TABLE OF CONTENTS

1.0 INTRODUCTION ........................................................................................................................... 1

1.1 STUDY PERSONNEL ......................................................................................................................... 2

1.2 PROJECT DESCRIPTION...................................................................................................................... 2

1.2.1 Construction of New 230 kV Double-Circuit Transmission Line .................................................... 4

1.2.2 Addition of New 230 kV Circuit................................................................................................... 14

1.2.3 Reconductoring of Existing Transmission Line ............................................................................. 14

1.2.4 Construction of New Switching Station ....................................................................................... 15

1.2.5 Expansion of Existing Switching Station ..................................................................................... 16

1.2.6 Project-Wide Mitigation Measures ............................................................................................... 16

1.2.7 Construction Work Force and Schedule ..................................................................................... 16

2.0 REGULATORY FRAMEWORK .................................................................................................... 18

2.1 FEDERAL ......................................................................................................................................... 18

2.2 STATE .......................................................................................................................................... 18

3.0 PROJECT AREA OVERVIEW .................................................................................................... 20

3.1 NATURAL ENVIRONMENT IN THE STUDY AREA ...................................................................... 20

3.1.1 Quaternary Alluvium .................................................................................................................. 20

3.1.2 Older Alluvium ............................................................................................................................. 22

3.1.3 Saugus Formation ......................................................................................................................... 22

3.1.4 Anaverde Formation ................................................................................................................... 23

3.1.5 Pico Formation ............................................................................................................................ 23

3.1.6 Castaic Formation ......................................................................................................................... 24

3.1.7 Towsley Formation ...................................................................................................................... 24

3.1.8 Hungry Valley Formation ............................................................................................................ 25

3.1.9 Ridge Route Formation .............................................................................................................. 25

3.1.10 Peace Valley Formation ............................................................................................................ 26

3.1.11 Oso Canyon Formation ............................................................................................................. 26

3.1.12 Quail Lake Formation ............................................................................................................... 27

3.1.13 Monterey/Modelo Formation ..................................................................................................... 27

3.1.14 Mint Canyon Formation ............................................................................................................ 27

3.1.15 Tick Canyon Formation ............................................................................................................ 28

3.1.16 Vasquez Formation ..................................................................................................................... 29

3.1.17 San Francisquito Formation ..................................................................................................... 29

3.1.18 Plutonic Igneous Rocks ............................................................................................................. 30

3.1.19 Mendenhall Gneiss ................................................................................................................... 30

3.1.20 Pelona Schist ............................................................................................................................. 31

4.0 INVENTORY METHODS ............................................................................................................. 32

5.0 AFFECTED ENVIRONMENT ...................................................................................................... 33

6.0 IMPACT ASSESSMENT .............................................................................................................. 34

6.1 SIGNIFICANCE CRITERIA .............................................................................................................. 34

6.2 SENSITIVITY VALUES ................................................................................................................... 34

6.3 IMPACT LEVELS............................................................................................................................ 35

6.4 MITIGATION PLANNING .............................................................................................................. 36

7.0 IMPACT RESULTS .................................................................................................................... 38

7.1 NEW 230 kV TRANSMISSION LINE............................................................................................. 38

7.1.1 Segment A.................................................................................................................................. 38
8.0 Alternatives

8.1 Development of Alternatives

8.2 Alternatives Description

8.2.1 Action Alternatives

8.2.2 No Action Alternative

8.3 Impact Results—Routing Alternatives

8.3.1 Alternative 1 (Segments A, C, and D)

8.3.2 Alternative 2 (Segments A, B, and G)—LADWP’s Proposed Action

8.3.3 Alternative 2a (Segments A, B, G, and 2a)

8.3.4 Alternative 3 (Segments A, B, F, and I)

8.4 No Action Alternative

8.5 Cumulative Effects

8.5.1 Cumulative Projects List—Major Present and Reasonably Foreseeable Future Actions

8.5.2 Cumulative Impacts

9.0 References

10.0 Acronyms and Abbreviations

Figures

Figure 1-1. LADWP’s Proposed Action Components

Figure 1-2. Types of Towers

Figure 1-3. Four-Circuit Towers To Be Utilized

Figure 1-4. Typical Tower Components

Figure 1-5. Preliminary Routing Segments

Figure 1-6. Three-Circuit Tower Types

Figure 1-7. Three-Circuit Tower Mitigation

Figure 3-1. Summary of Geologic Rock Units Along the Various Project Alternatives

