Paleontological Resources Technical Report

LS Power Grid California (LSPGC)
Round Mountain 500 kV Dynamic Reactive Support
Shasta County, California

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Executive Summary

This Paleontological Resources Technical Report was prepared for the proposed LS Power Grid California (LSPGC)'s Round Mountain 500 kV Dynamic Reactive Support project (Proposed Project). The purpose of this report is to identify and summarize existing conditions of paleontological resources that potentially occur within the Proposed Project area, identify individual Proposed Project construction elements that may negatively impact paleontological resources, and provide recommendations to minimize any potential negative impacts.

The goal of the Proposed Project is to ensure the reliability of this portion of the California Independent System Operator Corporation (CAISO) controlled grid. The Proposed project is located on approximately 40 acres within an approximately 426-acre parcel located directly adjacent to the Round Mountain - Table Mountain #1 and #2 500 kV transmission line corridor. The Proposed Project site is approximately 2,000 feet east of Fern Road, approximately 1.6 miles northwest of the unincorporated community of Whitmore, and approximately 9.3 miles north of State Highway 44 in unincorporated southern Shasta County. The main component of the Proposed Project is a Static Synchronous Compensator (STATCOM) Substation, herein referred to as the Fern Road Substation, which would include an approximately +/-529 MVAR (million volt-amperes, reactive) dynamic reactive support facility to include a minimum of two equally sized STATCOM units. The STATCOM units would be located within the new Fern Road Substation and would be independently connected (e.g., looped-in) to Pacific Gas and Electric Company's (PG&E) regional electric transmission system via the Round Mountain - Table Mountain #1 and #2 500 kV transmission lines that are located adjacent to the Proposed Project site. The Proposed Project would also upgrade the existing PG&E distribution line located along the west side of Fern Road by converting approximately eight wood poles from a single phase 12 kV to three phase 12 kV.

The Proposed Project site lies along the western slope of the Cascade Range, between a chain of prominent volcanic cones to the east and the Sacramento Valley to the west. Westward-flowing rivers and streams in this area have downcut through the extensive lava flows and volcaniclastic rocks that record the more recent history of volcanism in the region and exposed the underlying nonmarine sedimentary rocks. The immediate area of the Proposed Project site is underlain by volcaniclastic rocks of the late Pliocene-age Tuscan Formation and nonmarine sedimentary deposits of the middle Eocene-age Montgomery Creek Formation. The site-specific geotechnical investigation also identified the presence of 2 to 2 ½ feet of Recent alluvium and topsoil at the surface of the Proposed Project site.

The results of the paleontological records searches and literature review indicate that fossils have not been documented from these geologic units within a 5-mile radius of the Proposed Project site. However, a fossil dragonfly, fossil plants, and a fossil mussel have been documented from localities within the Montgomery Creek Formation located between 6 and 9 miles north of the Proposed Project site. Elsewhere in Shasta County, the Montgomery Creek Formation has produced a diverse middle Eocene-age flora. The Tuscan Formation, meanwhile, has produced poorly documented and scattered occurrences of fossil plants and freshwater diatoms in eastern Tehama County and northern Butte County.

Following the paleontological potential criteria developed by the Society of Vertebrate Paleontology (SVP, 2010), the Montgomery Creek Formation is assigned a high paleontological potential, the sedimentary portion of the Tuscan Formation is assigned an undetermined paleontological potential, and surficial alluvium and topsoil are assigned a low paleontological potential. Accordingly, any Project-related earthwork that extends greater than approximately 2 feet below existing grade has the potential to impact paleontological resources preserved within the Montgomery Creek Formation and sedimentary portions of the Tuscan Formation. Development and implementation of a project-specific Paleontological Resources Mitigation and Monitoring Plan (PRMMP), as outlined in APM PALEO-1, is recommended to mitigate potentially adverse impacts to paleontological resources during construction through the recovery and conservation of any fossils that are unearthed during construction. In addition, APM PALEO-2 is provided to account for possible inadvertent discoveries made during construction.

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1.0 Introduction

1.1 Proposed Project Description

The Round Mountain 500 kilovolt (kV) Area Dynamic Reactive Support Project (Proposed Project) was approved by the California Independent System Operator Corporation (CAISO) to ensure the reliability of the CAISO controlled utility grid. This would be accomplished through the construction of a dynamic reactive device between two equally sized blocks. The Proposed Project is being proposed by LS Power Grid California (LSPGC), a Delaware limited liability company established to own utility transmission projects in California.

The main component of the Proposed Project is a Static Synchronous Compensator (STATCOM) Substation, herein referred to as the Fern Road Substation, which would include an approximately +/- 529 MVAR (million volt-amperes, reactive) dynamic reactive support facility to include a minimum of two equally sized STATCOM units. The STATCOM units would be located within the new Fern Road Substation and would be independently connected (e.g., looped-in) to Pacific Gas and Electric Company's (PG&E) regional electric transmission system via the Round Mountain - Table Mountain #1 and #2 500 kV transmission lines that are located adjacent to the Proposed Project site. The Proposed Project would also upgrade the existing PG&E distribution line located along the west side of Fern Road by converting approximately eight wood poles from a single phase 12 kV to three phase 12 kV.

LSPGC holds an option to purchase 40 acres within an approximately 426-acre parcel located directly adjacent to the Pacific Gas & Electric Company's (PG&E) Round Mountain - Table Mountain #1 and #2 500 kV transmission line corridor. The Proposed Project site is located approximately 2,000 feet east of Fern Road, and approximately 1.6 miles northwest of the unincorporated community of Whitmore and approximately 9.3 miles north of State Highway 44 in unincorporated southern Shasta County (Figure 1).

