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Paleontological Resources Technical Report

Nirvana Industrial Buildings and Self Storage Complex
City of Chula Vista
San Diego County, California

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Executive Summary

This paleontological resources technical report was prepared for the Nirvana Industrial Buildings and Self Storage Complex project (Project) located in the southern portion of the City of Chula Vista, San Diego County, California. The purpose of this report is to identify and summarize paleontological resources that occur in the vicinity of the Project site, identify Project elements (if any) that may negatively impact paleontological resources, and if necessary provide recommendations to reduce any potential negative impacts to less than significant levels. The report includes the results of a literature review and an institutional paleontological records search conducted at the San Diego Natural History Museum (SDNHM).

The approximately 13.3-acre Project site is located at 821 Main Street, and is bordered to the south by Main Street, to the north and west by existing commercial development, and to the east by a small parcel of the Otay Ranch Village 3 development that lies at the northwest corner of Main Street and Heritage Road. The Project proposes to construct three industrial buildings and a self storage building. Additional planned site improvements include the installation of subgrade utilities (sewer and water) and stormwater management systems, surface parking and internal driveways, and landscaping. The Project also includes off-site grading of 0.37 acres to the north of the site (for the Project driveway and additional areas), 0.21 acres to the east of the site (to stabilize an existing slope), 0.22 acres of City right-of-way along the Main Street frontage, and 0.18 acres west of the site (to eliminate low and high points along the proposed retaining wall and promote positive drainage in a concrete brow ditch). The total proposed graded area is 14.44 acres.

Published geologic mapping reports that the Project site is underlain by the middle Eocene-age (approximately 43 million years old) Mission Valley Formation, remnant terraces of overlying middle to late Pleistocene-age (approximately 774,000 to 11,700 years old) old alluvial flood plain deposits, and Holocene-age (generally less than 11,700 years old) young colluvial deposits that have accumulated along a central drainage that divides the site approximately in half. In contrast, the site-specific geotechnical evaluation report assigns the sedimentary bedrock underlying the Project site to the late Oligocene-age (approximately 29 million years old) Otay Formation, not the Mission Valley Formation. In addition, the geotechnical evaluation reports that the Otay Formation is exposed in the lower portion of the slope along the north side of Main Street, and is capped elsewhere within the site by Pleistocene-age terrace deposits (or old alluvial flood plain deposits) measuring between 4 and 30 feet thick. Holocene-age alluvium measuring at least 5 feet thick is also reported to be present in shallow, north-south trending drainages that cross the western and central portions of the site. Superficial Holocene-age topsoil and slope wash are reported to each measure between 1 and 4 feet thick, with slope wash restricted to the steep, south-facing slopes within the site and topsoil locally present across the site. Finally, a wedge of undocumented fill is located within the north-central portion of the site at the top of the central drainage, and is estimated to measure 10 to 20 feet thick.

Fossil collection localities have been documented within a one-mile radius of the Project site by SDNHM staff from several of these geologic units: two localities within the Mission Valley Formation, which produced fossil molds of marine mollusks and remains of marine vertebrates, such as sharks and rays; seven localities within the Otay Formation, which produced fossil remains of artiodactyls, rodents, an unidentified carnivore, and a squamate reptile; and one locality within Pleistocene-age old alluvial flood plain deposits, which produced weathered upper molars and a right scapula of an ancient horse. Fluvial deposits of the Mission Valley Formation have produced a diverse assemblage of terrestrial mammals as well as fossilized wood, while the marine deposits have yielded a diverse fossil assemblage consisting of marine organisms. The Otay Formation preserves a remarkably rich assemblage of terrestrial plants and

animals consisting mostly of extinct land mammals, but also includes tortoise, lizards, and birds. Pleistocene-age old alluvial flood plain deposits have produced fossils at numerous locations in coastal San Diego County, and have yielded impressive collections of terrestrial vertebrates including pond turtle, passenger pigeon, hawk, mole, rabbit, gopher, squirrel, capybara, wolf, horse, camel, deer, bison, mastodon, mammoth, and ground sloth. Fossil collection localities are generally undocumented within Holocene-age alluvium, slope wash, and topsoil and undocumented fill. Accordingly, the Mission Valley Formation and Otay Formation are assigned a high paleontological sensitivity, Pleistocene-age old alluvial flood plain deposits are assigned a moderate paleontological sensitivity, Holocene-age alluvium, slope wash, and topsoil are assigned a low paleontological sensitivity, and undocumented fill deposits are assigned zero paleontological sensitivity.

It is anticipated that all undocumented fill, all Holocene-age alluvium, slope wash, and topsoil, and the vast majority of the Pleistocene-age old alluvial flood plain deposits present within the Project site will be removed during grading. In addition, the underlying geologic unit (Mission Valley Formation or Otay Formation) will be impacted near the base of excavations and during remedial grading to remove the bentonitic claystone horizons. Thus, implementation of a paleontological mitigation program centered around paleontological monitoring is recommended, as outlined in the provided Mitigation Measures 1–7. Implementation of the paleontological mitigation program will reduce any Project-related impacts to paleontological resources to less than significant levels.

Contents

1.0 Introduction

1.1 Project Description

This technical report provides an assessment of paleontological resources for the Nirvana Industrial Buildings and Self Storage Complex project (Project) site located in the southern portion of the City of Chula Vista, San Diego County, California (Figure 1; City of Chula Vista, 2019; Esri, 2021).