Figure 7-1. Initial Impacts

Figure 8-1. Action Alternatives

Figure 8-2. Identified Helicopter Mitigation Locations

Figure 8-3. Avenue L Re-route on Alternative 3

Figure 8-4. Cumulative Projects
TABLES

TABLE 1-1. ANTICIPATED CONSTRUCTION SEQUENCE.................................................................17
TABLE 1-2. CONSTRUCTION WORKFORCE AND SCHEDULE.........................................................17
TABLE 6-1. IMPACT MATRIX COMPARING PALEONTOLOGICAL RESOURCE SENSITIVITY AND GROUND DISTURBANCE. .................................................................................................36
TABLE 7-1. MILEAGE FOR INITIAL IMPACTS AND PALEONTOLOGICAL RESOURCE SENSITIVITY ........40
TABLE 8-1. PROPOSED GENERATION PROJECTS IN THE PROJECT VICINITY ..............................61
TABLE 8-2. BLM RIDGECREST OFFICE APPLICATIONS FOR WIND AND SOLAR ENERGY GENERATION PROJECTS IN THE PROJECT VICINITY .........................................................62
TABLE 8-3. PROPOSED LOCAL PROJECTS IN THE PROJECT VICINITY ........................................65
TABLE 8-4. POTENTIAL SOURCES OF IMPACTS TO PALEONTOLOGICAL RESOURCES CAUSED BY DIFFERENT TYPES OF PROJECTS ........................................................................66

APPENDICES

APPENDIX A: PALEONTOLOGY IMPACT TABLES
APPENDIX B: DETAILED CONSTRUCTION, OPERATION, AND MAINTENANCE PROCESS
1.0 INTRODUCTION

The City of Los Angeles Department of Water and Power (LADWP) is proposing the Barren Ridge Renewable Transmission Project (BRRTTP or Project) to access clean, renewable resources in the Tehachapi Mountains and Mojave Desert areas, and to improve reliability and upgrade transmission capacity.

LADWP, the US Department of Agriculture, Forest Service (USFS or Forest Service) and the U.S Department of the Interior, Bureau of Land Management (BLM) are preparing a joint Environmental Impact Statement (EIS) / Environmental Impact Report (EIR) for the proposed BRRTTP. LADWP is the California Environmental Quality Act (CEQA) Lead Agency, while the USFS and BLM are the federal Co-Lead Agencies under the National Environmental Policy Act (NEPA). An EIS/EIR is an informational disclosure document used to inform agency decision makers and the public of the potential significant environmental effects of a project, identify possible ways to eliminate or minimize the potential significant effects, and describe reasonable alternatives to the Proposed Action /Project.

The purpose of the Paleontological Resources study is to provide an inventory of paleontological resources within the study area and to assess the potential impacts to these resources resulting from construction and operation of each of the proposed transmission line alternative corridors (Segments), addition of a new circuit onto existing structures, reconductoring of the existing transmission line, proposed switching station, and expansion of an existing switching station. The Paleontological Resources Assessment: 1) presents the regulatory framework, 2) provides an overview of the technical methodology used in collecting baseline conditions and evaluating impacts, 3) examines the affected environment within the study corridors and vicinity, 4) describes the potential impacts on paleontological resources from construction and operation of the Project, 5) evaluates the level of potential impacts based upon NEPA/CEQA criteria; and 6) presents specific recommendations for mitigation measures to reduce or eliminate potential impacts.

Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in sedimentary rocks. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. The fossil record is the only direct evidence that life on earth has existed for more than 3.6 billion years. Fossils are important scientific and educational resources because they are used to:

- Study the phylogenetic (i.e., evolutionary) relationships between extinct organisms, as well as their relationships to modern groups,
- Elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record.
- Reconstruct ancient environments, climate change, and paleoecological relationships.
- Provide a measure of relative geologic dating which forms the basis for biochronology and biostratigraphy, and which is an independent and corroborating line of evidence for radiometric dating.
- Study the past geographic distribution of organisms and tectonic movements of land masses and ocean basins through time.
- Study patterns and processes of evolution, extinction, and speciation.