Proposed Project components and construction methods, as currently proposed, are outlined below and depicted in Figure 2:

- The new Fern Road Substation will be constructed, and will include two new STATCOM units, a 500 kV switchyard and associated facilities, and parking. The major associated equipment (e.g., power transformers, power circuit breakers, reactors, IGBT value/Control Enclosures, cooling equipment) will be installed on concrete foundations. Each transformer would have an oil containment system consisting of an impervious, lined, open or stone-filled sump area around the transformer. Take-off towers, lightning shielding masts, and a microwave tower will also be installed within the new substation footprint.
    - The overall site will be mass graded with cuts measuring up to 15 feet deep. A total of 63,000 cubic yards of excavated material is anticipated.
    - Sub-grade over-excavation will be required for structure and equipment foundations, underground ducts, ground grid, and the control shelter. The foundations will be supported on at least 12 inches of engineered fill.
    - The take-off towers will be installed on concrete pier foundations. Installation will require excavations extending 15 to 25 feet deep.
    - Oil containment basins will be constructed and are estimated to measure approximately 70 feet by 160 feet in area, and 3.5 feet deep.

Sources: World Topographic Map, Esri et al., 2021

PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

Figure 1: Overview Map
LSPGC Round Mountain 500 kV Dynamic Reactive Support, Shasta County, California

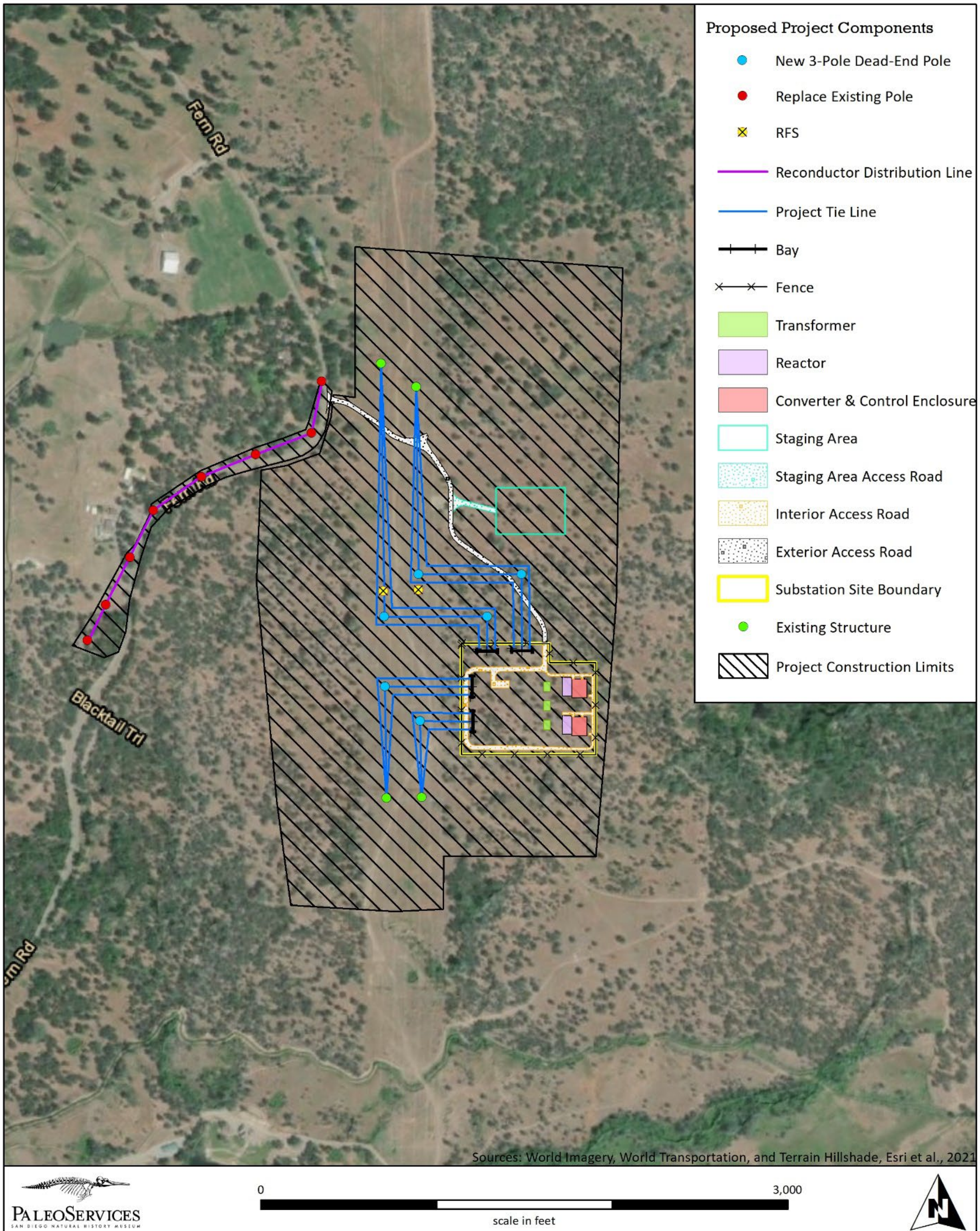

Figure 2: Project Overview, LSPGC Round Mountain 500 kV Dynamic Reactive Support, Shasta County, California

- The two existing PG&E Round Mountain – Table Mountain #1 and #2 500 kV overhead transmission lines will be modified to interconnect the Fern Road Substation to the regional transmission system. Reconfiguration will require the removal of two existing lattice steel structures and the installation of new tubular steel pole (TSP) dead-end structures to allow both transmission lines to make a 90-degree turn to the east, make another 90-degree turn to the south and into the Fern Road Substation, exit the Fern Road Substation to the west, and complete a final 90-degree turn to the south to rejoin the existing PG&E ROW. Nine new TSP dead-end structures will be installed per transmission line, for a total of 18 new TSP dead-end structures.
    - Excavations related to the removal of two existing lattice steel structures will take place within previously disturbed sediments.
    - The new TSP dead-end structures will be installed on concrete pier foundations. Installation will require excavation extending 15 to 25 feet deep.
    - Installation of the new overhead transmission lines will not require ground disturbance.
- The extension of distribution level power to the Fern Road Substation will be provided through a new tap into an existing PG&E distribution line that is located on the west side of Fern Road. PG&E distribution upgrades include the conversion of approximately eight wood poles from a single phase 12 kV to three phase 12 kV. This will require PG&E to replace approximately eight wood poles and reconductor approximately 1,600 feet of distribution line. The new wood or steel poles will be approximately 50 feet in height and will be installed as close to the original pole location as feasible.
    - The replacement wood or steel poles will be direct buried.
    - Reconductor of overhead distribution line will not require ground disturbance.
- Other on- and off-site improvements and/or construction elements include: new signage and lighting for the STATCOM units, access road improvements and new access road construction, installation of chain link and barb wire security fencing, and use of a construction staging/laydown area.
    - An existing access road leading from Fern Road will be widened to approximately 20 feet, graded, and improved with gravel or rock.
    - A new 20 foot-wide access road will be graded and graveled or rocked to provide internal access within the Fern Road Substation facility, and will loop around the interior of the substation.
    - An approximately 1.4-acre temporary construction staging area will be located directly north of the Fern Road Substation site, with access provided by a temporary driveway. Preparation of the staging area will involve clearing, grubbing, and limited grading.