The approximately 13.3-acre Project site is located at 821 Main Street, and is bordered to the south by Main Street, to the north and west by existing commercial development, and to the east by a small parcel of the Otay Ranch Village 3 development that lies at the northwest corner of Main Street and Heritage Road. The Project proposes to construct three industrial buildings and a self storage building. Additional planned site improvements include the installation of subgrade utilities (sewer and water) and stormwater management systems, surface parking and internal driveways, and landscaping. The Project also includes off-site grading of 0.37 acres to the north of the site (for the Project driveway and additional areas), 0.21 acres to the east of the site (to stabilize an existing slope), 0.22 acres of City right-of-way along the Main Street frontage, and 0.18 acres west of the site (to eliminate low and high points along the proposed retaining wall and promote positive drainage in a concrete brow ditch). The total proposed graded area is 14.44 acres.

1.2 Scope of Work

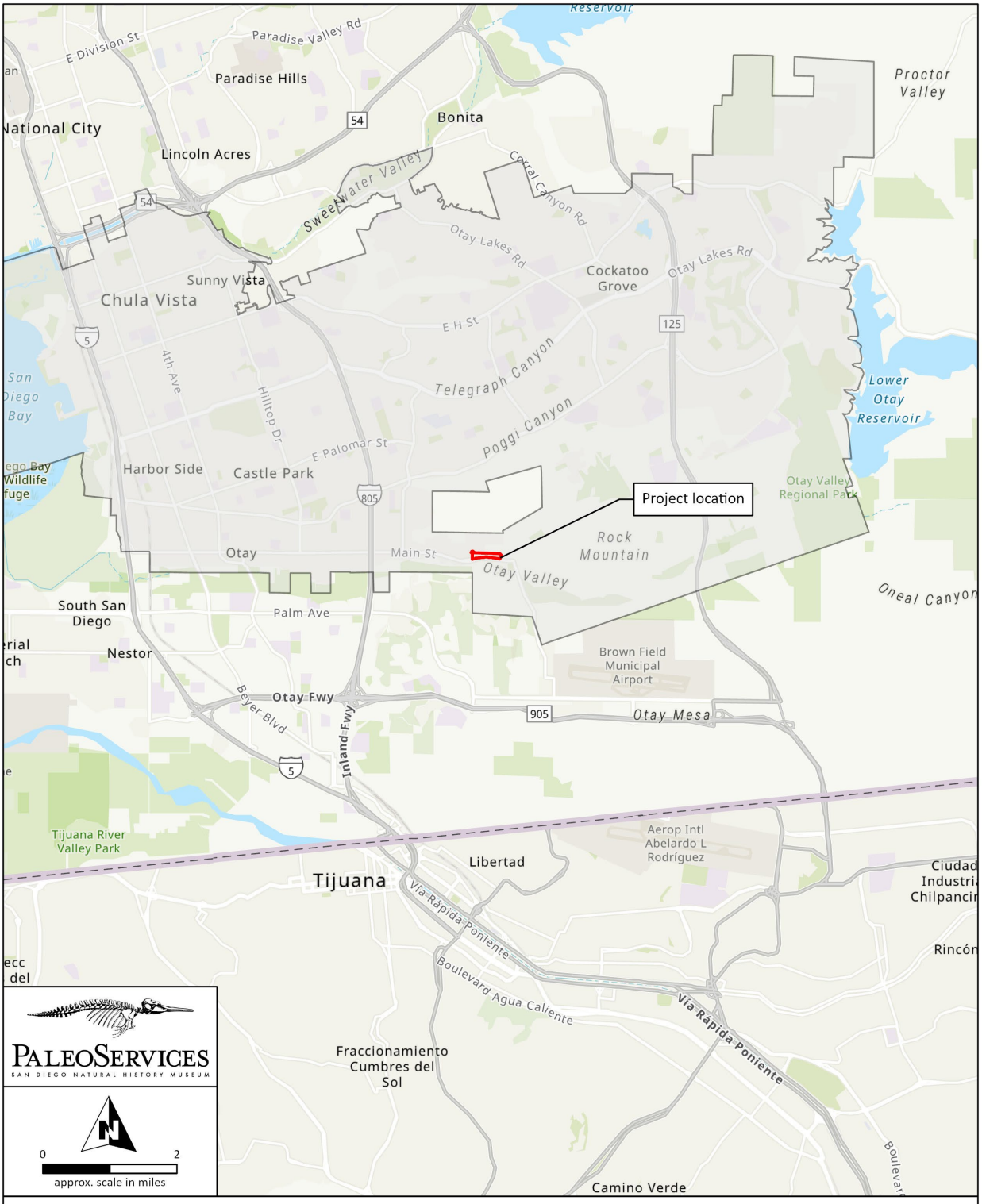
This paleontological resources technical report is being completed due to a review of maps that indicate the Project site is partially underlain by sedimentary deposits assigned a moderate to high paleontological sensitivity (Deméré and Walsh, 1993; Stephenson et al., 2009). The report is intended to summarize existing paleontological resource data at the Project site, discuss the significance of these resources, determine whether construction of the Project will impact paleontological resources, and develop measures to mitigate any potential impacts to paleontological resources.

