APPENDIX H

Paleontological Resource Assessment

PALEONTOLOGICAL RESOURCE ASSESSMENT
SOCWA COASTAL TREATMENT PLANT
ORANGE COUNTY, CALIFORNIA

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TECHNICAL REPORT
PALEONTOLOGICAL RESOURCE ASSESSMENT
SOCWA COASTAL TREATMENT PLANT
ORANGE COUNTY, CALIFORNIA

INTRODUCTION

Project Description

The South Orange County Wastewater Authority (SOCWA) Coastal Treatment Plant is located in the Aliso and Wood Canyons Wilderness Park in Orange County, California. Sludge from the plant is transported to the Regional Treatment Plant for treatment through cavity pumps and dual 4-inch ductile iron pipelines. SOCWA plans to replace the dual 4-inch export sludge force main with a new single 6-inch force main. The alignment extends along Aliso Creek to the west of California State Route (SR) 73, to the south of SR-133, and to the north of Niguel Hill (Figure 1).

The proposed project alignment is known as Force Main 1 (FM-1). This alignment is located on the east side of Aliso Creek along an existing dirt access road for the existing Moulton Niguel Water District 18-inch sewer line (Figure 2). The alignment extends approximately 16,600 feet along the dirt road that follows the Moulton Niguel easement, which would allow easy access for construction operations.

The alternative route (Force Main 2 [FM-2]) is located on the west side of Aliso Creek and would implement the previously permitted and planned alignment (Figure 2). The alignment includes construction of a new road, and it extends approximately 15,500 feet from the Coastal Plant, across Aliso Creek via an existing access bridge, and north along a similar course to an existing paved plant access road. This alignment veers from the existing road in two locations in order to relocate a new roadway and pipeline away from the creek. The pipeline would continue to the cul de sac in AVCA Road, where it would connect to an existing segment of 6-inch ductile iron pipeline. A new segment of pipeline would be installed along AWMA Road and Alicia Parkway to connect the new pipeline to the existing sludge export pipeline, which continues to the Regional Plant.

Figure 1. Location map of southern Orange County, including the SOCWA project alignment (FM-1) and alternative (FM-2).