1.2 Scope of Work

The Proposed Project site is located in an area underlain by native geologic units that are undisturbed at depth. For this reason, an assessment of paleontological resources was undertaken to determine whether construction of the Proposed Project has the potential to negatively impact paleontological resources. This report is intended to summarize existing paleontological resource data in the vicinity of the Proposed Project site, discuss the significance of these resources, examine potential Proposed

Project-related impacts to paleontological resources, and, if necessary, suggest mitigation measures to reduce any potential impacts to paleontological resources to less than significant levels. This report was written by Katie M. McComas and Thomas A. Deméré of the Department of PaleoServices, San Diego Natural History Museum (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 (Society of Vertebrate Paleontology [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.

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 is the case for 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 Significant Paleontological Resources

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 Proposed Project is located within an unincorporated portion of Shasta County, California. As such, state and local regulations are applicable to the Proposed Project.

1.4.1 State: California Environmental Quality Act

The California Environmental Quality Act (CEQA, Public Resources Code Section 21000 et seq.) addresses paleontological resources in the context of an environmental review for a discretionary state or local agency action. Guidelines for the Implementation of CEQA are included in the California Code of Regulations (CCR), sections 15000 *et seq*. Within the CCR, paleontological resources are specifically addressed in the Environmental Checklist (CCR Section 15023, Appendix G): "Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature."

CEQA does not provide a definition for a "unique paleontological resource" in the Environmental Checklist (CCR Section 15023, Appendix G), nor does it include specific guidelines for the mitigation of paleontological resources under Section 15126.4, Consideration and Discussion of Mitigation Measures Proposed to Minimize Significant Effects. Therefore, most CEQA lead agencies follow the definitions and guidelines provided by SVP (2010), which are in line with industry standards (e.g., Murphey et al., 2019; and see Section 1.3.1). The SVP (2010) additionally provides criteria for determining the significance of paleontological resources (see sections 1.3.1 and 2.2), and for appropriate measures to minimize impacts to paleontological resources. As advised by SVP (2010), impacts to paleontological resources can be minimized to a level below the threshold of significance through: 1.) the permanent preservation of a fossil locality and its contained fossil resources or 2.) the implementation of a paleontological mitigation program that would reduce any adverse impacts to a level below the threshold of significance through the salvage and permanent storage of any salvaged fossils in an established scientific institution.

1.4.2 Local: Shasta County

The Shasta County General Plan (amended through September 2004) briefly discusses paleontological resources in the Minerals Resource Group (Section 6.3). It notes: "Portions of Shasta County are underlain by sedimentary rocks that are known to produce valuable, scientifically significant vertebrate and invertebrate fossils. Vertebrate and certain invertebrate fossils are recognized as significant, nonrenewable paleontological resources and are protected under Federal, State, and local environmental laws." However, the Shasta County General Plan does not specifically outline any objectives or policies for the protection of paleontological resources.

2.0 Methods

2.1 Paleontological Literature Review and Records Searches

Paleontological records searches of the paleontological collections at the SDNHM and University of California Museum of Paleontology (UCMP) were conducted in order to identify any known fossil collection localities in the vicinity of the Proposed Project site. In addition, a literature review was conducted to gain a greater understanding of the geologic history of the area surrounding the Proposed Project site, as well as to determine the types of fossils that the specific geologic units underlying the Proposed Project site have produced. The literature review included examination of relevant published geologic maps and reports, peer-reviewed papers, and other relevant literature (e.g., field trip guidebooks, unpublished theses and dissertations, archived paleontological mitigation reports). This approach was followed in recognition of the direct relationship between paleontological resources and the geologic units within which they are entombed. Knowing the geologic history of a particular area and the fossil productivity of geologic units that occur in that area, it is possible to predict where fossils may or may not be encountered.

2.2 Paleontological Resource Assessment Criteria

The Society of Vertebrate Paleontology (SVP, 2010) has developed mitigation guidelines for paleontological resources that conform with industry standards (Murphey et al., 2019) and were developed with input from a variety of federal and state land management agencies. As described in Section 1.4.1, use of the SVP (2010) guidelines is common practice by CEQA lead agencies.

The SVP (2010) guidelines recognize that significant paleontological resources are considered to include not only actual fossil remains and traces, but also the fossil collecting localities and the geologic units containing those fossils and localities, and thus evaluate paleontological potential (or paleontological sensitivity) of individual geologic units within a project area. Paleontological potential is determined based on the existence of known fossil localities within a given geologic unit, and/or the potential for future fossil discoveries, given the age and depositional environment of a particular geologic unit. The SVP guidelines include four classes of paleontological potential: High Potential, Undetermined Potential, Low Potential, or No Potential (SVP, 2010). A summary of the criteria for each paleontological potential ranking is outlined below.