The report includes the results of a literature review and a search of the paleontological collections records at the San Diego Natural History Museum (SDNHM). This report was written by Katie M. McComas and Thomas A. Deméré of the Department of PaleoServices, SDNHM.

1.3 Definition of Paleontological Resources

As defined here, 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 bones, teeth, shells, leaves, and wood, as well as trace fossils such as tracks, trails, burrows, and footprints, are found in the geologic units/formations within which they were originally buried. The primary factor determining whether an object is a fossil or not is not how the organic remain or trace is preserved (e.g., “petrified”), but rather the age of the organic remain or trace. Although typically it is assumed that fossils must be older than ~11,700 years (i.e., the generally accepted end of the last glacial period of the Pleistocene Epoch), organic remains older than recorded human history and/or older than middle Holocene (about 5,000 radiocarbon years) can also be considered to represent fossils (SVP, 2010).

Fossils are considered important scientific and educational resources because they serve as direct and indirect evidence of prehistoric life and are used to understand the history of life on Earth, the nature of past environments and climates, the membership and structure of ancient ecosystems, and the pattern and process of organic evolution and extinction. In addition, fossils are considered to be non-renewable resources because typically the organisms they represent no longer exist. Thus, once destroyed, a particular fossil can never be replaced.



Sources: City Limit, City of Chula Vista, 2019; World Topographic Map, Esri, 2021

Figure 1: Project overview map, Nirvana Self Storage, City of Chula Vista, San Diego County, California

Finally, paleontological resources can be thought of as including not only the actual fossil remains and traces, but also the fossil collecting localities and the geologic units containing those localities. The locality includes both the geographic and stratigraphic context of fossils—the place on the earth and stratum (deposited during a particular time in earth's history) from which the fossils were collected. Localities themselves may persist for decades, in the case of a fossil-bearing outcrop that is protected from natural or human impacts, or may be temporarily exposed and ultimately destroyed, as in the case of fossil-bearing strata uncovered by erosion or construction. Localities are documented with a set of coordinates and a measured stratigraphic section tied to elevation detailing the lithology of the fossil-bearing stratum as well as overlying and underlying strata. This information provides essential context for any future scientific study of the recovered fossils.

1.3.1 Definition of Scientifically Significant Fossils

The California Environmental Quality Act (CEQA, Public Resources Code Section 21000 *et seq.*) dictates that a paleontological resource is considered significant if it "has yielded, or may be likely to yield, information important in prehistory or history" (Section 15064.5, [a][3][D]). The Society of Vertebrate Paleontology (SVP) has further defined significant paleontological resources as consisting of "fossils and fossiliferous deposits … consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information" (SVP, 2010).

1.4 Regulatory Framework

Paleontological resources are considered scientifically and educationally significant nonrenewable resources; they are protected under a variety of laws, regulations, and ordinances. The Project site is located within the City of Chula Vista in San Diego County, California. As such, state and local regulations are applicable to the Project.

1.4.1 State

The **California Environmental Quality Act (CEQA, Public Resources Code Section 21000 et seq.)** protects paleontological resources on both state and private lands in California. This act requires the identification of environmental impacts of a proposed project, the determination of significance of the impacts, and the identification of alternative and/or mitigation measures to reduce adverse environmental impacts. The Guidelines for the Implementation of CEQA (Title 14, Chapter 3, California Code of Regulations: 15000 et seq.) outlines these necessary procedures for complying with CEQA. Paleontological resources are specifically included as a question in the CEQA Environmental Checklist (Appendix G): "Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature." Also applicable to paleontological resources is the checklist question: "Does the project have the potential to… eliminate important examples of major periods of California history or pre-history." If significant paleontological resources may be impacted within a given project site, CEQA provides that "a lead agency shall identify potentially feasible measures to mitigate significant adverse changes in the significance of an historical resource. The lead agency shall ensure that any adopted measures to mitigate or avoid significant adverse changes are fully enforceable through permit conditions, agreements, or other measures" (Section 15064.5, [b][4]).

Other state requirements for paleontological resource management are included in the **Public Resources Code, Section 5097.5**. These statutes prohibit the removal of any paleontological site or feature on public lands without permission of the jurisdictional agency, defines the removal of paleontological sites or features as a misdemeanor, and requires reasonable mitigation of adverse impacts to paleontological resources from developments on public (state) lands.

1.4.2 Local: City of Chula Vista

The **City of Chula Vista** General Plan (adopted 2005) addresses potential impacts to paleontological resources within the Environmental Element of the General Plan (Chapter 9, Section 3.1.10) through two policies, with the stated objective to: "Protect important paleontological resources and support and encourage public education and awareness of such resources" (Objective E 10). The two policies outlined in support of this objective are:

- Policy E 10.1—Continue to assess and mitigate the potential impacts of private development and public facilities and infrastructure to paleontological resources in accordance with the California Environmental Quality Act.
- Policy E 10.2—Support and encourage public education and awareness of local paleontological resources, including the establishment of museums and educational opportunities accessible to the public.

