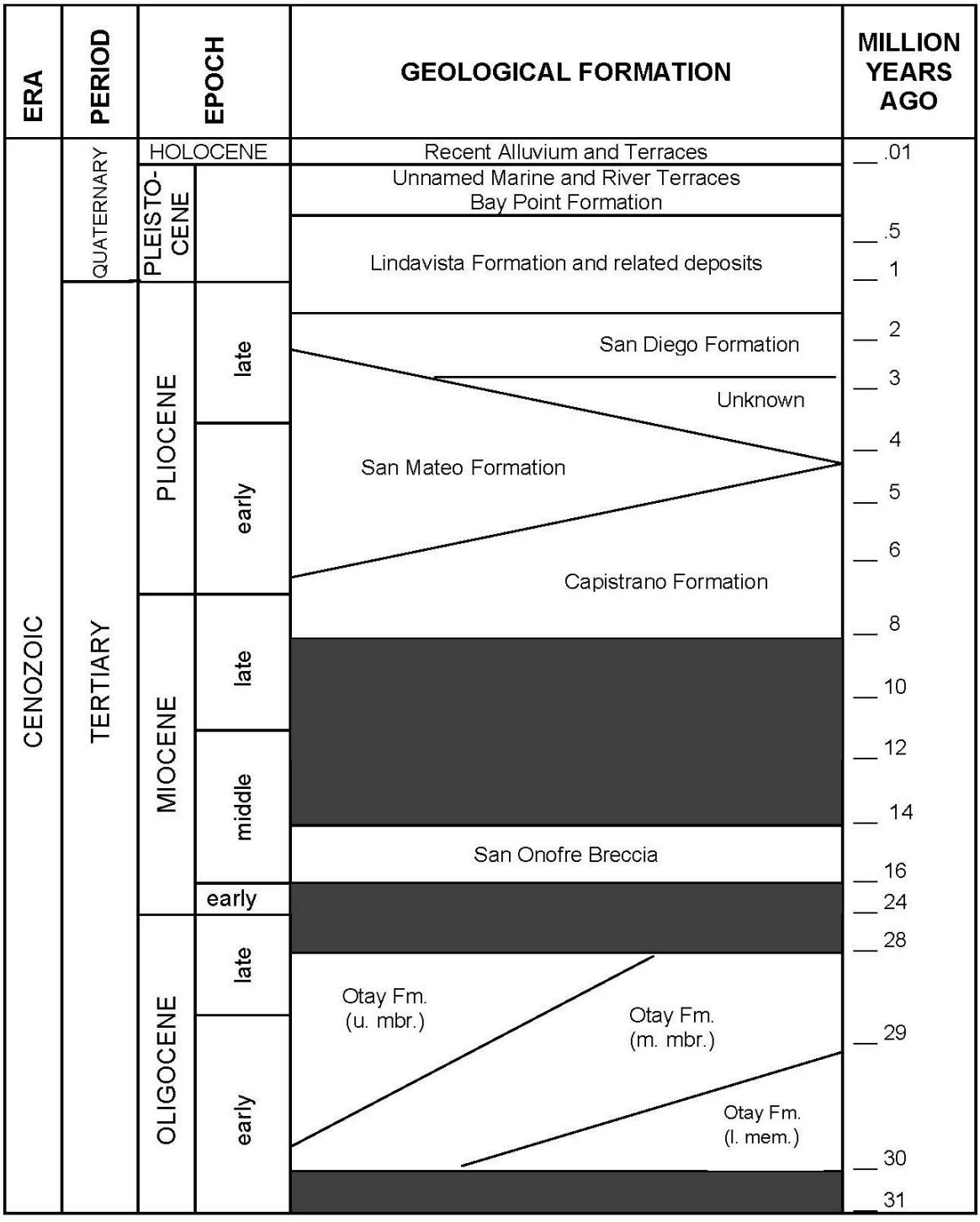

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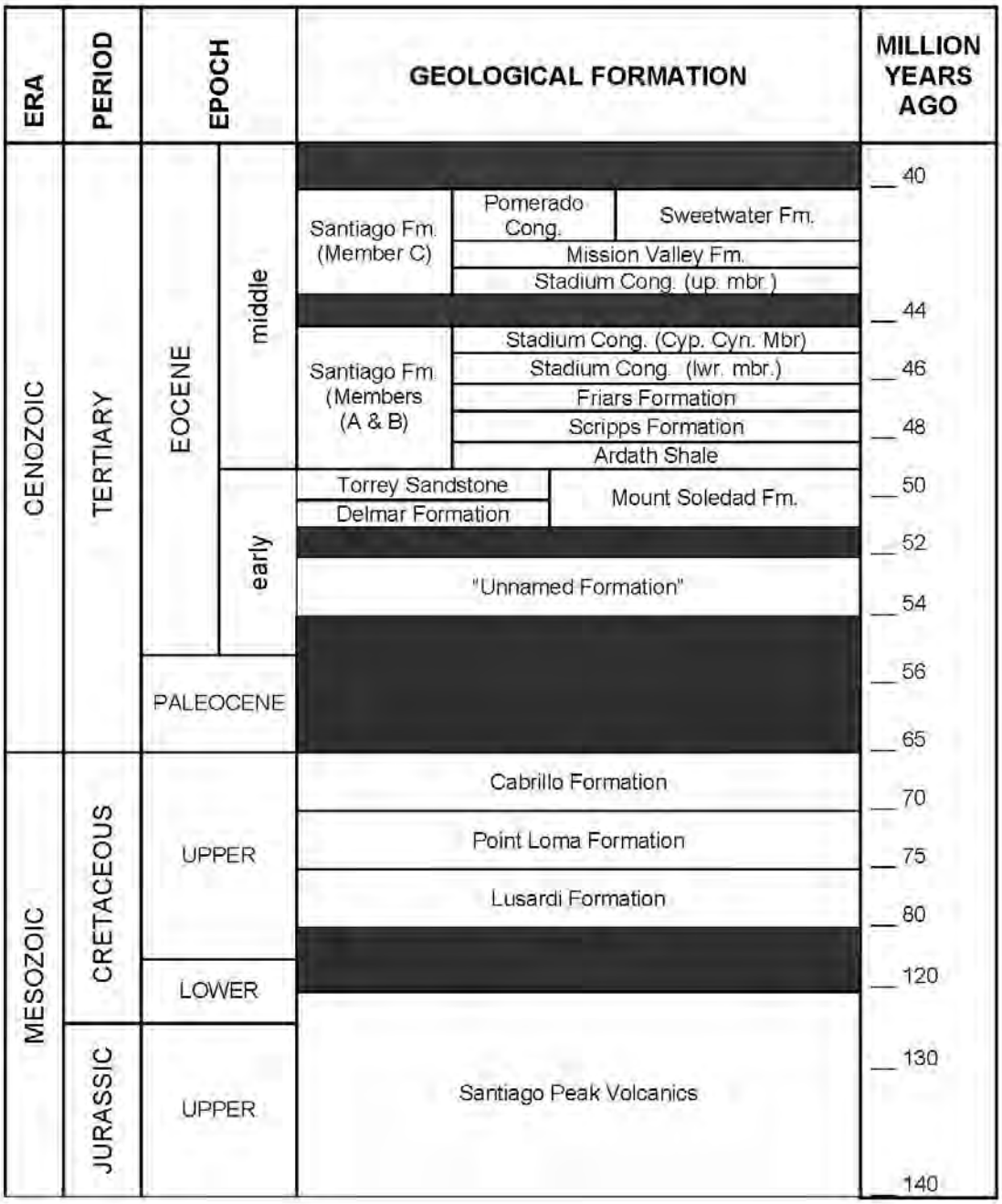
Figure 2. Generalized Stratigraphy for Northwestern San Diego County, Continued



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3 RESEARCH METHODS

This section discusses the field and background research methods used to perform this study.

3.1 Museum Records Search

A records search request was sent to the SDNHM on April 21, 2017. The purpose of the museum records search is to determine whether there are any known fossil localities in or near the study area, identify the sensitivity of geological units present within the study area, and determine whether EP-PAL-1 would apply to avoid or minimize potential adverse effects of construction on paleontological resources.

3.2 Geological Map and Literature Review

Published geological maps (Kennedy 1975; Tan and Kennedy 1996; Kennedy and Tan 2007; Kennedy and Tan 2008) and published and unpublished reports were reviewed to identify geological units on the site and determine their paleontological sensitivity.

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4 RESULTS

This section presents the results of the records search.

4.1 Museum Records Search Results

The record search conducted by the SDNHM found no records of fossil localities within the boundaries of potential MWMP project facilities or buffer area. However, 193 fossil localities are located within a one-quarter-mile radius of the study area. Of these, 177 fossil localities are from similar deposits to those that underlie the study area and have yielded Pleistocene- through Eocene-age fossils throughout the City (Appendix A). The following paragraphs summarize the records search results.

The Pleistocene-age Bay Point Formation underlies 18 of the potential MWMP project facilities and has produced 33 paleontological localities within a quarter-mile radius of the study area. These lagoonal and estuarine deposits have produced trace fossils, plants, foraminifers, bryozoans, chitons, snails, clams, mussels, oysters, scallops, ostracods, crabs, barnacles, sea urchins, and sand dollars, cartilaginous and bony fishes, birds, rodents, horses, and mammoths (Appendix A). Pleistocene-age localities elsewhere in San Diego County have produced scientifically significant Ice Age mammals such as mammoths, mastodons, ground sloths, dire wolves, short-faced bears, sabre-toothed cats, horses, camels, and bison (Deméré et al. 2013; Jefferson 1991a, 1991b; Rugh 2009).

The Pleistocene Lindavista Formation underlies 33 of the potential MWMP project sites; however, the SDNHM has no recorded paleontological localities within a quarter-mile radius of the study area (Appendix A). The Lindavista Formation has produced significant invertebrate fossil remains (snails, clams, scallops, barnacles, and sand dollars) in other areas of San Diego County (Appendix A).

The Pliocene to Pleistocene San Diego Formation underlies 15 of the potential MWMP project sites and has 48 localities within a quarter-mile radius of those sites (Appendix A). A multitude of fossil traces, plants, invertebrates, and vertebrates have been recovered from the San Diego Formation, including sponge borings, worm burrows, coprolites, coralline algae, vascular plants, bryozoans, brachiopods, snails, mussels, oysters, scallops, clams, tusk shells, shrimp, barnacles, crabs, starfish, sand dollars, sea urchins, cartilaginous and bony fishes, sea birds, eared seals, walruses, whales, sea cows , rabbits, skunks, deer, horse, camel, gomphothere, cat, wolf (Deméré and Walsh 1993; Appendix A).

The SDNHM reported the late Eocene Sweetwater Formation as underlying one potential MWMP project site and one fossil locality within one-quarter-mile radius of the site that produced rodent teeth (Appendix A).

The middle Eocene Mission Valley Formation underlies 10 potential MWMP project sites and has produced two paleontological localities within one-quarter-mile of the sites (Appendix A). Fossils reported by the SDNHM include terrestrial vertebrates (rodents, marsupials, artiodactyls, perissodactyls, insectivores, bats, and primates), marine invertebrates, (clams, snails, crustaceans, and sea urchins), and vertebrates (cartilaginous and bony fishes) (Appendix A).

The SDNHM reported the Stadium Conglomerate underlying 14 potential MWMP project sites; however, no paleontological localities were noted within a quarter-mile radius of the sites (Appendix A). In other regions of San Diego County, the upper member of the Stadium Conglomerate has produced invertebrates (marine mollusks) and terrestrial vertebrates (rodents, opossums, artiodactyls, rhinoceros, insectivores, carnivores, and primates) and the lower member has produced meager marine fossils and an important, scientifically significant, fossil mammal fauna (Deméré and Walsh 1993; Appendix A).

The middle Eocene Friars Formation underlies four potential MWMP project sites, and the SDNHM has 18 fossil collection localities from the Friars Formation within a quarter-mile radius of the MWMP sites (Appendix A). Fossils recovered from the Friars Formation include coprolites, plant remains, sea snails, clams, oysters, terrestrial snails, rays, turtles, lizards, crocodilians, birds, marsupials, rodents, insectivores, carnivores, artiodactyls, brontotheres, rhinoceroses, and primates (SDNHM 2017; Appendix A).

Five of the potential MWMP project sites are underlain by the middle Eocene, marine, Scripps Formation, and SDNHM (2017) reported 15 fossil localities from within a quarter-mile of the sites. Fossils from these localities include burrows, mangroves, willows, horsetails, bryozoans, gastropods, bivalves, crabs, heart urchins, and cartilaginous and bony fishes (SDNHM 2017; Appendix A).

The early middle Eocene Ardath Shale underlies one potential MWMP project site, and the SDNHM reported 11 fossil localities from within a quarter-mile of the MWMP site (Appendix A). The SDNHM reported the localities as having “produced trace fossils (e.g., borings) and fossilized impressions or remains of plants (e.g., flowering plants), marine invertebrates (e.g., foraminifers, corals, bryozoans, worms, brachiopods, snails, clams, mussels, oysters, scallops, tusk shells, crabs, sea stars, and sea urchins), and marine vertebrates (e.g., bony fish)” (Appendix A).

The SDNHM reported two potential MWMP project sites are underlain by Cretaceous intrusive igneous rocks and one MWMP site is underlain by undivided Mesozoic metasedimentary and metavolcanic rocks (Appendix A). No fossils have been recovered from these geological units (Appendix A).

4.2 Paleontological Resource Sensitivity

The surface geological mapping (Kennedy 1975; Tan and Kennedy 1996; Kennedy and Tan 2007; Kennedy and Tan 2008) details the underlying geology within the study area into artificial fill; Quaternary alluvium; Pleistocene Bay Point and Lindavista Formations; Pliocene to Pleistocene San Diego Formation; Eocene Sweetwater, Mission Valley, Stadium Conglomerate, Friars, Scripps, and Ardath Shale formations/geological units; Cretaceous intrusive igneous rocks; and Mesozoic metasedimentary and metavolcanic rocks.

A review of the records search results letter provided by the SDNHM indicates that the study area is underlain by geological units of low, moderate, and high paleontological potential (Table 1) (County of San Diego 2009). The SDNHM identified 177 fossil localities from geological units within a quarter-mile radius of the study area and 20 additional localities from geological units that are also within a quarter-mile radius of the study area but do not underlie the distinct potential MWMP project sites (Table 1) (Appendix A).

Numerous construction projects within sedimentary deposits throughout the City have produced scientifically significant paleontological resources (Appendix A). The potential, or sensitivity, of a given geological unit to produce scientifically significant paleontological resources is based on the Paleontological Monitoring Determination Matrix within the City of San Diego's (2002) Paleontology Guidelines and the City of San Diego's Land Development Manual Appendix P, General Grading Guidelines for Paleontological Resources (Table 2). The Bay Point Formation, San Diego Formation, Sweetwater Formation, Pomerado Conglomerate, Mission Valley Formation, Stadium Conglomerate, Friars Formation, Scripps Formation, Ardath Shale, should be considered to have high paleontological potential. The Lindavista Formation should be considered to have moderate paleontological potential, and Holocene age alluvium, intrusive igneous rocks, and undivided Mesozoic metasedimentary and metavolcanic rocks should be considered as having low paleontological potential.

4.3 Paleontological Review Matrix

Depending on the paleontological sensitivity of a potential MWMP project facility and the invasiveness of the proposed maintenance activity, the level of required paleontological review, if any, varies greatly. Due to the complex variables that must be considered, a list of review-exempt maintenance activities may not be sufficient to identify non-exempt activities at each potential MWMP project facility. Therefore, Dudek has designed a paleontological review matrix to specify which maintenance activities are exempt at which MWMP facility. The paleontological review matrix (Appendix C) will streamline the City's paleontological resources review process for all facilities in this study. The paleontological resource review matrix eliminates the majority of paleontological

resource review required for routine maintenance of facilities located in previously disturbed soils. Determining the paleontological sensitivity of maintenance facilities outlined in Appendix C is based on underlying geology (both surficial and subsurficial), proximity of known paleontological localities as determined through the paleontological records searches (Appendix A), the potential for original, as-built excavations within the channel to impact geological units with moderate to high paleontological sensitivity, and proposed grading activities.

Facilities are described as either those with manufactured/concrete substrate or those with earthen substrate. This report categorically excludes those facilities or channels with a manufactured/concrete substrate from consideration since maintenance and cleaning operations will not encounter or impact native soils or sediments. This report focuses on channels and basins that have earthen substrate and earthen walls. Moreover, the amount of grading required for concrete-lined channel maintenance is not anticipated to exceed the significance thresholds outlined by the City (City of San Diego 2016).

5 SUMMARY AND MANAGEMENT CONSIDERATIONS

Dudek's review of record search data and geological mapping did not identify any existing paleontological resources in the study area. Based on the records search results, the study area has low to high potential to produce paleontological resources during maintenance. A qualified paleontologist should be retained for the study area, in accordance with City, San Diego County, and State of California guidelines.

A paleontological records search performed by the SDNHM did not identify any known fossil localities in the study area, but there are 193 localities within a quarter-mile radius of the study area boundary. Of the 193 localities, 16 are from the Eocene Torrey Sandstone and Delmar Formation, which do not underlie any of the potential MWMP project sites and are not anticipated to be impacted by MWMP-related earthmoving. Geological mapping also indicates that the study area is underlain by the Bay Point Formation, San Diego Formation, Sweetwater Formation, Pomerado Conglomerate, Mission Valley Formation, Stadium Conglomerate, Friars Formation, Scripps Formation, and Ardath Shale, which have produced numerous plant and animal fossils in the region; therefore, the geological units should be considered to have high potential to contain significant paleontological resources.

Substantial impacts to paleontological resources are anticipated given the constraints of the proposed maintenance activities. However, prior to implementation of an MWMP activity in an earthen-bottom facility, activities would be reviewed along with Appendix C to determine if further steps (i.e., mitigation) are required. In the event that one of the earthen-bottom facilities proposed for maintenance now, or in the future, exceeds the significance thresholds for excavation in paleontologically sensitive areas as indicated in Appendix C, **EP-PAL-1** would be required. Implementation of **EP-PAL-1,** pursuant to LDC Section 142.0151, Land Development Manual Appendix P would ensure impacts would remain below a level of significance for paleontological resources. LDC Section 142.0151, Land Development Manual Appendix P is included as Appendix E of this report.

EP-PAL-1 **Paleontological Resource Compliance.** Pursuant to Land Development Code (LDC) Section 142.0151, the City of San Diego (City) Transportation & Storm Water Department **(**TSW) shall verify grading quantities and geologic formation sensitivity for all maintenance and repair activities and apply the appropriate requirements for paleontological monitoring in accordance with the General Grading Guidelines for Paleontological Resources in the City's Land Development Manual. Geologic formation sensitivity is provided in Paleontological Review Matrix in Appendix C of this report. Regulatory compliance for maintenance and repair activities would be ensured through notes on plans and/or substantial conformance review documentation.

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APPENDIX A

Museum Records Search Results

24 September 2018

Ms. Sarah Siren
Dudek
605 Third Street
Encinitas, CA 92024

RE: Paleontological Record Search – City of San Diego Master Stormwater Project, Revised

Dear Ms. Siren:

This letter presents the results of a paleontological record search conducted for the City of San Diego Master Stormwater project (Project), located at discrete sites across the City of San Diego. The sites span from the Rancho Bernardo Neighborhood in the northeast to the Otay Mesa Neighborhood in the southeast, and also lie near the coast. This report was originally prepared April 21, 2017, and has been revised to include an updated set of Project components.

A review of published geological maps covering the Project sites and surrounding area was conducted to determine the specific geologic units underlying the site. Each geologic unit was subsequently assigned a paleontological resource sensitivity following the City of San Diego and County of San Diego Guidelines (City of San Diego, 2011; County of San Diego, 2009; Deméré and Walsh, 1993). Published geological reports (e.g., Kennedy, 1975; Kennedy and Peterson, 1975; Kennedy and Tan, 2007; Kennedy and Tan, 2008; Todd, 2004) reveal that the proposed Project will impact 13 geologic units. Each of these geologic units and their paleontological sensitivity are summarized in detail in the following section.

In addition, a search of the paleontological collection records housed at the San Diego Natural History Museum (SDNHM) was conducted in order to determine if any documented fossil collection localities occur at the Project sites or within the immediate surrounding area (Appendix 1). The SDNHM has 193 fossil collection localities within a quarter-mile radius of the Project sites (Appendix 2). Sixteen of these localities are from geologic units that are not anticipated to be impacted by construction: the Eocene-age Torrey Sandstone and Delmar Formation. The remaining 177 localities are from the Pleistocene-age Bay Point Formation, the Pliocene to Pleistocene-age San Diego Formation, and the middle Eocene-age Sweetwater Formation, Mission Valley Formation, Friars Formation, Scripps Formation, and Ardath Shale, and are described in greater detail below.

Geologic Rock Units Underlying the Project Area

Artificial fill – Artificial fill underlies five of the Project sites (Appendix 3). The SDNHM does not have any fossil localities from deposits of artificial fill within a quarter-mile radius of the Project sites. Because artificial fill has been previously disturbed and may have been imported to a project site, any contained fossil remains have lost their original stratigraphic contextual data and are thus of little scientific value. For these reasons, artificial fill is assigned no paleontological sensitivity.

Holocene colluvial, alluvial, and paralic deposits – Holocene deposits (mapped by Kennedy and Tan, 2007, 2008, as Qya, Qyc, and Qpe) occur in modern canyons and floodplains, and

underlie 81 of the Project sites (Appendix 3). The SDNHM does not have any fossil localities from these deposits within a quarter-mile radius of the Project sites. Holocene alluvial deposits are generally less than 10,000 years old, and are assigned a low paleontological sensitivity based on their young geologic age and the lack of known fossil localities; however, these deposits may overlie sensitive units that could be impacted where the contact is relatively shallow.

Bay Point Formation – The nearshore marine deposits of the Pleistocene-age (approximately 10,000 to 750,000 years old) Bay Point Formation underlie 20 of the Project sites (Appendix 3). More specifically, these deposits rest on the Nestor and Bird Rock terraces (approximately 120,000 and 80,000 years old, respectively) of Kern and Rockwell (1992), and are equivalent to units 6 and 7, old paralic deposits, of Kennedy and Tan (2008). The SDNHM has 30 fossil collection localities from the Bay Point Formation within a quarter-mile radius of the Project sites. These localities yielded trace fossils (e.g., sponge borings in shell and worm tubes) and fossilized impressions or remains of plants (e.g., magnolias and other vascular plants), marine invertebrates (e.g., foraminifers, bryozoans, chitons, snails, clams, mussels, oysters, scallops, ostracods, crabs, barnacles, sea urchins, and sand dollars), marine vertebrates (e.g., sharks, rays, and bony fish), and terrestrial vertebrates (e.g., birds, rodents, horses, and mammoths). The Bay Point Formation has been assigned a high paleontological sensitivity for the diverse and well-preserved fossils of marine invertebrates and marine vertebrates that have been recovered from these deposits.

Lindavista Formation – Fifteen of the Project sites are underlain by the marine and/or non-marine terrace deposits of the early to middle Pleistocene-age (approximately 1.5 to 0.5 million years old) Lindavista Formation (mapped by Kennedy and Tan, 2008, as Quaternary very old paralic deposits, various units) (Appendix 3). The SDNHM does not have any fossil collection localities from these deposits within a quarter-mile radius of the Project sites. The rare fossil localities in San Diego County have produced remains of nearshore marine invertebrates (e.g., snails, clams, scallops, barnacles, and sand dollars). Fossils have primarily been recovered from localities in Tierrasanta and Mira Mesa where the Lindavista Formation is assigned a high paleontological sensitivity; elsewhere in San Diego County, including in the vicinity of the Project sites, the Lindavista Formation is assigned a moderate paleontological sensitivity.

San Diego Formation – Marine sedimentary deposits of the late Pliocene to early Pleistocene-age (approximately 3 to 1.5 million years old) San Diego Formation underlie 21 of the Project sites (Appendix 3). The SDNHM has 87 fossil collection localities from the San Diego Formation within a quarter-mile radius of the Project sites. These localities produced trace fossils (e.g., sponge borings, worm tubes and burrows, and coprolites) and fossilized impressions or remains of plants (e.g., coralline algae and vascular plants), marine invertebrates (e.g., foraminiferans, bryozoans, ostracods, brachiopods, snails, mussels, oysters, scallops, clams, tusk shells, chitons, shrimp, barnacles, crabs, starfish, sand dollars, and sea urchins), marine vertebrates (e.g., sharks, rays, bony fish, sea birds, eared seals, walruses, dolphins, whales, and sea cows), and terrestrial vertebrates (e.g., rabbits and horses). Based on the important fossil remains of marine mammals, sea birds, and mollusks recovered from this geologic unit, the San Diego Formation has been assigned a high paleontological sensitivity.

Sweetwater Formation – The river channel deposits of the middle Eocene-age (approximately 42 to 37 million years old) Sweetwater Formation has been tentatively identified underlying one Project site in the Colina del Sol neighborhood of eastern San Diego (Appendix 3). The outcrop occurs in an

upfaulted block within the La Nacion Fault, and is mapped as the Mission Valley Formation by Kennedy and Tan (2008). The one SDNHM fossil collection locality from the Sweetwater Formation within a quarter-mile radius of the Project sites (SDSNH 5840, see Appendix 1, 2) was recovered from this outcrop, and yielded several rodent teeth indicative of the Sweetwater Formation. This geologic unit has produced important new remains of terrestrial mammals elsewhere in San Diego County, and the Sweetwater Formation is therefore assigned a high paleontological sensitivity.

Mission Valley Formation – The marine and fluvial deposits of the middle Eocene-age (approximately 42 million years old) Mission Valley Formation underlie ten Project sites (Appendix 3). The SDNHM has two fossil collection localities from the Mission Valley Formation within a quarter-mile radius of the Project sites, which yielded fossilized remains of terrestrial mammals (e.g., marsupials, insectivores, bats, primates, and rodents). Elsewhere in San Diego County, marine deposits of the Mission Valley Formation have produced abundant and well-preserved remains of marine invertebrates (e.g., foraminifers, clams, snails, crustaceans, and sea urchins) and marine vertebrates (e.g., sharks, rays, and bony fish). Based on the faunal diversity and co-occurrence of marine invertebrates and terrestrial vertebrates within this unit, the Mission Valley Formation has been assigned a high paleontological sensitivity.

Stadium Conglomerate – Non-marine deposits of the middle Eocene-age (approximately 44 to 42 million years old) Stadium Conglomerate underlie 13 of the Project sites (Appendix 3). The SDNHM does not have any fossil collection localities from the Stadium Conglomerate within a quarter-mile radius of the Project sites. The upper member of the Stadium Conglomerate has produced fossilized impressions or remains of plants (e.g., petrified wood), marine invertebrates (e.g., foraminifers and mollusks), and sparse remains of fossil mammals (e.g., opossums, insectivores, primates, rodents, carnivores, rhinoceroses, and artiodactyls). The lower member has yielded sparse marine fossil remains and a scientifically important assemblage of fossil mammals (Deméré and Walsh, 1993). While the upper and lower members of the Stadium Conglomerate have been assigned distinct paleontological resource sensitivities (high to moderate, and high, respectively), these deposits should be treated as having a high fossil potential when it is not possible to distinguish the two members.

Friars Formation – The fluvial deposits of the middle Eocene-age (approximately 47 to 46 million years old) Friars Formation underlie four Project sites (Appendix 3). The SDNHM has 12 fossil collection localities from the Friars Formation within a quarter-mile radius of the Project sites. These localities produced trace fossils (e.g., coprolites) and fossilized impressions or remains of plants (e.g., flowering plants), marine invertebrates (e.g., sea snails, clams, and oysters), nonmarine invertebrates (e.g., land or freshwater snails), marine vertebrates (e.g., rays), and terrestrial vertebrates (e.g., turtles, lizards, crocodiles, birds, marsupials, assorted insectivorous mammals, primates, carnivorous mammals, rodents, artiodactyls, and perissodactyls such as brontotheres and rhinoceroses). The Friars Formation is assigned a high paleontological sensitivity on the basis of the recovery of diverse and well-preserved assemblages of both marine invertebrates and terrestrial vertebrates from these deposits.