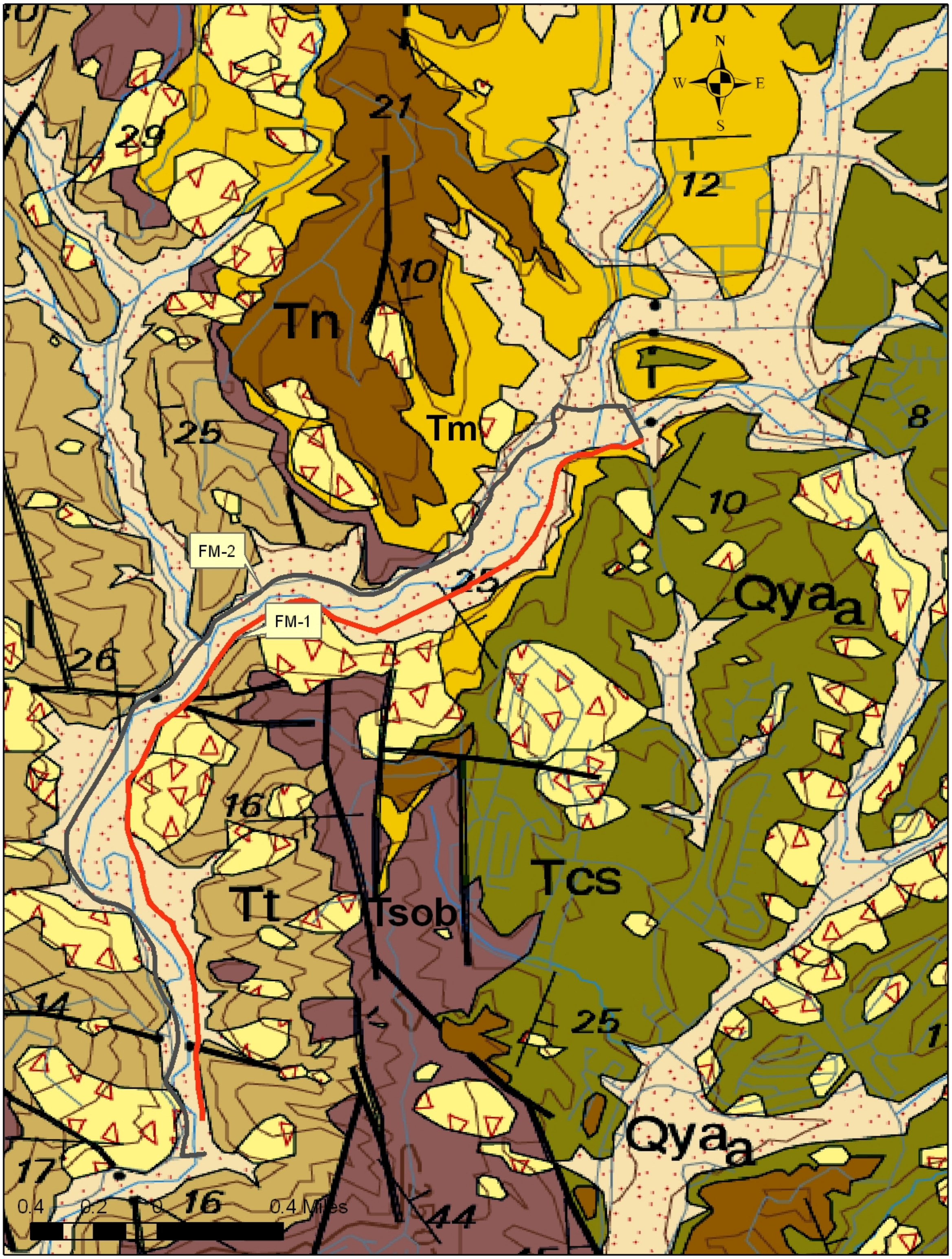

Figure 2. Project alignment (FM-1) and alternative (FM-2) with regional geology (Qya = younger alluvium, Tn = Niguel Formation, Tcs = Capistrano Formation, Tm = Monterey Formation, Tsob = San Onofre Breccia, and Tt = Topanga Formation). Base map: Morton, 2004.

Paleontological Resources

The purpose of this Paleontological Resource Assessment Report is to assist SOCWA in planning and design efforts for the proposed project as related to paleontological resource issues. Specifically, this report is intended to summarize existing paleontological resource data in the Area of Potential Effect (APE) and vicinity, assess potential impacts to paleontological resources from project-related activities, and to determine the need for additional impact mitigation. Additional discussion of report methodology is provided below. This report was prepared by Eric G. Ekdale, Sarah A. Siren, and Thomas A. Deméré of the Department of PaleoServices at the San Diego Natural History Museum (SDNHM), San Diego, California under contract to Dudek.

As defined here, paleontological resources (i.e., fossils) are the remains and/or traces of prehistoric plant and animal life. Although typically it is assumed that fossils must be older than approximately 10,000 years (i.e., the generally accepted end of the last glacial interval of the Pleistocene Epoch), organic remains of early Holocene age can also be considered to represent fossils because they are part of the record of past life. Fossil remains such as bones, teeth, shells, leaves, wood, burrows, and trackways are found in the geologic deposits (rock formations) within which they were originally buried. For the purposes of this report, paleontological resources can be thought of as including not only the actual fossil remains but also the collecting localities and the geologic formations containing those localities.

Methodology

A review was conducted of relevant published and unpublished geologic and paleontologic reports (e.g., White, 1956; Deméré and Walsh, 1993; Audell and Baghoonian, 1995; Morton, 2004; Deméré and Berta, 2005; Firestine, 2008) and museum paleontological site records (Natural History Museum of Los Angeles County, Los Angeles, California). In addition, a field survey was conducted by Eric G. Ekdale and Sarah A. Siren of the San Diego Natural History Museum in order to verify the previously mapped geology. This approach was followed in recognition of the direct relationship between paleontological resources and the geologic formations within which they are entombed. Knowing the geology of a particular area and the fossil productivity of individual formations that occur in that area, it is possible to predict where fossils will, or will not, be encountered.

EXISTING CONDITIONS

Physical Geological Setting

The APE approaches within one half mile of six sedimentary rock units, including from oldest to youngest the Topanga Formation (Middle Miocene), San Onofre Breccia (Middle Miocene), Monterey Formation (Middle to Upper Miocene), siltstone facies of the Capistrano Formation (Upper Miocene to Lower Pliocene), Niguel Formation (Pliocene), and later Quaternary alluvial deposits (Upper Pleistocene to Holocene). Fossils have been recovered from strata in each of these rock units.

The following section provides a brief overview of the nature and paleontological sensitivity of each of these rock units (ordered chronologically from oldest to youngest). A subsequent section will summarize the known paleontological resources recovered from the rock units exposed within the APE.

Stratigraphic Rock Units

<u>Topanga Formation</u>

Introduction – The Topanga Formation consists of marine sandstone, siltstone, and shale units that were deposited during the middle Miocene (Morton, 2004). The formation is divided into three members, which include the lower Bommer Member, the middle Los Trancos Member, and the upper Paulerino Member. In the northern portion of the Santa Ana Mountains in Riverside County, the Topanga Formation overlies the undifferentiated Sespe and Vaqueros formations by a slight erosional unconformity, and underlies the lower member of the Monterey Formation (Whistler and Lander, 2003).

Paleontology – Marine benthic foraminiferans (minute protozoans) have been recovered from the Topanga Formation that, when coupled with the presence of the marine snail *Turritella temblorensis*, allows assignment of the formation to the Middle Miocene. In addition to foraminiferan microfossils, strata of the Topanga Formation have yielded significant plant, marine invertebrate, and marine vertebrate macrofossils (Whistler and Lander, 2003; Morton, 2004), including sea birds (Howard and Barnes, 1987), pinnipeds, sea cows, and cetaceans (Stinson et al., 2005).