2.0 Methods

2.1 Paleontological Literature Review and Records Search

A review was conducted of relevant published geologic maps (e.g., Kennedy and Tan, 1977, 2008), published geological and paleontological reports (e.g., Deméré, 1988; Walsh, 1996), the Project site-specific geotechnical evaluation report (Geocon, Inc., 2021), and other relevant literature (e.g., field trip guidebooks, theses and dissertations, and unpublished paleontological mitigation reports). This approach was followed in recognition of the direct relationship between paleontological resources and the geologic formations within which they are entombed. Knowing the geologic history of a particular area and the fossil productivity of geologic formations that occur in that area, it is possible to predict where fossils are likely or unlikely to be encountered.

A paleontological records search was also conducted at the SDNHM in order to determine if any documented fossil collection localities occur within the Project site or immediately surrounding area. The records search involved examination of the SDNHM paleontological database for any records of known fossil collection localities within a 1-mile radius of the proposed Project site. The results of the records search are discussed in the report.

2.2 Paleontological Resource Assessment Criteria

Impacts to paleontological resources are typically assigned a paleontological sensitivity rating based on the resource potential of an impacted geologic unit. The County of San Diego has developed its own guidelines for assigning paleontological sensitivity (Stephenson et al., 2009), which includes a five-tiered scale of High Sensitivity, Moderate Sensitivity, Low Sensitivity, Marginal Sensitivity, or Zero Sensitivity ratings. An expanded description of each paleontological sensitivity rating, as outlined by the County (Stephenson et al., 2009) is provided below.

2.2.1 High Sensitivity

Geologic units with high sensitivity have produced, or are likely to produce, significant vertebrate, invertebrate, or paleobotanical remains. High sensitivity geologic units may contain fossil materials that are rare, well-preserved, critical for stratigraphic or paleoenvironmental interpretation, and/or provide important information about the paleobiology and evolutionary history (phylogeny) of animal and plant groups.

2.2.2 Moderate Sensitivity

Moderate sensitivity is assigned to geologic units known to contain paleontological localities with fossil material that is poorly preserved, common elsewhere, or stratigraphically unimportant.

2.2.3 Low Sensitivity

Low sensitivity is assigned to geologic units that, based on their relatively young age and/or high-energy depositional history, are judged unlikely to produce important fossil remains. Typically, low sensitivity units produce fossil remains in low abundance, or only produce common/widespread invertebrate fossils whose taphonomy, phylogeny, and ecology is already well understood.

2.2.4 Marginal Sensitivity

Marginal sensitivity is assigned to geologic units 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.

2.2.5 Zero Sensitivity

Geologic units with no sensitivity are either entirely igneous in origin and therefore do not contain fossil remains, or are moderately to highly metamorphosed and thus any contained fossil remains have been destroyed. Undocumented fill materials also have no sensitivity, because the stratigraphic and geologic context of any contained organic remains (i.e., fossils) has been lost.

2.3 Paleontological Impact Analysis

Direct impacts to paleontological resources occur when earthwork activities (e.g., grading, augering, trenching), cut into the geologic units within which fossils are buried, and physically destroy the fossil remains. As such, only earthwork activities that will disturb potentially fossil-bearing geologic units (i.e., those rated with a high or moderate paleontological sensitivity) have the potential to significantly impact paleontological resources. Under California Environmental Quality Act and County of San Diego guidelines, paleontological mitigation typically is recommended to reduce any negative impacts to paleontological resources to less than significant levels.

The purpose of the impact analysis is to determine whether proposed Project-related earthwork may disturb potentially fossil-bearing geologic units, and where and to what depths this earthwork will occur. The paleontological impact analysis involved analysis of available Project documents (e.g., project plans), and comparison with geological and paleontological data gathered during the literature review and records search.

3.0 Results

3.1 Results of the Literature Review and Records Search

The Project site is located along the coastal plain of San Diego County, within the Peninsular Ranges Geomorphic Province of California. Along the coastal plain, basement rocks of the early Cretaceous-age Santiago Peak Volcanics and the Cretaceous-age Peninsular Ranges Batholith are nonconformably overlain by a “layer cake” sequence of sedimentary strata of late Cretaceous, Eocene, Oligocene, Miocene, Pliocene, and/or Pleistocene age (Givens and Kennedy, 1979; Hanna, 1926; Kennedy, 1975; Kennedy and Moore, 1971; Kennedy and Peterson, 1975; Peterson and Kennedy, 1974; Walsh and Deméré, 1991). Kennedy and Moore (1971) divided the Eocene portion of this sequence into the early

middle Eocene La Jolla Group and late middle Eocene Poway Group (which includes the Mission Valley Formation), which together include nine formations.