Scripps Formation – The marine continental shelf deposits of the early middle Eocene-age (approximately 47 million years old) Scripps Formation underlie one of the Project sites (Appendix 3). The SDNHM has 23 fossil collection localities from the Scripps Formation within a quarter-mile radius of the Project sites. These localities produced trace fossils (e.g., burrows) and fossilized impressions or remains of plants (e.g., mangroves, willows, horsetails, and other vascular plants), marine invertebrates

(e.g., bryozoans, snails, clams, mussels, oysters, crabs, and heart urchins), and marine vertebrates (e.g., sharks and bony fish). Based on the diverse fossil assemblages known from this unit, as well as the co-occurrence of marine invertebrate and terrestrial vertebrate fossils, the Scripps Formation has been assigned a high paleontological sensitivity.

Ardath Shale – The marine outer shelf deposits of the early middle Eocene-age (approximately 48 to 47 million years old) Ardath Shale underlie two Project sites (Appendix 3). The SDNHM has 20 fossil collection localities from the Ardath Shale within a quarter-mile radius of the Project sites. These localities produced trace fossils (e.g., borings) and fossilized impressions or remains of plants (e.g., flowering plants), marine invertebrates (e.g., foraminifers, corals, bryozoans, worms, brachiopods, snails, clams, mussels, oysters, scallops, tusk shells, crabs, sea stars, and sea urchins), and marine vertebrates (e.g., bony fish). The Ardath Shale has been assigned a high paleontological sensitivity, as indicated by the diverse and well-preserved fossil assemblages that have been recovered from this geologic unit.

Cretaceous intrusive igneous rocks – The Cretaceous intrusive igneous rocks of San Diego County comprise part of the northern end of the Peninsular Ranges Batholith, and includes units mapped as granodiorite and tonalite, undivided, and tonalite, undivided, by Kennedy and Tan (2007, 2008). Two Project sites are underlain by these rocks (Appendix 3). The SDNHM does not have any fossil localities from intrusive igneous rocks within a quarter-mile radius of the Project sites. Plutonic igneous rocks do not preserve fossils because they crystallize at extremely high temperatures and pressures several miles below the earth's surface, so these rocks are assigned no paleontological sensitivity.

Mesozoic metasedimentary and metavolcanic rocks – Crystalline basement rocks of early Cretaceous age (approximately 125 to 145 million years old), mapped as Mesozoic metasedimentary and metavolcanic rocks, undivided, by Kennedy and Tan (2007), underlie one Project site (Appendix 3). The SDNHM does not have any fossil localities from this undivided unit within a quarter-mile radius of the Project sites. The metavolcanic portions of this unit rarely preserve fossils due to the high temperatures associated with their formation; some of the volcanic breccias, however, have produced petrified wood, and are assigned a marginal sensitivity (Deméré and Walsh, 1993). The metasedimentary portions have the potential to yield fossils, including siliceous microfossils (e.g., radiolarians) and marine macroinvertebrates (e.g., clams and belemnites), and are assigned a moderate paleontological sensitivity. The lack of nearby localities from these deposits indicates that fossil recovery is unlikely, so the geologic unit as a whole is assigned a low paleontological sensitivity.

Summary and Recommendations

The high sensitivity of eight of the geologic units underlying the Project sites (the Bay Point Formation, San Diego Formation, Sweetwater Formation, Mission Valley Formation, Stadium Conglomerate, Friars Formation, Scripps Formation, and Ardath Shale) and moderate sensitivity of the Lindavista Formation (City of San Diego, 2011; County of San Diego, 2009; Deméré and Walsh, 1993), as well as the abundant fossil collection localities nearby, suggest the potential for construction of the proposed Project to result in impacts to paleontological resources (Appendix 3). Any proposed excavation activities that extend deep enough to encounter previously undisturbed deposits of these geologic units have the potential to impact the paleontological resources preserved therein. For these

reasons, implementation of a complete paleontological resource mitigation program during ground-disturbing activities is recommended.

The fossil collection locality information contained within this paleontological record search should be considered private and is the sole property of the San Diego Natural History Museum. Any use or reprocessing of information contained within this document beyond the scope of the City of San Diego Master Stormwater project is prohibited.

If you have any questions concerning these findings please feel free to contact me at 619-255-0321 or kmccomas@sdnhm.org.

Sincerely,

Katie McComas, M.S.
Paleontological Report Writer & GIS Specialist
San Diego Natural History Museum

Enc: Appendix 1: Project site maps
Appendix 2: List of SDNHM fossil localities within a quarter-mile radius of the Project
Appendix 3: Paleontological sensitivity of geologic units underlying Project sites

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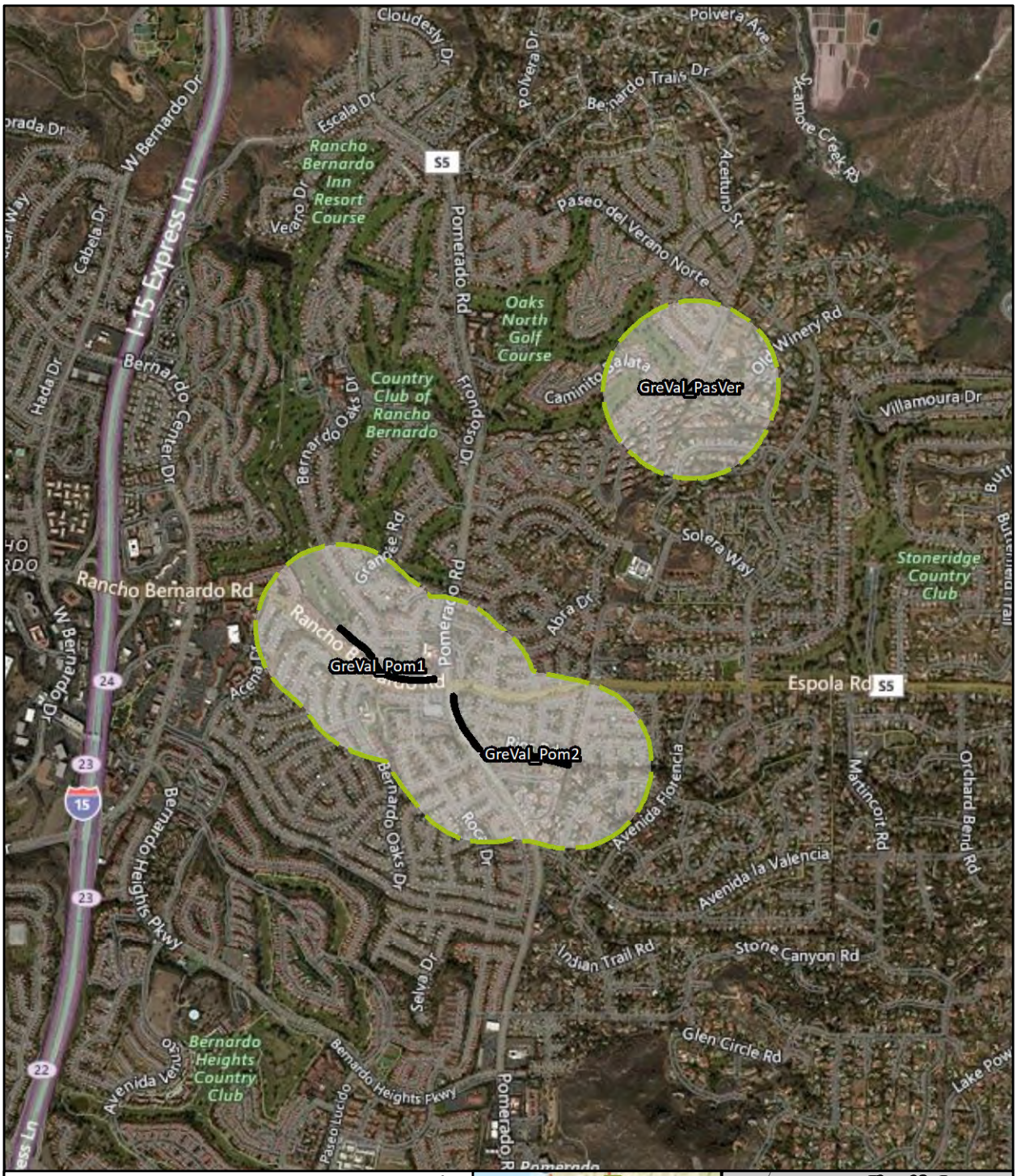
GreVal_PasVer
GreVal_Pom1
GreVal_Pom2
I-15 Express Ln
Rancho Bernardo Rd
Espola Rd
Pomerado Rd
Bernardo Oaks Dr
Rancho Bernardo Inn Resort Course
Oaks North Golf Course
Country Club of Rancho Bernardo
Bernardo Heights Country Club
Stoneridge Country Club
Sources: Bing Maps Hybrid imagery, Microsoft et al., 2018
Page 1 of 19
Project boundary/structure
1/4 mile radius buffer
SDSNH localities
Riverside Co.
San Diego Co.
Imperial Co.
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Diego
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APPENDIX 1
Project Map
City of San Diego Master Stormwater
City of San Diego, San Diego County, California
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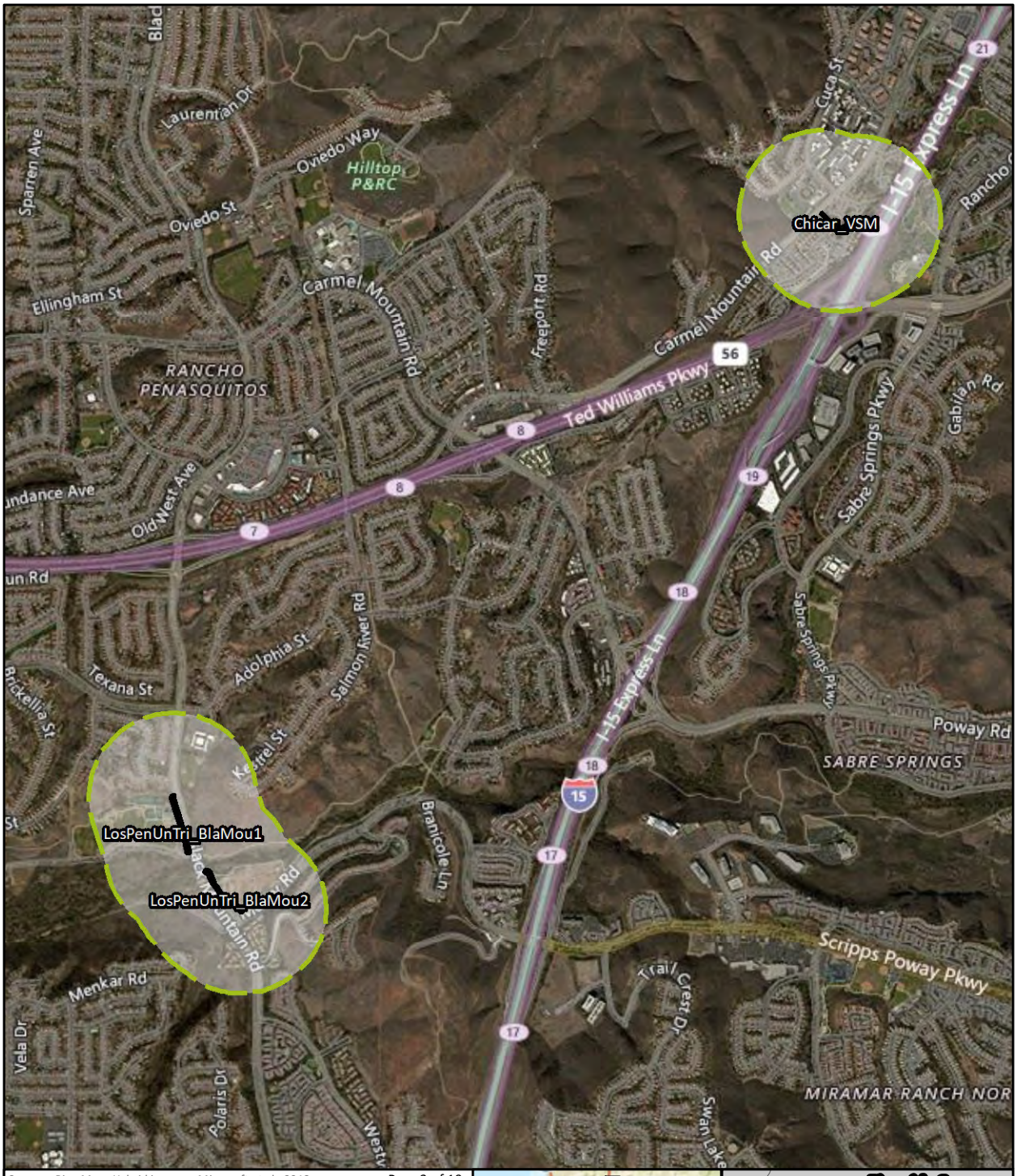

Project boundary/structure

1/4 mile radius buffer

SDSNH localities

PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

APPENDIX 1

Project Map
City of San Diego Master Stormwater
City of San Diego, San Diego County, California

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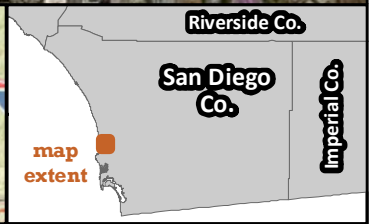
Sources: Bing Maps Hybrid imagery, Microsoft et al., 2018

Project boundary/structure

1/4 mile radius buffer

SDSNH localities



PALEOSERVICES

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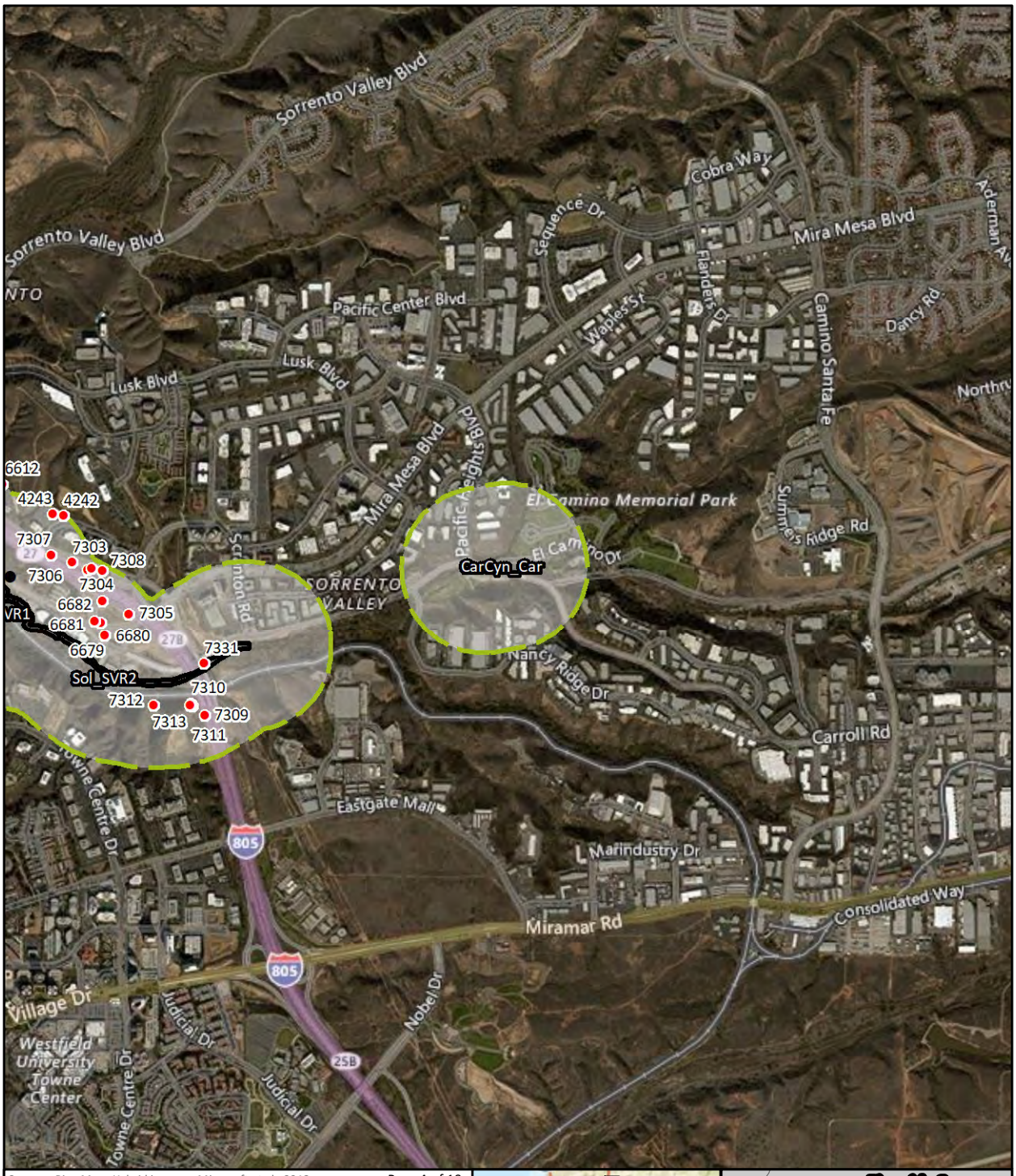

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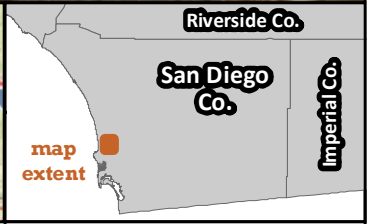
SDSNH localities



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City of San Diego, San Diego County, California

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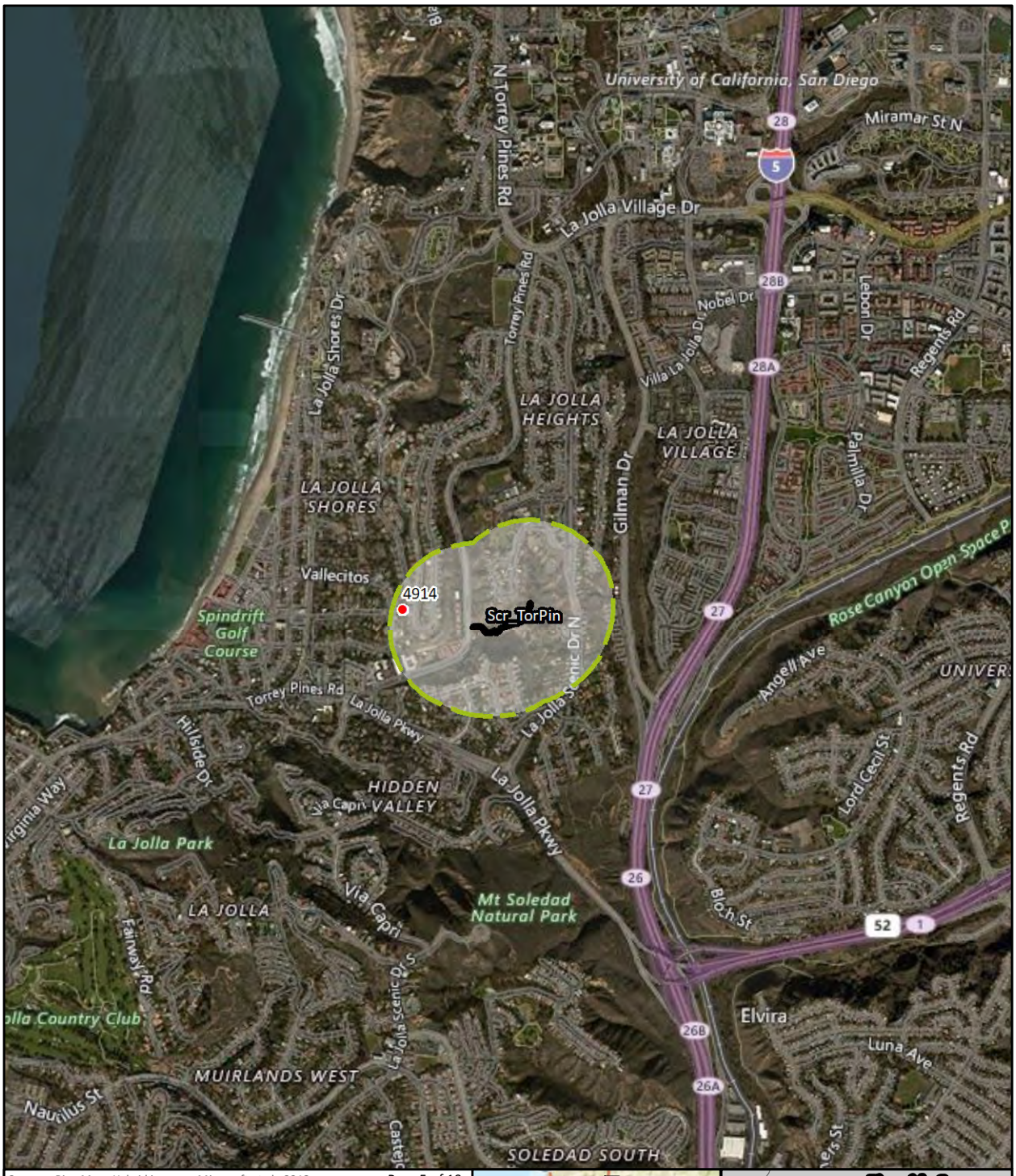

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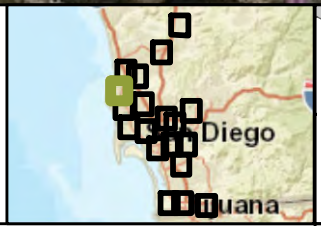
SDSNH localities



PALEOSERVICES

APPENDIX 1

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SDSNH localities

PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

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SDSNH localities

PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

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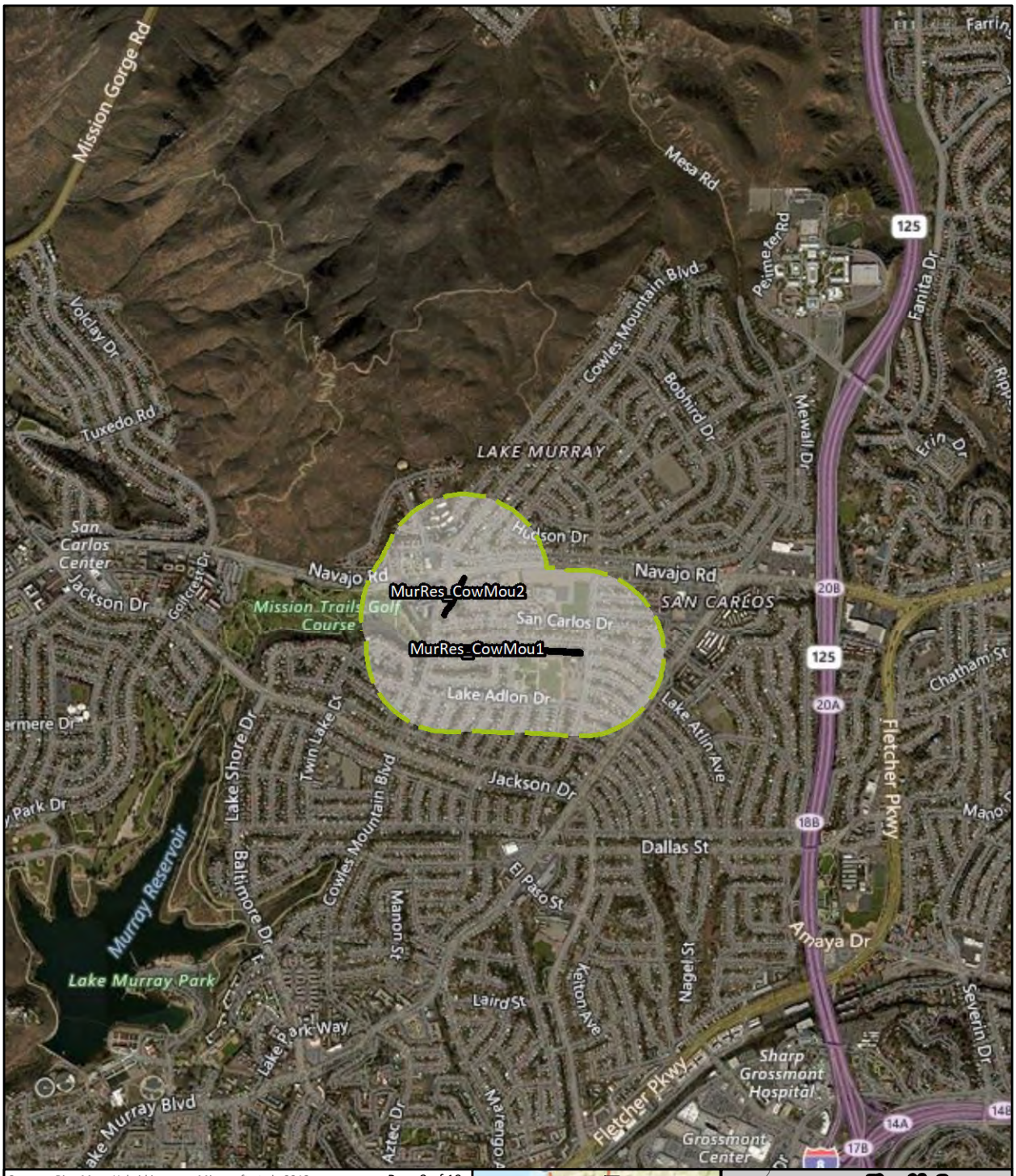

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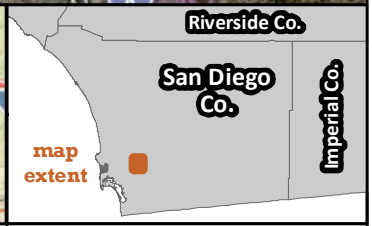

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SAN DIEGO NATURAL HISTORY MUSEUM

APPENDIX 1

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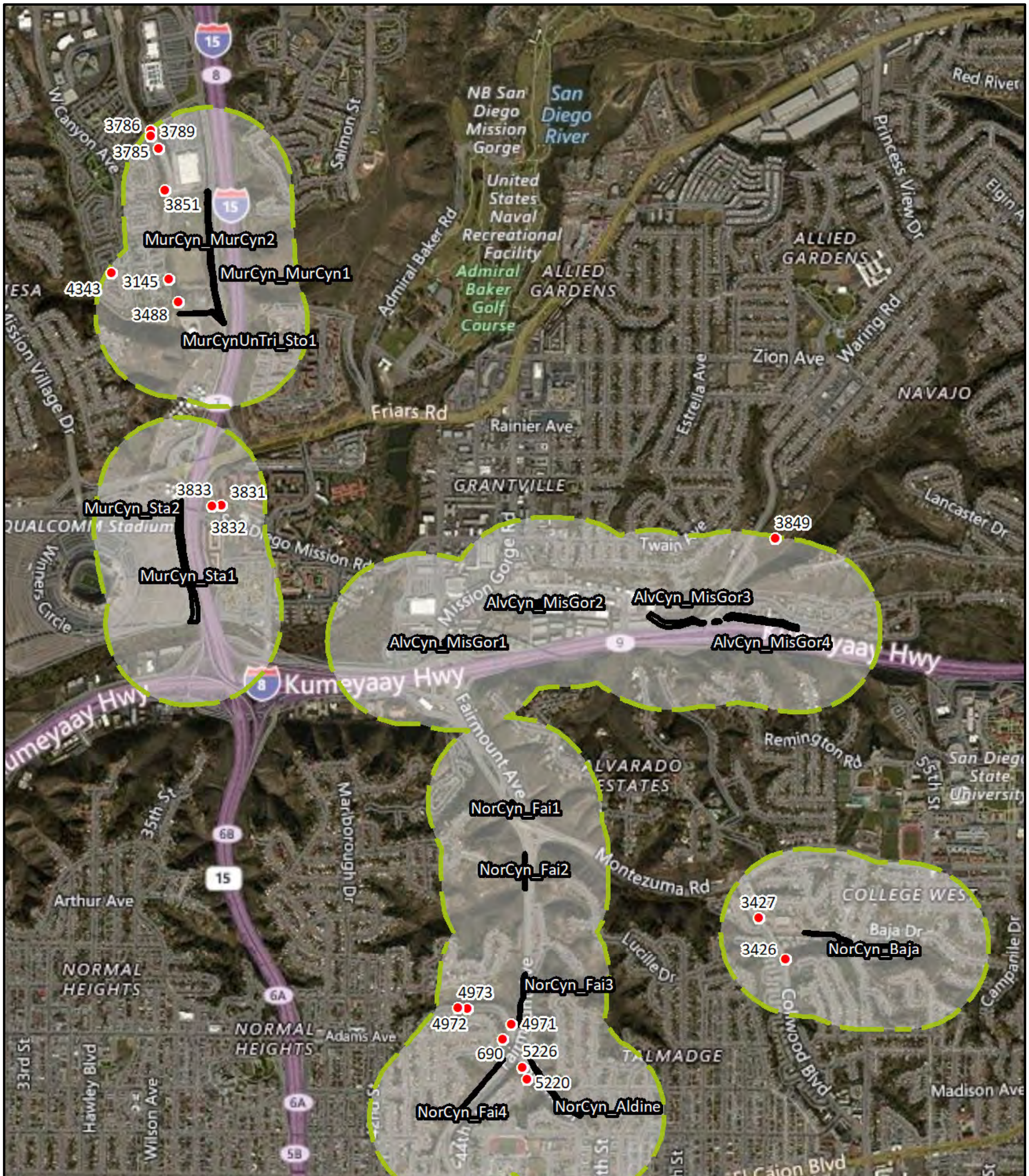