2.2.1 High Potential

Geologic units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources. Geologic units classified as having high potential include, but are not limited to, some volcaniclastic formations (e. g., ashes or tephras), some low-grade metamorphic rocks which contain significant paleontological resources anywhere within their geographical extent, and geologic units temporally or lithologically suitable for the preservation of fossils (e. g., deposits aged middle Holocene and older consisting of fine-grained fluvial sandstones, argillaceous and carbonate-rich paleosols, cross-bedded point bar sandstones, fine-grained marine sandstones, etc.). Paleontological potential includes both the potential for yielding abundant or significant vertebrate fossils or for yielding significant invertebrate, plant, or trace fossils, as well as the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data. Geologic units which contain potentially datable organic remains older than late Holocene, including deposits associated with animal nests or middens, and geologic units which may contain new vertebrate deposits, traces, or trackways are also classified as having high potential.

2.2.2 Undetermined Potential

The definition for undetermined potential provided by SVP (2010) has been expanded for the purposes of this report in order to add more information related specifically to the management of paleontological resources in the context of mitigation paleontology. Geologic units are assigned an undetermined potential if there is little information available concerning their paleontological content, geologic age, and depositional environment. Further field study of the specific formation is necessary to determine if these geologic units have high or low potential to contain significant paleontological resources. For planning purposes, this class of resource potential represents a conservative assessment that assumes an undetermined geologic unit is fossiliferous until proven otherwise.

In the context of mitigation paleontology, gaining additional information about a geologic unit assigned an undetermined potential in order to refine the resource potential ranking (e.g., to high potential or low potential) can be accomplished in several ways depending on the nature of the geologic unit and whether it is exposed at the surface. Field surveys (e.g., a pre-construction survey as part of a paleontological resource assessment) can be conducted when a geologic unit is well exposed at the ground surface, allowing paleontologists to physically search for fossils while also studying the stratigraphy of the unit. In cases where the geologic unit is not exposed at the surface (e.g., is covered by disturbed areas such as concrete or agricultural topsoil, or occurs in the subsurface underlying another geologic unit), strategically located excavations into subsurface stratigraphy may be conducted to gain additional information (e.g., geotechnical investigation boreholes or trenches). Paleontological monitoring of excavations into a geologic unit with an undetermined potential as part of a paleontological monitoring program may also allow for refinement of the resource potential ranking of the unit over the course of the monitoring program. In this case, the results of the monitoring program are used to routinely reevaluate the resource potential ranking of the geologic unit.

2.2.3 Low Potential

Reports in the paleontological literature or field surveys by a qualified professional paleontologist may allow determination that some geologic units have low potential for yielding significant fossils. Such geologic units will be poorly represented by fossil specimens in institutional collections, or, based on general scientific consensus, only preserve fossils in rare circumstances where the presence of fossils is an exception not the rule, e. g. basalt flows or Recent colluvium. Geologic units with low potential typically will not require impact mitigation measures to protect fossils.

2.2.4 No Potential

Geologic units with no potential 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. Artificial fill materials also have no potential, because the stratigraphic and geologic context of any contained organic remains (i.e., fossils) has been lost. For projects encountering only these types of geologic units, paleontological resources can generally be eliminated as a concern, and no further action taken.

2.3 Paleontological Impact Analysis

Direct impacts to paleontological resources occur when earthwork operations cut into the geologic units within which fossils are buried and physically destroy the fossil remains. As such, only those excavations that will disturb potentially fossil-bearing geologic units have the potential to significantly impact paleontological resources. As described above, potentially fossil-bearing geologic units are those rated with a high potential. Taking a conservative approach, geologic units with an undetermined potential are also considered to be potentially fossil-bearing until proven otherwise. Although impact avoidance is possible through relocation of a proposed action, paleontological monitoring during construction is typically recommended to reduce any negative impacts to paleontological resources to less than significant levels.

The purpose of the impact analysis is to determine which (if any) of the Proposed Project-related earthwork activities may disturb potentially fossil-bearing geologic units, and where and at what depths these impacts are likely to occur. The paleontological impact analysis involved analysis of available Project documents and comparison with geological and paleontological data gathered during the records searches and literature review.

3.0 Results

The Proposed Project site is located within the southern portion of the Cascade Range Geomorphic Province of California. The Cascade Range is characterized by a chain of prominent stratovolcanoes (e.g., Mount Shasta to the north and Mount Lassen to the southeast of the Proposed Project site) and associated smaller volcanic cones (e.g., Crater Peak to the east of the Proposed Project site) and volcanic flows that extends from northern California through Oregon and into Washington and British Columbia—part of the Pacific Ring of Fire that encircles the Pacific Ocean. The Cascade Volcanic Arc formed as the result of the ongoing subduction of the Juan de Fuca, Explorer, and Gorda oceanic plates beneath the North American continental plate. As the denser oceanic slabs descend into the superheated mantle, buoyant plumes of magma rise through the crust to form magma chambers that feed intermittent volcanism at the surface.

The Proposed Project site lies along the western slope of this volcanic range, where Pleistocene and Pliocene lava flows and volcaniclastic rocks (e.g., Pleistocene and Pliocene basalt, andesite, and dacite flows, and lahars of the Pliocene-age Tuscan Formation) record the more recent (last approximately 3.5-million-year) history of Cascadian volcanism. Westward-flowing rivers and streams have downcut through the Tuscan Formation volcanic rocks and exposed the underlying Eocene-age nonmarine sedimentary rocks of the Montgomery Creek Formation and Cretaceous-age marine sedimentary rocks of the Chico Formation. Farther west, these rivers and streams feed into the Sacramento River and Sacramento Valley alluvial plain south of Redding.

As mapped by Macdonald & Lydon (1972), the immediate area of the Proposed Project site is underlain by the Tuscan Formation and Montgomery Creek Formation (Figure 3). In addition, the site-specific geotechnical investigation of the Proposed Project site identified surficial alluvium and topsoil measuring 2 to 2 ½ feet thick overlying native bedrock in the vicinity of the Proposed Project site (Terracon, 2020).