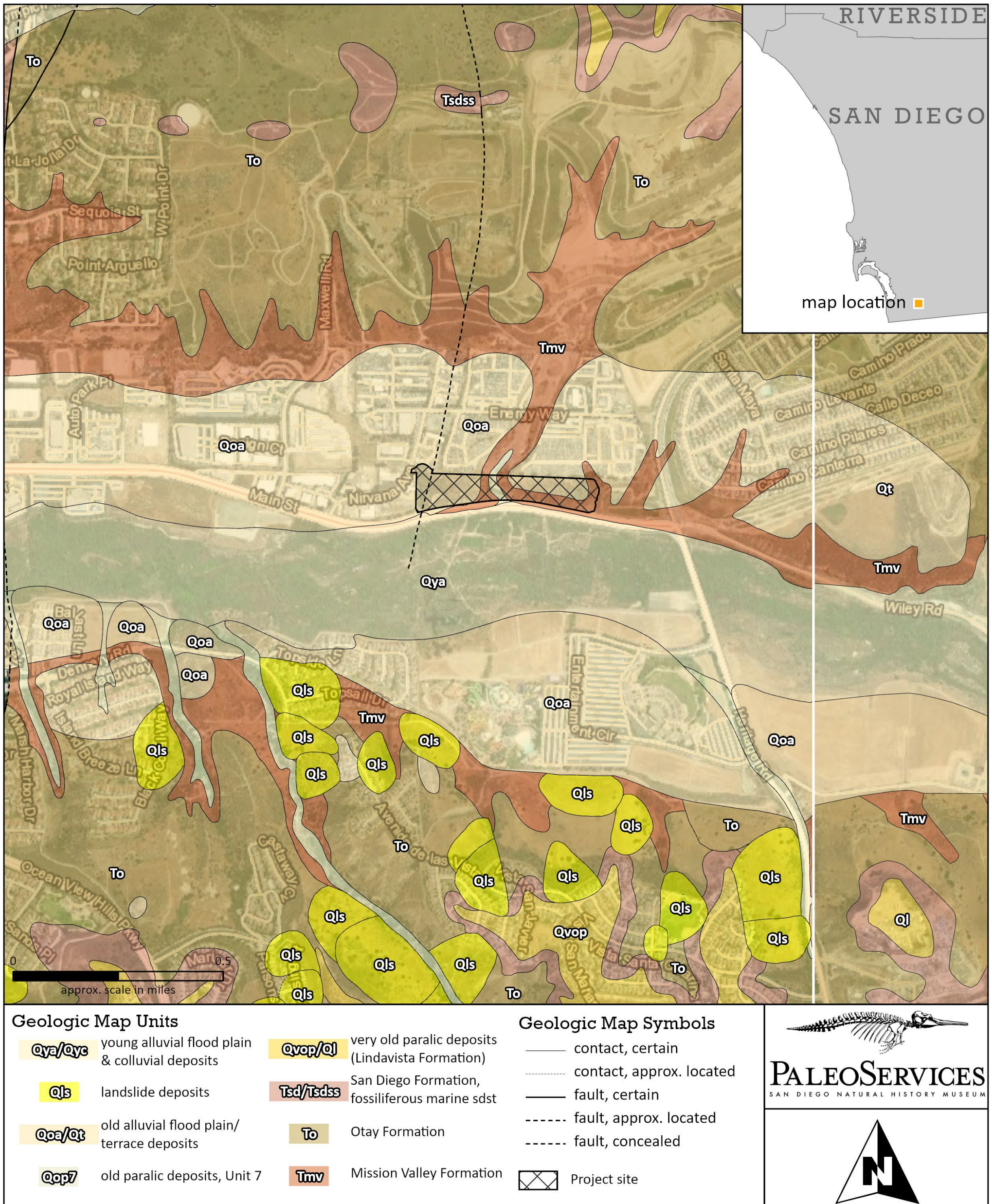
The Eocene strata accumulated in a large depositional basin, the Cenozoic San Diego Embayment. A large river system occupied the eastern portion of the embayment, while in the west, the alluvial and fluvial paleoenvironments of this river system mixed with nearshore marine paleoenvironments in a river-dominated delta (Kennedy and Moore, 1971). Farther west, the submarine portions of the delta transitioned into continental shelf and slope paleoenvironments (May, 1985; May and Warme, 1991). Thus, the Eocene strata record a series of intertonguing marine and terrestrial paleoenvironments deposited over a relatively short lateral distance (west to east) during a period of approximately 10 million years (50 to 40 million years ago) (Walsh et al., 1996). Strata of the Mission Valley Formation accumulated in a portion of the Eocene river floodplain, as well as on the adjacent Eocene continental shelf (Kennedy and Moore, 1971; Walsh, 1996).

Following a period of erosion or nondeposition that lasted approximately 11 million years, deposition resumed within the broad flood plain of a large, slow-moving river system that occupied the southwestern coastal plain of San Diego. Conglomeratic channel lag deposits, sandy braided stream deposits, and fine-grained lake and pond sediments of the Otay Formation provide a record of this ancient paleoenvironment (Walsh and Deméré, 1991).

Approximately 28 million years later, during the Pleistocene, the prehistoric Otay River and its tributaries carved out the Otay River Valley in response to changes in global sea level (Deméré and Walsh, 1993). During periods of low sea level, the river incised through the Oligocene Otay Formation and the underlying Eocene rocks. As sea level rose, alluvium was deposited and filled the valley. Several cycles of fluctuating sea level led to the conditions observed today at the Project site, with Pleistocene-aged old alluvial flood plain or terrace deposits buttressed against the older strata.

3.1.1 Project Geology

Based on published geologic mapping by Kennedy and Tan (2008), the Project site is reported to be underlain by strata of the middle Eocene-age (approximately 43 million years old) Mission Valley Formation, as well as middle to late Pleistocene-age (approximately 774,000 to 11,700 years old) old alluvial flood plain deposits (Cohen et al., 2021) (Figure 2). In addition, Holocene-age (generally less than 11,700 years old) young colluvial deposits have accumulated along a central drainage that divides the Project site approximately in half. These existing conditions were confirmed by SDNHM field paleontologists during a 2015 paleontological field survey that was conducted prior to proposed widening of Main Street (PaleoServices, 2015). The survey focused on the area along the north side of Main Street, and documented a terrestrial red mudstone facies of the Mission Valley Formation that consisted of pale red to grayish orange, well indurated, massive mudstones with minor claystone.