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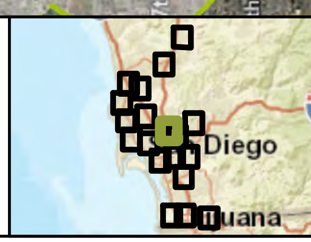
1/4 mile radius buffer

SDSNH localities



PALEOSERVICES

SAN DIEGO NATURAL HISTORY MUSEUM

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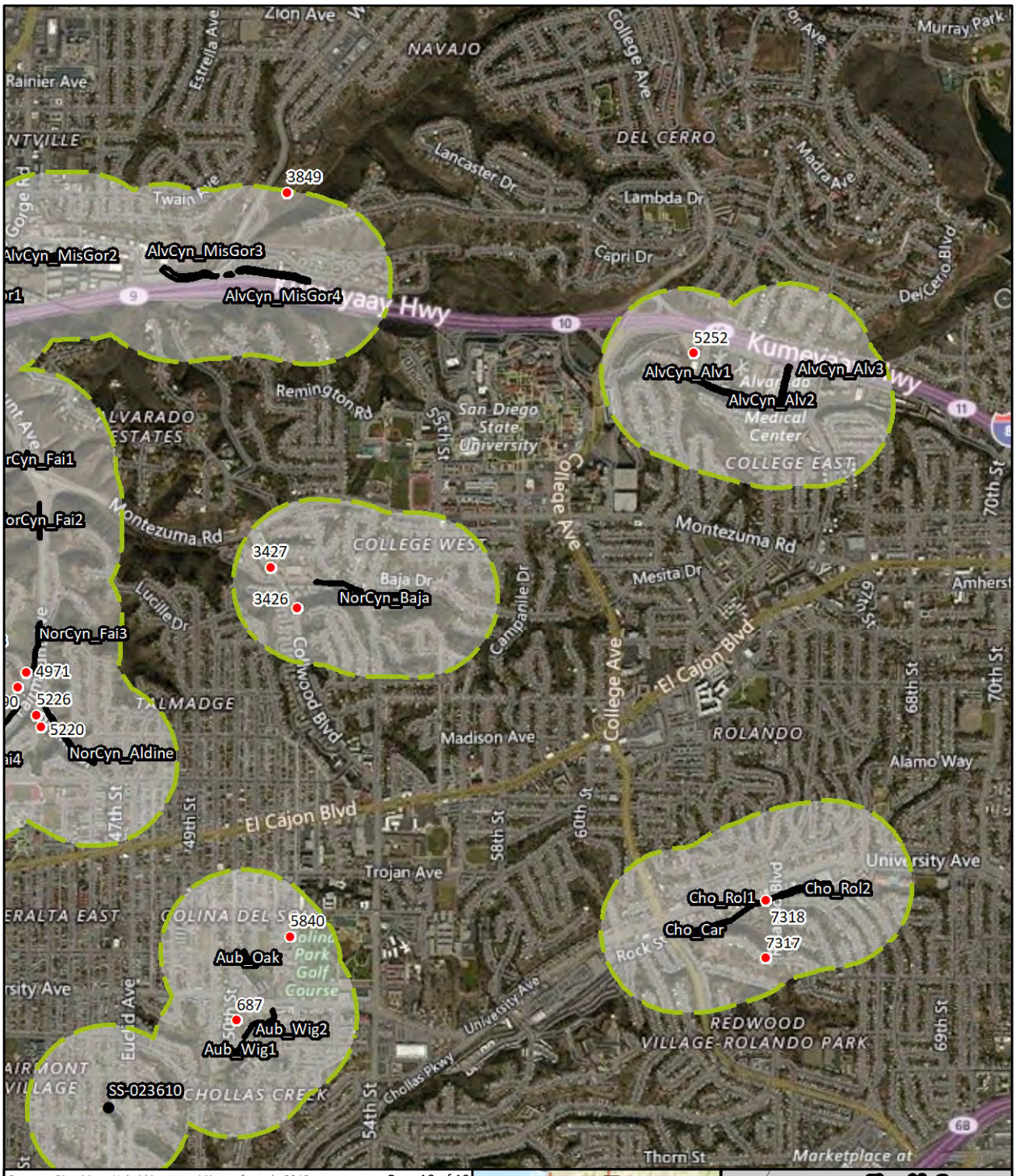

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1/4 mile radius buffer

SDSNH localities

PaleoServices

APPENDIX 1

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City of San Diego, San Diego County, California

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Project boundary/structure

1/4 mile radius buffer

SDSNH localities

PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

APPENDIX 1

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City of San Diego Master Stormwater
City of San Diego, San Diego County, California

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PALEOSERVICES

APPENDIX 1

Project Map
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City of San Diego, San Diego County, California

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APPENDIX 1

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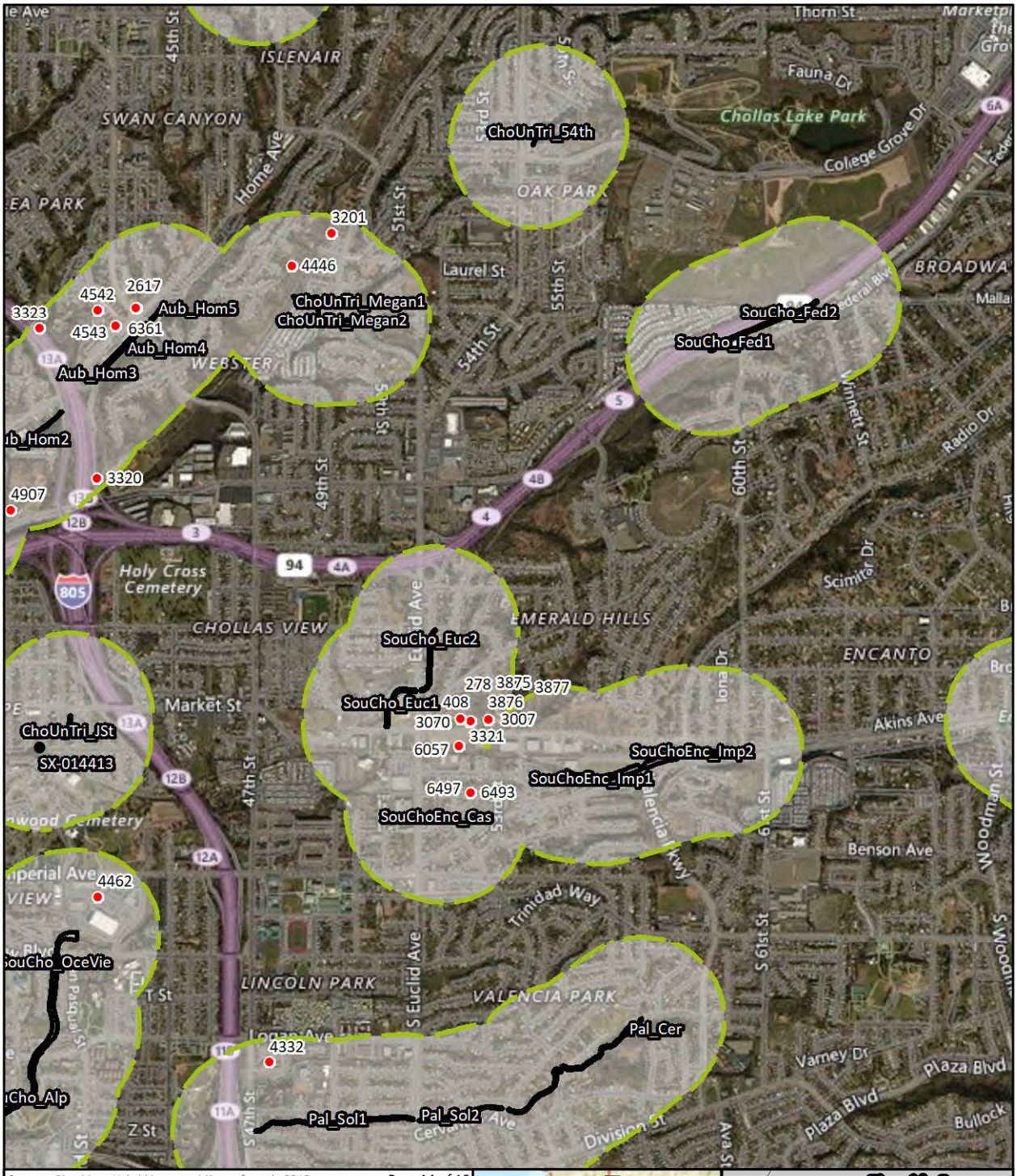

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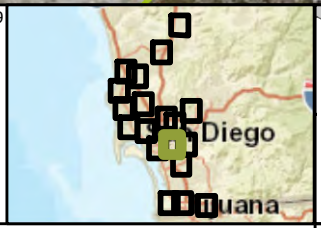

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City of San Diego, San Diego County, California

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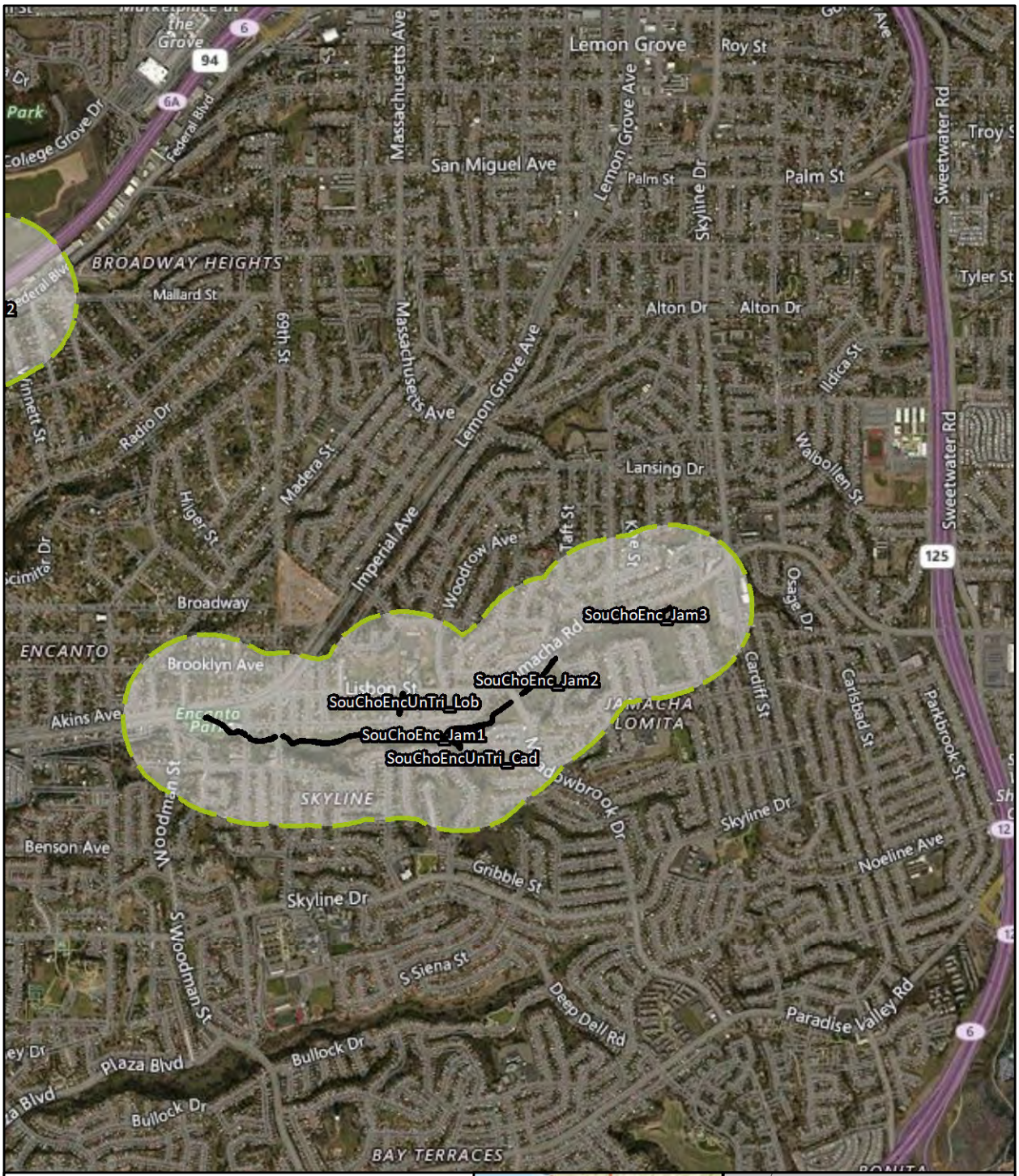

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SAN DIEGO NATURAL HISTORY MUSEUM

APPENDIX 1

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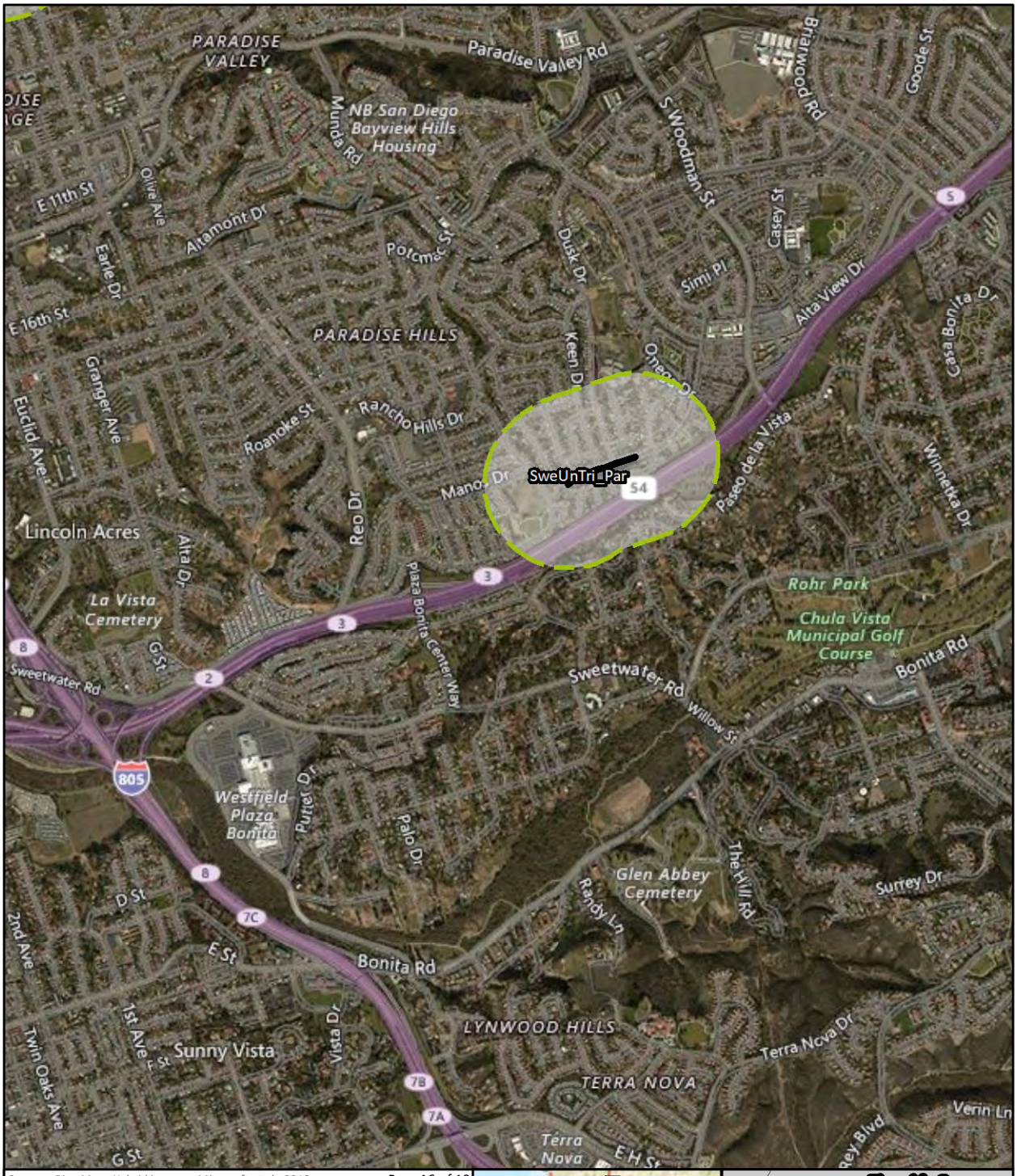
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Paradise Valley Rd
NB San Diego Bayview Hills Housing
Munda Rd
S Woodman St
Briarwood Rd
Goode St
E 11th St
Olive Ave
Altamont Dr
Earle Dr
Potomac St
Dusk Dr
Casey St
Simi Pl
Alta View Dr
E 16th St
PARADISE HILLS
Keen Dr
Granger Ave
Euclid Ave
Roanoke St
Rancho Hills Dr
Paseo de la Vista
Casa Bonita Dr
Winnetka Dr
SweUnTri_Par
54
Lincoln Acres
Reo Dr
Mano
Alta Dr
La Vista Cemetery
Plaza Bonita Center Way
Rohr Park
Chula Vista Municipal Golf Course
Bonita Rd
G St
Sweetwater Rd
Willow St
805
Westfield Plaza Bonita
Purter Dr
Palo Dr
Glen Abbey Cemetery
The Hill Rd
Surrey Dr
Randy Ln
D St
2nd Ave
E St
Bonita Rd
1st Ave
F St
Sunny Vista
Vista Dr
LYNWOOD HILLS
Terra Nova Dr
Twin Oaks Ave
TERRA NOVA
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Page 16 of 19
Project boundary/structure
1/4 mile radius buffer
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PALEOSERVICES
APPENDIX 1
Project Map
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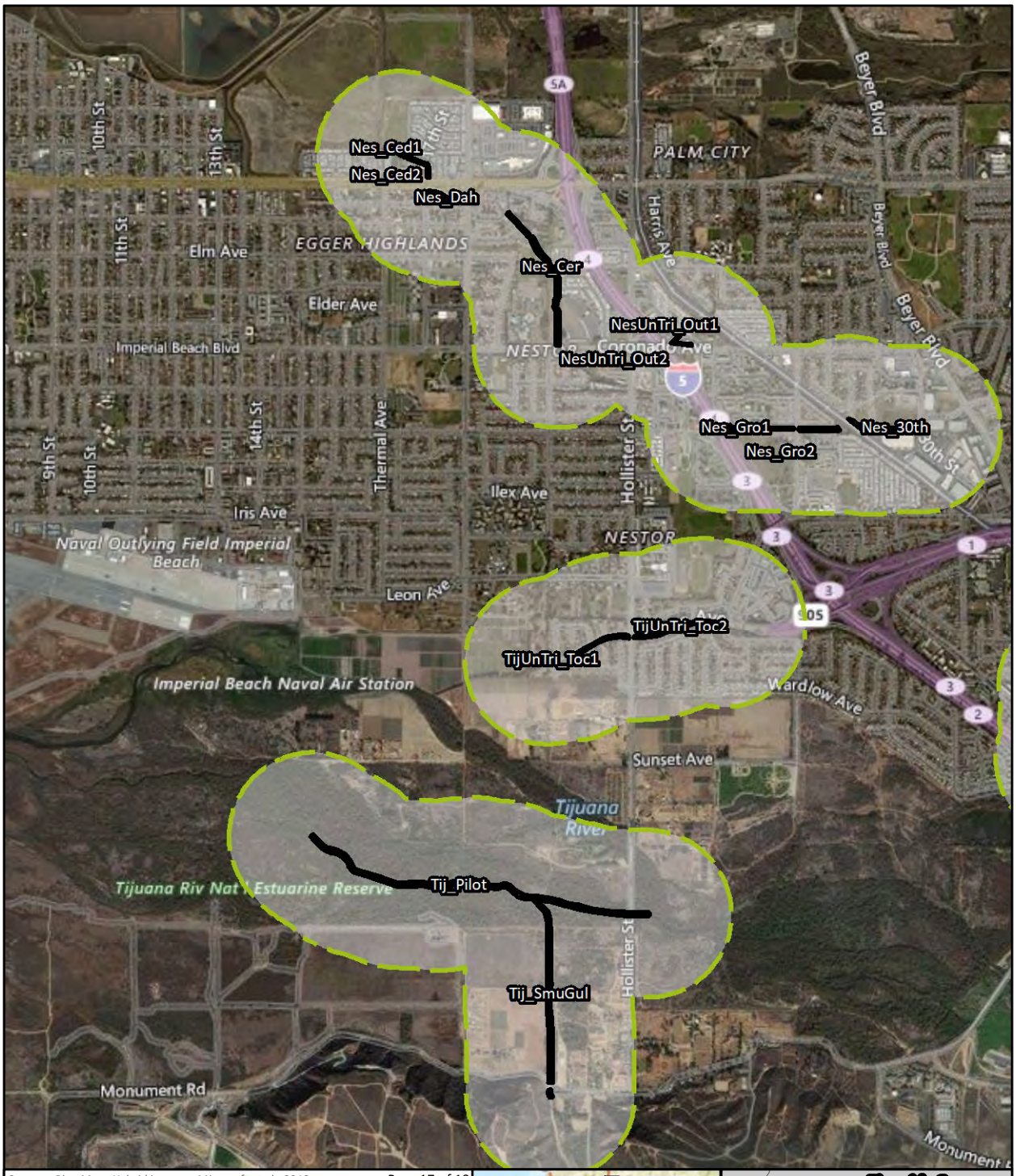

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Project boundary/structure

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SDSNH localities

PALEOSERVICES

APPENDIX 1

Project Map
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City of San Diego, San Diego County, California

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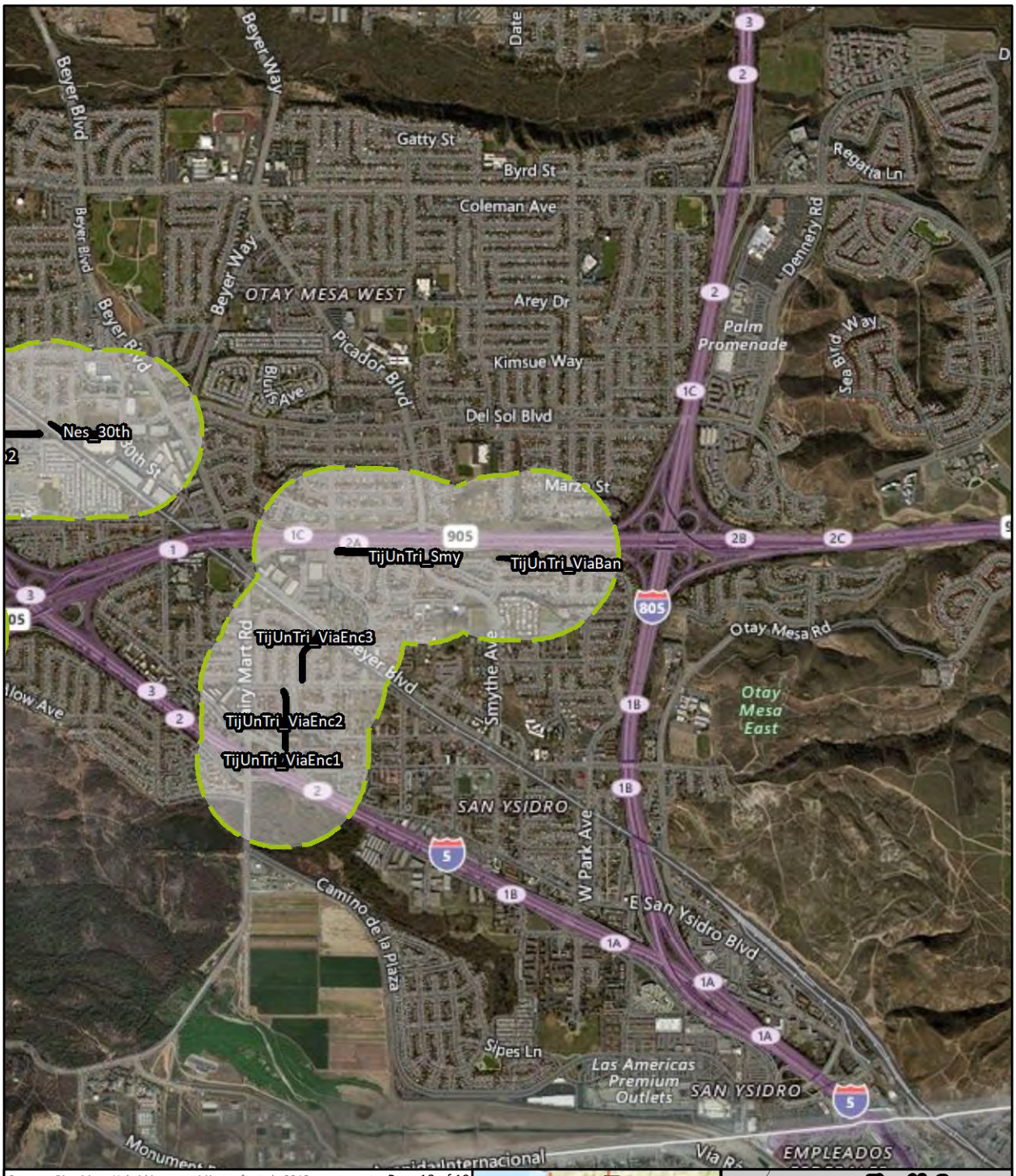

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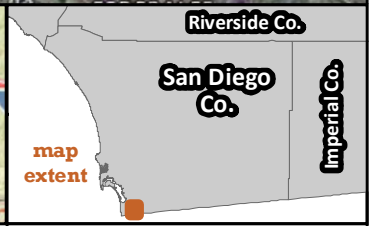
Project boundary/structure

1/4 mile radius buffer

SDSNH localities



PALEOSERVICES

APPENDIX 1

Project Map
City of San Diego Master Stormwater
City of San Diego, San Diego County, California

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scale in miles

Sources: Bing Maps Hybrid imagery, Microsoft et al., 2018

Project boundary/structure

1/4 mile radius buffer

SDSNH localities

PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

APPENDIX 1

Project Map
City of San Diego Master Stormwater
City of San Diego, San Diego County, California

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scale in miles
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Appendix 2: Locality List