Regional Distribution – Undifferentiated deposits of the Topanga Formation crop out in southern Orange County extending from the southern region of the City of Laguna Beach to the Shady Canyon Fault northeast of the City of Laguna Beach. Differentiated deposits of the formation are exposed north of the City of Laguna Beach to south of Newport Bay. The southern three quarters of the differentiated exposure consists of the lower Bommer Member of the Topanga Formation, which crops out in the San Joaquin Hills. North of the Bommer Member outcrops are patches of the Los Trancos Member. Small areas of the Paulerino Member crop out north of the Los Trancos Member exposures.

Distribution within the APE – Undifferentiated deposits of the Topanga Formation occur within the APE on both sides of Aliso Creek for the entire length of the project alignment. Outcrops of the Topanga Formation were encountered during the field survey adjacent to the paved road along the west side of Aliso Creek. Exposures of this rock unit were also observed on the east side of the creek, but were separated from the dirt access road by vegetation. Numerous landslide deposits occur within outcrops of the Topanga Formation along the sides of the creek valley as well.

Resource Sensitivity – The Topanga Formation has yielded scientifically significant collections of invertebrate, vertebrate, and plant fossils, and it is assigned a high paleontological resource sensitivity in this report.

<u>San Onofre Breccia</u>

Introduction – The San Onofre Breccia consists of alluvial fan and nearshore marine deposits from the Middle Miocene (14 to 16 million years old). Lithologies that are encountered in the formation include gray to red-brown, poorly sorted, and cross-bedded to tuffaceous sandstones, sandy mudstones, and poorly sorted, pebble to boulder breccias, which are conglomerates with angular clasts (Morton and Miller, 2006). Typical outcrops of the San Onofre Breccia are well-cemented and form steep slopes (Deméré and Walsh, 1993).

Paleontology – Poorly preserved fossil remains of nearshore foraminiferans and bivalve mollusks have been recovered from the San Onofre Breccia (Stuart, 1979), as well as sparse terrestrial reptile and mammal fossils (Deméré and Walsh, 1993). Fossils recovered from the San Onofre Breccia were collected from the sandstone and mudstone units of the formation, rather than the more widespread brecciated conglomeratic portion.

Regional Distribution – The San Onofre Breccia crops out in a thin band along the coast in the City of Dana Point, and again along the coast of the City of Laguna Beach. More extensive exposures of the formation crop out west of the City of Laguna Niguel. An additional band of San Onofre Breccia is exposed extending north from Emerald Bay to the City of Newport Beach.

Distribution within the APE – The APE contains a small area of the San Onofre Breccia on both sides of Aliso Creek, from the turnout at the western extent of Aliso Canyon Road west to the creek overcrossing. Outcrops of San Onofre Breccia were encountered and examined during the field survey southwest of manhole 19 on the east side of the creek and at approximately the same level on the other side of the creek. The exposures on either side of the creek were slightly offset.

Resource Sensitivity – Although the San Onofre Breccia has yielded only sparse fossil remains, the fact that vertebrate fossils have been recovered from this rock unit indicates the likely potential for additional discoveres. Based on these existing conditions, the formation is assigned a moderate paleontological resource sensitivity.

Monterey Formation

Introduction – In the Santa Barbara and Ventura areas of California, sedimentary rocks of the Miocene-age Monterey Formation serve as important hydrocarbon reservoirs (Bodnar, 1990). The formation is lithologically complex, consisting of diatomaceous shale and mudstone, chert, phosphatic shale, siliceous mudstone, limestone, and sandstone. The Monterey Formation generally is divided into a lower calcareous unit dominated by coccolithophores (minute marine phytoplankton), a middle phosphatic unit, and an upper siliceous unit dominated by diatoms (Chang et al., 1998). The depositional environment of the Monterey Formation is thought to have been a deep marine basin associated with an active continental margin (Bodnar, 1990). Microfossils, particularly foraminiferans and diatoms, have played a key role in the correlation and interpretation of the geological history of the Monterey Formation (Finger et al., 1990).

Paleontology – Numerous microfossils have been recovered from rocks of the Monterey Formation (Finger et al., 1990), as well as marine mollusks (Saul and Stadum, 2005) and scientifically important marine mammals including pinnipeds, sea cows, desmostylians, baleen whales, and dolphins (Barnes, 1976; Domning and Furusawa, 1994; Pyenson and Haasl, 2007)

Regional Distribution – The Monterey Formation crops out in two general areas in southern Orange County, north of the City of Dana Point and the Capistrano Bight. One area is west of Interstate 5 (I-5), and contacts the interstate for a short distance near the northern extremity of its exposure in the City of Laguna Hills. A second area of exposure is located east of I-5.