Fossils are considered non-renewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced. 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 rock units (i.e., formations) containing those localities.
1.1 STUDY PERSONNEL

This report was prepared by Thomas A. Deméré, Ph.D., a paleontologist with over 34 years of experience, Michael X. Kirby, Ph.D., a paleontologist with over 10 years of experience, and Sarah A. Siren, M.S. a paleontologist with over 7 years of experience. Dr. Deméré and Ms. Siren are current staff members of the Department of PaleoServices at the San Diego Natural History Museum (SDNHM), San Diego, California. Dr. Kirby is a former SDNHM staff member, but still consults for the Museum on an as-needed basis.

1.2 PROJECT DESCRIPTION

The BRRTP would be located in Kern and Los Angeles counties. As proposed by LADWP, it would be approximately 76 miles in length extending from the Barren Ridge Switching Station to Rinaldi Substation, and extending approximately 12 miles from the Castaic Power Plant to the proposed Haskell Canyon Switching Station. As shown in Figure 1-1, the proposed BRRTP would include the following:

1) Construction of approximately 61 miles of a new 230 kilovolt (kV) double-circuit transmission line from the LADWP Barren Ridge Switching Station to Haskell Canyon;
2) Addition of approximately 12 miles of a new 230 kV circuit on the existing double-circuit structures from Haskell Canyon to the Castaic Power Plant;
3) Reconductoring of approximately 76 miles of the existing Barren Ridge-Rinaldi (BR-RIN) 230 kV transmission line with larger capacity conductors between the Barren Ridge Switching Station and the Rinaldi Substation;
4) Construction of a new switching station in Haskell Canyon;
5) Expansion of the existing Barren Ridge Switching Station.
FIGURE 1-1. LADWP’S PROPOSED ACTION COMPONENTS
1.2.1 **Construction of New 230 kV Double-Circuit Transmission Line**

The proposed double-circuit 230 kV transmission line component of the BRRTP would consist of two alternating current (AC) circuits from the Barren Ridge Switching Station to the proposed Haskell Canyon Switching Station in Haskell Canyon.

The proposed structures for the new transmission line would primarily be self-supporting double-circuit steel lattice towers fabricated from galvanized steel members, as shown on the left side of Figure 1-2. Depending on the environmental conditions of the surrounding terrain, the height of the proposed lattice structures would range from 110 to 195 feet, with an average tower-to-tower span of 1,000 to 1,100 feet. Appendix B lists the structure specifications for the number of structures per mile, average span length, and average heights for towers and components. Exact structure placement would be determined during engineering surveys and detailed design studies for the selected Alternative route following the Record of Decision (ROD) on the EIS/EIR. A variety of engineering, constructability, existing access, and environmental issues would be considered during detailed structure siting within the permitted ROW.

“Dead-end” towers of self-supporting, steel-lattice design would be required periodically to add longitudinal strength along the line. Dead-end towers would also be used at turn (angle) locations along the line, at heavily loaded tower locations, and at specific utility crossings (e.g., other transmission lines) for added safety. Dead-ended towers are of the same basic configuration as suspension towers (non-angle structures), the difference being in the tower “arms,” insulator systems, and tower weights.