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
3718	Morena Boulevard	City of San Diego, San Diego County, CA	30	Bay Point Formation	Cenozoic	Quaternary	late Pleistocene
6338	Famosa Accelerated Water & Sewer Main	City of San Diego, San Diego County, CA	10	Bay Point Formation	Cenozoic	Quaternary	Pleistocene
6493	Sewer Group 748	City of San Diego, San Diego County, CA	141	Bay Point Formation	Cenozoic	Quaternary	Pleistocene
6966	Sewer and Water Group 698	City of San Diego, San Diego County, CA	30	Bay Point Formation	Cenozoic	Quaternary	late Pleistocene
6967	Sewer and Water Group 698	City of San Diego, San Diego County, CA	32	Bay Point Formation	Cenozoic	Quaternary	late Pleistocene
6968	Sewer and Water Group 698	City of San Diego, San Diego County, CA	34	Bay Point Formation	Cenozoic	Quaternary	late Pleistocene
6969	Sewer and Water Group 698	City of San Diego, San Diego County, CA	40	Bay Point Formation	Cenozoic	Quaternary	late Pleistocene
412	Greely St & 32nd St.	City of San Diego, San Diego County, CA	50	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
3020	Greely and 32nd Street	City of San Diego, San Diego County, CA	40	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4867	Sewer Group 632	City of San Diego, San Diego County, CA	42	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4868	Sewer Group 632	City of San Diego, San Diego County, CA	0	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4869	Sewer Group 632	City of San Diego, San Diego County, CA	41	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
6970	Sewer and Water Group 698	City of San Diego, San Diego County, CA	41	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
3133 A	Logan Heights, Greely Ave. & 32nd St.	City of San Diego, San Diego County, CA	20	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
3133 B	Logan Heights, Greely Ave. & 32nd St.	City of San Diego, San Diego County, CA	20	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
3133 C	Logan Heights, Greely Ave. & 32nd St.	City of San Diego, San Diego County, CA	20	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
3133 D	Logan Heights, Greely Ave. & 32nd St.	City of San Diego, San Diego County, CA	20	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
3133 E	Logan Heights, Greely Ave. & 32nd St.	City of San Diego, San Diego County, CA	20	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4013 B	36th Street & Oceanview Boulevard	City of San Diego, San Diego County, CA	70	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4013 C	36th Street & Oceanview Boulevard	City of San Diego, San Diego County, CA	70	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4014 A	Franklin Street & Bancroft Street	City of San Diego, San Diego County, CA	72	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4014 B	Franklin Street & Bancroft Street	City of San Diego, San Diego County, CA	77	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4014 C	Franklin Street & Bancroft Street	City of San Diego, San Diego County, CA	78	Bay Point Formation, Broadway Faunal Horizon	Cenozoic	Quaternary	middle Pleistocene
4210	Torrey Reserve Heights/Hills	City of San Diego, San Diego County, CA	175	Bay Point Formation, Parry Grove Marine Terrace	Cenozoic	Quaternary	Pleistocene
5935	Interstate 5/805 Merge	City of San Diego, San Diego County, CA	167	Bay Point Formation, Parry Grove Marine Terrace	Cenozoic	Quaternary	Pleistocene
3761	Morena Boulevard Pipeline 2	City of San Diego, San Diego County, CA	34	Bay Point Formation, unnamed marine deposit	Cenozoic	Quaternary	late Pleistocene
4008	Mission Bay Sewage Interceptor System/Pit 72	City of San Diego, San Diego County, CA	6	Bay Point Formation, unnamed marine deposit	Cenozoic	Quaternary	late Pleistocene
4332	Magenta Street	City of San Diego, San Diego County, CA	75	Bay Point Formation, unnamed marine deposit	Cenozoic	Quaternary	late Pleistocene
6965	Sewer and Water Group 698	City of San Diego, San Diego County, CA	13	Bay Point Formation, unnamed marine deposit	Cenozoic	Quaternary	late Pleistocene
4462	Imperial Marketplace	City of San Diego, San Diego County, CA	78	Bay Point Formation, unnamed nonmarine deposit	Cenozoic	Quaternary	Pleistocene
27	Reynard Way	City of San Diego, San Diego County, CA	100	San Diego Formation	Cenozoic	Neogene	Pliocene
88	Reynard Way	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
153	Reynard Way	City of San Diego, San Diego County, CA	140	San Diego Formation	Cenozoic	Neogene	Pliocene
169	Imperial Avenue	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
172	Reynard Way	City of San Diego, San Diego County, CA	140	San Diego Formation	Cenozoic	Neogene	Pliocene
173	Reynard Way - South End of Old Brickyard	City of San Diego, San Diego County, CA	100	San Diego Formation	Cenozoic	Neogene	Pliocene
278	Market & Euclid St. - Chollas Valley	City of San Diego, San Diego County, CA	240	San Diego Formation	Cenozoic	Neogene	Pliocene
280	Reynard Way - Arroyo Drive near Palm Street	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene

Appendix 2: Locality List

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
408	Market & Euclid St. - East San Diego	City of San Diego, San Diego County, CA	150	San Diego Formation	Cenozoic	Neogene	Pliocene
463	Reynard Way (Maple and State Street)	City of San Diego, San Diego County, CA	70	San Diego Formation	Cenozoic	Neogene	late Pliocene
516	Market and Euclid St.	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
687	East San Diego	City of San Diego, San Diego County, CA	274	San Diego Formation	Cenozoic	Neogene	Pliocene
690	Havens' Cave, Talmadge	City of San Diego, San Diego County, CA	290	San Diego Formation	Cenozoic	Neogene	Pliocene
1961	Reynard Way	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
2621	Mt. Soledad	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
2640	Mt. Soledad	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
2641	Mt. Soledad	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
2655	Mt. Soledad	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
2757	Mt. Soledad	City of San Diego, San Diego County, CA	415	San Diego Formation	Cenozoic	Neogene	Pliocene
2807	Market and Euclid Streets	City of San Diego, San Diego County, CA	160	San Diego Formation	Cenozoic	Neogene	Pliocene
2969	Washington Street	City of San Diego, San Diego County, CA	150	San Diego Formation	Cenozoic	Neogene	Pliocene
2970	Washington Street - General Locality	City of San Diego, San Diego County, CA	180	San Diego Formation	Cenozoic	Neogene	Pliocene
2996	Washington Street	City of San Diego, San Diego County, CA	200	San Diego Formation	Cenozoic	Neogene	Pliocene
3007	Market & Euclid Streets	City of San Diego, San Diego County, CA	140	San Diego Formation	Cenozoic	Neogene	Pliocene
3047	Market & Euclid Streets - Chollas Valley	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
3059	Arroyo Drive	City of San Diego, San Diego County, CA	200	San Diego Formation	Cenozoic	Neogene	Pliocene
3070	Market Street East (near Euclid)	City of San Diego, San Diego County, CA	0	San Diego Formation	Cenozoic	Neogene	Pliocene
3148	California Street	City of San Diego, San Diego County, CA	120	San Diego Formation	Cenozoic	Neogene	late Pliocene
3193	Mt. Soledad - southwest side	City of San Diego, San Diego County, CA	340	San Diego Formation	Cenozoic	Neogene	Pliocene
3323	I-805 near Hixson Road (extended)	City of San Diego, San Diego County, CA	200	San Diego Formation	Cenozoic	Neogene	late Pliocene
3875	Malcolm X Library (Market & Euclid Sts.)	City of San Diego, San Diego County, CA	136	San Diego Formation	Cenozoic	Neogene	late Pliocene
3876	Malcolm X Library (Market & Euclid Sts.)	City of San Diego, San Diego County, CA	134	San Diego Formation	Cenozoic	Neogene	late Pliocene
3877	Malcolm X Library (Market & Euclid Sts.)	City of San Diego, San Diego County, CA	148	San Diego Formation	Cenozoic	Neogene	late Pliocene
4828	Sewer and Water Group 673 #4 (Horton-Linwood)	City of San Diego, San Diego County, CA	75	San Diego Formation	Cenozoic	Neogene	Pliocene
4908	Chollas Valley, Central Police Facility	City of San Diego, San Diego County, CA	90	San Diego Formation	Cenozoic	Neogene	Pliocene
5074	Dove and Maple - South End of Old Brickyard	City of San Diego, San Diego County, CA	100	San Diego Formation	Cenozoic	Neogene	Pliocene
5082	Dove and Maple - South End of Old Brickyard	City of San Diego, San Diego County, CA	100	San Diego Formation	Cenozoic	Neogene	Pliocene
5220	Aldine Drive & Fairmount Avenue	City of San Diego, San Diego County, CA	265	San Diego Formation	Cenozoic	Neogene	Pliocene
5226	Fairmount Avenue and Aldine Drive	City of San Diego, San Diego County, CA	240	San Diego Formation	Cenozoic	Neogene	Pliocene
5252	SDSU Parking Lot D	City of La Mesa, San Diego County, CA	330	San Diego Formation	Cenozoic	Neogene	Pliocene
5462	Sewer Group 680 - Modiolus Shell (Union St)	City of San Diego, San Diego County, CA	115	San Diego Formation	Cenozoic	Neogene	late Pliocene
5463	Sewer Group 680 - Union Street Blue Grey Bed	City of San Diego, San Diego County, CA	108	San Diego Formation	Cenozoic	Neogene	late Pliocene
5582	Sewer Group 700-Dove St. South Mission Hills	City of San Diego, San Diego County, CA	85	San Diego Formation	Cenozoic	Neogene	Pliocene
6057	Chollas Creek Restoration	City of San Diego, San Diego County, CA	101	San Diego Formation	Cenozoic	Neogene	Pliocene
6119	Balboa Park - Maintenance Yard Well	City of San Diego, San Diego County, CA	-15	San Diego Formation	Cenozoic	Neogene	Pliocene
6432	San Diego Zoo Equalization Tank	City of San Diego, San Diego County, CA	140	San Diego Formation	Cenozoic	Neogene	Pliocene

Appendix 2: Locality List

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
6494	Sewer Group 682 (Bankers Hill)	City of San Diego, San Diego County, CA	89	San Diego Formation	Cenozoic	Neogene	Pliocene
6497	Sewer Group 748 (Valencia Park)	City of San Diego, San Diego County, CA	136	San Diego Formation	Cenozoic	Neogene	Pliocene
6498	Sewer Group 753 (Downtown S of Balboa Park)	City of San Diego, San Diego County, CA	92	San Diego Formation	Cenozoic	Neogene	Pliocene
7284	Grant K-8 School, Phase 1	City of San Diego, San Diego County, CA	235	San Diego Formation	Cenozoic	Neogene	Pliocene
409	East San Diego	City of San Diego, San Diego County, CA	50	San Diego Formation?	Cenozoic	Neogene	Pliocene
464	Chollas Valley, 38th and Beech St.	City of San Diego, San Diego County, CA	120	San Diego Formation, upper member	Cenozoic	Neogene	late Pliocene
2617	East San Diego, Fairmount & Home Ave.	City of San Diego, San Diego County, CA	0	San Diego Formation, upper member	Cenozoic	Neogene	Pliocene
2618	Home Ave. and Highway 94	City of San Diego, San Diego County, CA	0	San Diego Formation, upper member	Cenozoic	Neogene	Pliocene
3173	Chollas Valley, Beech St. & 38th St.	City of San Diego, San Diego County, CA	127	San Diego Formation, upper member	Cenozoic		Pliocene/Pleistocene
3201	East San Diego	City of San Diego, San Diego County, CA	0	San Diego Formation, upper member	Cenozoic	Neogene	Pliocene
3320	Little League Park	City of San Diego, San Diego County, CA	120	San Diego Formation, upper member	Cenozoic	Neogene	late Pliocene
4446	Sand Dollar Heaven - Chollas Valley	City of San Diego, San Diego County, CA		San Diego Formation, upper member	Cenozoic	Neogene	Pliocene
4907	Chollas Valley, Central Police Facility	City of San Diego, San Diego County, CA	100	San Diego Formation, upper member	Cenozoic	Neogene	Pliocene
5427	Sewer Group 680 - In Situ Oyster Bed	City of San Diego, San Diego County, CA	79	San Diego Formation, upper member	Cenozoic	Neogene	late Pliocene
5428	Sewer Group 680 - In Situ Pecten Bed	City of San Diego, San Diego County, CA	83	San Diego Formation, upper member	Cenozoic	Neogene	late Pliocene
5429	Sewer Group 680 - Oyster Bed Spoils Pile	City of San Diego, San Diego County, CA	75	San Diego Formation, upper member	Cenozoic	Neogene	late Pliocene
5430	Sewer Group 680 - Pecten Bed Spoils Pile	City of San Diego, San Diego County, CA	75	San Diego Formation, upper member	Cenozoic	Neogene	late Pliocene
5461	Sewer Group 680 - Union Street Oyster Bed	City of San Diego, San Diego County, CA	115	San Diego Formation, upper member	Cenozoic	Neogene	late Pliocene
6361	Fairmount & Home Avenue	City of San Diego, San Diego County, CA	160	San Diego Formation, upper member	Cenozoic	Neogene	Pliocene
6666	SDCC Science Building Project	City of San Diego, San Diego County, CA	34	San Diego Formation, upper member	Cenozoic	Quaternary	early Pleistocene
6667	SDCC Science Building Project	City of San Diego, San Diego County, CA	34	San Diego Formation, upper member	Cenozoic	Quaternary	early Pleistocene
6668	SDCC Science Building Project	City of San Diego, San Diego County, CA	46	San Diego Formation, upper member	Cenozoic	Quaternary	early Pleistocene
6669	SDCC Science Building Project	City of San Diego, San Diego County, CA	48	San Diego Formation, upper member	Cenozoic	Quaternary	early Pleistocene
4542	Fox Hollow Apartments	City of San Diego, San Diego County, CA	206	San Diego Formation, member 5/6?	Cenozoic	Neogene	late Pliocene
4543	Fox Hollow Apartments	City of San Diego, San Diego County, CA	170	San Diego Formation, member 5/6?	Cenozoic	Neogene	late Pliocene
3321	Market Street (East of Euclid)	City of San Diego, San Diego County, CA	140	San Diego Formation, lower member	Cenozoic	Neogene	late Pliocene
4971	Sewer Group 652 - Aldine Drive	City of San Diego, San Diego County, CA	302	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
4972	Sewer Group 652 - Aldine Drive	City of San Diego, San Diego County, CA	313	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
4973	Sewer Group 652 - Aldine Drive	City of San Diego, San Diego County, CA	313	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5038	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5039	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5040	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5041	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5042	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5043	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5044	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
5045	Mt. Soledad - Foothill Boulevard	City of San Diego, San Diego County, CA	275	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
6369	Sewer and Water Group 689 - Lincoln	City of San Diego, San Diego County, CA	282	San Diego Formation, lower member	Cenozoic	Neogene	late Pliocene

Appendix 2: Locality List

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
6718	Sewer and Water Group 761 (3600 Blk State St)	City of San Diego, San Diego County, CA	140	San Diego Formation, lower member	Cenozoic	Neogene	Pliocene
7317	Sewer & Water Group 940	City of San Diego, San Diego County, CA	435	San Diego Formation, lower member	Cenozoic	Neogene	late Pliocene
7318	Sewer & Water Group 940	City of San Diego, San Diego County, CA	347	San Diego Formation, lower member	Cenozoic	Neogene	late Pliocene
5840	Fay Elementary School	City of San Diego, San Diego County, CA	335	Sweetwater Formation	Cenozoic	Paleogene	middle Eocene
3426	Collwood South	City of San Diego, San Diego County, CA	280	Mission Valley Formation	Cenozoic	Paleogene	middle Eocene
3427	Collwood and Montezuma	City of San Diego, San Diego County, CA	270	Mission Valley Formation	Cenozoic	Paleogene	middle Eocene
3145	Murphy Canyon	City of San Diego, San Diego County, CA	120	Friars Formation	Cenozoic	Paleogene	middle Eocene
3488	Unocal Cut Slope	City of San Diego, San Diego County, CA	100	Friars Formation	Cenozoic	Paleogene	middle Eocene
3784	Stonecrest Square site 4	City of San Diego, San Diego County, CA	217	Friars Formation	Cenozoic	Paleogene	middle Eocene
3785	Stonecrest Square site 5	City of San Diego, San Diego County, CA	220	Friars Formation	Cenozoic	Paleogene	middle Eocene
3786	Stonecrest Square site 6	City of San Diego, San Diego County, CA	240	Friars Formation	Cenozoic	Paleogene	middle Eocene
3789	Stonecrest Square site 9	City of San Diego, San Diego County, CA	230	Friars Formation	Cenozoic	Paleogene	middle Eocene
3831	Mission Terrace	City of San Diego, San Diego County, CA	89	Friars Formation	Cenozoic	Paleogene	middle Eocene
3832	Mission Terrace	City of San Diego, San Diego County, CA	93	Friars Formation	Cenozoic	Paleogene	middle Eocene
3833	Mission Terrace	City of San Diego, San Diego County, CA	77	Friars Formation	Cenozoic	Paleogene	middle Eocene
3849	Waring Road Friars Hole	City of San Diego, San Diego County, CA	180	Friars Formation	Cenozoic	Paleogene	middle Eocene
3851	Stonecrest Square site 11	City of San Diego, San Diego County, CA	170	Friars Formation	Cenozoic	Paleogene	middle Eocene
4343	Stonecrest Village, Phase II	City of San Diego, San Diego County, CA	200	Friars Formation	Cenozoic	Paleogene	middle Eocene
4337	Torrey Reserve Gateway #1	City of Del Mar, San Diego County, CA	171	Scripps Formation	Cenozoic	Paleogene	middle Eocene
4441	Torrey Reserve Gateway #2	City of Del Mar, San Diego County, CA	168	Scripps Formation	Cenozoic	Paleogene	middle Eocene
5792	Interstate 5/805 Merge	City of San Diego, San Diego County, CA	121	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6746	Torrey Hills Lots 1,2,3	City of San Diego, San Diego County, CA	90	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6747	Torrey Hills, Lots 1,2,3	City of San Diego, San Diego County, CA	128	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6748	Torrey Hills Lots 1,2,3	City of San Diego, San Diego County, CA	130	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6749	Torrey Hills Lots 1,2,3	City of San Diego, San Diego County, CA	140	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6750	Torrey Hills Lots 1,2,3	City of San Diego, San Diego County, CA	160	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6751	Torrey Hills Lots 1,2,3	City of San Diego, San Diego County, CA	174	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6752	Torrey Hills Lots 1,2,3	City of San Diego, San Diego County, CA	167	Scripps Formation	Cenozoic	Paleogene	middle Eocene
6753	Torrey Hills Lots 1,2,3	City of San Diego, San Diego County, CA	171	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7304	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	166	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7305	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	180	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7306	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	180	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7307	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	150	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7308	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	169	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7309	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	248	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7310	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	275	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7311	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	280	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7312	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	285	Scripps Formation	Cenozoic	Paleogene	middle Eocene

Appendix 2: Locality List

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
7313	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	300	Scripps Formation	Cenozoic	Paleogene	middle Eocene
7331	Nexus Esplanade	City of San Diego, San Diego County, CA	352	Scripps Formation	Cenozoic	Paleogene	middle Eocene
5478	Homewood Suites, Sorrento Hills	City of San Diego, San Diego County, CA	185	Scripps Formation?	Cenozoic	Paleogene	middle Eocene
4242	Corporate Research Park	City of San Diego, San Diego County, CA	190	Scripps/Ardath	Cenozoic	Paleogene	middle Eocene
4243	Corporate Research Park	City of San Diego, San Diego County, CA	205	Scripps/Ardath	Cenozoic	Paleogene	middle Eocene
3797	Interstate 5 and State Route 56	City of San Diego, San Diego County, CA	193	Ardath Shale	Cenozoic	Paleogene	middle Eocene
3857	Interstate 5 and State Route 56	City of San Diego, San Diego County, CA	194	Ardath Shale	Cenozoic	Paleogene	middle Eocene
3977	Cooper Dirt	City of San Diego, San Diego County, CA	239	Ardath Shale	Cenozoic	Paleogene	middle Eocene
3978	Cooper Dirt	City of San Diego, San Diego County, CA	266	Ardath Shale	Cenozoic	Paleogene	middle Eocene
4201	Torrey Reserve Heights	City of San Diego, San Diego County, CA	101	Ardath Shale	Cenozoic	Paleogene	Eocene
4219	Torrey Reserve Heights/Hills	City of San Diego, San Diego County, CA	190	Ardath Shale	Cenozoic	Paleogene	Eocene
4220	Torrey Reserve Heights/Hills	City of San Diego, San Diego County, CA	220	Ardath Shale	Cenozoic	Paleogene	Eocene
4914	Mohyi Residence, La Jolla Shores	City of San Diego, San Diego County, CA	225	Ardath Shale	Cenozoic	Paleogene	middle Eocene
4915	Homewood Suites, Sorrento Hills	City of San Diego, San Diego County, CA	180	Ardath Shale	Cenozoic	Paleogene	middle Eocene
5505	Dunham Parking Garage	City of San Diego, San Diego County, CA	358	Ardath Shale	Cenozoic	Paleogene	middle Eocene
5580	Interstate 5/805 Merge	City of San Diego, San Diego County, CA	100	Ardath Shale	Cenozoic	Paleogene	middle Eocene
5581	Interstate 5/805 Merge	City of San Diego, San Diego County, CA	112	Ardath Shale	Cenozoic	Paleogene	middle Eocene
6611	SDPOB	City of San Diego, San Diego County, CA	124	Ardath Shale	Cenozoic	Paleogene	middle Eocene
6612	SDPOB	City of San Diego, San Diego County, CA	130	Ardath Shale	Cenozoic	Paleogene	middle Eocene
6615	SDPOB	City of San Diego, San Diego County, CA	157	Ardath Shale	Cenozoic	Paleogene	middle Eocene
6679	Caltrans 805 Carroll Canyon Road	City of San Diego, San Diego County, CA	82	Ardath Shale	Cenozoic	Paleogene	middle Eocene
6680	Caltrans 805 Carroll Canyon Road	City of San Diego, San Diego County, CA	101	Ardath Shale	Cenozoic	Paleogene	middle Eocene
6681	Caltrans 805 Carroll Canyon Road	City of San Diego, San Diego County, CA	111	Ardath Shale	Cenozoic	Paleogene	middle Eocene
6682	Caltrans 805 Carroll Canyon Road	City of San Diego, San Diego County, CA	131	Ardath Shale	Cenozoic	Paleogene	middle Eocene
7303	Skanska I805N HOV BRT	City of San Diego, San Diego County, CA	130	Ardath Shale	Cenozoic	Paleogene	middle Eocene
5793	Interstate 5/805 Merge	City of San Diego, San Diego County, CA	98	Torrey Sandstone	Cenozoic	Paleogene	middle Eocene
7273	Sorrento Pointe 2015	City of San Diego, San Diego County, CA	115	Torrey Sandstone	Cenozoic	Paleogene	middle Eocene
7274	Sorrento Pointe 2015	City of San Diego, San Diego County, CA	113	Torrey Sandstone	Cenozoic	Paleogene	middle Eocene
3968	Cooper Dirt	City of San Diego, San Diego County, CA	112	Torrey Sandstone, pebbly sandstone unit	Cenozoic	Paleogene	middle Eocene
454	Sorrento Valley Road	San Diego County, CA	20	Delmar Formation	Cenozoic	Paleogene	middle Eocene
3975	Sorrento Valley Utilities Improvement	City of San Diego, San Diego County, CA	31	Delmar Formation	Cenozoic	Paleogene	early Eocene
4065	Torrey Pines 4	City of San Diego, San Diego County, CA	0	Delmar Formation	Cenozoic	Paleogene	middle Eocene
5633	Interstate 5/805 Merge	City of San Diego, San Diego County, CA	115	Delmar Formation	Cenozoic	Paleogene	middle Eocene
5624	Interstate 5/805 Merge - Turritella Bed	City of San Diego, San Diego County, CA	103	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene
5625	Interstate 5/805 Merge - Cemented Bed	City of San Diego, San Diego County, CA	102	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene
5626	Interstate 5/805 Merge - Cemented Bed II	City of San Diego, San Diego County, CA	102	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene
5627	Interstate 5/805 Merge - Coral Bed, Molds	City of San Diego, San Diego County, CA	101	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene
5628	Interstate 5/805 Merge - Coral Bed, white	City of San Diego, San Diego County, CA	101	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene

Appendix 2: Locality List

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
5629	Interstate 5/805 Merge - Plant Hash	City of San Diego, San Diego County, CA	100	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene
5630	Interstate 5/805 Merge - Lower Oyster Bed	City of San Diego, San Diego County, CA	99	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene
5631	Interstate 5/805 Merge - Steinkern Bed	City of San Diego, San Diego County, CA	103	Delmar Formation, upper member	Cenozoic	Paleogene	middle Eocene

Appendix 3: Paleontological Sensitivity

San Diego Natural History Museum
Department of Paleontology

Project Site ID	Geologic Unit	Paleontological Sensitivity
AltLaJ_Vic	Ardath Shale	High
AltLaJ_Vic	Holocene deposits	Low
AlvCyn_Alv1	Holocene deposits	Low
AlvCyn_Alv1	Stadium Conglomerate	High
AlvCyn_Alv2	Holocene deposits	Low
AlvCyn_Alv2	Stadium Conglomerate	High
AlvCyn_Alv3	Holocene deposits	Low
AlvCyn_Alv3	Stadium Conglomerate	High
AlvCyn_MisGor1	Holocene deposits	Low
AlvCyn_MisGor2	Holocene deposits	Low
AlvCyn_MisGor3	Holocene deposits	Low
AlvCyn_MisGor4	Holocene deposits	Low
Aub_Hom1	Holocene deposits	Low
Aub_Hom2	Holocene deposits	Low
Aub_Hom3	Holocene deposits	Low
Aub_Hom4	Holocene deposits	Low
Aub_Hom5	Holocene deposits	Low
Aub_Hom5	San Diego Formation	High
Aub_Oak	Lindavista Formation	Moderate
Aub_Oak	Sweetwater Formation	High
Aub_Wig1	San Diego Formation	High
Aub_Wig2	San Diego Formation	High
CarCyn_Car	Holocene deposits	Low
Chicar_VSM	Mesozoic metasedimentary and metavolcanic rocks, undivided	Low
Cho_Car	Holocene deposits	Low
Cho_Car	Stadium Conglomerate	High
Cho_Nat	Holocene deposits	Low
Cho_OceVie	Holocene deposits	Low
Cho_Rol1	Holocene deposits	Low
Cho_Rol2	Holocene deposits	Low
ChoUnTri_54th	Stadium Conglomerate	High
ChoUnTri_JSt	Lindavista Formation	Moderate
ChoUnTri_Martin	Bay Point Formation	High
ChoUnTri_Megan1	Holocene deposits	Low
ChoUnTri_Megan1	San Diego Formation	High
ChoUnTri_Megan2	San Diego Formation	High
GreVal_PasVer	Cretaceous intrusive igneous rocks	None

Appendix 3: Paleontological Sensitivity

San Diego Natural History Museum
Department of Paleontology

Project Site ID	Geologic Unit	Paleontological Sensitivity
GreVal_PasVer	Holocene deposits	Low
GreVal_Pom1	Holocene deposits	Low
GreVal_Pom2	Holocene deposits	Low
LosPen_5-805	Bay Point Formation	High
LosPen_5-805	Holocene deposits	Low
LosPen_SorVal	Holocene deposits	Low
LosPenUnTri_BlaMou1	Holocene deposits	Low
LosPenUnTri_BlaMou2	Holocene deposits	Low
LosPenUnTri_Ind	Bay Point Formation	High
LosPenUnTri_Ind	Holocene deposits	Low
LosPenUnTri_Tri	Holocene deposits	Low
MapCyn_Map	San Diego Formation	High
MirUnTri_Eng	Lindavista Formation	Moderate
MisBayUnTri_MBD	artificial fill	None
MisBayUnTri_MBHS	artificial fill	None
MisBayUnTri_PBO	artificial fill	None
MisHilCyn_Tit	Lindavista Formation	Moderate
MisHilCyn_Tit	San Diego Formation	High
MurCyn_MurCyn1	Holocene deposits	Low
MurCyn_MurCyn2	Friars Formation	High
MurCyn_MurCyn2	Holocene deposits	Low
MurCyn_Sta1	Holocene deposits	Low
MurCyn_Sta2	Holocene deposits	Low
MurCynUnTri_Sto1	Holocene deposits	Low
MurRes_CowMou1	Mission Valley Formation	High
MurRes_CowMou1	Stadium Conglomerate	High
MurRes_CowMou2	Cretaceous intrusive igneous rocks	None
MurRes_CowMou2	Stadium Conglomerate	High
Nes_30th	Bay Point Formation	High
Nes_30th	Holocene deposits	Low
Nes_Ced1	Holocene deposits	Low
Nes_Ced2	Holocene deposits	Low
Nes_Cer	Holocene deposits	Low
Nes_Dah	Holocene deposits	Low
Nes_Gro1	Holocene deposits	Low
Nes_Gro2	Holocene deposits	Low
NesUnTri_Out1	Bay Point Formation	High

Appendix 3: Paleontological Sensitivity

San Diego Natural History Museum
Department of Paleontology

Project Site ID	Geologic Unit	Paleontological Sensitivity
NesUnTri_Out2	Bay Point Formation	High
NorCyn_Aldine	San Diego Formation	High
NorCyn_Baja	Mission Valley Formation	High
NorCyn_Baja	Stadium Conglomerate	High
NorCyn_Fai1	Stadium Conglomerate	High
NorCyn_Fai2	Stadium Conglomerate	High
NorCyn_Fai3	Mission Valley Formation	High
NorCyn_Fai4	San Diego Formation	High
Pal_Cer	Holocene deposits	Low
Pal_Cer	Lindavista Formation	Moderate
Pal_Cer	San Diego Formation	High
Pal_Cot1	Bay Point Formation	High
Pal_Cot1	Holocene deposits	Low
Pal_Cot2	Bay Point Formation	High
Pal_Cot2	Holocene deposits	Low
Pal_Sol1	Holocene deposits	Low
Pal_Sol1	Lindavista Formation	Moderate
Pal_Sol2	Holocene deposits	Low
Pal_Sol2	Lindavista Formation	Moderate
PowCyn_Per1	San Diego Formation	High
PowCyn_Per2	San Diego Formation	High
SanBayUnTri_28th	San Diego Formation	High
SanUnTri_CamArr	Holocene deposits	Low
SanUnTri_CamRio	artificial fill	None
SanUnTri_Nim1	Bay Point Formation	High
SanUnTri_Nim2	Bay Point Formation	High
SanUnTri_Nim3	Bay Point Formation	High
SanUnTri_Val1	Holocene deposits	Low
Scr_TorPin	Ardath Shale	High
Scr_TorPin	Holocene deposits	Low
Sol_Ros1	Holocene deposits	Low
Sol_Ros2	artificial fill	None
Sol_Ros2	Holocene deposits	Low
Sol_SVR1	Holocene deposits	Low
Sol_SVR2	Holocene deposits	Low
SolUnTri_Dun	Holocene deposits	Low
SolUnTri_Fli	Bay Point Formation	High