3.1 Paleontological Literature Review and Records Searches

3.1.1 Surficial Alluvium & Topsoil

As described in the site-specific geotechnical investigation report, surficial alluvium and topsoil measuring 2 to 2 ½ feet thick was observed to directly overlie sandstones of the Montgomery Creek Formation in three borings spanning the central portion of the Proposed Project site (west to east). This material is characterized as sandy clay, poorly graded gravel with silt, and clayey sand (Terracon, 2020). Surficial regolith and colluvium is unmapped within the Proposed Project site, but likely occurs throughout the area as the result of natural weathering of the underlying bedrock.

These deposits are likely late Holocene to Recent in age (less than approximately 4,200 years old), and are therefore too young to contain fossil remains.

3.1.2 Tuscan Formation (Tt)

As mapped by Macdonald & Lydon (1972), the Tuscan Formation nonconformably overlies the Montgomery Creek Formation in the northern one-third of the Proposed Project construction limits, and in a smaller patch located along the southern portion of the proposed work area for the PG&E distribution line upgrades. Geotechnical borings were located south of the mapped extent of the Tuscan Formation, so this geologic unit was not identified in the geotechnical study (Terracon, 2020).

The late Pliocene-age (approximately 3 million years old) Tuscan Formation is primarily composed of tuff breccias formed by lahars (volcanic mudflows), along with lapilli tuff, volcanic pebble conglomerate, sandstone, and siltstone, and lesser lava flows (Lydon, 1968; Macdonald & Lydon, 1972). Clasts within the breccias are composed of andesite and basaltic andesite, with the volcanic source of the Tuscan Formation likely located to the east in the vicinity of Lassen Peak (Anderson & Russell, 1939; Lydon, 1968). The geologic age of the Tuscan Formation has been determined based on the recovery of late Pliocene (Blancan) vertebrate fossils from alluvial fan and fluvial deposits of the Tehama Formation, which interfingers with the Tuscan Formation in the Sacramento Valley (Anderson & Russell, 1939;

Helley & Harwood, 1985). In addition, a welded tuff layer located near the base of both formations has been dated at 3.3 million years old (Lydon, 1968; Prihar, 1987).

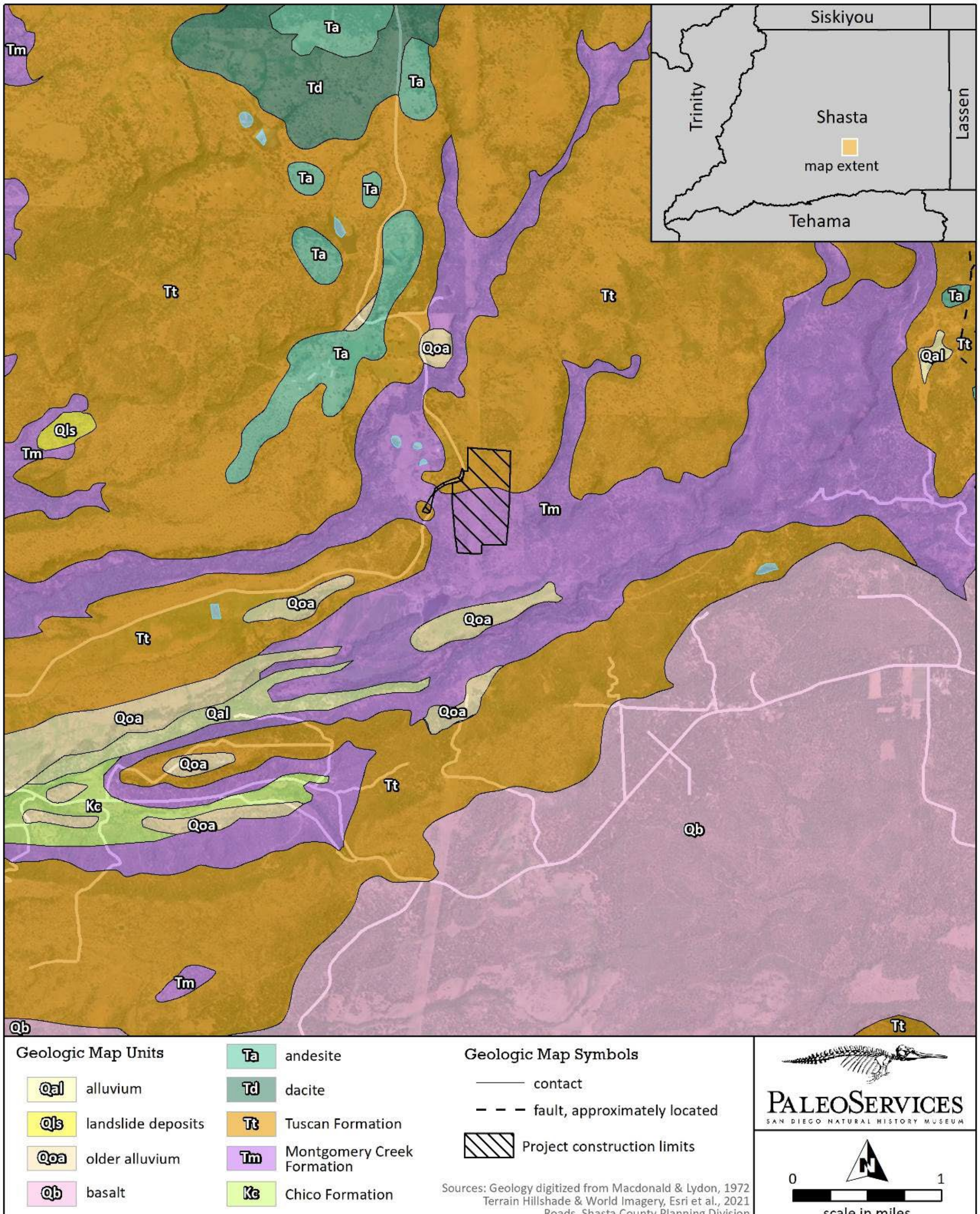

Figure 3: Geologic Map, LSPGC Round Mountain 500 kV Dynamic Reactive Support, Shasta County, California