**Figure 1-2. Types of Towers**

Self-supporting, tubular steel poles (TSP) have been proposed by LADWP as an available mitigation structure where appropriate to reduce potential impacts, such as conflicts with cultivation on agricultural lands. The TSPs can reduce impacts in some cases due to a smaller footprint than the proposed self-supporting steel lattice structures; however, more TSPs per mile are necessary due to a shorter average span between structures. The TSPs would have an average height range between 95 and 180 feet, depending on the conditions of the surrounding terrain, with an average tower-to-tower span of 700 to 800 feet. Refer to Figure 1-2 for an illustration of the double-circuit poles.
For the majority of the alignment, the two new 230 kV circuits would be placed on new double-circuit transmission towers, but for approximately 1.5 miles, the circuits would be placed on existing four-circuit structures that are located just north of the proposed Haskell Canyon Switching Station. Between where the existing BR-RIN crosses Dry Canyon to the intersection of the Castaic transmission lines, LADWP has existing four-circuit towers with three vacant positions. The existing towers would be utilized in this section for the proposed 230 kV double circuit transmission line instead of constructing new towers. See Figure 1-3 for the location and illustration of the existing four-circuit towers to be utilized.
FIGURE 1-3. FOUR-CIRCUIT TOWERS TO BE UTILIZED
The self-supporting steel lattice structures and TSPs would utilize concrete foundations. Steel lattice structures would require four footings (one for each leg); TSPs would require single footings. Footings would be steel-reinforced concrete pier type and be cast in place. The typical design for the concrete footings for lattice structures would be between 2.5 and 5.0 feet in diameter, with an average depth of 20 feet depending on soil conditions. Typical design for single foundations for TSPs would include augered holes approximately five to seven feet in diameter and 15 to 30 feet deep, depending on conditions. Formwork steel reinforcing would be assembled in the hole prior to casting concrete in place. Reinforcing steel would become integral to the lower leg of the steel lattice structure during assembly. An above-ground concrete form placed over each hole would result in a final concrete foundation height of 0.5 to 2.0 feet above ground level.

As illustrated in Figure 1-4, Typical Tower Components, each tower carries conductors (“wires”), insulators, and ground wires. The conductor being considered for the new double-circuit 230 kV transmission line and installation of the Castaic – Haskell Canyon #4 circuit on existing structures is a bundled 715.5 kcmil “Starling” ACSS/AW. The reconductoring of the BR-RIN transmission line between Barren Ridge Switching Station and Rinaldi Substation would require a bundled 1,433.6 kcmil “Merrimack” ACSS/TW/HS conductor.

**FIGURE 1-4. TYPICAL TOWER COMPONENTS**

Each circuit would consist of three phases (“wires”) as illustrated in Figure 1-4. To increase the current-carrying capability of the transmission lines and reduce power loss, the Proposed Action (Alternative 2) would utilize bundled conductors installed for each phase. The bundled conductors would consist of two conductor cables connected by a spacer. The new 230 kV double-circuit transmission line would consist of a total of six double-bundled (12 individual) wires.

Minimum conductor height above the ground, under normal operation of the line, is 30 feet. Greater clearances may be required in certain areas to allow for clearances over trees or other vegetation that
could pose a risk to the operation of the transmission line. Minimum conductor clearance would dictate the exact height of each tower based on topography and safety clearance requirements.

Insulators are used to provide the physical connection of conductors to structures. These system components are made of very low conducting materials (polymer insulators) that inhibit the flow of electric current from energized conductors to ground or to other energized system elements. Insulators and their associated hardware are to be configured in an “I” assembly to support conductors while maintaining required distances between phases and grounded structures. Each “I” string would consist of six-inch diameter insulators between six and eight feet long.

To shield conductors from hazard of direct lightning strikes by transferring lightning currents into the ground, overhead ground wires (shield wires) or fiber optic ground wire would be installed on top of new structures.

Construction of a transmission line involves the following general sequence of events: surveying activities; identifying and constructing access roads; clearing ROW and tower sites (including construction yards and batch plants); installing foundations; assembling and installing the towers; clearing, pulling, tensioning, and splicing; installing ground wires and conductors; installing counterpoise; switching station tie-in; and site upkeep and site reclamation. Various phases of construction would occur at different locations throughout the construction process for the BRRTP. This would require several contractors operating at the same time and in different locations. Refer to Appendix B for a description of each construction activity.

Existing paved and unpaved highways and roads would be used where possible. Roads along existing utility corridors would also be used where possible to minimize new access road construction. In locations where existing roads could be used, that are located in close proximity to the proposed or existing ROW centerlines, only new spur roads to the tower sites would be constructed. The specific locations and design of all new access and spur roads would be determined during final Project design.

It is anticipated that one or two construction yards or staging areas would be required for materials storage, construction equipment, construction vehicles, and temporary construction offices. Staging areas would be approximately five acres in size, and located centrally or near each end of the transmission line route. The staging areas would likely be located on previously disturbed land and would be level and surfaced with crushed aggregate base. The LADWP would negotiate with landowners for specific locations of the staging areas.