Appendix 3: Paleontological Sensitivity

San Diego Natural History Museum
Department of Paleontology

Project Site ID	Geologic Unit	Paleontological Sensitivity
SolUnTri_Fli	Holocene deposits	Low
SouCho_Alp	Bay Point Formation	High
SouCho_Alp	Holocene deposits	Low
SouCho_Euc1	Holocene deposits	Low
SouCho_Euc1	San Diego Formation	High
SouCho_Euc2	Holocene deposits	Low
SouCho_Euc2	San Diego Formation	High
SouCho_Fed1	Holocene deposits	Low
SouCho_Fed1	Stadium Conglomerate	High
SouCho_Fed2	Holocene deposits	Low
SouCho_Fed2	Stadium Conglomerate	High
SouCho_OceVie	Bay Point Formation	High
SouCho_OceVie	Holocene deposits	Low
SouCho_OceVie	San Diego Formation	High
SouChoEnc_Cas	Lindavista Formation	Moderate
SouChoEnc_Imp1	Holocene deposits	Low
SouChoEnc_Imp2	Holocene deposits	Low
SouChoEnc_Imp2	Mission Valley Formation	High
SouChoEnc_Jam1	Holocene deposits	Low
SouChoEnc_Jam1	Mission Valley Formation	High
SouChoEnc_Jam2	Holocene deposits	Low
SouChoEnc_Jam2	Mission Valley Formation	High
SouChoEnc_Jam3	Mission Valley Formation	High
SouChoEncUnTri_Cad	Holocene deposits	Low
SouChoEncUnTri_Cad	Mission Valley Formation	High
SouChoEncUnTri_Lob	Mission Valley Formation	High
Spr_Cac1	Lindavista Formation	Moderate
Spr_Cac2	Lindavista Formation	Moderate
SS-004621	Bay Point Formation	High
SS-005783	Holocene deposits	Low
SS-008101	Stadium Conglomerate	High
SS-011513	Holocene deposits	Low
SS-013389	Holocene deposits	Low
SS-013792	Holocene deposits	Low
SS-023610	Lindavista Formation	Moderate
SS-025270	Holocene deposits	Low
SS-028300	San Diego Formation	High

Appendix 3: Paleontological Sensitivity

San Diego Natural History Museum
Department of Paleontology

Project Site ID	Geologic Unit	Paleontological Sensitivity
SweUnTri_Par	Holocene deposits	Low
SX-014413	San Diego Formation	High
Tec_Cha1	Friars Formation	High
Tec_Cha1	Scripps Formation	High
Tec_Cha2	Friars Formation	High
TecUnTri_Gen	Friars Formation	High
TecUnTri_Gen	Holocene deposits	Low
TecUnTri_Mor	Holocene deposits	Low
Tij_Pilot	Holocene deposits	Low
Tij_SmuGul	Holocene deposits	Low
TijUnTri_LaMed	Lindavista Formation	Moderate
TijUnTri_SieViv	Lindavista Formation	Moderate
TijUnTri_Smy	San Diego Formation	High
TijUnTri_Toc1	Bay Point Formation	High
TijUnTri_Toc1	Holocene deposits	Low
TijUnTri_Toc2	Bay Point Formation	High
TijUnTri_ViaBan	Holocene deposits	Low
TijUnTri_ViaBan	San Diego Formation	High
TijUnTri_ViaEnc1	Bay Point Formation	High
TijUnTri_ViaEnc1	Holocene deposits	Low
TijUnTri_ViaEnc2	Bay Point Formation	High
TijUnTri_ViaEnc2	Holocene deposits	Low
TijUnTri_ViaEnc3	Bay Point Formation	High
TijUnTri_ViaEnc3	Holocene deposits	Low
WasCyn_Was1	Lindavista Formation	Moderate
WasCyn_Was2	Lindavista Formation	Moderate
WasCyn_Was2	Mission Valley Formation	High
WasCyn_Was2	San Diego Formation	High

APPENDIX B

Geologic Mapping by Facility

Map Sheet Extent

Project Facility Maintenance Plans (FMPs)

Project Facilities Evaluated (No FMP Proposed)

Additional Facilities (Limited Program-Level Activities)

Figure 1-1

Figure 1-2

Sheet 1-3

Sheet 1-4

Sheet 1-5

Sheet 1-6

Sheet 1-7

Sheet 1-8

Sheet 1-9

Sheet 1-10

Sheet 1-11

Sheet 1-12

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SOURCE: ESRI, 2017; SANDAG, 2017

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Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Figure 1a

Geologic Map - Index

Map Symbol	Geological Unit
Qaf	Artificial Fill
Qal	Holocene Age Alluvium
Qsw	Slope Wash Deposits
Qal + Qsw	Undifferentiated Alluvium and Slope Wash Deposits
Qpb	Bay Point Formation
Qln	Lindavista Formation
Tsd, Tsdss	San Diego Formation
Tsw	Sweetwater Formation
Tp	Pomerado Conglomerate
Tmv	Mission Valley Formation
Tst	Stadium Conglomerate
Tf	Friars Formation
Tsc	Scripps Formation
Ta	Ardath Shale
Kg	Cretaceous Intrusive Igneous Rocks
Mzu	Mesozoic Metasedimentary and Metavolcanic Rocks

Source: California Division of Mines and Geology Bulletin 1975

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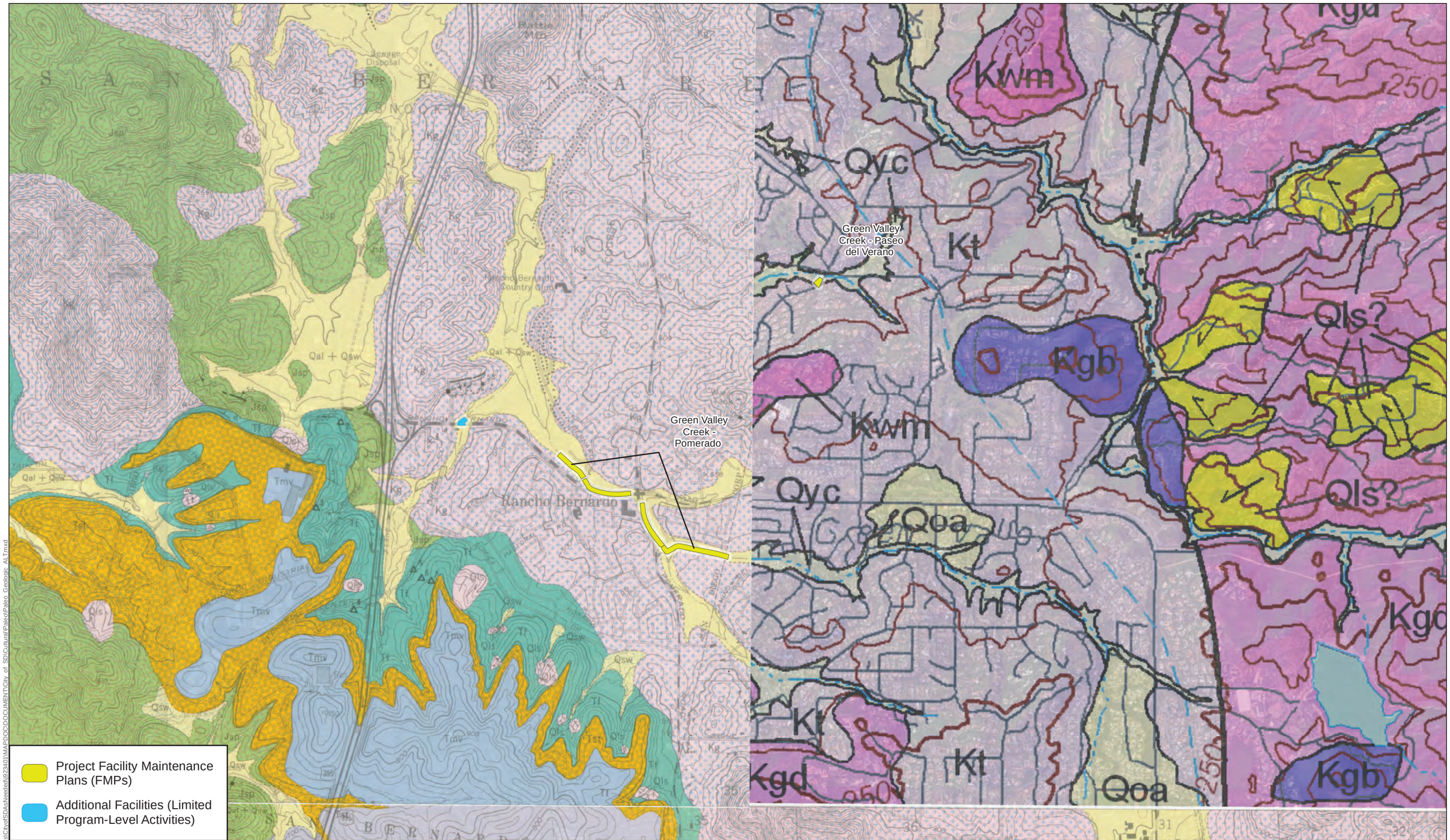
Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Figure 1b

Geologic Map - Legend



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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 1 of 12

Figure 1-1

Geologic Map

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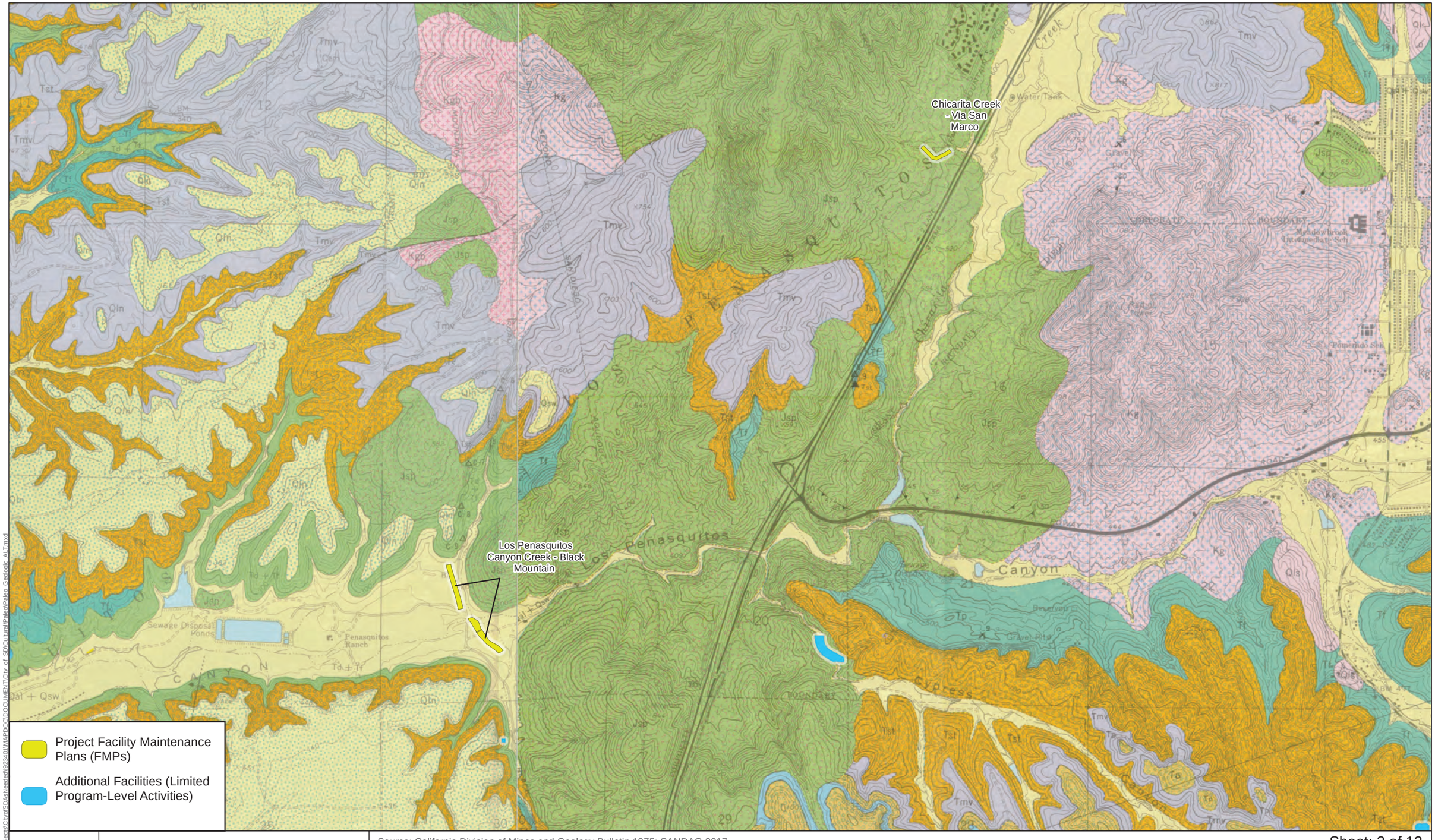

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 2 of 12

Figure 1-2

Geologic Map

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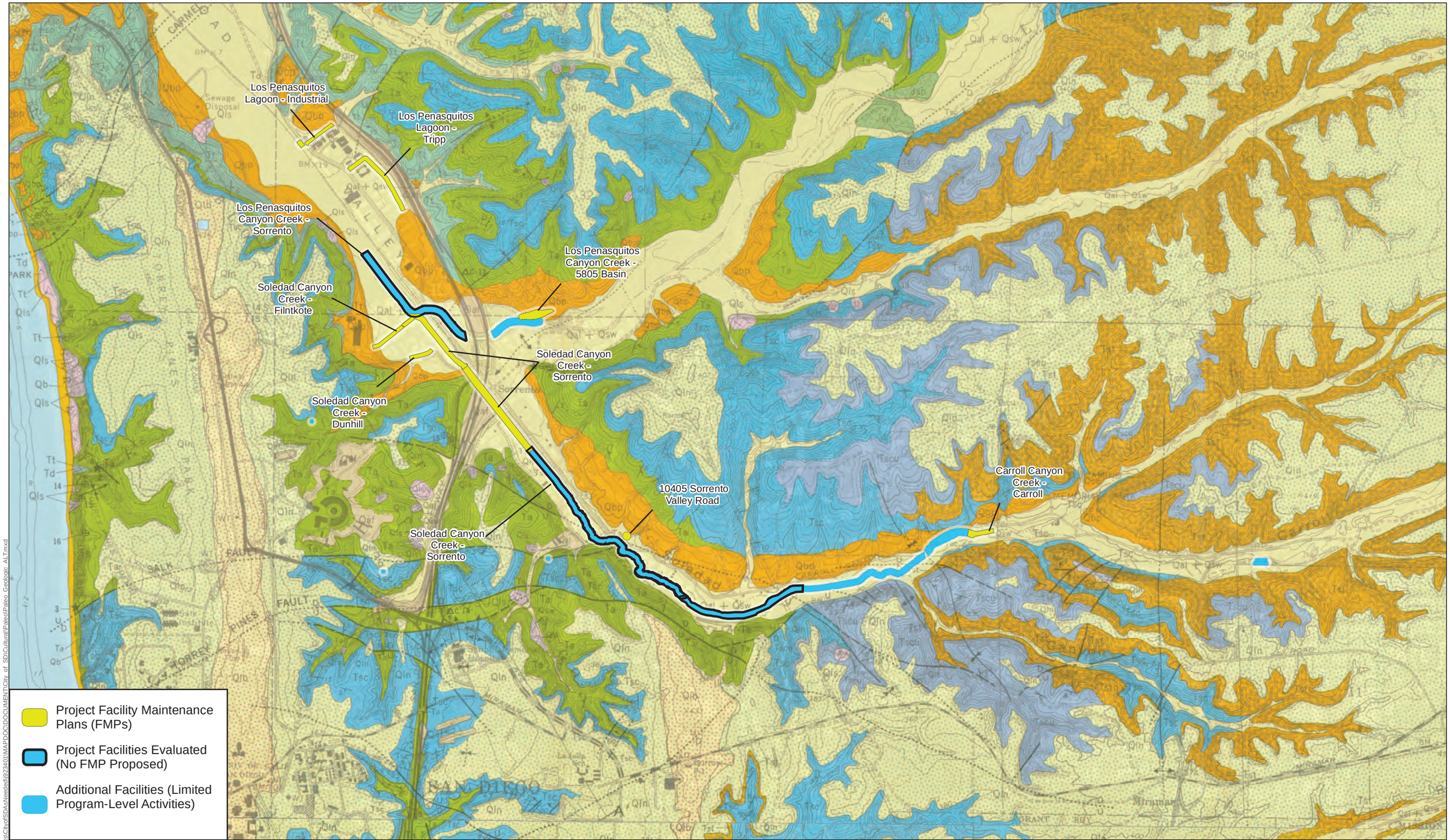

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 3 of 12

Figure 1-3

Geologic Map

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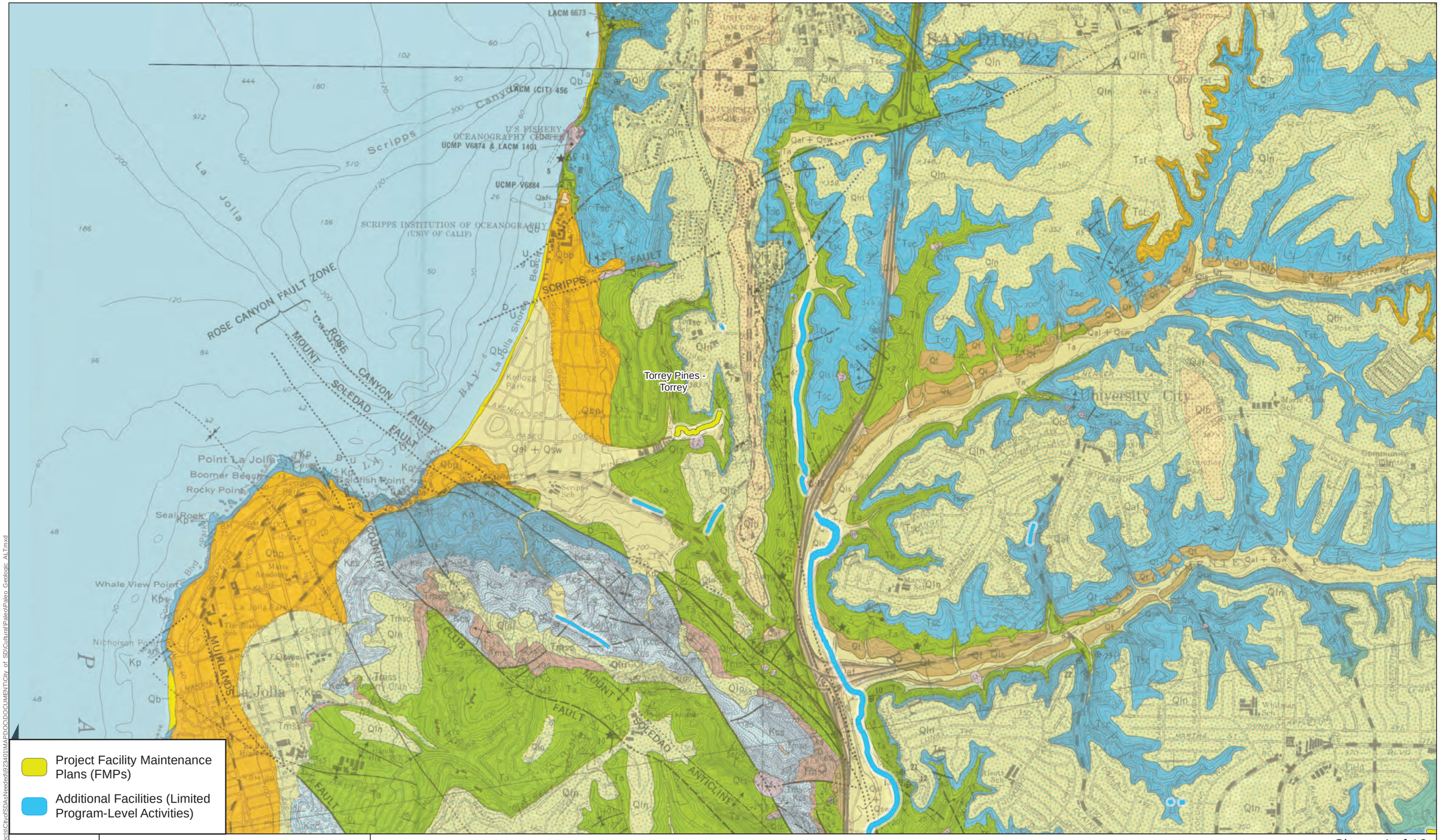

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 4 of 12

Figure 1-4

Geologic Map

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 5 of 12

Figure 1-5

Geologic Map

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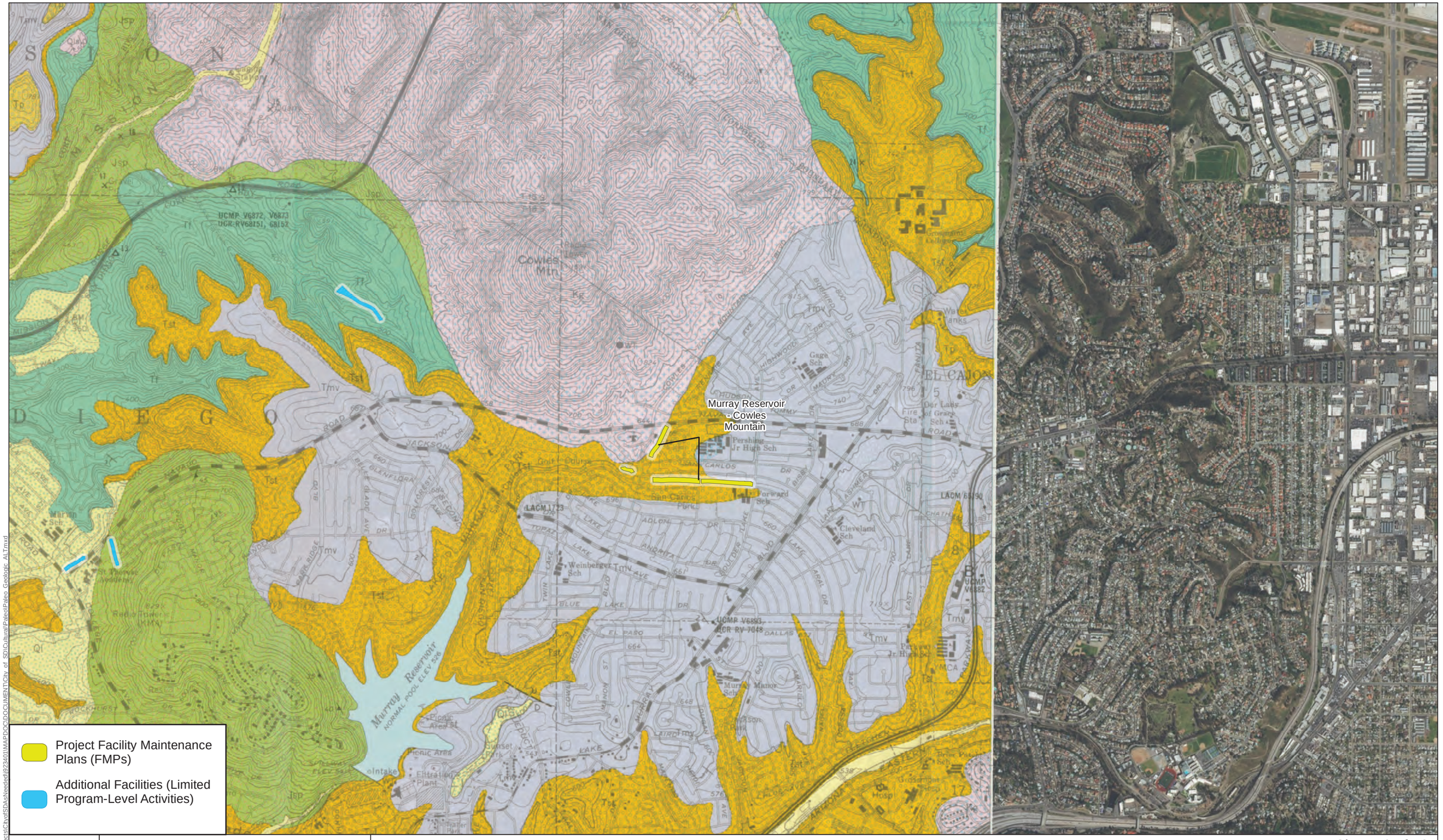

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 6 of 12

Figure 1-6

Geologic Map

Document Path: Z:\Projects\CityofSDasNeeded\923401\MAPDOC\DOCUMENT\City of SD\Cultural\Paleo\Paleo Geologic ALT.mxd

Murphy Canyon Creek - Stadium

Murphy Canyon Creek - Stadium

Alvarado Canyon Creek - Mission Gorge

Alvarado Canyon Creek - Alvarado

Norfolk Canyon Creek - Fairmount

Norfolk Canyon Creek - Fairmount

Norfolk Canyon Creek - Fairmount

Norfolk Canyon Creek - Fairmount

- Project Facility Maintenance Plans (FMPs)
- Project Facilities Evaluated (No FMP Proposed)
- Additional Facilities (Limited Program-Level Activities)

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 7 of 12

Figure 1-7

Geologic Map

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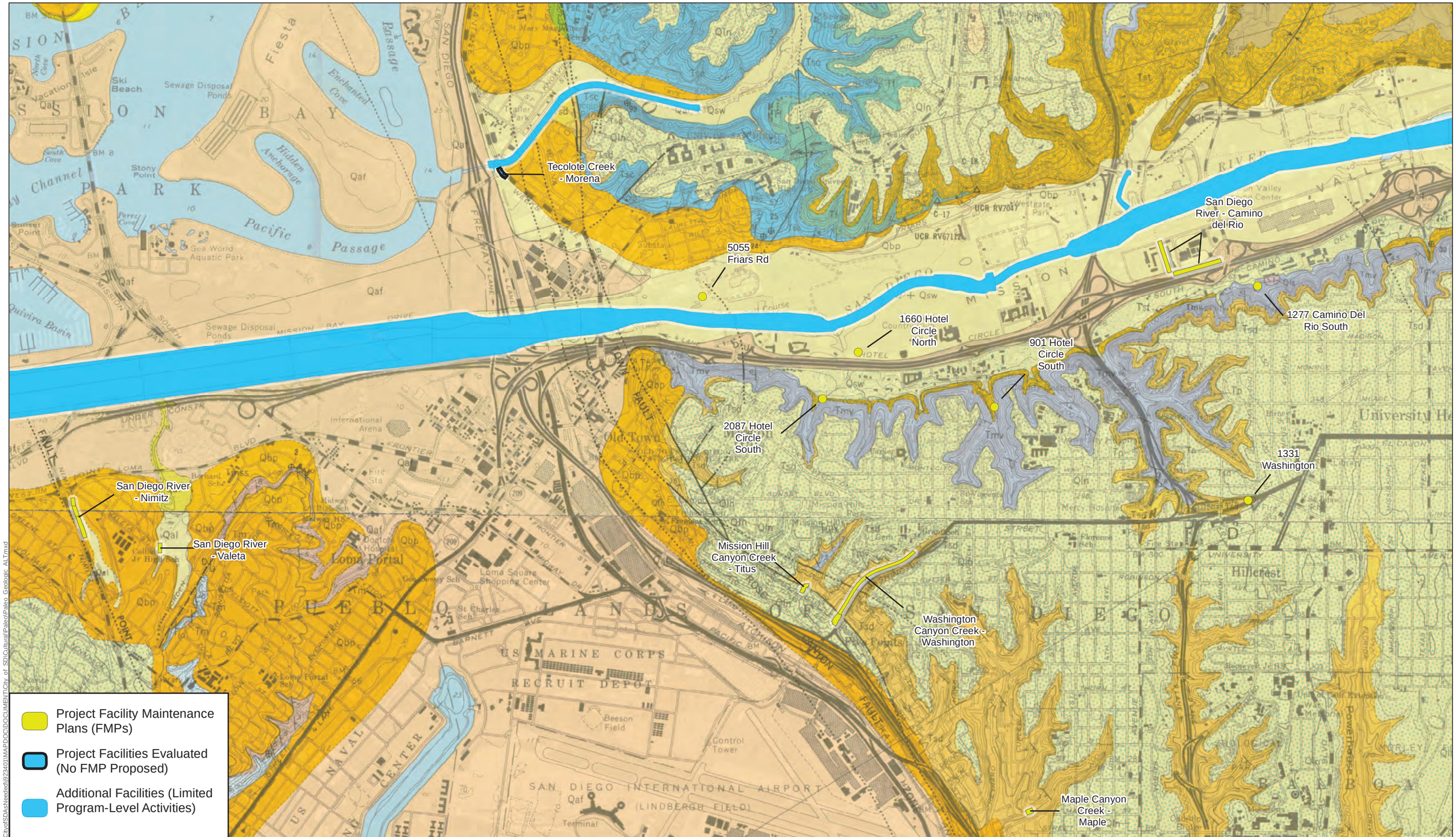

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 8 of 12

Figure 1-8

Geologic Map

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Project Facility Maintenance Plans (FMPs)

Project Facilities Evaluated (No FMP Proposed)

Additional Facilities (Limited Program-Level Activities)

Chollas Creek - Rolando

Auburn Creek - Oakcrest

3634 Roselawn

Auburn Creek - Wightman

Chollas Creek - 54th St.