Distribution within APE – The Monterey Formation is exposed on both sides of Aliso Creek in the northern portion of the project alignment. An exposure of yellowish sandstone was observed near the north end of the east side of the creek during the field survey. The outcrop was on the side of a steep hill and was not examined closely, but rather observed from a distance. The exposure appeared to be the result of slumping. According to published geologic maps, the Monterey Formation contacts the Topanga Formation on the west side of Aliso Creek, and it is underlying the siltstone facies of the Capistrano Formation on the east side of the creek. However, the contacts between these units were not observed during the field survey on account of thick vegetation within the creek valley.

Resource Sensitivity – Because scientifically significant marine vertebrate and invertebrate fossils have been collected from the Monterey Formation, the unit is assigned a high resource sensitivity.

Capistrano Formation

Introduction – The Capistrano Formation is a marine sedimentary rock unit of the Upper Miocene (approximately five to seven million years ago). This formation consists of gray, massive siltstones and mudstones that may have been deposited on the deeper flanks of a prehistoric continental shelf or slope. Three members of the Capistrano Formation are recognized, which are from oldest to youngest the Oso Sand Member, siltstone facies, and turbidite facies (Morton and Miller, 1981).

Paleontology – Exposures of the Capistrano Formation in Orange County are known to contain fossil foraminiferans and an abundant diversity of marine vertebrate fossils, including bony and cartilaginous fishes, toothed and baleen whales, fur seals, walruses, sea cows, and sea birds (White, 1956; Barnes, 1976; Deméré and Walsh, 1993; Deméré and Berta, 2005; Fierstine, 2008). In particular, baleen whale fossils were recovered from exposures of the Oso Sand Member in Aliso Creek in an area south of El Toro Road and east of Interstate 5 in the City of Lake Forest, California in 2006 (Molina, 2008; Tan, 2008).

Regional Distribution – The Capistrano Formation crops out in southern Orange County as a thick band extending from the southern county line to just north of the El Toro Marine Corps Air Station. The turbidite facies of the Capistrano Formation are exposed in only a small area at the southwest corner of Orange County. The siltstone facies of the Capistrano Formation extend from the San Diego/Orange County border to Mission Viejo, and the Oso Sand Member extends from Mission Viejo to north of the El Toro Marine Air Corps Station.

Distribution within the APE – The rocks that make up the siltstone facies of the Capistrano Formation overlie the Monterey Formation on the east side of Aliso Creek according to published geologic maps. However, the unit was not observed during the field survey, at least not *in situ*. The lithology of the creek bed and in particular the deposits upon which the dirt service road along the east side of the creek appeared to consist of reworked material from the Capistrano Formation that crops out at the top of the hills north of the APE. The APE only comes close to the siltstone facies of the Capistrano Formation, and this unit is not exposed west of Aliso Creek. No units of the Capistrano Formation come into contact with any of the project alternatives.

Resource Sensitivity – Given the abundant marine vertebrate fossils recovered from this rock unit in Orange County, the Capistrano Formation is assigned a high resource sensitivity.

Younger Alluvium

Introduction – The floors and floodplains of modern drainages are underlain by poorly consolidated alluvial sediments of Holocene age (i.e., younger than 10,000 years old). Lithologies of these deposits generally consist of poorly consolidated clays, silts, sands, and gravels.

Paleontology – Fossils are generally unknown from the younger alluvial deposits in modern drainages of Orange County on account of the young age of the sediments.

Regional Distribution – Younger alluvium occurs on the floors of river beds, canyons, and other modern drainages across Orange County. The majority of metropolitan Orange County is built upon the younger alluvium deposits.

Distribution within the APE – Deposits of younger alluvium occur on the creek bed and floodplains on both sides of Aliso Creek. Some of the material in the northern portion of the project area appears to have been reworked from the Capistrano Formation based on color and lithology.

Resource Sensitivity – Based on its post-Pleistocene age, younger alluvium is assigned a low paleontological resource sensitivity.

Results of Field Survey

A windshield field survey was conducted on August 27, 2011 in order to confirm the observations in published reports and geologic maps. The survey was conducted first traveling south along the east side of the creek via the dirt access road and was repeated on the west side of the creek via the paved access road. Observation of natural exposures was hindered by thick vegetation along the length of the creek valley (Figure 3), and the majority of exposures were high in the hills above the flood plain on either side of the creek. However, natural exposures were encountered and examined close to the access roads in several places.

Figure 3. A) View facing southwest along dirt access road on east side of creek with Aliso Creek surrounded by vegetation on right. B) View facing northwest across thickly vegetated creek.

An exposure was observed on the steep side of a hill on the east side of the creek. Although the outcrop was only observed at a distance, the rock appeared to consist of massive, yellowish sandstone (Figure 4). According to the geologic map this unit should be the Monterey Formation, which agrees with what was observed in the field.

The walls of the creek bed dropped off vertically by 20 to 30 feet along its most of its length thereby limiting access to the creek bed. The rocks that comprised the drop-off in the northern part of the APE, as well as the deposit upon which the access roads were built, was a light greenish gray (5YG 8/1), clayey, matrix-supported sandstone with numerous pebble and cobble sized clasts (Figure 5). These are likely younger alluvial deposits consisting of material reworked from the Capistrano Formation. No fossils were recovered or observed from the alluvium.