The records searches at the SDNHM and UCMP found no documented fossil collection localities from the Tuscan Formation in the vicinity of the Proposed Project site. More broadly, however, the Tuscan Formation has produced plant fossils from several localities in northern Butte and eastern Tehama counties, including decomposed plant stems (from the type section, Tuscan Springs, located northeast of Red Bluff, Tehama County), rush imprints (north of Red Bluff, Tehama County), a 10-inch-diameter tree trunk (about 14 miles north of Chico, in Tehama County), a leaf imprint (from a well core near Chico, Butte County), and casts of pine cones (Lindo Channel near Chico, Butte County) (Lydon, 1968). One fossil plant locality is recorded from the Tuscan Formation within the UCMP paleontological collections online database (UCMP Locality PA511, Spring Creek where it empties into the Sacramento River, north of Red Bluff, Tehama County)—however, there are no databased specimen records attached to this locality, and the details of exactly what was collected from this locality are unavailable (P. Holroyd, personal communication, March 31, 2021). Helley & Harwood (1985) also note the presence of abundant casts of wood fragments within lahars of the Tuscan Formation exposed north of Chico (near Richardson Springs, Butte County). In addition, two localities near the type section in Tuscan Springs have produced small assemblages of freshwater diatoms, including *Cymbella* sp., *Epithemia* sp., *Eunotia* (?) sp., *Coscinodiscus* sp., *Stephanodiscus* sp., and *Melosira granulata* (Lydon, 1968).

3.1.3 Montgomery Creek Formation (Tm)

The Montgomery Creek Formation underlies surficial alluvium in the southern two-thirds of the Proposed Project construction limits, as mapped by Macdonald & Lydon (1972) and as identified in three geotechnical borings spanning the central portion of the Proposed Project site (Terracon, 2020). This geologic unit underlies the Tuscan Formation at unknown depths in the northern one-third of the construction limits and the southern portion of the proposed work area for the PG&E distribution line upgrades. The upper portion of the Montgomery Creek Formation, as identified in the geotechnical borings, consists of gray and black, fine- to coarse-grained sandstone that weathers to light brown and reddish orange, with minor interbedded claystone, and measured 10 feet thick (in the vicinity of the new substation site) to 40 feet thick (along the west side of the existing transmission line) (Terracon, 2020). The lower conglomeratic portion was identified in the eastern two borings (near the new substation site), and consisted of poorly sorted subrounded gravel and cobbles in a matrix of brown to black fine- to coarse-grained sandstone, and measured 25.5 to 27.5 feet thick (Terracon, 2020).

The middle Eocene-age (approximately 48 to 37 million years old) Montgomery Creek Formation generally consists of grayish green, micaceous, arkosic, massive to thick-bedded sandstones with horizons of pebble conglomerate and silty carbonaceous shale (Helley & Harwood, 1985; Macdonald & Lydon, 1972). The formation was primarily deposited in fluvial to deltaic paleoenvironments, but lacustrine and swamp paleoenvironments are also recorded, as indicated by the presence of seams of lignite and sub-bituminous coal (Anderson & Russell, 1939). In the vicinity of the Proposed Project site, the Montgomery Creek Formation unconformably overlies the Cretaceous-age Chico Formation, and it is nonconformably overlain by the Tuscan Formation (Anderson & Russell, 1939).

A records search of the paleontological collections at the SDNHM and UCMP found one documented fossil collection locality from the Montgomery Creek Formation in the vicinity of the Proposed Project site. This locality (UCMP Locality IP12971) is located approximately 6 miles north of the Proposed Project site, at "Phillips Sawmill" (located along Bullskin Ridge Road in Oak Run, CA) (P. Holroyd, personal communication, March 19, 2021). The type specimen of the extinct dragonfly *Protothore explicata* (UCMP 12463, consisting of the central portion of a wing) was recovered from this locality in "soft bluish rock" alongside fossil plants (Cockerell, 1930). In addition, an isolated specimen of the freshwater mussel *Unio* sp. and poorly preserved fossil leaves have been reported from Little Cow Creek (approximately 9 miles north of the Proposed Project site) (Diller, 1895; Macdonald & Lydon, 1972).

Fragments of silicified wood have also been reported from this area (Macdonald & Lydon, 1972). Elsewhere in Shasta County, the Montgomery Creek Formation has produced a diverse middle Eocene-age flora, including fern (*Lastraea* sp.), willow (*Salix* sp.), witch hazel (*Hamamelites* sp.), and aralia (*Aralia whitneyi*), and the following taxa, reported from the headwaters of Kosk Creek (north of Bald Mountain, north central Shasta County): palmetto (*Sabalites californicus*), elm (*Ulmus californica*), fig (*Figus tiliaefolia*), poplar (*Populus zaddachi*), oak (*Quercus convexa*), beech (*Fagus antipofii abich*), persea (*Persea pseudo-carolinensis*), laurel (*Laurus* sp.), magnolia (*Magnolia californica*), and sumac (*Rhus mixta*) (Higinbotham, 1986). Many of these genera only became common under the warm, wet climates of the Eocene (Higinbotham, 1986).

3.2 Paleontological Resource Potential Analysis

Following the SVP (2010) criteria for determining paleontological potential, as outlined in Section 2.2, each of the geologic units present within the Proposed Project construction limits has been assigned a paleontological potential, as summarized in Table 1 below and depicted in Figure 4. The Montgomery Creek Formation is assigned a high paleontological potential based on the recovery of a diverse and scientifically significant fossil flora and isolated insect fossil from this geologic unit. The sedimentary portion of the Tuscan Formation is assigned an undetermined paleontological potential based on the poorly documented and scattered occurrences of fossil plants and freshwater diatoms recovered from this portion of the geologic unit, and lack of documented fossils within Shasta County. The purely volcanic portions of the Tuscan Formation are assigned a low paleontological potential because of the high temperatures associated with the formation of volcanic rocks. Finally, the surficial alluvium and topsoil present within the Proposed Project site is assigned a low paleontological potential because these deposits are too young to contain fossils.