Routing

In 2007, a siting analysis was conducted to identify appropriate sites for a new 230 kV transmission line. Over 200 miles of routing opportunities were identified and referred to as Segments A through I (see Figure 1-5). These segments were then combined to create end-to-end routing “alternatives” as discussed in Section 8.2. All routing Segments were identified assuming the need for a 200-foot ROW for the new 230 kV transmission line and the use of conventional transmission line construction. However, as discussed in Section 8.2, the end-to-end alternatives have included specific mitigation measures to reduce certain impacts. These mitigation measures would eliminate the need for new ROW in some locations and would require the use of helicopters for tower assembly in designated areas on the ANF. Also, to the maximum extent possible, all existing access and spur roads would be utilized for the construction, operation, and maintenance of the BRRTP. Below is a brief description of each segment.
FIGURE 1-5. PRELIMINARY ROUTING SEGMENTS

Alternative Routes For New 230kV Transmission Line

- New 230kV Line and Towers (Proposed Action)
- New 230kV Line and Towers (Alternative)

Project Components Applicable for Each Alternative

- Switching Station Component
- New 230kV Circuit (Existing towers)
- Reconductoring of Existing 230kV Transmission Line (Barren Ridge - Rinaldi)

Project Components

LADWP BARREN RIDGE RENEWABLE TRANSMISSION PROJECT
Segment A is 13 miles long and runs from LADWP’s Barren Ridge Switching Station to the unincorporated community of Mojave, California. It would traverse four miles of BLM managed public lands and parallel LADWP’s existing 230 kV Barren Ridge – Rinaldi Transmission Line (BR-RIN) and the 500 kV Pacific Direct Current Intertie (PDCI). It traverses four miles of BLM-managed lands.

Segment B is 27 miles long and starts just north of the unincorporated community of Mojave, California and travels south to a point one mile east of the Antelope Valley California Poppy Reserve. This segment parallels LADWP’s existing 230 kV BR-RIN and 500 kV PDCI transmission lines for its entire length.

Segment C is 22 miles long and begins at the location as Segment B, north of the unincorporated community of Mojave, California. Segment C parallels the Los Angeles Aqueduct in a southwest direction to Cottonwood Creek. No existing transmission lines are located within the aqueduct corridor; however, Southern California Edison’s (SCE’s) Tehachapi Renewable Transmission Project’s (TRTP) Alternative 10A is also proposed along the same corridor.

Segment D is 48 miles long and would traverse 16 miles of National Forest System (NFS) lands. This segment generally parallels the Los Angeles Aqueduct in a southwest direction, beginning near Cottonwood Creek and traveling to Lancaster Road. It then travels west to the Interstate 5 freeway utility corridor and continues southeast along LADWP’s existing Castaic – Rinaldi corridor to the proposed Haskell Canyon Switching Station. Five high voltage transmission lines are located along the Interstate 5 section of the segment. Oil and gas pipelines are also located in the same I-5 corridor. Continuing further south near Castaic Power Plant, Segment D would be located to the south of two existing LADWP double-circuit 230 kV transmission line towers until reaching the proposed Haskell Canyon Switching Station.

Segment E is 11 miles long and begins near Cottonwood Creek at the intersection of Segments C and D. Segment E travels in a southeast direction and intersects Segment B one mile east of the Antelope Valley California Poppy Reserve. Three existing high voltage transmission lines (Midway-Vincent 500 kV, Antelope-Vincent 230 kV, and Antelope-Mesa 230 kV) are located within the corridor that Segment E would parallel. SCE’s proposed TRTP Segment 4 is also proposed adjacent this same corridor.

Segment F is the shortest segment, at four miles in length, and begins at the intersection of Segments B and E one mile east of the Antelope Valley California Poppy Reserve. Three existing high voltage transmission lines (Midway-Vincent 500 kV, Antelope-Vincent 230 kV, and Antelope-Mesa 230 kV) are also located parallel to this segment.