Chollas Creek - Megan

South Chollas Creek - Federal

Auburn Creek - Home

Powerhouse Canyon Creek - Pershing

San Diego Bay - 28th St.

South Chollas Creek - Euclid

East San Diego

North Park

South Park

Encanto

Qal + Qs

Tsdss

Tmv

Tst

Tp

Ql

Qn

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

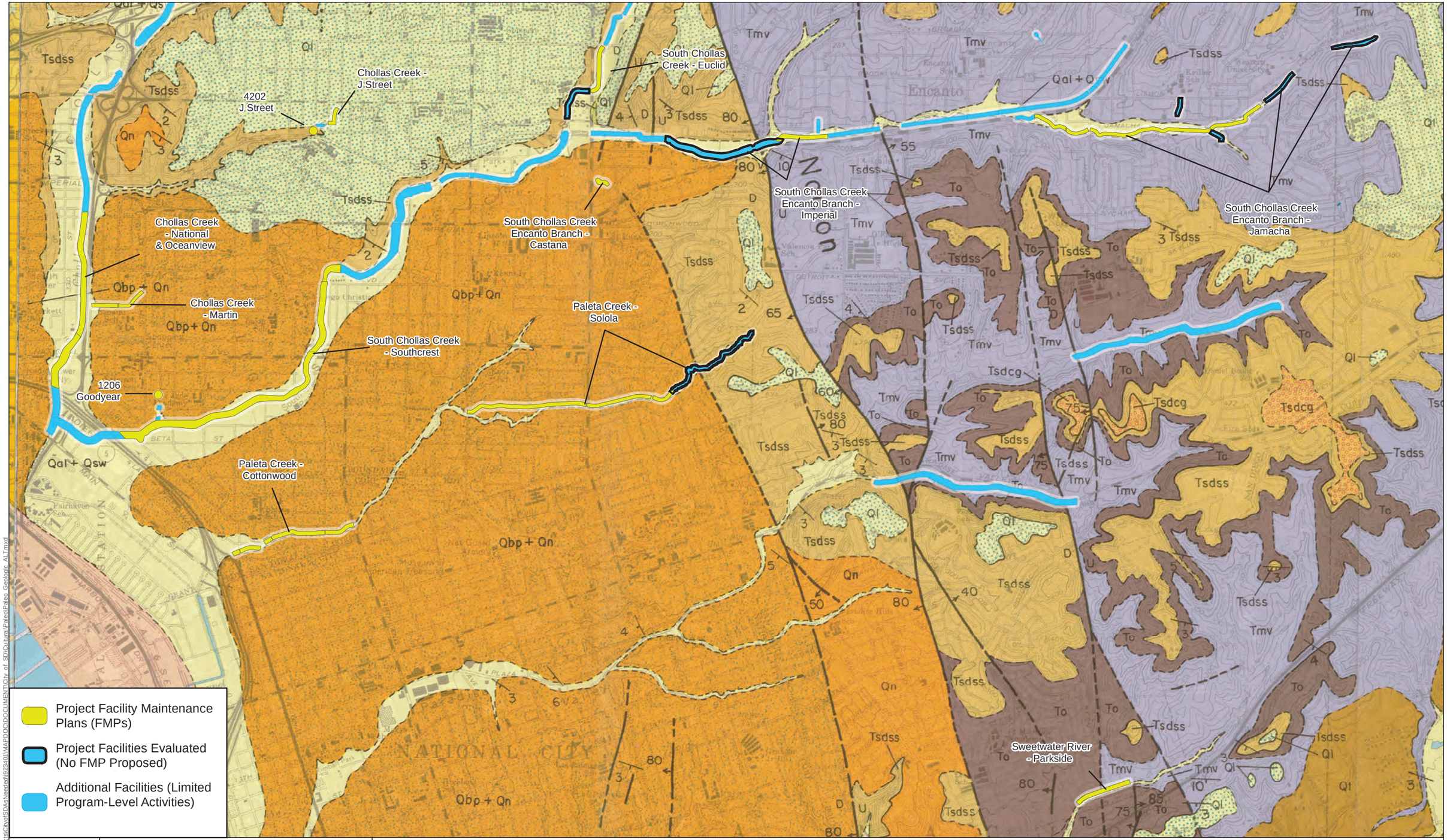
Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 9 of 12

Figure 1-9

Geologic Map



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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 10 of 12

Figure 1-10

Geologic Map

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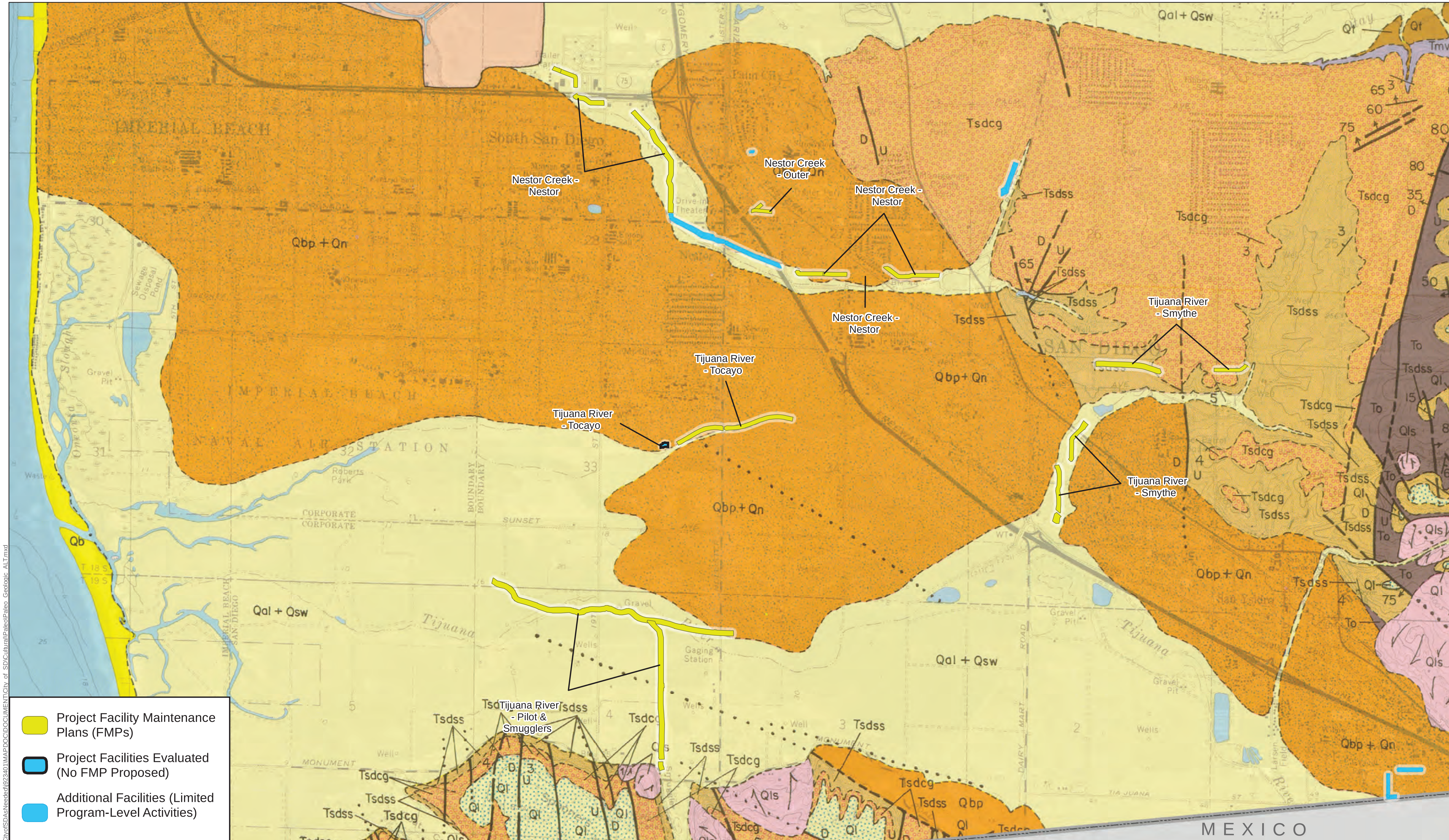

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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

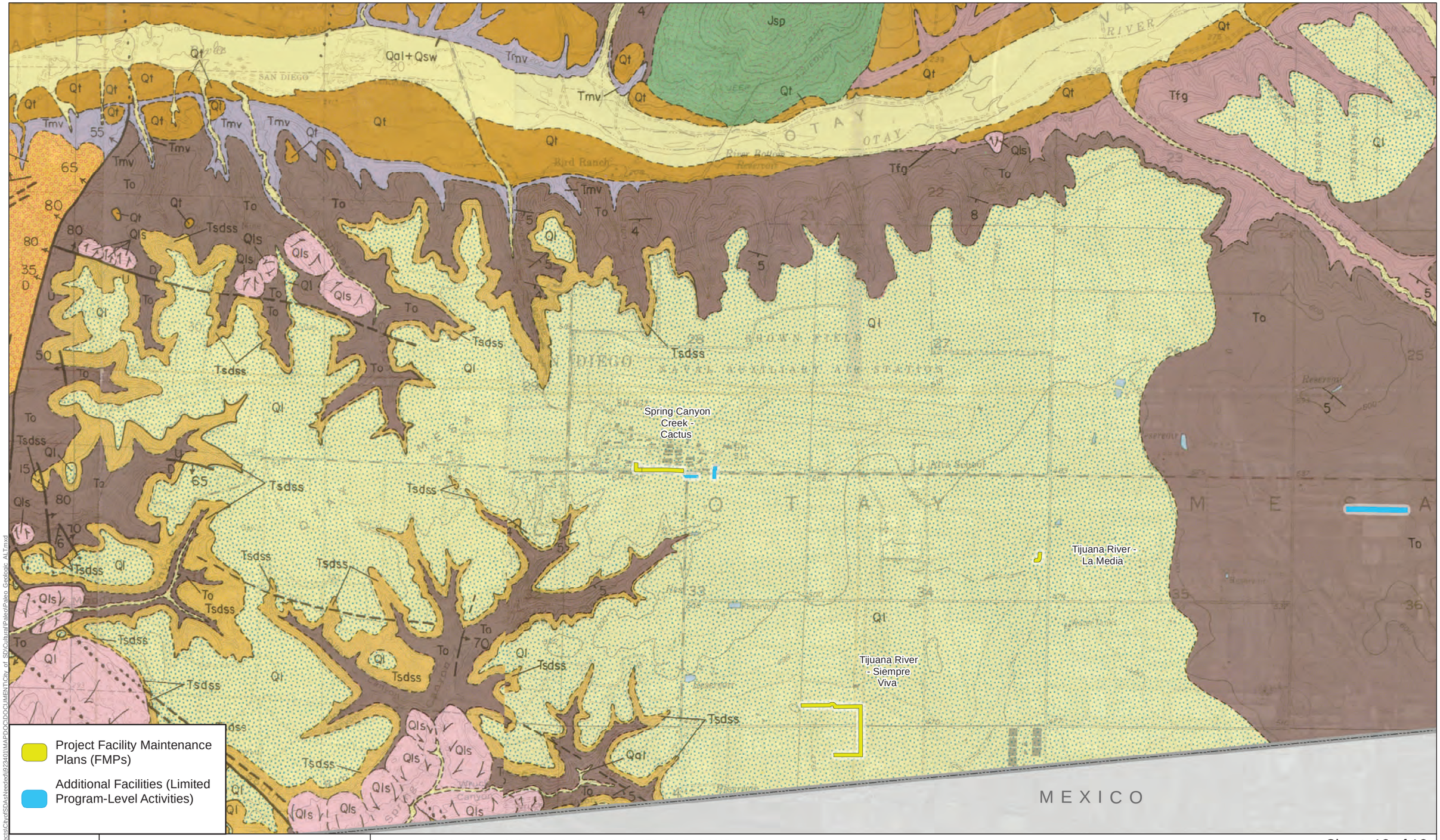
Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 11 of 12

Figure 1-11

Geologic Map



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Source: California Division of Mines and Geology Bulletin 1975; SANDAG 2017

Municipal Waterways Maintenance Plan

Paleontological Resource Inventory Report

Sheet: 12 of 12

Figure 1-12

Geologic Map

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APPENDIX C

Paleontological Review Matrix

APPENDIX C
Paleontological Review Matrix

Facility No.	Facility Group Name	MWMP Appendix	Acronym in SDNHM Records Search	Sheet No.	Substrate	Paleo Sensitivity	Further Evaluation Required?	
Los Peñasquitos Watershed								
2-01-000	Los Peñasquitos Canyon Creek - Sorrento Valley	A5	LosPen_SorVal	2	Earthen	Low	No	Based on Geology
2-01-120	Los Penasquitos Lagoon – Industrial	A1	PenUnTri_Ind	2	Earthen	Low to High	Yes	Based on Geology
2-01-200	Los Peñasquitos Canyon Creek - Black Mountain	A1	LosPenUnTri_BlaMou1	2	Earthen	Low	No	Based on Geology
2-01-210	Los Peñasquitos Canyon Creek - Black Mountain	A1	LosPenUnTri_BlaMou2	2	Earthen	Low	No	Based on Geology
2-01-900	Los Peñasquitos Canyon Creek - 5-805 Basin	A2	LosPen_5-805	3	Earthen	Low to High	Yes	If Thresholds Exceeded
2-03-000	Soledad Canyon Creek – Roselle	A1	Sol_Ros1	3	Earthen	Low	No	Based on Geology
2-03-004	Soledad Canyon Creek - Sorrento	A5	SorValRd	1	Earthen	Low to High	Yes	If Thresholds Exceeded
2-03-006	Soledad Canyon Creek - Sorrento	A5	SorValRd	2	Earthen	Low	No	Based on Geology
2-03-012	Carroll Canyon Creek - Carroll	A1	CarCan_CarCan	3	Earthen & Concrete	Low	No	Based on Geology
2-03-150	Soledad Canyon Creek - Dunhill	A1	SolUnTri_Dun	3	Earthen	Low	No	Based on Geology
Mission Bay Watershed								
3-00-120	Torrey Pines – Torrey	A1	Scr_TorPin	4	Earthen	Low to High	Yes	If Thresholds Exceeded
3-00-150	Alta La Jolla - Vickie	A2	Vickie - 1	5	Earthen	Low to High	Yes	If Thresholds Exceeded
3-02-101	Mission Bay - MBHS	A1	MisBayUnTri_MBHS	5	Earthen	None	No	Based on Geology
3-02-130	Mission Bay - Mission Bay Drive	A1	MisBayUnTri_MBD	5	Earthen	None	No	Based on Geology
3-03-901	Miramar – Engineer	A1	MisBayUnTri_Eng	5	Earthen & Concrete	Moderate	Yes	If Thresholds Exceeded
3-04-101	Tecolote Creek - Morena	A5	TecUnTri_Mor	8	Earthen	Low to High	Yes	If Thresholds Exceeded
3-04-160	Tecolote Creek - Genesee	A1	TecUnTri_Gen	5	Earthen	Low	No	Based on Geology
San Diego River Watershed								
4-01-103	San Diego River - Nimitz	A1	SanUnTri_Nim1	8	Earthen	High	Yes	If Thresholds Exceeded
4-01-107	San Diego River - Nimitz	A1	SanUnTri_Nim3	8	Earthen	High	Yes	If Thresholds Exceeded
4-04-000	Murphy Canyon Creek – Stadium	A1	MurCan_Sta1	7	Earthen	Low	No	Based on Geology
4-04-008	Murphy Canyon Creek – Stadium	A5	MurCan_MurCan2	7	Earthen	Low to High	Yes	If Thresholds Exceeded
4-07-021	Alvarado Canyon Creek – Alvarado	A1	AlvCyn_Alv1	7	Earthen & Concrete	Low to High	Yes	If Thresholds Exceeded
4-08-014	Norfolk Canyon Creek – Fairmount	A1	NorCan_Fai3	7	Earthen	High	Yes	If Thresholds Exceeded
4-08-105	Norfolk Canyon Creek – Fairmount	A1	NorCyn_Baja	7	Earthen & Concrete	High	Yes	If Thresholds Exceeded
4-08-150	Norfolk Canyon Creek - Fairmount	A5	NorCan_Ald	7	Earthen	High	Yes	If Thresholds Exceeded
Pueblo San Diego Watershed								
5-02-140	Maple Canyon Creek - Maple	A2	Maple - 1	8	Earthen	High	Yes	If Thresholds Exceeded
5-02-151	Washington Canyon Creek - Washington	A1	WasCan_Was1	8	Earthen	Moderate to High	Yes	If Thresholds Exceeded
5-02-162	Mission Hills Canyon Creek - Titus	A1	MisHilCan_Tit	8	Earthen	Moderate to High	Yes	If Thresholds Exceeded
5-03-901	San Diego Bay - 28th St	A1	SanBayUnTri_28th	9	Earthen	High	Yes	If Thresholds Exceeded
5-04-004	Chollas Creek - National	A1	Cho_Nat	10	Earthen & Concrete	Low	No	Based on Geology
5-04-048	Chollas Creek - Rolando	A1	Cho_Rol2	9	Earthen	Low	No	Based on Geology

Facility No.	Facility Group Name	MWMP Appendix	Acronym in SDNHM Records Search	Sheet No.	Substrate	Paleo Sensitivity	Further Evaluation Required?	
5-04-101	Chollas Creek - Martin	A1	Cho_UnTri_Martin	10	Earthen & Concrete	High	Yes	If Thresholds Exceeded
5-04-163	Chollas Creek - J St	A1	Cho_UnTri_JSt	10	Earthen	High	Yes	If Thresholds Exceeded
5-04-220	Auburn Creek - Home	A1	Aub_Hom1	9	Earthen	Low	No	Based on Geology
5-04-224	Auburn Creek - Home	A1	Aub_Hom2	9	Earthen	Low	No	Based on Geology
5-04-229	Auburn Creek - Home	A5	Aub_Hom4	9	Earthen & Concrete	Low	No	Based on Geology
5-04-231	Auburn Creek - Home	A1	Aub_Hom5	9	Earthen & Concrete	Low to High	Yes	If Thresholds Exceeded
5-04-239	Auburn Creek - Wightman	A1	Aub_Wig1	9	Earthen & Concrete	Low to High	Yes	If Thresholds Exceeded
5-04-241	Auburn Creek - Wightman	A1	Aub_Wig2	9	Earthen & Concrete	Low to High	Yes	If Thresholds Exceeded
5-04-245	Auburn Creek - Oakcrest	A5	Aub_Oak	9	Earthen	Moderate	Yes	If Thresholds Exceeded
5-04-262	Chollas Creek - Megan	A1	Cho_UnTri_Megan2	9	Earthen	High	Yes	If Thresholds Exceeded
5-05-006	South Chollas Creek – Southcrest	A1	SouCho_Alp	10	Earthen & Concrete	Low to High	Yes	If Thresholds Exceeded
5-05-008	South Chollas Creek – Southcrest	A1	SouCho_OceVie	10	Earthen & Concrete	Low to High	Yes	If Thresholds Exceeded
5-05-019	South Chollas Creek - Euclid	A5	SouCho_Euc1	10	Earthen	Low to High	Yes	If Thresholds Exceeded
5-05-035	South Chollas Creek - Federal	A1	SouCho_Fed1	9	Earthen & Concrete	High	Yes	If Thresholds Exceeded
5-05-205	South Chollas Creek Encanto Branch - Castana	A1	SouChoEnc_Cas	10	Earthen & Concrete	High	Yes	If Thresholds Exceeded
5-05-304	South Chollas Creek Encanto Branch - Imperial	A5	SouChoEnc_Imp1	10	Earthen	Low	No	Based on Geology
5-05-603	South Chollas Creek Encanto Branch - Jamacha	A1	SouChoEnc_Jam1	10	Earthen	Low to High	Yes	If Thresholds Exceeded
5-05-606	South Chollas Creek Encanto Branch - Jamacha	A5	SouChoEnc_Jam2	10	Earthen	Low to High	Yes	If Thresholds Exceeded
5-05-610	South Chollas Creek Encanto Branch - Jamacha	A5	SouChoEnc_Jam3	10	Earthen	High	Yes	If Thresholds Exceeded
5-05-702	South Chollas Creek Encanto Branch - Jamacha	A5	SouChoEncUnTri_Lob	10	Earthen	High	Yes	If Thresholds Exceeded
5-05-802	South Chollas Creek Encanto Branch – Jamacha	A5	SouChoEncUnTri_Cad	10	Earthen	High	Yes	If Thresholds Exceeded
5-06-025	Paleta Creek – Solola	A5	Par_Cer	10	Earthen	Low to High	Yes	If Thresholds Exceeded
Otay Watershed								
5-22-008	Nestor Creek - Nestor	A1	Nes_Ced1	11	Earthen	Low	No	Based on Geology
5-22-016	Nestor Creek - Nestor	A1	Nes_Cer	11	Earthen	Low	No	Based on Geology
5-22-023	Nestor Creek - Nestor	A1	Nes_Gro1	11	Earthen	Low to High	Yes	If Thresholds Exceeded
5-22-028	Nestor Creek – Nestor	A1	Nes_30th1	11	Earthen & Concrete	High	Yes	If Thresholds Exceeded
5-22-110	Nestor Creek - Nestor	A1	NesUnTri_Out	11	Earthen	High	Yes	If Thresholds Exceeded
Tijuana River Watershed								
6-01-020	Tijuana River - Pilot & Smuggler's	A1	Tij_Pilot	11	Earthen	Low to High	Yes	If Thresholds Exceeded
6-01-100	Tijuana River Pilot & Smuggler's	A1	SmuGul_SmuGul	11	Earthen	Low	No	Based on Geology

Facility No.	Facility Group Name	MWMP Appendix	Acronym in SDNHM Records Search	Sheet No.	Substrate	Paleo Sensitivity	Further Evaluation Required?	
6-02-115	Tijuana River - Tocayo	A5	TijUnTri_Toc1	11	Earthen & Concrete	High	Yes	If Thresholds Exceeded
6-03-135	Tijuana River - Smythe	A1	TijUnTri_ViaEnc1	13	Earthen	Low	No	Based on Geology
6-03-147	Tijuana River - Smythe	A1	TijUnTri_Smy	11	Earthen	High	Yes	If Thresholds Exceeded
6-05-110	Tijuana River - Siempre Viva	A2	Wru_SieViv	12	Earthen	Moderate	Yes	If Thresholds Exceeded
6-06-011	Tijuana River - La Media	A1	TijUnTri_LaMed	12	Earthen	Moderate	Yes	If Thresholds Exceeded

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APPENDIX D

Qualifications of Key Personnel

Sarah Siren

Senior Paleontologist

Sarah Siren is a senior paleontologist with 18 years' experience as a paleontological resources consultant. Ms. Siren has served as paleontologist for numerous projects throughout California, with extensive experience in Imperial, Orange, Riverside, Los Angeles, San Bernardino, and San Diego Counties. These projects involved multiple agencies, public and private sector clients, a variety of resources, and multidisciplinary staff supervision. She specializes in California Environmental Quality Act (CEQA) and Bureau of Land Management (BLM) compliance standards. She taught at Saddleback Community College in Mission Viejo, California as an associate geology professor, and worked as a curatorial assistant with the Natural History Museum of Los Angeles County and, more recently, as a field manager with the San Diego Natural History Museum.

While in college pursuing her degrees, she conducted studies at both the Smithsonian Institution and Badlands National Park, and supervised as lead research scientist for various field activities, curation projects, and laboratory preparations. Her diverse experience includes recovering, identifying, mapping, and preparing fossils. Ms. Siren is able to effectively manage projects and complete deliverables from assessments to final technical reports in a timely manner.

EDUCATION

South Dakota School of Mines and Technology
MS, Paleontology, 2002

George Washington University
BS, Geology, 1999
BA, French Language and Literature, 1999

CERTIFICATIONS

Geologist-in-Training, No. 167 California, 2007

Certified GIS Professional (GISP), 2013

40-hour HAZWOPER Training, 2008

Qualified Paleontologist, City of San Diego and Counties of Kern, Los Angeles, Orange, Riverside, San Diego, and San Luis Obispo

AFFILIATIONS

San Diego Natural History Museum, Departmental Associate

Natural History Museum of Los Angeles County, Museum Associate

Society of Vertebrate Paleontology

Geological Society of America

South Coast Geological Society

Project Experience

Development

Sea Summit (Marblehead Coastal), Taylor Morrison, City of San Clemente, California. Served as paleontologist responsible for a paleontological assessment of the 266-acre property and oversight of paleontological resource monitoring during rough grading. Designed and implemented an archaeological survey in consultation with the California Coastal Commission (CCC) and local Native Americans. Survey methods were tailored in response to specific CCC concerns regarding ground surface visibility, historical land use, previously recorded archaeological traces, and diverse development impacts. Successfully developed a detailed archaeological, Native American, and paleontological monitoring and discoveries treatment plan to address CCC, Native American, and City of San Clemente concerns. Prepared final technical report for submittal to the City of San Clemente as a condition of occupancy.

Patton State Hospital Project, California Department of General Services, County of San Bernardino, California. As project manager and principal investigator, supervised the cultural and paleontological resources mitigation program during construction improvements to the facility in accordance with the mitigation measures and treatment plan for the project.

Tejon Mountain Village, Tejon Mountain Village LLC, County of Kern, California. Responsible for paleontological resources monitoring during geotechnical drilling within a portion of this 28,000-acre master planned community.

Kettner Lofts Project, Citymark Development, City of San Diego, California. As project manager and principal investigator, responsible for cultural resources construction monitoring during construction of this residential complex located in Little Italy.

Heather Lane Corti Residence, City of Del Mar, California. As project manager and principal investigator, responsible for cultural and paleontological resources construction monitoring for residential development located in the City of Del Mar.

1902 Grandview Street, City of Oceanside, California. Provided a paleontological resources review for the tentative tract map location, including management considerations and recommendations.

Winchester 1800 Project, City of Temecula, California. Project manager and principal investigator responsible for a paleontological resources survey and report prepared for this development located in the City of Temecula. Also provided editorial comments on the cultural resources report for the same project.

Mira Loma Commerce Center, County of Riverside, California. Project manager and principal investigator, responsible for cultural and paleontological resources monitoring during the construction of two commercial buildings on 31 acres and completion of a final technical report.

Palm Avenue Distribution Center, IDS Real Estate Group, City of San Bernardino, California. Project manager and principal investigator, responsible for preparation of a field survey report, cultural and paleontological resources monitoring program, and final report for this warehouse/distribution center construction.

Otay Ranch, Parcels B (Village 8 West) and C (Village 9), Otay Land Company, City of Chula Vista, California. As field manager and co-principal investigator, conducted the pedestrian field survey of an approximately 600 acre site in the City of Chula Vista. Ms. Siren also co-authored the paleontological assessment for the project.