Sources: Geology from Kennedy and Tan, 2008, Todd, 2004; Terrain Hillshade, World Transportation and Imagery, Esri et al., 2023

Figure 2: Geologic map of the Project site, Nirvana Self Storage, City of Chula Vista, San Diego County, California

In contrast, the site-specific geotechnical evaluation report assigns the sedimentary bedrock underlying the Project site to the late Oligocene-age (approximately 29 million years old) Otay Formation, not the Mission Valley Formation (Geocon, Inc., 2021). The geotechnical report describes these deposits as "dense, silty, fine- to coarse-grained sandstone, clayey and sandy siltstone, and silty claystone with continuous and discontinuous interbeds of highly expansive bentonitic claystone." The geotechnical evaluation reports that the Otay Formation is exposed in the lower portion of the slope along the north side of Main Street, and is capped elsewhere within the site by Pleistocene-age terrace deposits (or alluvial flood plain deposits) measuring between 4 and 30 feet thick that consist of "dense to very dense, reddish brown, silty to clayey sand with gravel and cobbles." Holocene-age alluvium measuring at least 5 feet thick is also reported to be present in shallow, north-south trending drainages that cross the western and central portions of the site, and generally consists of loose to medium dense silty to clayey sand with gravel and cobbles. Superficial Holocene-age topsoil and slope wash are reported to each measure between 1 and 4 feet thick, with slope wash restricted to the steep, south-facing slopes within the site and topsoil locally present across the site. Finally, a wedge of undocumented fill is reported to occur within the north-central portion of the site at the top of the central drainage, and is estimated to measure 10 to 20 feet thick (Geocon, Inc., 2021).

For the purposes of this report, it is not of paleontological importance to definitively know whether the older sedimentary rocks exposed on the Project site represent the Mission Valley Formation or the Otay Formation, because both geologic units are assigned a high paleontological sensitivity (see Section 3.3), and thus impacts to either geologic unit would require paleontological mitigation. Given this level of uncertainty but equivalent paleontological sensitivity, the following section provides general overviews of the geology and paleontology of both geologic units.

3.1.2 Project Paleontology

The SDNHM has documented a total of 10 fossil collection localities from the geologic units underlying the Project site within a one-mile radius of the proposed Project site (Appendix A). Two localities are from the Mission Valley Formation, seven localities are from the Otay Formation, and one locality is from Pleistocene-age old alluvial flood plain deposits. These localities are discussed in greater detail below.

Fluvial deposits of the **Mission Valley Formation** have yielded a diverse assemblage of terrestrial mammals, including opossums, insectivores, bats, rodents, primates, artiodactyls, and perissodactyls (Golz and Lillegraven, 1977; Walsh, 1996), as well as fossilized wood (SDNHM unpublished paleontological collections data), while the marine deposits have yielded a diverse fossil assemblage consisting of marine microfossils (e.g., foraminifers), invertebrates (e.g., clams, snails, crustaceans, sand dollars, sea urchins), and vertebrates (e.g., sharks, rays, bony fishes) (Deméré and Walsh, 1993). There are two SDNHM localities from the Mission Valley Formation that lie between 0.5 and 0.75 miles to the west and southwest of the Project site, both documented during previous paleontological monitoring of construction earthwork. SDSNH Locality 4752, located within the Dennery Ranch residential development along the north side of Otay Mesa, produced numerous burrows, along with internal and external molds of bivalves and gastropods. SDSNH Locality 5648, located along the south side of Main Street between Auto Park Avenue and Maxwell Road, produced numerous isolated teeth of sharks (*Striatolamna*, *Heterodontus*, and *Squatina*) and rays (rhinobatids and myliobatids), and internal and external molds of marine mollusks, primarily continental shelf-inhabiting bivalves (*Glycymeris*, *Acanthocardia*, *Spisula*, and *Callista*).

The **Otay Formation** preserves a remarkably rich assemblage of terrestrial plants and animals consisting mostly of extinct land mammals, but also includes tortoise, lizards, and birds. The land mammals include

exotic species of hedgehog, rhinoceros, and camel, as well as gopher, squirrel, mouse, and several carnivores, including a small fox-like canid, a medium-sized short-faced dog, and a false-saber-toothed nimravid (Deméré, 1986, 1988; Hoffman and Prothero, 2004; Prothero and Lubar, 2016). The most common fossils are remains of oreodonts, an extinct group of wholly North American hoofed mammals (ungulates) distantly related to camels and pigs. Plant fossils known from the Otay Formation include leaf impressions of aquatic species like cattails and reeds. There are seven SDNHM localities from the Otay Formation in the vicinity of the Project site, all documented during previous paleontological monitoring of construction earthwork. Two localities (SDSNH Localities 4264 and 5411) were recovered from the middle "gritstone member" of the Otay Formation during construction of residential developments along the north side of Otay Mesa between 0.75 and 1.0 miles southwest of the Project site, and produced numerous skulls, skeletons, and isolated cranial, mandibular, dental, and postcranial remains of the oreodont *Sespia*. The remaining five localities lie between 0.75 and 1.0 miles northeast of the Project site, and were documented within the upper "sandstone-mudstone member" of the Otay Formation during excavations for the Otay Landfill (SDSNH Localities 4857, 6050, and 6051) and mass grading for the Otay Ranch Village 2 South residential development (SDSNH Localities 7594 and 7599). These localities produced teeth, jaws, and postcranial bones of artiodactyls (including camel, the oreodonts *Mesoreodon* and *Sespia*, and the mouse deer *Hypertragulus*), teeth and jaws of rodents (*Leidymys* and *Heliscomys*), a partial humerus of an unidentified carnivore, and a vertebra of a squamate reptile.