The 115th Street Segment was proposed as a modification to avoid impacts to residents in the Antelope Valley near Segments F and H, described below. It begins mid-way within Segment F near SCE’s Antelope Substation and parallels 115th Street south to the California Aqueduct. No existing transmission lines occur within this corridor; however, TRTP’s proposed Segment 4 would be located along this alignment. This segment would split Segments F and H as shown in Figure 1-5 creating these Segments into F1, F2, H1 and H2.

Segment G is 21 miles long. Thirteen miles traverse National Forest System (NFS) lands. It travels south from the intersection of Segments B and F one mile east of the Antelope Valley California Poppy Reserve to the proposed Haskell Canyon Switching Station, located near the southern boundary of the ANF. It is a designated utility corridor containing LADWP’s existing 230 kV BR-RIN and 500 kV PDCI lines. The BRRTP proposes to use its existing four-circuit structures for two miles, from towers 234-3 to 236-2 (see Figure 1-3).

Segment 2a is seven miles long. It would bypass the unincorporated community of Green Valley and follow an existing fire road through ANF. Segment 2a would not parallel existing transmission facilities, and a new utility corridor would be required.
Segment H is 20 miles long and would parallel SCE’s Antelope-Pardee line. It starts near SCE’s Antelope Substation at the intersection of Segments F and I and traverses 13 miles of NFS lands to the proposed Haskell Canyon Switching Station. As requested by the USFS, all portions of this segment that fall within the northern and southern borders of the ANF would be constructed entirely by the use of helicopters. The helicopter construction requirement was established by the USFS for consistency of transmission line construction within the existing Antelope-Pardee transmission line corridor. No new access roads would be constructed except those required for pulling and tensioning sites or staging locations for construction materials. The addition of the 115th Street Segment, described above, splits the Segment into H1 (northern portion) and H2 (southern portion).

Segment I is 32 miles long. It begins near the Antelope Substation at the intersection of Segments F and H, and heads southeast through the City of Palmdale, parallel SCE’s existing high voltage transmission lines (Midway-Vincent 500 kV, Antelope-Vincent 230 kV, and Antelope-Mesa 230 kV). The segment continues directly south to an existing LADWP transmission line corridor, then continues in a southeast direction to the proposed Haskell Canyon Switching Station, parallel LADWP’s existing high voltage transmission lines (Victorville-Rinaldi 500 kV and Adelanto-Rinaldi 230 kV). A majority of this segment would be located outside of NFS lands. Two miles would be located on NFS lands.

Segment J is located parallel to the southern portion of Segment D. Segment J would consist of a new single 230 kV circuit to be placed on existing double-circuit towers between Castaic Power Plant and the proposed Haskell Canyon Switching Station (see discussion in Section 1.2.2 below).

Three-Circuit Tower Mitigation

In areas where there are ROW expansion constraints and where LADWP has existing 230 kV transmission lines, LADWP is proposing to construct three-circuit towers within the existing ROW to carry the existing BR-RIN circuit and the two proposed Barren Ridge to Haskell Canyon (BR-HC) circuits. This would avoid various impacts, including the acquisition of residential property in the unincorporated communities of Willow Springs (milepost 27.1 to 27.6) and Elizabeth Lake and Green Valley (milepost 44.6 to 51.7). Refer to Figure 1-6 for an illustration of three-circuit tower types, and to Figure 1-7, the Three-Circuit Tower Mitigation Map, for proposed locations.

**FIGURE 1-6. THREE-CIRCUIT TOWER TYPES**
Figure 1-7. Three-Circuit Tower Mitigation
LADWP must maintain the electrical service along the existing BR-RIN transmission line to avoid impacts to the hydroelectric power plants north of the Barren Ridge Switching Station. Therefore, a temporary transmission line would be constructed to keep the BR-RIN circuit energized during construction of the three-circuit towers. After the temporary line is constructed, the existing BR-RIN single-circuit towers would be removed to allow the new three-circuit towers to be constructed within the existing ROW. Once construction of the three-circuit towers is completed, the temporary transmission line would be removed. The temporary transmission line is expected to be in place from six to nine months.