Olympic Pointe (East and West) Project, Alta Geotechnical Inc., City of Chula Vista, California. As field manager and co-principal investigator, responsible for oversight of field studies conducted as part of the paleontological mitigation program for the project. The findings of this paleontological mitigation program were included in a final technical report co-authored by Ms. Siren.

Beaumont Four Seasons, K. Hovnanian, Beaumont, California. As project manager and principal investigator, responsible for paleontological resources mitigation program on this approximately 600-acre residential community.

Terranea, Lowe Destination Development, City of Rancho Palos Verdes, California. As project manager, provided comprehensive archaeological and paleontological consultation services for this planned resort property located on the Palos Verdes Peninsula. This project site was known to be both archaeologically and paleontologically sensitive and yielded fossils and artifacts. Responsible for overseeing the cultural and paleontological resource management, and co-authored the final report.

Portola Springs (Planning Area 6), The Irvine Company, City of Irvine, California. As project manager, provided comprehensive paleontological consultation services for a large-scale development. This project yielded fossils that dated from the Cretaceous age (over 65 million years ago) deposits through the Pleistocene age (until 11,000 years ago). Responsible for overseeing the paleontological

resource management, including large fossil salvages and monitoring during rough grading. Evaluation studies are in progress and large-scale mitigation efforts are ongoing.

Orchard Hills (Planning Area 1), The Irvine Company, City of Irvine, California. As project manager, responsible for archaeological and paleontological services provided during rough grading at Fire St. #55 for Irvine Community Development Company (ICDC).

607 Kings Road, City of Newport Beach, California. Served as paleontologist for fossil salvage of a Pleistocene baleen whale skull from a private residence for the City of Newport Beach. Was instrumental in coordinating with the City, the property owner, and the Los Angeles Times journalists who covered the breaking news story.

Pelican Hill, The Irvine Company, City of Newport Beach, California. Managed the on-site paleontological mitigation program operated by Stantec for the Pelican Hill Project in Newport Beach, Orange County, California. In accordance with local and state guidelines, supervised the recovery of over 200 fish fossils from the middle to late Miocene marine Monterey Formation, and both terrestrial and marine specimens from the overlying Pleistocene age terrace deposits.

The Preserve at Mystic Ridge, City of Moreno Valley, California. This project consists of approximately 700 lots ranging from condos to large single-family estates within the existing Quail Ranch Golf Club. Project entitlements will include an EIR, Change of Zone, and Tentative Tract Map through the City of Moreno Valley concurrently with an annexation application including a Plan of Services through LAFCO and a land exchange with California Department of Fish and Wildlife. Mrs. Siren was responsible for a paleontological assessment of the 200-acre property, and oversight during paleontological resource monitoring of geotechnical bore hole drilling and trenching.

Shady Canyon, The Irvine Company, City of Irvine, California. Assumed supervisory role of a 4-year monitoring project during mass grading for the Shady Canyon residential community. During that time, the majority of the fossils salvaged by paleontological monitors were from the Vaqueros Formation. These marine sediments yielded a relatively complete skull of a new species of primitive baleen whale, in addition to mollusks, echinoderms, sharks, fishes, a marine bird, and mammals that lived in the early Miocene ocean, approximately 20 to 23 million years ago. The collection has been reported on and placed in the Natural History Museum of Los Angeles County at Exposition Park.

Turtle Ridge, The Irvine Company, City of Irvine, California. Supervised paleontological monitoring during rough grading for this large residential community. Monitoring personnel collected a variety of marine fossils during the course of the project. Most notable was the complete skull of a primitive tusked sea cow (*Dioplotherium)* from the Topanga Formation; this skull was prepared in the Stantec paleontological laboratory, reported on, and placed at the Smithsonian Institution, Washington, DC, for further research.

Vellano Project, Chino Hills Land West LLC, City of Chino Hills, California. Supervised paleontological monitoring services for this 570-acre property during mass grading. Over 2,000 fossil fish specimens were collected, which expanded the known species recorded from the Puente Formation. This residential community project afforded the rare opportunity to monitor Miocene sediments for the presence of marine fossils. Also collected on this project were Ice Age mega fauna remains, most notably the best-preserved Shasta ground sloth skull outside Rancho La Brea and a large bison femur. The most complete

dolphin skeleton ever recovered from the Pacific region was collected during the course of this project and is described as a newly discovered species of kentriodontid dolphin by Dr. Barnes of the Natural History Museum of Los Angeles County. A replica of this animal is currently on display at the City of Chino Hills City Hall. The collection was placed at the Natural History Museum of Los Angeles County.

Planning Areas 18 and 39 (Verizon Amphitheater and Wild Rivers) City of Irvine, California. Stantec performed historical, archaeological, and paleontological technical studies for the EIRs prepared in accordance with CEQA Guidelines. Records research, Native American consultation, archaeological surveys, and paleontological assessments were conducted to identify and evaluate cultural and paleontological resources within and near two adjacent project sites. Three 20th century historical resource sites, four prehistoric Native American archaeological sites, and three paleontologically sensitive geologic formations were identified and evaluated. The technical reports analyzed proposed project impacts and provided mitigation measures.

Planning Area 9A – Woodbury, The Irvine Company, City of Irvine, California. Planning Area 9A – Woodbury, Irvine, California (Project Paleontologist) Responsible for providing services including monitoring and collection of any archaeological or paleontological material found at Planning Area 9A – Phase I and Phase II (Woodbury). Fossils collected were discovered within Ice Age deposits, and included specimens of bison, camel, tapir, horse, sloth, and mammoth. All work was designed to comply with the California Environmental Quality Act, County Guidelines, and City Mitigation Measures.

Aliso Creek, County of Orange, California. Responsible for field survey and analysis of surface fossils exposed in the creek noted in a newspaper article. The fossil whale skull pictured in the article was that of a right whale preserved within the Oso Sandstone Member of the Capistrano Formation. Other fossils included a jawbone from a small baleen whale (*Herpetocetinae*). These specimens were later jacketed and airlifted by helicopter for transport to the Orange County facility for storage.

Education

Fullerton College Master Plan Program EIR, North Orange County Community College District, Cypress, California. Paleontologist for the Facilities Master Plan Program EIR. Issues include historic building preservation, traffic, and parking, and adjacent neighbor concerns associated with noise, traffic, parking, and growth inducement.

Coast Community College District, County of Orange, California. As project manager and co-principal investigator, conducted the field surveys and prepared the paleontological resources assessments for Orange Coast College, Golden West College, and Coastline Community College for submittal to Dudek.

Thomas Jefferson School of Law Project, Thomas Jefferson School of Law, City of San Diego, California. As field manager, conducted multiple fossil salvages for this East Village project site. A mammoth skull, tusks, and partial skeleton were recovered and are currently awaiting preparation. In addition, a partial gray whale (*Eschrichtius robustus*) skeleton was discovered at the site and is housed at the museum's storage facility.

San Ysidro School District (SYSD) Vista Del Mar School, RBF, County of San Diego, California. As field manager and co-principal investigator, responsible for preconstruction WEAP training and supervision of paleontological monitoring program for the project. A series of fossil producing strata were discovered

and collected from approximately 2–3 million year old San Diego Formation consisted of significant fossil remains of marine invertebrates.

Energy

California Flats Solar Project, First Solar/NextEra, Counties of Monterey and San Luis Obispo, California. As project manager and principal investigator, supervised the cultural and paleontological resources mitigation program in accordance with the mitigation measures and treatment plan for the project.

McCoy Solar Project, First Solar, County of Riverside, California. Managed cultural and paleontological resource staff during construction of this 250-megawatt (MW) solar photovoltaic facility located in easternmost Riverside County. As the BLM-permit holder, served as principal investigator for paleontology and paleontological resources compliance manager.

Imperial Solar Energy Center West Project, First Solar, County of Imperial, California. Managed cultural and paleontological resource staff during construction of this 250-MW solar photovoltaic facility located in Imperial County. Mitigation was conducted in accordance with the Conditional Use Permit (CUP) for the project, including screenwashing of sediment samples collected during excavation.

Jacumba Solar, County of San Diego, California. As senior paleontologist, provided paleontological resources recommendations and guidelines during the design phase of this project, and oversite during mitigation monitoring.

San Joaquin Cross Valley Loop Project, Southern California Edison (SCE), City of Visalia, California. As project manager, co-authored the final technical report on paleontological resources for the San Joaquin Cross Valley Loop Project in Tulare County, California. The final report was written in compliance with CEQA and Tulare County guidelines for approval by the California Public Utilities Commission (CPUC).

Valley South Subtransmission Line Project, SCE, County of Riverside, California. As project manager, conducted a field survey and co-authored the paleontological resources survey report in advance of proposed construction along the approximately 17.76 miles of subtransmission line in Riverside County, California. The final preliminary environmental assessment (PEA) was written in compliance with CEQA and Riverside County guidelines for approval by the CPUC.

Stateline Solar Farm Project, First Solar, County of San Bernardino, California. As project manager and co-principal investigator, prepared the paleontological resources plan and provided technical review and editorial comments on the field survey report for this project located on BLM-managed land.

Antelope Valley Solar Ranch Project, Sun Power, Counties of Los Angeles and Kern, California. As field manager and co-principal investigator, supervised the paleontological mitigation program in accordance with the paleontological monitoring and treatment plan for the project.

California Valley Solar Ranch Project, NRG/Sun Power, County of San Luis Obispo, California. As field manager and co-principal investigator, supervised the paleontological mitigation program in accordance with the paleontological monitoring and treatment plan for the project.

Sunrise Powerlink, San Diego Gas and Electric (SDG&E), Counties of San Diego and Imperial, California. As field manager and co-principal investigator, responsible for implementation of the field mitigation program for the project. Additionally, aided in the preparation of the SDG&E Sunrise Powerlink

Paleontological Records Search, Monitoring and Treatment Plan, and co-authored Final Technical Report on paleontological resources for submittal to the BLM.

Paleontological Services On-Call Contract, SDG&E, Counties of San Diego and Imperial, California. As field manager investigator, responsible for oversight of paleontological monitoring being conducted as part of several work orders for SDG&E. Over thirty work orders ongoing or completed under the on-call contract. Also responsible for co-authoring final project reports (both mitigation and assessment).

Ocotillo Express Wind Project, Insignia Environmental, County of Imperial, California. As field manager and co-principal investigator, responsible for obtaining the BLM permit and assisting the Project Manager in preparation of a Paleontological Monitoring and Treatment Plan for the project. Additionally responsible for oversight of paleontological monitoring by another consultant during construction related activities on the project.

SDG&E East County (ECO) Substation Project, Insignia Environmental, County of San Diego, California. As field manager and co-principal investigator, co-authored the paleontological resources mitigation plan which was accepted by the BLM. She was also responsible for supervising the paleontological monitoring on this project located in eastern San Diego County, California.

Tehachapi Renewable Transmission Project (TRTP), Pacific Legacy, Counties of Kern, Los Angeles, and San Bernardino County, California. As project manager and principal investigator, evaluated paleontological resource discoveries during construction for this multiyear SCE project. Excavation activities within the Miocene-age Puente Formation in Los Angeles and San Bernardino counties had the potential to yield scientifically significant fossils during construction on this large-scale project.

CSE Centinela Solar Farm, kp environmental, County of Imperial, California. As field manager and co-principal investigator, responsible for obtaining the BLM permit and assisting in review of the assessment and paleontological monitoring and treatment plan for the project. A series of fossil producing strata were discovered and collected from ~14,000 to 7,000 year old lacustrine sedimentary rocks ancient Lake Cahuilla. Recovered fossils consisted of significant fossil remains of late Pleistocene- to early Holocene-age marine invertebrates.

Simbol Calipatria Plant I Project, Ecology and Environment, County of Imperial, California. As field manager and co-principal investigator, responsible for oversight of field studies conducted on Energy Source LLC's property within the Salton Sea Known Geothermal Resource Area. She also co-authored the paleontological assessment for the project.

Hudson Ranch II Geothermal Project, Ecology and Environment, County of Imperial, California. As field manager and co-principal investigator, responsible for oversight of field studies conducted as part of the paleontological assessment of the project. The paleontological assessment program included completion of a paleontological records search and literature review, completion of a field survey, and preparation of a final report summarizing findings and proposing appropriate mitigation measures to reduce potential adverse impacts to a level below significance. The findings of this paleontological assessment report indicated that the potential adverse impacts to a variety of marine and non-marine sedimentary rocks could be avoided.

Imperial Irrigation District (IID) Imperial to Dixieland 230 kilovolt Transmission Line and Expansion of Dixieland Substation, AECOM, County of Imperial County, California. As field manager and co-

principal investigator, responsible for field studies oversight and preparation of the paleontological assessment report. The paleontological assessment program included completion of a paleontological records search and literature review, completion of a field survey, and preparation of a final report summarizing findings and proposing appropriate mitigation measures to reduce potential adverse impacts to a level below significance. The findings of this paleontological assessment report indicated that the potential adverse impacts to a variety of marine and non-marine sedimentary rocks could be avoided.

SCG Imperial Valley Loop, Insignia Environmental, City of Brawley, California. As field manager, responsible for oversight of monitoring and fossil salvage being conducted on site by another consultant. Mitigation efforts consisted of monitoring during mass grading activities, recovery of fossils discovered, laboratory preparation and curation of fossils, and preparation of the final report. A series of fossil producing strata were discovered and collected from ~14,000 to 7,000 year old lacustrine sedimentary rocks ancient Lake Cahuilla. Recovered fossils consisted of significant fossil remains of late Pleistocene- to early Holocene-age marine invertebrates.

Municipal

Block 4N (North Encanto) Project, City of San Diego, California. As project manager and principal investigator, responsible for archaeological and paleontological monitoring for underground conduit system installation by SDG&E for the City of San Diego in the neighborhood of Encanto. A marine mollusk and vertebrate assemblage was recovered from the San Diego Formation. Ms. Siren served as the primary author of the report. Specimens were prepared and curated according to the City of San Diego and the San Diego Natural History Museum's guidelines for paleontology.

Transportation

Mid-Coast Corridor Transit Project, City of San Diego, California. As project manager and principal investigator, responsible for cultural and paleontological resources construction monitoring during excavation for this San Diego Association of Governments (SANDAG) project.

San Elijo Lagoon Double Track Project, AECOM, City of Encinitas, California. As project manager and principal investigator, responsible for cultural and paleontological resources construction monitoring during excavation on this SANDAG project.

Keller Road and I-215 Interchange Project, Jacobs Engineering and California Department of Transportation (Caltrans), City of Murrieta, California. As project manager and principal investigator for cultural and paleontological resources on this interchange project for the City of Murrieta, conducted the field survey and drafted a report in accordance with the Caltrans Standard Environmental Reference.

California High-Speed Rail Project Construction Package 2–3, Fresno to Bakersfield, Dragados/Flatiron Joint Venture, Fresno to Bakersfield, California. Managed cultural and paleontological resource staff on the Fresno to Bakersfield Section of the project. Responsible for Worker Environmental Awareness Program (WEAP) training and Paleontological Resources Mitigation and Monitoring Plan (PRMMP) consistent with the Final Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) created for the project.

Old Otay Mesa Road Improvement Project, City of San Diego, California. As project manager and principal investigator, responsible for cultural and paleontological resources construction monitoring during excavation on this City of San Diego project.

Mid-City Bus Rapid Transit Project, City of San Diego, California. Co-authored the paleontological evaluation report for the Caltrans District 11. Completed the field survey for the study, and made recommendations for future mitigation monitoring in accordance with the Standard Environmental Reference for Paleontology. Responsible for WEAP training preconstruction and paleontological resources monitoring during excavation by Granite Construction on this SANDAG project.

Paleontological Services On-Call Contract, Caltrans, Counties of San Diego and Imperial, California. As field manager investigator, responsible for oversight of paleontological monitoring being conducted as part of Caltrans road improvement projects along the SR-52, SR-76, SR-78, SR-94, SR-805, SR-905, and I-15 freeways. Numerous concurrent work orders were issued and completed under the on-call contract. Also responsible for co-authoring final project reports (both mitigation and assessment).

SR-210 Mixed Flow Lane Addition from Highland Avenue to San Bernardino Avenue, County of San Bernardino, California. Conducted field survey and co-authored the Paleontological Identification and Evaluation Report for submittal to Caltrans District 8.

I-15/Limonite Avenue Interchange Improvements Project, County of Riverside, California. Conducted field survey and co-authored the Paleontological Identification and Evaluation Report for submittal to the California Department of Transportation (Caltrans) District 8.

SR-76/I-15 Interchange Improvement Project, Caltrans, City of San Diego, California. During grading by Flatiron Construction for the Caltrans District 11 roadway improvements to the SR-76/I-15 interchange, field manager responsible for recovery of a nearly complete skull and postcrania of a long-horned bison (*Bison latifrons*).

Water/Wastewater

North City Pure Water Conveyance Project, City of San Diego, California. Served as project manager and principal investigator on this public works project. Responsible for managing cultural and paleontological resources studies for a new underground pipeline with improvements to existing infrastructure.

Cultural Resources Support for Master Stormwater System Maintenance Program (MSWSMP), County of San Bernardino, California. As project manager and principal investigator for paleontology, responsible for the review and edit of the paleontological resources assessment of approximately 500 flood control facilities within San Bernardino County. The scope of services included providing a mitigation monitoring plan should monitoring and collection of paleontological resources be necessary.

Little Lake Line B Town Drain System Construction Project, Riverside County Flood Control and Water Conservation District, California. Served as project manager and principal investigator on this public works project. Responsible for managing cultural and paleontological resources monitoring for a new underground pipeline.

North Broadway Pipeline, City of Escondido, California. Served as principal investigator and paleontologist on this project. Managed mitigation monitoring project for this water pipeline project traversing Quaternary older alluvial deposits within the City of Escondido.

Los Angeles Department of Power and Water (LADWP) Path 46 Transmission Line Project, Environmental Science Associates (ESA), County of San Bernardino County, California, and Clark

County, Nevada. As project manager and principal investigator, reviewed the final survey report for submittal to the client. Co-authored annual report for submittal to the BLM.

San Vicente Dam Raise Project, San Diego County Water Authority (SDCWA), County of San Diego, California. As field manager and co-principal investigator, Ms. Siren conducted the field survey and co-authored the paleontological resources assessment report.

South Orange County Water Authority (SOCWA) Coastal Treatment Plant, County of Orange, California. As field manager and co-principal investigator, Ms. Siren conducted the field survey and co-authored the paleontological resources assessment report.

Otay Water Treatment Plant, ICF International Inc., County of San Diego, California. As field manager and co-principal investigator, Ms. Siren co-authored the paleontological resources final technical report which was accepted by the Otay Water District. She was also responsible for supervising the paleontological monitoring on this project located in eastern San Diego County, California.

Holly Hills Storm Drain Project, Los Angeles Department of Public Works, Los Angeles County, California. As project manager and paleontologist, responsible for providing on-call paleontological monitoring. The scope of services included providing on-site monitoring and collection of archaeological or paleontological resources found. Evaluated and prepared salvaged fossils in compliance with CEQA guidelines. Wrote quarterly reports on the findings.

Relevant Previous Experience

Paleo Solutions Inc., City of Monrovia, California. Served as project manager/principal investigator of paleontology responsible for managing projects and report preparation for private and public sector projects located throughout California. (2013–2014)

San Diego Natural History Museum, City of San Diego, California. Served as paleontological field manager responsible for managing field operations and preparing reports for the Department of PaleoServices projects in Central and Southern California. (2008–2013)

Natural History Museum of Los Angeles County, City of Los Angeles, California. Served as curatorial assistant responsible for assisting collections manager with curation; is well versed in the latest preparation and casting and molding techniques. (2007–2008)

Saddleback College, City of Mission Viejo, California. Served as associate professor responsible for teaching fossil preparation techniques in addition to leading lecture classes for the Department of Geology. (2004–2008)

Stantec Consulting Inc., City of Irvine, California. Served as project manager/paleontologist responsible for managing field operations for multiple projects throughout Southern California. (2003–2008)

South Dakota School of Mines and Technology, Rapid City, South Dakota.

- Served as research scientist I. Assisted the collections manager/preparatory in several field activities, curation projects, and laboratory preparation. (Summer 2002)
- Served as graduate research assistant. Prepared, identified, mapped, and curated fossils from new bone beds located during the 2000 and 2001 summer field seasons of the Natural Resources Preservation Program (NRPP) Project. (Fall 2001 and Spring 2002; Fall 2000 and Spring 2001)

- Served as fossil resource monitor. Monitored potentially fossiliferous areas in the Badlands National Park for construction crews. (May 2001 and 2002)
- Served as co-principal investigator. Assisted with the NRPP 2001 project in the Badlands National Park by filling administrative duties, mapping using aerial photos and GPS unit, and collecting and preparing fossils for transport to the Museum of Geology in Rapid City, South Dakota. (Summer 2001)
- Served as paleontological supervisor. Interpreted fossil remains for tourists visiting an ongoing excavation site in the Badlands National Park, filled administrative duties, and collected and prepared fossils for transport to the Museum of Geology (Summer 2001).
- Served as research assistant at the Badlands National Park for Museum of Geology Bone Bed Project.. (Summer 2000)
- Served as fossil interpreter/paleontologist at the Pig Dig, Badlands National Park. (Summer 1999 and 2000)
- Served as graduate research assistant at the Museum of Geology/Department of Geology and Geological Engineering. (Fall 1999 and Spring 2001)
- Attended field paleontology course. (2000)

National Museum of Natural History, Smithsonian Institution, Invertebrate Paleobiology Department, Washington, DC. Served as a contract employee. Identified microfossil species for stable isotope analysis and sorted microfossils based on morphology for population studies. (1998–1999)

Disability Services, George Washington University, Washington, DC. Served as a tutor to students in Physical and Historical Geology. (1998–1999)

Field Paleontology in the Bahamas. *Cerion* snail fossil collection and documentation on various islands such as Cat Island and Long Island, for Stephen J. Gould. (1998)

National Science Foundation Research Experience for Undergraduates, Green River, Wyoming. Served as field participant. Prospected and collected fossils for the Natural Science Museum, Michigan. Prepared a report on the results of activities and presented it to her peers. (1997)

Vertebrate Paleontology Laboratory, National Museum of Natural History, Smithsonian Institution, Washington, DC. Served as a volunteer in the department and prepared fossil samples of vertebrates for study. (1997)

Specialized Training

- Geology field course, Lehigh University, 1999.

Publications

Black, S.A., C.L. Herbel, and R.C. Benton. 2001. "Bone Beds in the Lower Scenic Member, Brule Formation (*Oligocene*), Badlands National Park, South Dakota." Abstract. Poster presentation at the Sixty-First Annual Society of Vertebrate Paleontology Meeting, Bozeman, Montana.

Deering, M.R., L.G. Barnes, S.A. Siren, S.A. McLeod, M.O. Walsh, and K.R. Rice. 2007. "A Fossil Ziphiid Whale (*Cetacea*: *Odontoceti*) from the Latest Miocene Capistrano Formation in Southern Orange County, California." Los Angeles, California: Southern California Academy of Sciences.

Deering, M.R., M.L. Kearin, S.A. Black, and L.G. Barnes. 2004. "An Archaic Baleen-Bearing Mysticete Whale Resembling *Eomysticetus* from the Lower Miocene Vaqueros Formation in Southern California." Abstract. Western Association of Vertebrate Paleontologists, Annual Meeting, Occidental College. February 14, 2004.

Deméré, T.A., K.A. Randall, B.O. Riney, and S.A. Siren.[1] 2013. Forthcoming. "Discovery of remains of an extinct giant bison (*Bison latifrons*) in Upper Pleistocene (*Rancholabrean*) fluvial strata in the San Luis Rey River Valley, San Diego County, California, USA." In *Alternative Rocks: The Geology and Natural Resources Above and Below the San Luis Rey River Valley, Northern Dan Diego County, California*, edited by B. Olson. San Diego, California: San Diego Association of Geologists Field Trip Guide.

Herbel, C.L., R.C. Benton, and S.A. Black. 2002. "Bone Bed Surveys: Making Use of the Data." Abstract. Geological Society of America Annual Meeting, Abstracts with Programs 34, no. 6, paper no. 237–5.

Santos, Comer, K. S. Siren, A. Nouri, T. Deméré, and Randall, K. 2010. "Paleontological Sensitivity Map for San Diego County: A Categorical Risk Analysis." ESRI Users Conference, Map Gallery Poster.

Siren, S.A. 2006. "Site Analysis of the Buffalo Alley Bone Bed Located in the Lower Scenic Member of the Brule Formation (*Oligocene*), Badlands National Park, South Dakota." Abstract. Poster presentation at the Sixty-Sixth Annual Society of Vertebrate Paleontology Meeting, Ottawa, Ontario, Canada.

Awards

SDNHM Staff Appreciation Award, 2012.

SDSM&T Award for Outstanding Contributions to Campus Leadership, April 2001 and 2002.

[1] Née S.A. Black.

Michael Williams, PhD

Paleontologist

EDUCATION

Louisiana State University

PhD, Geology and Geophysics, 2009

BS, Zoology, 2002

CERTIFICATIONS

Qualified Paleontologist; Orange, Riverside, and San Diego Counties

BLM California Paleontological Resource Use Permit

PROFESSIONAL AFFILIATIONS

Society of Vertebrate Paleontology

Dr. Michael Williams is a paleontologist and crossed-trained archaeological field technician with more than 14 years' experience with fieldwork, fossil vertebrate specimen processing, and writing of reports for the U.S. Army Corps of Engineers (ACOE). Dr. Williams has project experience in all aspects of paleontological mitigation, including Phase I preconstruction surveys and report preparation and writing paleontological mitigation plans, initial studies (ISs)/mitigated negative declarations, and environmental impact reports (EIRs). He also has experience attending pre-grade meetings; preparing and presenting on-site Worker Environmental Awareness Programs (WEAPs); monitoring for paleontological resources and supervising paleontological monitoring; coordinating spot checks and monitoring with construction superintendents and foremen; collecting and processing sediments for vertebrate microfossils, writing final monitoring reports; and accessioning fossils to the Natural History Museum of Los Angeles County, San Bernardino County Museum and the Cooper Center in Orange County.

Mr. Williams has California Department of Transportation (Caltrans), Bureau of Land Management (BLM) and private company paleontological mitigation experience in San Diego, Imperial, Orange, Los Angeles, Riverside, San Bernardino, Ventura, Kern, Inyo, Fresno, San Francisco, and Alameda counties. In addition, he has worked as a cross-trained archaeological surveyor and monitor on several field projects.

Project Experience

Development

Double D Mine Project, Mitchell Chadwick, Blythe, California. Co-wrote the paleontological resources survey report.

Pacific Palisades Village 1 CAH Acquisitions Co. LLC, Los Angeles, California. Presented the paleontological WEAP, provided senior paleontological support of paleontological monitors, and assisted in writing the final monitoring report.

Vista Del Mar Project, VD Pacific Terrace LLC, Oceanside, California. Co-wrote the Paleontological Resources Impact Mitigation Program and spot-checked project site for paleontological resources.

Interim Ranch-Wide Management Plan, Tejon Ranch Corporation, Kern County, California. Presented the WEAP and provided senior paleontological support to field monitors.

Entitlement Contract, LLJ Orion PacificVista LLC, Vista, California. Drafted the paleontological resources section of the EIR.

Kettner Lofts, CVCM Kettner 106 LLC, San Diego, California. Provided paleontological monitoring.

Solana Highlands Multifamily Development, City of Solana Beach, California. Provided information for Draft EIR.

Education

San Diego State University New Student Housing Expansion, Gatzke, Dillon and Balance, California. Wrote the paleontological resources section of the technical report.

Fullerton College Master Plan Program EIR, North Orange County Community College District, Cypress, California. Conducted paleontological resources survey and wrote the paleontological resources survey report.

Chapman University Packinghouse EIR, Orange County, California. Requested paleontological records search from the Natural History Museum of Los Angeles County and drafted paleontological resources section for the EIR.

Energy

California Flats Solar Project, McCarthy Building Companies Inc., San Luis Obispo County, California. Conducted archaeological and paleontological monitoring, assisted in fossil evaluation, and wrote the final paleontological monitoring report

California Flats High Voltage, First Solar Electric Inc., San Luis Obispo County, California. Conducted archaeological and paleontological monitoring, assisted in fossil evaluation, and wrote the final paleontological monitoring report.

ISEC West Paleontological Services, Tenaska Inc., Imperial County, California. Curated fossil invertebrate fauna, accessioned fossil invertebrates to the Natural History Museum of Los Angeles County, and co-wrote the final paleontological resources final report.

FTHL Habitat Management Lands, Tenaska Inc., Imperial County, California. Curated fossil invertebrate fauna, accessioned fossil invertebrates to the Natural History Museum of Los Angeles County, and co-wrote the final paleontological resources final report.