Figure 4. Exposure of Monterey Formation (indicated by arrow) above floodplain on east side of Aliso Creek.

Figure 5. Exposure of younger alluvium along west side of creek bed south of creek cross-over

near manhole #13. Vertical relief approximately 20 feet.

At the creek crossover still in the northern portion of the project alignment, the rocks underlying the dirt service road on the east side of the creek changed to a tan color and contained less clay than what was observed to the north.

South of manhole #19, the hills to the east steepened and an exposure of the San Onofre Breccia cropped out near the service road. The rocks were covered with a resistant crust, but once the crust was breached the rocks were found to be quite friable. In general, the rocks of this outcrop consisted of friable, poorly sorted, matrix-supported, medium- to coarse-grained, very pale orange (10YR 8/2) to grayish orange (10YR 7/4) sandstone with oblong, gravel/pebble sized, subrounded to subangular clasts (Figure 6). A similar outcrop was observed at roughly the same position on the west side of the creek, although the outcrops were slightly offset. The misalignment of the San Onofre Breccia on either side of Aliso Creek was mapped as well (Morton and Miller, 1981) as an indication of the Temple Hill Fault.

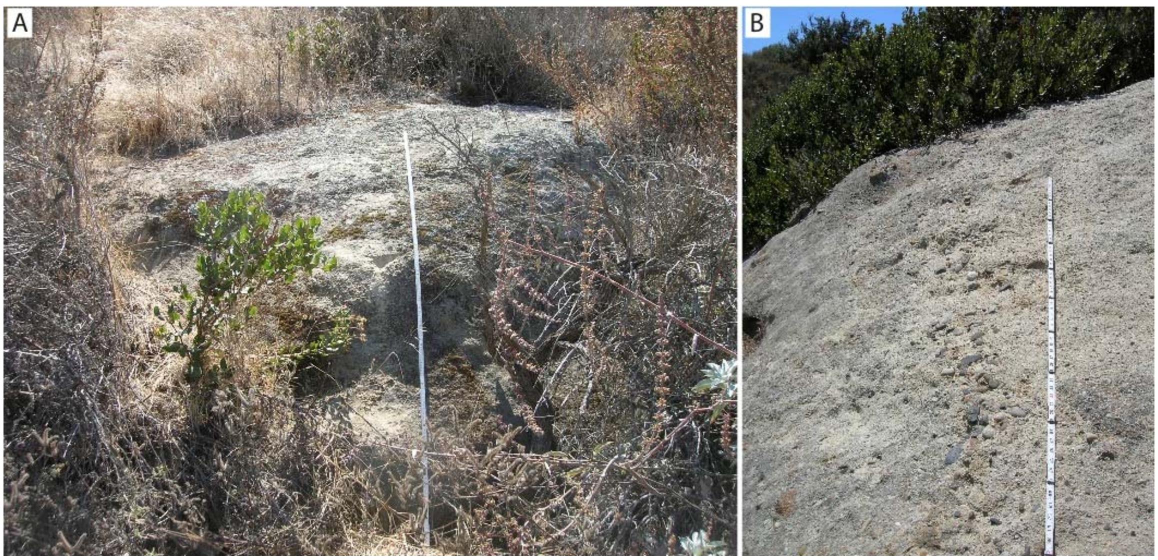

Figure 6. Exposure of San Onofre Breccia. A. Outcrop on east side of creek south of manhole #19. B. Outcrop on west side of creek south of creek crossing. Scale equals six feet.

Further south and west, light greenish gray rocks of the Topanga Formation were observed cropping out on either side of the creek. One such outcrop occurred close to the paved service road on the west side of the creek allowing a closer examination of the lithology (Figure 6). The unit consisted of fine-grained, very well-indurated, pale greenish yellow (10Y 8/2) to light greenish gray (5GY 8/1) sandstone. Further southward on the east side of the creek, the exposures of the Topanga Formation exhibited slight iron staining, but this was not observed on the outcrops on the west side of the creek. No fossils were discovered in the Topanga Formation during the field survey.

Results of Record Search

The results of a record search of the paleontological collections at the Natural History Museum of Los Angeles County (LACM) did not identify any paleontological collecting localities within one half mile of the proposed alignment and alternative. However, there are several LACM localities nearby in the same rock units that underlie the APE (Appendix). More specifically, significant vertebrate fossils were collected in the vicinity of the SOCWA Coastal Treatment Plant project area from strata of the younger Quaternary alluvium on the northwest side of the Sulphur Creek Reservoir to the east of the APE (*Bison* sp.), exposures of the Monterey Formation that were exposed during construction of the Chet Holifield Federal Building north of the APE as well as at the confluence of Aliso Creek and Sulphur Creek (fossil sea lions, dolphins, and other marine vertebrates) and the Topanga Formation in the hills above the access road on the west side of the creek (fossil marine mammal known as *Desmostylus* sp.). In all of these instances, the fossils that were recovered represent significant paleontological discoveries. The proposed alignment and its alternative come into contact with each of these fossiliferous units; thus, it is likely that sediments known to produce significant fossils will be impacted.