The temporary transmission line would be 7.5 miles long and would consist of wood and steel single poles with an average height of 95 feet, a 3-foot by 3-foot footprint, and an average of eight poles per mile. Construction would occur within a new temporary 80- to 100-foot ROW. The majority of the temporary transmission line would be constructed along San Francisquito Road. Portions would also be constructed along Elizabeth Lake Road and Johnson Road. Pole placement would be adjacent to public roadways wherever possible. If necessary, temporary ROW on private property would be needed where poles could not be placed within public road ROW. The majority of poles would be direct-embedded when set in place and would not require a permanent foundation. Where additional strength is necessary at larger angle points, steel poles would be required, which could require an excavation approximately 6 feet in diameter by 20 feet deep to accommodate the concrete pier foundation that would be cast in place. Once all the poles have been constructed and the conductor installed, the existing BR-RIN circuit would be connected into the temporary line and energized. The construction would require establishment of a staging area, work areas around poles, and pull and tension sites. Access to pole sites and pull and tension sites would be from the adjacent roadways.

Approximately seven miles of the existing BR-RIN single-circuit towers would be removed, with existing ROW utilized to access the existing towers. The new three-circuit towers would be placed within the existing ROW, utilizing existing access roads. Helicopter Mitigation, as described in this section below, would be applied in steeper terrain if additional access is required. The new three-circuit tower would require a 25-foot by 30-foot structure footprint and an average of seven structures per mile; the average structure height would be 170 feet, with a maximum tower-to-tower span length of 780 feet. The construction process for the new three-circuit towers would be the same as the double-circuit towers discussed above. After completion of construction of the three-circuit towers, the temporary transmission line would be removed and all temporary staging and work area land disturbances would be restored as close to previous conditions as possible and revegetated as required.

**Helicopter Mitigation**

Within the ANF where the terrain is steep and access is limited, the USFS would require that the new double-circuit 230 kV structures be constructed with the use of helicopters (such as the Hughes 500 or Bell 212, or Sikorsky Skycrane). Although no specific locations for this mitigation have been identified for the Proposed Action, as defined, it is expected USFS would require the helicopter mitigation for construction in any area more than 300 feet from an existing road and with slopes greater than approximately 25 percent. The use of helicopters for the construction of transmission tower structures would eliminate the need for new access roads to structure locations, and would therefore minimize land disturbance associated with crane pads, structure laydown areas, and the trucks and tractors used for delivery of structures to sites. However, the following site and ground disturbing construction activities would be required to construct the new transmission line within the identified helicopter construction areas: portable landing pads, helicopter fly yards/staging areas and associated access roads, tower structure vegetation clearing, guard structures at major crossings, and access road pullouts.

Temporary 24-foot wide access roads would be required to access the helicopter fly yards/staging areas. The transmission line materials (tower steel, conductor reels, structure hardware, etc.) would be delivered by truck to the helicopter fly yards/staging areas. Vegetation clearing may be required at these sites to
ensure safe working conditions. The fly yards/staging areas would serve as helicopter support yards for fueling and maintenance, as well as for the transport of materials and personnel. Towers may also be assembled in sections at these yards prior to delivery to the tower sites. Heavy lift helicopters would then fly the towers from the yards to the tower sites.

Portable landing pads would be located at each tower site. These pads would allow helicopters to load and unload personnel, tools, and equipment necessary for construction of foundations and assembly of tower structures. Helicopter-constructed towers that would not be in close proximity to existing access roads would utilize micropile foundations. For each tower leg, micropile foundations would use a group of three to eight 6- to 9-inch diameter casings that would be drilled and grouted into the ground. The exposed portion of the pile group would be encased in a reinforced concrete cap from the top of the casings to a depth anywhere from one to eight feet below the ground surface, depending on the terrain.

Conductor installation would proceed in the same manner as the double-circuit tower installation. The equipment necessary for conductor installation would be large, heavy construction equipment that could only be brought in by truck. Some NFS roads could need maintenance or improvement to allow pulling and tensioning, but no new access or spur roads would be created for conductor installation on the helicopter-constructed towers. After project completion, any maintained access roads to helicopter fly yards/staging areas to would be reduced to 16 feet.