Pleistocene-age old alluvial flood plain deposits have produced fossils at numerous locations in coastal San Diego County, and have yielded impressive collections of terrestrial vertebrates including pond turtle, passenger pigeon, hawk, mole, rabbit, gopher, squirrel, capybara, wolf, horse, camel, deer, bison, mastodon, mammoth, and ground sloth (Chandler, 1982; Deméré et al., 2013; Guthrie, 2012; Jefferson, 1991; Majors, 1993; SDNHM unpublished paleontological collections data). The SDNHM has one locality from Pleistocene-age old alluvial flood plain deposits in the vicinity of the Project site, located approximately 0.75 to the southeast in the Otay River Valley along the east side of Heritage Road. SDSNH Locality 6699 was discovered during monitoring of remediation grading activities at the former Otay Skeet and Trap Shooting Range, and produced weathered upper molars and a right scapula of an ancient horse (*Equus* sp.).

Fossil collection localities are generally undocumented within **Holocene-age alluvium, slope wash, and topsoil** and **undocumented fill**. In the case of Holocene-age deposits, this is due to their relatively young geologic age and the recognition that organic remains preserved in such deposits are conspecific with organisms living in the area today. Artificial fill has been previously disturbed and may have been imported to its current location. Any fossils these deposits may contain have lost their original stratigraphic and geographic context, and are thus not considered to be scientifically significant.

3.2 Results of the Paleontological Resource Assessment

Following San Diego County's paleontological sensitivity guidelines, as outlined in Section 2.2, the sedimentary deposits underlying the Project site are assigned paleontological sensitivity ratings ranging from zero to high (Table 1, Figure 3). The Mission Valley Formation is assigned a high paleontological sensitivity based on the recovery of diverse and scientifically significant fossil assemblages of terrestrial vertebrates and marine organisms from these strata. Likewise, the Otay Formation is assigned a high paleontological sensitivity based on the recovery of scientifically significant fossil assemblages of terrestrial mammals from this geologic unit. Pleistocene-age old alluvial flood plain deposits are assigned a moderate paleontological sensitivity based on the scattered occurrence of scientifically significant vertebrate fossils in similar deposits in western San Diego County. Holocene-age alluvium,

slope wash, and topsoil are assigned a low paleontological sensitivity, and undocumented fill deposits are assigned zero paleontological sensitivity.

Sources: Existing conditions approximately as presented by Geocon, Inc., 2021; Terrain Hillshade, World Transportation and Imagery, Esri et al., 2023

Figure 3: Paleontological sensitivity map, Nirvana Self Storage, City of Chula Vista, San Diego County, California

Table 1. Summary of geologic units underlying the Project site and paleontological monitoring recommendations.

Geologic Unit	Age	Paleontological Sensitivity	Monitoring Recommended?
Undocumented fill	Recent	Zero sensitivity	No
Young alluvium, slope wash, topsoil	Holocene	Low sensitivity	No
Old alluvial flood plain deposits	middle to late Pleistocene	Moderate sensitivity	**Yes**
Otay Formation	late Oligocene	High sensitivity	**Yes**
Mission Valley Formation	middle Eocene	High sensitivity	**Yes**

3.3 Results of the Paleontological Impact Analysis

Based on a review of the available Project design review grading plans (dated 22 September 2021) and geotechnical design recommendations (Geocon, Inc., 2021), it appears that proposed earthwork will primarily involve grading to create a level building pad, located between approximately 183 and 186 feet above sea level (asl). The building pad is proposed to be constructed as a transition pad, with cuts primarily required in the northern portion of the site, and fill required in the southern portion of the site. The estimated maximum cut depth as outlined on the Project design review grading plans is 35 vertical feet, with planned fill depths of up to 52 vertical feet. The geotechnical report also recommends remedial grading to remove the bentonitic claystone horizons present within the Otay Formation (or Mission Valley Formation) at or near the proposed finished pad grade. Current plans suggest that this remedial grading may extend excavation depths an additional 10 or more feet below the finished grade. Trenching for subgrade utilities and storm drains is also anticipated to require deeper excavations.

It is anticipated that all undocumented fill, all Holocene-age alluvium, slope wash, and topsoil, and the vast majority of the Pleistocene-age old alluvial flood plain deposits present within the Project site will be removed during grading. In addition, the underlying older geologic unit (Otay Formation or Mission Valley Formation) will be impacted near the base of excavations and during remedial grading to remove the bentonitic claystone horizons and during trenching for deep utilities.