Healthcare

Specialty Medical Office Building, Kaiser Foundation Health Plan Inc., Irwindale, California. Served as paleontological field lead. Co-wrote the Paleontological Resources Impact Mitigation Program, performed spot-check monitoring, supervision of paleontological monitors, and co-wrote the final paleontological monitoring report.

Biology and Cultural Resource Review for Mapleton Park Centre Site Land Purchase, Kaiser Foundation Health Plan Inc., Murrieta, California. Wrote the final paleontological monitoring report.

Municipal

Machado Lake Pipeline Project, City of Los Angeles, California. Served as paleontological field lead. Monitored and supervised monitoring for archaeological and paleontological resources and co-wrote the final monitoring report.

Van Norman Reservoir Well Drilling Project, City of Los Angeles, California. Served as paleontological field lead. Monitored and supervised monitoring for archaeological and paleontological resources and co-wrote the final monitoring report.

City Truck Line South-Unit 4, City of Los Angeles, California. Served as paleontological field lead. Monitored and supervised monitoring for paleontological resources.

Dairy Fork Wetlands, City of Aliso Viejo, California. Conducted archaeological resources monitoring.

As-Needed Environmental Services, City of San Diego, California. Conducted paleontological monitoring and wrote the final paleontological monitoring report.

San Diego Association of Governments (SANDAG) Continuing Services Agreement, AECOM Technical Services, California. Assisted with review of monitoring field logs.

As-Needed Environmental Services, Department of General Services, Southern California. Co-wrote the paleontological resources final monitoring report.

Public Utilities Department As-Needed Environmental Services, City of San Diego, California. Edited the paleontological resources table for the EIR/Environmental Impact Statement (EIS).

SANDAG General On-Call Environmental Compliance, California. Co-wrote the final paleontological resources monitoring report.

Resource Management

As-Needed Projects, Habitat Restoration Sciences Inc., San Diego County, California. Provided archaeological monitoring.

San Jacinto Wildlife Area EIR, California Wildlife Foundation, Riverside County, California. Reviewed the paleontological resources section of the EIR.

Transportation

Construction Management Services for the Mid-Coast Corridor Projects, PGH Wong Engineering Inc., San Diego, California. Conducted archaeological and paleontological resources monitoring.

Gilman Drive Bridge Environmental Compliance, PGH Wong Engineering Inc., San Diego, California. Provided paleontological resources monitoring, assisted with managing paleontological resources monitors, and evaluated fossil discoveries

Confidential Transportation Project, San Pedro, California. Reviewed project geology, wrote a paleontological records search summary, and assisted in drafting mitigation measures.

Water/Wastewater

Interlake Tunnel and Spillway Modification Project, Horizon Water and Environment LLC, San Luis Obispo County, California. Conducted the paleontological resources survey, assisted in the archaeological resources survey and drafted the paleontological resources section of the EIR.

Sewer Master Plan, Rincon del Diablo Municipal Water District, Escondido, California. Drafted paleontological resources section of EIR.

Palm Springs Wastewater Treatment Plant Expansion, W.M. Lyles Co. Southern District, California. Conducted paleontological resources monitoring.

Zone E Recycled Water System Expansion Archaeological and Native American Monitoring, Santa Margarita Water District, Orange County, California. Co-managed the project and provided

archaeological monitoring.

Capital Project Funding and Environmental Clearance Assistance, San Elijo Joint Powers Authority, San Diego County, California. Co-wrote the geological context section.

Relevant Previous Experience

Development

Palatino Little Italy Apartments Project, Kirkham Road and McMillin, San Diego, California. Served as principal paleontologist and provided oversight for paleontological monitoring.

South Pointe West Project, JCCL-South Pointe West LLC, Diamond Bar, California. Served as principal paleontologist and paleontological monitor. Managed monitoring of excavations for paleontological resources, stabilized and prepared fossils, and processed sediments for vertebrate microfossils.

Sixth and Virgil (Next on Sixth) Streets Multifamily Residential Development Projects, Century West Partners, Los Angeles, California. Served as principal paleontologist. Coordinated and conducted paleontological monitoring and collected, stabilized, and prepared fossil fishes.

Northwest Village Creek Phase 2 Project, Jacobs Center for Neighborhood Innovation, San Diego, California. Served as principal paleontologist. Provided senior paleontological oversight for paleontological monitoring.

Treasure Island and Yerba Buena Island Major Phase 1, City and County of San Francisco, California. Served as principal paleontologist. Wrote the paleontological resources mitigation monitoring and reporting program.

Altair Development Project, Ambient Communities, Temecula, California. Served as principal paleontologist and wrote the paleontological resources section of the EIR.

Berendo and New Hampshire Streets Multifamily Residential Development Projects, Fifield Companies, Los Angeles, California. Served as principal paleontologist. Supervised paleontological monitoring, collected and processed sediment samples for microvertebrates, and accessioned fossils into the Natural History Museum of Los Angeles County.

San Juan Capistrano Medical Office, Edward Almanza and Associates, San Juan Capistrano, California. Served as principal paleontologist and supervised paleontological monitoring.

Lifetime Fitness Construction Project, Lifetime Fitness Inc., Laguna Niguel, California. Served as principal paleontologist. Monitored excavations for paleontological resources; accessioned fossils into the Cooper Center at California State University, Fullerton; and wrote the final monitoring report.

Orange County Great Park Paleontological Monitoring, City of Irvine, California. Served as staff paleontologist. Developed and presented the WEAP. Monitored construction activities for former underground storage tank 240b and pond excavations for paleontological resources, accessioned fossils into the Natural History Museum of Los Angeles County, and wrote the final monitoring reports.

Anaheim Henning View Terrace Home Construction Project, KTK Construction Inc., Anaheim Hills, California. Served as principal paleontologist. Supervised paleontological monitoring and co-wrote the final monitoring report.

College Park Home Construction Project, Lennar Corporation, Chino, California. Served as principal paleontologist and supervised paleontological monitoring.

Whisler Ridge Home Construction Project, KB Homes, Lake Forest, California. Served as principal paleontologist. Surveyed construction site for paleontological resources. Monitored and supervised monitoring of grading activities.

Cahuilla Gold Project, Consolidated Goldfields Corporation, Imperial County, California. Served as staff paleontologist and participated in survey for paleontological resources.

Education

Rancho Campana High School, Oxnard Union High School District, Camarillo, California. Served as principal paleontologist. Supervised paleontological monitoring, collected and processed sediments for microfossils, and contributed to the final monitoring report.

Browning High School, Long Beach Unified School District, Signal Hill, California. Served as principal paleontologist. Spot-checked paleontological monitoring; collected and processed sediments for microfossils; accessioned fossils to the Natural History Museum of Los Angeles County, Invertebrate Paleontology Division; and contributed to the final monitoring report.

Long Beach Unified School District Project, Long Beach, California. Conducted an inventory of paleontological resources within the Long Beach Unified School District for use in the formulation of preservation guidelines and during future development and redevelopment of multiple school sites.

Energy

Scattergood Transmission Line Project, Los Angeles Department of Water and Power (LADWP), Los Angeles County, California. Served as paleontological and archaeological monitor. Monitored excavations for paleontological and archaeological resources.

Path 46 Clearances Project, LADWP, San Bernardino County, California. Served as principal paleontologist and archaeological surveyor. Surveyed for paleontological and archaeological resources and wrote the paleontological resources assessment.

Haskell Canyon Substation, LADWP, Santa Clarita, California. Served as principal paleontologist. Monitored excavations for paleontological resources and reviewed the final paleontological monitoring report.

Glenarm Power Plant Project, City of Pasadena, California. Served as paleontological and archaeological monitor. Coordinated and monitored excavations for paleontological and archaeological resources.

Marsh Landing Generating Station, California Energy Commission (CEC), Contra Costa County, California. Served as staff paleontologist. Assisted in managing daily monitoring activities, writing monthly reports, and writing the final report.

Plains Exploration and Production Company Project, Kern County, California. Served as staff paleontologist. Surveyed for paleontological resources and co-wrote the paleontological resource assessments.

Rio Mesa Solar Project, BrightSource Energy Inc., Blythe, California. Served as staff paleontologist. Participated in paleontological survey on both BLM and private lands. Assisted with writing the paleontological resources section for the Application for Certification and final report.

Sonoran West Solar Project, BrightSource Energy Inc., Blythe, California. Served as staff paleontologist. Participated in paleontological survey on both BLM and private lands. Assisted with writing the final report.

Proposed Oasis Date Gardens Development, Golden Sands Properties, Thermal, California. Served as principal paleontologist. Conducted paleontological survey and wrote paleontological resources assessment.

Proposed Cascade Solar Project, Cascade Solar LLC/Axio Power Holdings LLC, San Bernardino County, California. Served as principal paleontologist. Conducted paleontological survey and co-wrote the paleontological resources assessment.

Pio Pico Energy Center, CEC, Otay Mesa, California. Served as staff paleontologist and participated in survey for paleontological resources.

Calico Solar Project, San Bernardino County, California. Served as staff paleontologist and participated in survey for paleontological resources.

Military

Legislative EIS for Renewal of the Chocolate Mountain Aerial Gunnery Range Land Withdrawal, U.S. Department of the Navy (DON), California. Served as staff paleontologist. Contributed to paleontological resource sections of Legislative EIS for extension of the DON aerial munitions gunnery range and test ground.

Sites TVOR SE and TVOR S Paleofaunal and Paleoenvironmental Research, ACOE/Prewitt and Associates Inc., Fort Polk, Louisiana. Served as paleontological technician. Participated in field and laboratory work, research, and writing of final report.

Site TVOR SE Paleofaunal and Paleoenvironmental Research, ACOE/Prewitt and Associates Inc., Fort Polk, Louisiana. Served as paleontological technician. Participated in field and laboratory work, research, and writing of report.

Municipal

Proboscidean Recovery Effort, LADWP, Lone Pine, California. Served as principal paleontologist. Organized and led the field crew in the recovery of a proboscidean tusk found in a borrow pit at the Lone Pine Landfill and wrote the final report.

Calabasas Landfill Project, County of Los Angeles, California. Served as principal paleontologist and wrote the paleontological resources technical report.

Mountain View Acres Drainage Improvement Project, San Bernardino Associated Governments (SANBAG), Victorville, California. Served as principal paleontologist and paleontological monitor. Monitored excavations for paleontological resources and wrote the final monitoring report.

Transportation

Mid Coast Rail Project, PGH Wong Engineering, San Diego, California. Served as archaeological and paleontological monitor and supervisor during extension of the trolley service to University City. Daily activities included working closely with biologists, Native American monitors, and construction personnel to complete the project in compliance with all mitigation measures and state and federal regulations. In addition, salvaged, collected associated data, and curated fossils discovered during construction.

Livermore Extension Project, Bay Area Rapid Transit, Alameda County, California. Served as principal paleontologist. Contributed to the paleontological resources section of the EIR.

Merced to Fresno Project, California High Speed Rail Authority (CHSRA), Fresno County, California. Served as principal paleontologist. Administered the WEAP and monitored for paleontological resources.

SR-91 Corridor Improvement Project, Riverside County Transportation Commission/Caltrans, Corona, California. Served as paleontological monitor. Monitored geotechnical drilling for paleontological resources, collected and processed sediment samples for microvertebrates, and assisted in the recovery of a fossil bison.

I-15/I-215 Interchange Improvement Project, Caltrans, Devore, California. Served as paleontological monitor and monitored excavations for paleontological resources.

Palmdale to Los Angeles Union Station Project, CHSRA, Los Angeles County, California. Served as staff paleontologist. Participated in survey for paleontological resources and writing of EIR/EIS and technical report.

I-10/Cherry Avenue Interchange Improvement Project, SANBAG/Caltrans, Fontana, California. Served as principal paleontologist. Supervised paleontological monitoring, processed sediment samples, and participated in writing the final monitoring report.

I-10/Citrus Avenue Interchange Improvement Project, SANBAG/Caltrans, Fontana, California. Served as principal paleontologist and supervised the paleontological monitor. Collected and processed sediment samples for vertebrate microfossils, and co-wrote the final paleontological mitigation report.

I-215 Murrieta Hot Springs Road to Scott Road, Caltrans, Murrieta, California. Served as staff paleontologist. Participated in survey for paleontological resources, monitored excavations for paleontological resources, and wrote the final monitoring report.

I-215 Scott Road to Nuevo Road, Caltrans, Riverside County, California. Served as staff paleontologist and wrote the paleontological mitigation plan.

I-215 Newport Overcrossing Bridge Reconstruction Project, Caltrans, Grand Terrace, California. Served as principal paleontologist. Conducted paleontological survey and wrote combined Paleontological Identification Report (PIR)/Paleontological Evaluation Report (PER).

I-405 from SR-73 to I-605 Improvement Project PIR/PER, Parsons/Caltrans, Orange County, California. Served as staff paleontologist and participated in survey for paleontological resources.

Water/Wastewater

Eastern Recycled Water System Project, Escondido, California. Served as archaeological surveyor and participated in a survey for archaeological resources.

Peters Canyon Water Capture and Reuse Project, Irvine Ranch Water District, Irvine and Tustin, California. Served as principal paleontologist. Coordinated and conducted paleontological monitoring, and collected and processed sediments for microfossil recovery.

Cadiz Valley Water Conservation Recovery and Storage Project, Cadiz Inc./Santa Margarita Water District, Cadiz, California. Served as principal paleontologist. Conducted paleontological monitoring and wrote the paleontological mitigation and monitoring plan.

Hauled Water Project, County of Los Angeles, California. Served as principal paleontologist and geologist. Wrote the geology and soils IS, the technical report, and the paleontological section of the EIR.

Enhanced Watershed Management Programmatic EIR, County of Los Angeles, California. Served as principal paleontologist. Wrote the paleontological section of the programmatic EIR.

Publications

Bonett, R.M., A.L. Trujano-Alvarez, M.J. Williams, and E.K. Timpe. 2013. "Biogeography and Body Size Shuffling of Aquatic Salamander Communities on a Shifting Refuge." *Proceedings of the Royal Society*. B: 1–8.

Stewart, J. D., M. Williams, M. Hakel, and S. Musick. 2012. "Was it Washed In? New Evidence for the Genesis of Pleistocene Fossil Vertebrate Remains in the Mojave Desert of Southern California." *2012 Desert Symposium Field Guide and Proceedings*: 140–143.

Williams, M.J. 2009. "Miocene Herpetofaunas from the Central Gulf Coast, USA: Their Paleoecology, Biogeography, and Biostratigraphy." http://etd.lsu.edu/docs/available/etd-11132009 034120/.

Williams, M.J. 2009. "Neogene Herpetofaunas from Louisiana, USA and their Biogeographical and Paleoenvironmental Significance." *Bulletin, Southern California Academy of Sciences*. 108, 89–136, Abstract No. 97.

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

Schiebout, J.A. S. Ting, J. L. Hill, M. D. Hagge, M. J. Williams, and G. S. Boardman. 2006. "Quarrying in the Pascagoula Formation: First Miocene (Hemphillian) Fauna of Terrestrial Mammals from the Central Gulf Coast East of the Mississippi." *Journal of Vertebrate Paleontology, Abstracts of Papers*. 26, supplement to No. 3.

Williams, M.J. 2005. "A New Late Miocene (Late Barstovian) Herpetofauna from Fort Polk, Louisiana." *Journal of Vertebrate Paleontology, Abstracts of Papers*. 25, supplement to No. 3

Schiebout, J. A., S. Ting, Williams, M.J., Boardman, G., Wulf Gose, Wilhite, D. R., White, P.D., and Kilbourne, B. 2004. "Paleofaunal and Environmental Research on Miocene Fossil Sites TVOR SE and TVOR S on Fort Polk, Louisiana, With Continued Survey, Collection, Processing, and Documentation of other Miocene Localities." ACOE, Fort Worth District. Open-File Report.

Williams, M.J. and Schiebout, J.A., 2003. "Miocene Lower Vertebrates from Fort Polk, Louisiana: A Preliminary Report:" *Transactions, Gulf Coast Association of Geological Societies and Gulf Coast Section of SEPM*. 53, 856–863.

Williams, M.J., Boardman, G., Schiebout, J.A., Kilbourne, B., Nguyen, H., 2003. "Miocene of Fort Polk, Western Louisiana." *Journal of Vertebrate Paleontology, Abstracts of Papers*. 23. Supplement to No. 3.

Conference Presentations

"Miocene Amphibians and Reptiles from Fort Polk, Louisiana: Evaluating their Usefulness in Paleoenvironmental Reconstruction and Biostratigraphy." 2011. Presented at Geological Society of America South Central Section 45th Annual Meeting. New Orleans, Louisiana.

APPENDIX E

General Grading Guidelines for Paleontological Resources

LAND DEVELOPMENT MANUAL
APPENDIX P

GENERAL GRADING GUIDELINES FOR PALEONTOLOGICAL RESOURCES

Paleontological resources (i.e., fossils) are the buried remains and/or traces of prehistoric organisms (i.e., animals, plants, and microbes). Body fossils such as bonesor teeth, shells, leaves, and wood, as well as trace fossils such as tracks, trails, burrows, and footprints, are found in the geologic deposits (formations) within which they were originally buried. Fossil remains are considered important if they are: 1) well preserved; 2) taxonomically identifiable; 3) type/topotypic specimens; 4) age diagnostic; 5) useful in environmental reconstruction; or 6) represent new, rare, and/or endemic taxa.

Fossils are typically found buried in geologic deposits of sedimentary rock layers. They are exposed by natural weathering as well as by manmade earthmoving operations. Paleontological resources may be encountered during grading/excavation activities associated with project construction (e.g., residential subdivision projects, new roadway projects, urban redevelopment projects, or utility installation/improvement projects) where such work would be performed in previously undisturbed geologic deposits/formations/rock units (i.e., not in artificial fill materials).

The mapping of geologic deposits/formations/rock units can be located in the published geologic maps by Kennedy and Tan, 2008 all areas of the City of San Diego except Otay Mesa; and Todd, 2004 for the Otay Mesa area. The maps use colors to indicate the geographic distribution of individual geologic deposits/formations/rock units, with a map legend for reference of the geologic deposits/formations/rock units that are present in the project area. The geologic maps are available through the California Geological Survey and United State Geological Survey. Online digital versions of 1:100,000 scale maps are available at the following websites: https://ngmdb.usgs.gov/mapview/; http://www.conservation.ca.gov/cgs/rghm/rgm/Pages/preliminary_geologic_maps.aspx; and https://pubs.usgs.gov/of/2004/1361/.

These General Grading Guidelines for Paleontological Resources do not replace the Significance Determination Thresholds set forth in Land Development Manual Appendix A for Paleontological Resources.

The following is the standard monitoring requirement that shall be placed on grading plans and implemented when required pursuant to LDC section 142.0151:

I. Prior to Permit Issuance

Entitlements Plan Check

Prior to issuance of any construction permits, including but not limited to, the first Grading Permit, Demolition Plans/Permits and Building Plans/Permits or a Notice to Proceed for Subdivisions, but prior to the first preconstruction meeting, whichever is applicable, the City Engineer (CE) and/or Building Inspector (BI) shall verify that the requirements for Paleontological Monitoring have been noted on the appropriate construction documents.

1. The applicant shall submit a letter of verification to Resident Engineer (RE) and/or Building Inspector (BI) identifying the qualified Principal Investigator (PI) for the project and the names of all persons involved in the paleontological monitoring program. A qualified PI is defined as a person with a Ph.D. or M.S. or equivalent in paleontology or closely related field (e.g., sedimentary or stratigraphic geology, evolutionary biology, etc.) with demonstrated knowledge of southern California paleontology and geology, and documented experience in professional paleontological procedures and techniques.

2. **II. Prior to Start of Construction**

A. Verification of Records Search

1. The PI shall provide verification to RE and/or BI that a site specific records search has been completed. Verification includes, but is not limited to a copy of a confirmation letter from the San Diego Natural History Museum, or another relevant institution that maintains paleontological collections recovered from sites within the City of San Diego.

2. The letter shall introduce any pertinent information concerning expectations and probabilities of discovery during trenching and/or grading activities.

B. PI Shall Attend Preconstruction Meetings

1. Prior to beginning any work that requires monitoring, the Applicant shall arrange a Preconstruction Meeting that shall include the PI, Construction Manager (CM) and/or Grading Contractor, RE, and BI, as appropriate. The qualified paleontologist (PI) shall attend any grading/excavation related Preconstruction Meetings to make comments and/or suggestions concerning the Paleontological Monitoring program with the Construction Manager and/or Grading Contractor.

a. If the PI is unable to attend the Preconstruction Meeting, the Applicant shall schedule a focused Preconstruction Meeting with the PI, RE, CM or BI, if appropriate, prior to the start of any work that requires monitoring.

2. Identify Areas to be Monitored

   Prior to the start of any work that requires monitoring, the PI shall submit a Paleontological Monitoring Exhibit (PME) based on the appropriate construction documents (reduced to 11x17) to RE and/or BI identifying the areas to be monitored including the delineation of grading/excavation limits. The PME shall be based on the results of a site specific records search as well as information regarding existing known geologic conditions (e.g., geologic deposits as listed in the Paleontological Monitoring Determination Matrix below).

3. When Monitoring Will Occur
   a. Prior to the start of any work, the PI shall also submit a construction schedule to the RE and/or BI indicating when and where monitoring will occur.

   b. The PI may submit a detailed letter to RE and/or BI prior to the start of work or during construction requesting a modification to the monitoring program. This request shall be based on relevant information such as review of final construction documents and geotechnical reports which indicate conditions such as depth of excavation and/or thickness of artificial fill overlying bedrock, presence or absence of fossils , etc., which may reduce or increase the potential for resources to be present.

III. During Construction

A. Monitor Shall be Present During Grading/Excavation/Trenching

1. The paleontological monitor shall be present full-time during grading/excavation/trenching activities as identified on the PME that could result in impacts to formations with high and moderate resource sensitivity. **The Construction Manager is responsible for notifying the PI, RE and/or BI of changes to any construction activities such as in the case of a potential safety concern within the area being monitored. In certain circumstances OSHA safety requirements may necessitate modification of the PME.**

2. The PI may submit a detailed letter to RE and/or BI during construction requesting a modification to the monitoring program when a field condition such as trenching activities that do not encounter previously undisturbed and paleontologically sensitive geologic deposits as previously assumed, and/or when unique/unusual fossils are encountered, which may reduce or increase the potential for paleontological resources to be present.

3. The paleontological monitor shall document field activity via the Consultant Site Visit Record (CSVR). The CSVR's shall be emailed by the CM to the RE and/or BI the first day of monitoring, the last day of monitoring, monthly (**Notification of Monitoring Completion)**, and in the case of ANY discoveries.

B. Discovery Notification Process

1. In the event of a discovery, the paleontological monitor shall direct the contractor to temporarily divert trenching activities in the area of discovery and notify the RE and/or BI. The contractor shall also process a construction change for administrative purposes to formalize the documentation and recovery program, including modification to Mitigation Monitoring and Compliance (MMC).

2. The paleontological monitor shall notify the PI (unless paleontological monitor is the PI) of the discovery.

3. The PI shall notify MMC of the discovery, and shall submit documentation to MMC within 24 hours by email with photos of the resource in context.

C. Recovery of Fossils

If a paleontological resource is encountered:

1. The paleontological monitor shall salvage unearthed fossil remains, including simple excavation of exposed specimens or, if necessary as determined by the PI, plaster-jacketing of large and/or fragile specimens or more elaborate quarry excavations of richly fossiliferous deposits.

2. The paleontological monitor shall record stratigraphic and geologic data to provide a context for the recovered fossil remains, including a detailed description of all paleontological localities within the project site, as well as the lithology of fossil-bearing strata within the measured stratigraphic section, and photographic documentation of the geologic setting.

V. Post Construction

A. Preparation and Submittal of Draft Paleontological Monitoring Report

1. The PI shall submit two copies of the Draft Paleontological Monitoring Report (even if negative), prepared to the satisfaction of the Development Services Department. The Draft Paleontological Monitoring Report shall describe the methods, results, and conclusions of all phases of the Paleontological Monitoring Program (with appropriate graphics) to MMC for review and approval within 90 days following the completion of monitoring,

a. For significant or potentially significant paleontological resources encountered during monitoring, as identified by the PI, the Paleontological Recovery Program shall be included in the Draft Monitoring Report.

b. The PI shall be responsible for recording (on the appropriate forms) any significant or potentially significant fossil resources encountered during the Paleontological Monitoring Program in accordance with the City's Paleontological Guidelines (revised November 2017), and submittal of such forms to the San Diego Natural History Museum and MMC with the Draft Paleontological Monitoring Report.

2. MMC shall return the Draft Paleontological Monitoring Report to the PI for revision or, for preparation of the Final Report.

3. The PI shall submit revised Draft Paleontological Monitoring Report to MMC for approval.

4. MMC shall provide written verification to the PI of the approved Draft Paleontological Monitoring Report.

5. MMC shall notify the RE and/or BI, of receipt of all Draft Paleontological Monitoring Report submittals and approvals.

B. Handling of Recovered Fossils

1. The PI shall ensure that all fossils collected are cleaned to the point of curation (e.g., removal of extraneous sediment, repair of broken specimens, and consolidation of fragile/brittle specimens) and catalogued as part of the Paleontological Monitoring Program.

2. The PI shall ensure that all fossils are analyzed to identify stratigraphic provenance, geochronology, and taphonomic context of the source geologic deposit; that faunal material is taxonomically identified; and that curation has been completed, as appropriate.

C. Curation of Fossil Remains: Deed of Gift and Acceptance Verification

1. The PI shall be responsible for ensuring that all fossils associated with the paleontological monitoring program for this project are permanently curated with an accredited institution that maintains paleontological collections (such as the San Diego Natural History Museum).

2. The PI shall include an acceptance verification from the curation institution in the Final Paleontological Monitoring Report submitted to the RE and/or BI, and MMC.

D. Final Paleontological Monitoring Report(s)

1. The PI shall submit two copies of the Final Paleontological Monitoring Report to MMC (even if negative), within 90 days after notification from MMC that the Final Paleontological Monitoring Report has been approved.

2. The RE and/or BI shall, in no case, issue the Notice of Completion until receiving a copy of the approved Final Paleontological Monitoring Report from MMC, which includes the Acceptance Verification from the curation institution.

Paleontological Monitoring Determination Matrix

Geological Deposit/Formation/Rock Unit	Potential Fossil Localities	Sensitivity Rating
Alluvium (Qsw, Qal, or Qls)	All communities where this unit occurs	Low
Ardath Shale (Ta)	All communities where this unit occurs	High
Bay Point/Marine Terrace (Qbp) [1]	All communities where unit occurs	High
Cabrillo Formation (Kcs)	All communities where unit occurs	Moderate
Delmar Formation (Td)	All communities where unit occurs	High
Friars Formation (Tf)	All communities where unit occurs	High
Granite/Plutonic (Kg)	All communities where unit occurs	Zero
Lindavista Formation (Qln, Qlb) [2]	A. Mira Mesa/Tierrasanta B. All other areas	A. High B. Moderate
Lusardi Formation (Kl)	Black Mountain Ranch/Lusardi Canyon Poway/Rancho Santa Fe B. All other areas	A. High B. Moderate
Mission Valley Formation (Tmv)	All communities where unit occurs	High
Mt. Soledad Formation (Tm, Tmss, Tmsc)	A. Rose Canyon B. All other areas where this unit occurs	A. High B. Moderate
Otay Formation (To)	All communities where unit occurs	High
Point Loma Formation (Kp)	All communities where unit occurs	High
Pomerado Conglomerate (Tp)	A. Scripps Ranch/Tierrasanta B. All other areas	High
River /Stream Terrace Deposits (Qt)	A. South Eastern/Chollas Valley/Fairbanks Ranch/Skyline/Paradise Hills/Otay Mesa, Nestor/San Ysidro B. All other areas	A. Moderate B. Low
San Diego Formation (Qsd)	All communities where this unit occurs.	High
Santiago Peak Volcanics (Jsp) A. Metasedimentary B. Metavolcanic	A. Black Mountain Ranch/La Jolla Valley, Fairbanks Ranch/Mira Mesa/Peñasquitos B. All other areas	A. Moderate B. Zero
Scripps Formation (Tsd)	All communities where this unit occurs	High
Stadium Conglomerate (Tst)	All communities where this unit occurs	High
Sweetwater Formation	All communities where this unit occurs	High
Torrey Sandstone (Tf)	A. Black Mountain Ranch/Carmel Valley B. All other areas	A. High B. Low