Figure 7. Exposure of Topanga Formation west of paved service road on west side of creek. Scale equals six feet.

IMPACT ANALYSIS

Introduction

Direct impacts to paleontological resources occur when earthwork activities, such as access roads and trenching for pipeline construction, cut into the geologic deposits (formations) within which fossils are buried. These direct impacts are in the form of physical destruction of fossil remains. Since fossils are the remains of prehistoric animal and plant life, they are considered to be nonrenewable. Such impacts have the potential to be significant and, under the California Environmental Quality Act (CEQA) guidelines, may require mitigation.

During the assessment of impacts upon paleontological resources, the affected geologic formations are classified based on the relative abundance of vertebrate fossils and significant non-vertebrate fossils using a scale from zero to high depending upon the resource sensitivity of the impacted geologic formations. The specific criteria applied for each sensitivity category are summarized below.

High Sensitivity

High sensitivity is 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 paleobiology and evolutionary history (phylogeny) of animal and plant groups. Generally speaking, highly sensitive formations produce vertebrate fossil remains or are considered to have the potential to produce such remains. Geologic formations that have been assigned a high paleontological resource sensitivity that crop out within the APE include the Miocene to Pliocene-age Topanga Formation, Monterey Formation, and siltstone facies of the Capistrano Formation.

Moderate Sensitivity

Moderate sensitivity is assigned to geologic formations known to contain paleontological localities with poorly preserved, common elsewhere, or stratigraphically unimportant fossil material. The moderate sensitivity category is also applied to geologic formations that are judged to have a strong, but unproven potential for producing important fossil remains. Geologic formations that have been assigned a moderate paleontological resource sensitivity that crop out within the APE include the Miocene-age San Onofre Breccia.

Low Sensitivity

Low sensitivity is assigned to geologic formations that, based on their relatively youthful age and/or high-energy depositional history, are judged unlikely to produce important fossil remains. Typically, low sensitivity formations produce poorly-preserved invertebrate fossil remains in low abundance. Due to the young age and coarse-grained nature of younger alluvium, these surficial sedimentary deposits are generally considered to have little potential to yield scientifically significant fossils. However, on occasion deeper excavations into sedimentary deposits mapped as younger alluvium penetrate into alluvial deposits of Pleistocene age and do yield fossils. For this reason sedimentary deposits mapped as younger alluvium are generally assigned a low paleontological resource sensitivity (Deméré and Walsh, 2003). Sedimentary deposits of younger alluvium contribute the only unit that occurs within the APE that is considered to have a low paleontological resource sensitivity.

Zero Sensitivity

Zero sensitivity is assigned to geologic formations that are entirely igneous in origin (i.e., plutonic and/or volcanic), and therefore have no potential for producing fossil remains. Volcanic ash deposits can represent an exception to this general rule and preserve fossils as both body fossils or natural casts. Artificial fill materials are also assigned a paleontological resource sensitivity of zero. There are no geologic units that occur within the APE that have been assigned a paleontological resource sensitivity of zero.

PROJECT RELATED IMPACTS

Deposits of younger alluvium underlie the majority of the area traversed by the project and its alternative, while other portions are underlain by surface or subsurface exposures of the Topanga Formation, Monterey Formation, and the San Onofre Breccia. As summarized in Table 1, the younger alluvium and San Onofre Breccia are categorized as having low and moderate sensitivity respectively. In contrast, the Topanga and Monterey formations have a high sensitivity rating.

Geologic deposits that have a high likelihood of being impacted include the younger alluvium deposits, which occupy much of the floodplain of Aliso Creek, the Topanga Formation, the Monterey Formation, and San Onofre Breccia, which cross the creek and are contacted by the dirt access road on the east side of the creek and the paved access road on the west side of the creek. The locations of exposure of the siltstone facies of the Capistrano Formation (not observed during the field survey) away from the creek along the hills surrounding the floodplain decrease the likelihood of impact to this formation.

Table 1**.** Paleontological Resource Sensitivity and Impact Likelihood of Geologic Units

Geologic Unit	Resource Sensitivity	Likelihood to be Impacted
Younger Quaternary Alluvium	low	high
Capistrano Formation	high	low
Monterey Formation	high	high
San Onofre Breccia	moderate	high
Topanga Formation	high	high

According to the paleontology collection records housed at the LACM from previously recorded sites in Orange County (e.g., those discovered during construction of the Chet Holifield Federal Building north of the project area), it has been determined that the Topanga Formation has a high paleontological resource sensitivity. One such locality is located above the access road at the westernmost extent of Aliso Creek and approximately one mile north of the sewage disposal junction with Aliso Creek. Exposures of the Topanga Formation approach the access roads on either side of the creek, particularly near manhole 10 on the east side of the creek, and it is likely that excavation in those areas will impact the geological units (Figure 8).