3.3 Paleontological Impact Analysis

As discussed above, the Proposed Project site is immediately underlain by Recent to late Holocene-age surficial alluvium and topsoil measuring 2 to 2 ½ feet thick, which overlies two bedrock geologic units: the late Pliocene-age Tuscan Formation, which underlies the northern half of the exterior access road and a small portion of the proposed staging area, and the middle Eocene-age Montgomery Creek Formation, which underlies the locations of all other Proposed Project components (Figure 4). Impacts to paleontological resources may occur only during excavations that will disturb the Montgomery Creek Formation and sedimentary portions of the Tuscan Formation. Therefore, shallow excavations that will likely only disturb surficial alluvium and topsoil do not have the potential to impact paleontological resources, while excavations that will extend greater than about 2 feet bgs (and will potentially disturb the underlying bedrock geologic units) have the potential to impact paleontological resources (Table 1).

Table 1. Summary of paleontological potential of the geologic units underlying the Proposed Project site and paleontological monitoring recommendations for earthwork impacting each geologic unit.

Geologic unit (map symbol)	Age (years old)	Paleontological potential	Monitoring recommended?
Surficial alluvium (not mapped)	Recent to late Holocene (less than 4,200)	Low potential	No
Tuscan Formation (Tt)	Late Pliocene	Sedimentary portions – Undetermined potential; Volcanic portions – Low Potential	Sedimentary portions – Yes; Volcanic portions – No
Montgomery Creek Formation (Tm)	Middle Eocene	High potential	Yes

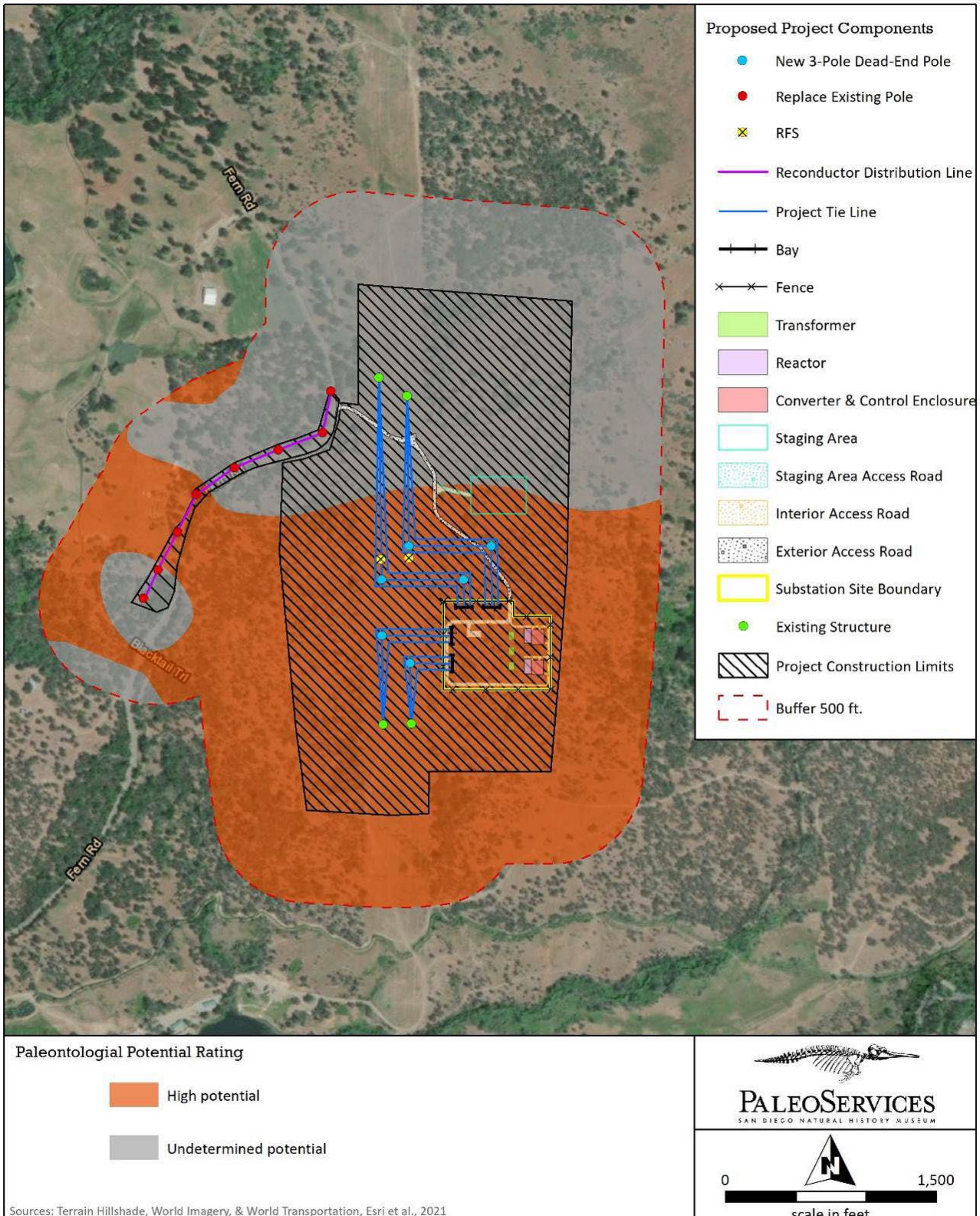

Figure 4: Paleontological Potential Map, LSPGC Round Mountain 500 kV Dynamic Reactive Support, Shasta County, California

Project components and construction methods, as currently proposed, will require varying degrees of ground disturbance, ranging from no or only superficial ground disturbance, to shallow excavation, to deeper excavation. The anticipated ground disturbance associated with each Proposed Project component and its potential to impact paleontological resources is outlined below and summarized in Table 2.