4.0 Recommendations & Conclusions

The Project site is underlain by geologic units ranging from zero sensitivity (undocumented fill deposits) to low sensitivity (Holocene-age young alluvium, slope wash, and topsoil) to moderate sensitivity (Pleistocene-age old alluvial flood plain deposits) to high sensitivity (the Otay Formation or Mission Valley Formation). Only excavation activities within Pleistocene-age old alluvial flood plain deposits, the Otay Formation, and/or Mission Valley Formation have the potential to result in impacts to paleontological resources. It is anticipated that Pleistocene-age old alluvial flood plain deposits will be impacted during grading across the majority of the Project site and off-site areas (see Figure 3), while the underlying older geologic unit (Otay Formation or Mission Valley Formation) will be impacted near the base of excavations, during remedial grading to remove the bentonitic claystone horizons, and during trenching for deep utilities. Therefore, these excavation activities have the potential to result in impacts to paleontological resources.

Implementation of a paleontological mitigation program, in the form of paleontological monitoring, is recommended for earthwork at the Project site that may directly impact previously undisturbed deposits of the Mission Valley Formation, Otay Formation, and/or Pleistocene-age old alluvial flood plain deposits. Implementation of the following mitigation measures will reduce any Project-related impacts to paleontological resources to a level that is less than significant. The mitigation measures outlined below are based on established industry best practices (Murphey et al., 2019).

4.1 Mitigation Measures

1. **Pre-construction (personnel and repository):** Prior to the commencement of construction, a qualified Project Paleontologist shall be retained to oversee the mitigation program (a Project Paleontologist is a person with a Ph.D. or M.S. Degree in paleontology or related field, and who has a working knowledge of San Diego County paleontology and documented experience in professional paleontological procedures and techniques). In addition, a regional fossil repository shall be designated to receive any discovered fossils. Because the Project is located in San Diego County, the recommended repository is the San Diego Natural History Museum.
2. **Pre-construction (meeting):** The Project Paleontologist should attend the pre-construction meeting to consult with the grading and excavation contractors concerning excavation schedules, paleontological field techniques, and safety issues.
3. **During construction (monitoring):** A paleontological monitor (working under the direction of the Project Paleontologist) should be on-site on a full-time basis during earthwork impacting previously undisturbed deposits of high paleontological sensitivity (e.g., Mission Valley Formation and/or Otay Formation) and moderate paleontological sensitivity (e.g., Pleistocene-age old alluvial flood plain deposits) to inspect exposures for unearthed fossils. It is anticipated that these geologic units will be impacted during site grading and other miscellaneous excavations occurring at or below finished grade (e.g., storm drain excavations, trenching for subgrade utilities and foundations, grading of driveways). Monitoring may be reduced or terminated at the discretion of the Project Paleontologist based on the results of initial monitoring.
4. **During construction (fossil recovery):** If fossils are discovered, the Project Paleontologist (or paleontological monitor) should recover them. In most cases, fossil recovery can be completed in a short period of time. However, some fossil specimens (e.g., a bone bed or a complete large mammal skeleton) may require an extended recovery period. In these instances, the Project Paleontologist (or paleontological monitor) has the authority to temporarily direct, divert, or halt grading to allow recovery of fossil remains in a timely manner.
5. **Post-construction (treatment):** Fossil remains collected during monitoring and recovery should be cleaned, repaired, sorted, and cataloged as part of the mitigation program.
6. **Post-construction (curation):** Prepared fossils, along with copies of all pertinent field notes, photos, and maps, should be deposited (as a donation) in the designated fossil repository. Donation of the fossils shall be accompanied by financial support for initial specimen processing and storage.
7. **Post-construction (final report):** A final summary paleontological mitigation report should be completed that outlines the results of the mitigation program. This report should include

discussions of the methods used, stratigraphic section(s) exposed, fossils collected, inventory lists of catalogued fossils, and significance of recovered fossils.

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Appendix A

List of SDNHM fossil collection localities in the vicinity of the Project site.

Appendix A: Locality List
San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
6699	Flat Rock	City of Chula Vista, San Diego County, California	171	Bay Point Formation, unnamed nonmarine deposit	Cenozoic	Quaternary	late Pleistocene
4752	Dennery Ranch Road Cut	San Diego County, California	120	Mission Valley Formation	Cenozoic	Paleogene	middle Eocene
5648	Sunroad Auto Park	City of Chula Vista, San Diego County, California	90	Mission Valley Formation	Cenozoic	Paleogene	middle Eocene
4264	Dennery Ranch	City of San Diego, San Diego County, California	275	Otay Formation, gritstone member	Cenozoic	Paleogene	late Oligocene
5411	Hidden Trails	City of San Diego, San Diego County, California	280	Otay Formation, gritstone member	Cenozoic	Paleogene	late Oligocene
6051	Otay Landfill Canyon 3, Phase 3C	San Diego County, California	398	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene
6050	Otay Landfill Canyon 3, Phase 3C	San Diego County, California	350	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene
4857	Otay Landfill Canyon 3 Phase 3A, Microsite	San Diego County, California	412	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	Oligocene
7594	Otay Ranch Village 2 South	City of Chula Vista, San Diego County, California	406	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene
7599	Otay Ranch Village 2 South	City of Chula Vista, San Diego County, California	470	Otay Formation, sandstone-mudstone member	Cenozoic	Paleogene	late Oligocene