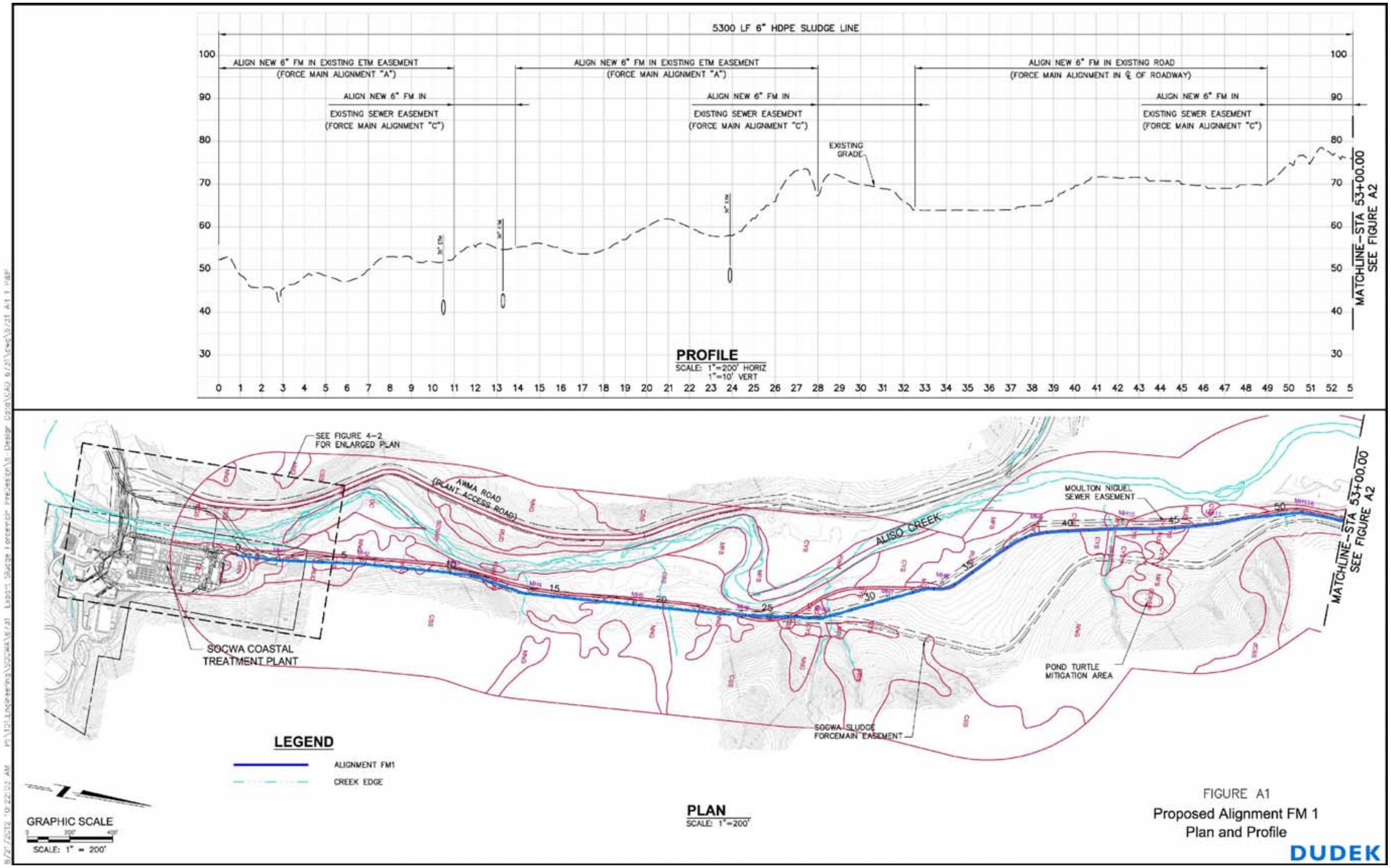

Figure 8. Proposed plan for the SOCWA project (courtesy of Dudek, 2012).

SITE SPECIFIC IMPACTS

Potential impacts to scientifically significant paleontological resources typically occur in the form of destruction of buried fossil remains during earth moving activities associated with construction. The replacement of sludge force mains proposed for the SOCWA Coastal Treatment Plant project has the potential to impact paleontologically sensitive geologic units along most of the alignment. The location and distribution of these sensitive rock units within the APE can be generally determined by referring to the published geologic maps (e.g., Morton and Miller, 1981).

RECOMMENDED COURSE OF ACTION

It is anticipated that the excavation activities associated with the SOCWA Coastal Treatment Plant project have to potential to impact paleontologically sensitive rock units with low (younger Quaternary alluvium), moderate (San Onofre Breccia), and high paleontological resource sensitivities (Topanga and Monterey formations). The impacts on paleontological resources by FM-1 and FM-2 would essentially be equivalent.

Given the reasonably high expectation of encountering rock units of high paleontological resource sensitivity, the determination must be made as to: (1) whether adverse effects cannot be avoided; (2) whether the adverse impacts can be avoided by altering the location or scope of the project; or (3) whether the impacts can be mitigated through development of special stipulations such as requiring on-site monitoring.