The Proposed Project components requiring the deepest excavations (on the order of 15 to 25 feet below ground surface [bgs]) will include the installation of the 18 new PG&E TSP dead-end structures and the take-off towers located within the new Fern Road Substation site, both of which will be installed on concrete pier foundations, and the installation of eight replacement wood or steel poles along the PG&E distribution line, which will be direct buried. Large-diameter helical augers used for the excavation of such boreholes and/or hand digging of holes both have the potential to bring up spoils containing unbroken fossils, and can therefore be successfully monitored for paleontological resources. Overall grading of the new Fern Road Substation site will also require relatively deep excavations, with cuts on the order of 15 feet deep. Grading operations also typically produce spoils consisting of large blocks that may contain unbroken fossils, and can be successfully monitored for paleontological resources. This deeper earthwork is recommended for paleontological monitoring.

Shallow earthwork associated with the other various Proposed Project components within the new substation footprint (e.g., excavation for equipment foundations, excavation of transformer oil containment basins, installation of security fencing and retaining walls) are also recommended for paleontological monitoring, as this excavation will extend deeper than the graded substation pad. Outside of the new substation footprint, shallow earthwork will include grading of access roads and the temporary staging area. If this earthwork will extend greater than 2 feet bgs (or deeper than the surficial alluvium and topsoil), it is recommended for paleontological monitoring.

Proposed Project components not requiring significant ground disturbance will include the installation of the new overhead transmission lines, reconductor of the distribution line along Fern Road, and installation of aboveground equipment. In addition, the removal of the existing lattice steel structures will likely take place entirely within previously disturbed and backfilled deposits related to their original installation, and are therefore not anticipated to require excavations into undetermined or high paleontological potential geologic units.

Table 2. Summary of anticipated ground disturbance associated with Proposed Project components and paleontological monitoring recommendations for this work.

Proposed Project component	Anticipated ground disturbance	Monitoring recommended?
Fern Road Substation site grading	Cuts extending up to 15 feet bgs	Yes
Excavation for shallow foundations and transformer oil containment basins	Shallow subgrade over-excavation	Yes
Installation of take-off towers	Deep augering (15 to 25 feet bgs)	Yes
Removal of existing lattice steel structures	Minimal ground disturbance within previously disturbed backfill	No
Installation of new TSP dead-end structures	Deep augering (15 to 25 feet bgs)	Yes

Installation of new overhead transmission lines	No ground disturbance	No
Installation of aboveground equipment	No ground disturbance	No
Installation of replacement wood or steel distribution poles	Deep augering or hand digging (15 to 25 feet bgs)	Yes
Reconductor of overhead distribution line	No ground disturbance	No
Installation of security fencing and retaining walls	Shallow subgrade over-excavation	Yes
Interior access road grading	Minimal at-grade resurfacing	No
Exterior access road widening and grading	Limited grading	Yes, if >2 feet bgs
Grading of temporary staging area and access road	Limited grading	Yes, if >2 feet bgs

4.0 Recommendations & Conclusions

For the Proposed Project, earthwork extending greater than 2 feet bgs has the potential to impact paleontological resources preserved within the Montgomery Creek Formation and sedimentary portions of the Tuscan Formation (Tables 1–2, Figure 4). Development and implementation of a project-specific Paleontological Resources Mitigation and Monitoring Plan (PRMMP), as outlined in Applicant Proposed Measure (APM) PALEO-1 below, is recommended to mitigate potentially adverse impacts to paleontological resources during construction through the discovery, recovery, and conservation of any fossils that are unearthed during construction.

Standard elements of a PRMMP include a description of the project earthwork to be monitored for paleontological resources (e.g., specific areas, depths of excavation, and/or project components), proposed methods for paleontological monitoring, procedures for fossil discoveries and determining the significance of a discovery, proposed field methods for fossil salvage, proposed laboratory methods for preparation and curation of recovered fossils, reporting requirements, and a curatorial agreement with a designated regional repository.

The following measures are recommended for the Proposed Project. Implementation of these measures will reduce potential adverse impacts to paleontological resources through the recovery and conservation of any fossils that are unearthed during construction.

APM PALEO-1: Prior to the issuance of grading permits, a Qualified Paleontologist shall be retained to prepare and oversee the Paleontological Resources Mitigation and Monitoring Plan (PRMMP) for the Proposed Project. The PRMMP shall contain monitoring procedures, define areas and types of earthwork to be monitored, and provide methods for determining the significance of fossil discoveries. The PRMMP shall direct that a qualified paleontological monitor (working under the supervision of the Qualified Paleontologist) shall monitor all excavations or grading at depths exceeding 2 feet bgs in sedimentary deposits of the Montgomery Creek Formation and the sedimentary portions of the Tuscan Formation. Determination of whether or not the Tuscan Formation on the Proposed Project site contains sedimentary deposits can be made based either on results of any new geotechnical information or on observations of fresh exposures during initial earthwork in the northern portion of the Proposed Project site. The duration and timing of paleontological monitoring shall be determined by the Qualified Paleontologist based on the grading plans and construction schedule, and may be modified based on the initial results of monitoring. The PRMMP shall state that any fossils that are collected shall be prepared to the point of curation, identified to the lowest reasonable taxonomic level, and curated into a recognized professional repository (e.g., SDNHM, UCMP), along with associated field notes, photographs, and compiled fossil locality data. Donation of the fossils shall be accompanied by financial support for initial specimen curation and storage.

Following the completion of the above tasks, the Qualified Paleontologist shall prepare a final mitigation report that outlines the results of the mitigation program. This report shall include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and significance of recovered fossils. The report shall be submitted to appropriate agencies, as well as to the designated repository.

APM PALEO-2: If paleontological resources are encountered during ground disturbing activities when the Qualified Paleontologist (or paleontological monitor) is not on site (an inadvertent discovery), earthwork within the vicinity of the discovery shall immediately halt, and the Qualified Paleontologist should evaluate the significance of the fossil discovery. If the fossil discovery is deemed significant, the fossil shall be recovered using appropriate recovery techniques based on the type, size, and mode of preservation of the unearthed fossil. Earthwork may resume in the area of the fossil discovery once the fossil has been recovered and the Qualified Paleontologist deems the site has been mitigated to the extent necessary.

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