Mitigation – Development of a Paleontological Monitoring and Discovery Treatment Plan

Mitigation of construction related impacts to significant paleontological resources is generally accomplished through implementation of a rigorous mitigation program. Such a program typically requires development of a well-considered and focused paleontological monitoring and discovery plan that indicates the treatments recommended for the area of the proposed disturbance, the methods of fossil and data recovery, the level of monitoring, the types of field personnel, the post-field treatment of recovered paleontological resources, the designated specimen repository, and the format of the final mitigation report.

CONCLUSION

1. The SOCWA Coastal Treatment Plant project is underlain by geologic rock units assigned to low (younger Quaternary alluvium), moderate (San Onofre Breccia), and high paleontological resource sensitivity (Topanga and Monterey formations).

2. Proposed construction related excavation activities associated with installation of sewer mains will likely impact paleontological resources of high sensitivity.

3. The proposed alternative, FM-2, would have essentially the same level of impact on paleontological resources as the proposed project alignment, FM-1.

4. Potential impacts to paleontological resources can be mitigated through development and implementation of a paleontological monitoring and discovery treatment plan.

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APPENDIX

Natural History Museum
of Los Angeles County
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Los Angeles, CA 90007

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NATURAL HISTORY MUSEUM
LOS ANGELES COUNTY

Vertebrate Paleontology Section
Telephone: (213) 763-3248
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17 June 2011

Department of PaleoServices
San Diego Natural History Museum
P.O. Box 121390
San Diego, CA 92112

Attn: Dr. Eric G. Ekdale, Staff Paleontologist

re: Paleontological resources for the proposed South Orange County Wastewater Authority (SOCWA), near Laguna Niguel, Orange County, project area

Dear Eric:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed South Orange County Wastewater Authority (SOCWA), near Laguna Niguel, Orange County, project area as outlined on a section of the San Juan Capistrano USGS topographic quadrangle map that you sent to Dr. Samuel A. McLeod via e-mail on 1 June 2011. We do not have any vertebrate fossil localities that lie directly within the proposed project site boundaries, but we do have several localities nearby from the same sedimentary units that may occur in the proposed project area.

The central part of the Aliso Creek drainage has surficial deposits of younger Quaternary Alluvium. Our closest vertebrate fossil locality from these deposits is LACM 4543, situated on the northwest side of Sulphur Creek Reservoir due east of the northern portion of the proposed project area, that produced a fossil specimen of bison, *Bison*. The hills bordering Aliso Creek on the southwestern portion of the proposed project area have *in situ* exposures of the marine middle Miocene (Barstovian equivalent) Topanga Formation, in addition to several natural slumps of Topanga Formation rocks. We have one vertebrate fossil locality, LACM 3222, from these Topanga Formation exposures adjacent to the proposed project area just above the access road at the westernmost extent of Aliso Creek approximately one mile north of the sewage disposal junction with Aliso Creek just north of Niguel Hill. Locality LACM 3222 produced a fossil specimen of desmostylian, *Desmostylus*.

In the northern portion of the proposed project area there are some exposures of the middle Miocene San Onofre Breccia. This coarse rock unit is unlikely to contain significant vertebrae fossils and we have no vertebrate fossils from these deposits. North of the San Onofre Breccia exposures, on both sides of the Aliso Creek drainage, there are exposures of the marine middle Miocene (Clarendonian equivalent) Monterey Formation bordering the Aliso Creek drainage. Our closest vertebrate fossil locality from the Monterey Formation is LACM 3510, situated immediately north of the northernmost portion of the proposed project area on the hill just north of the junction of Aliso Creek with Sulphur Creek. Locality LACM 3510 produced fossil specimens of primitive sea lion, *Imagotaria*, and dolphin, Delphinidae. We have numerous localities in the Monterey Formation just north of locality LACM 3510 that were mostly discovered during the excavations for the Autonetics building [= the "Ziggurat"]. From the extensive marine vertebrate fauna produced by these localities, we have the holotype (name bearing specimen for a species new to science) for the fossil dolphin *Pithanodelphi nasalis*, described by L.G. Barnes in 1985 (The Late Miocene Dolphin *Pithanodelphis* Abel, 1905 (Cetacea: Kentriodontidae) from California. Contributions in Science, Natural History Museum of Los Angeles County, 367:1-27).

Surface grading or shallow excavations in the uppermost layers of the younger Quaternary Alluvium in the proposed project area probably will not uncover significant fossil vertebrate remains. Deeper excavations in the proposed project area that extend down into older sedimentary deposits, or any excavations in the adjacent Topanga or Monterey Formations, however, may well encounter significant vertebrate fossils. Any substantial excavations in the proposed project area, therefore, should be closely monitored to quickly and professionally collect any specimens without impeding development. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

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

Sincerely,

Vanessa R. Rhue

Vanessa R. Rhue
Vertebrate Paleontology

enclosure: draft invoice