1.2.2 Addition of New 230 kV Circuit

Between the proposed Haskell Canyon Switching Station and the existing Castaic Power Plant, LADWP proposes the addition of 12 miles of a new 230 kV transmission circuit onto existing Castaic – Olive 230 kV Transmission Line structures. The circuit would cross the unincorporated communities of Castaic and Saugus and the city of Santa Clarita. A total of 300 feet of BLM-managed public lands and four miles of NFS lands would be traversed; however, the new circuit would not require a new or additional ROW. This new circuit would be called Castaic – Haskell Canyon #4 and would utilize the same conductor (bundled 715.5 kcmil “Starling” ACSS/AW [aluminum conductor steel supported/aluminum-clad steel wire]) as that proposed for the new 230 kV transmission line between Barren Ridge and Haskell Canyon Switching Stations.

The addition of a new circuit on existing towers would require many of the same construction activities associated with a new transmission line (refer to Appendix B for a description of each construction activity). However, all work would be within existing ROW and no new towers would be constructed. Some towers may need to be modified or reinforced to carry the additional weight of the new conductor. Specific towers requiring reinforcement would be determined following detailed design of the Project. Tower reinforcement would not alter the general design or the location of the structures. This process would generally include reinforced foundations or steel member replacements. Refer to Figure 1-1 for a map showing the location of the new 230 kV circuit.

1.2.3 Reconductoring of Existing Transmission Line

LADWP proposes the reconductoring of 76 miles of the existing BR-RIN 230 kV transmission line with larger conductors from the Barren Ridge Switching Station to Rinaldi Substation. Four miles of BLM-managed public lands, 13 miles of National Forest System (NFS) lands, and 44 miles of private property would be traversed. The existing conductors (954/2,312 kcmil) would be replaced with a new 1,433.6 kcmil “Merrimack” ACSS/TW/HS (aluminum conductor steel supported/trapezoidal wires/high strength) conductor. The new conductor would have a larger diameter that allows for greater electrical capacity.

The upgrade of the existing BR-RIN would also require many of the same activities of the new transmission line (surveying of right-of-way [ROW], rehabilitation of existing access and spur roads, clearing of ROW, conductor installation, and cleanup). Removal of the existing conductor would be used to string a pulling line, and this line would then be used to pull in the new conductor. All work would
remain within the existing 250-foot-wide ROW, with no additional ROW required. Some of the towers would need to be modified, replaced, and/or have foundations reinforced or replaced to carry the additional weight of the new heavier conductor. Refer to Figure 1-1 for the location of the reconductoring.

1.2.4 Construction of New Switching Station

As a component of the BRRTP, LADWP proposes the construction of a new switching station in Haskell Canyon, south of the Angeles National Forest on LADWP-owned property at the convergence of several existing and proposed 230 kV transmission lines (the existing BR-RIN, the proposed double-circuit Barren Ridge – Haskell Canyon, existing Castaic – Northridge, Castaic – Sylmar, Castaic – Olive, and the proposed Castaic – Haskell Canyon). Refer to Figure 1-1 for the location of the new switching station.

The station would be approximately 500 feet by 600 feet to accommodate the necessary circuit positions, which are made up of equipment, such as steel support structures, circuit breakers, disconnect switches, and associated equipment, and a relay house and control house containing control and protective relaying equipment. The relay and control houses would each be approximately 30 feet long by 12 feet wide by 10 feet high and constructed of gray concrete block. The station yard would include a paved internal access road approximately 16 feet wide and would be enclosed by chain-link fencing with barbed-wire extension for security. The preliminary grading plan for the station is located in Appendix B.

Necessary pre-construction geotechnical investigation on-site would include six borings by a drill rig to investigate bedrock and soil stability and four cone penetration test locations after site grading to determine friction resistance for piers. The cone penetration test rig would be a small truck with a hydraulic ram assembly mounted on the back, which is used to push a 2.5-inch diameter cone into the ground to a depth up to 50 feet. Existing roads would be used to access the site.

Construction of the new Haskell Canyon Switching Station would consist of preconstruction surveys, clearing and grading of access roads, site grading and drainage development, installation of concrete foundations and steel support structures, installation of below- and above-ground electrical conduits for equipment power and control, installation of below- and above-grade grounding conductors, and installation of control and relay houses. Equipment required for station construction would include graders and excavators, backhoes, drill rigs, water trucks, scrapers, sheep’s foot compactors, front end loaders, concrete trucks, trucks, and flatbed trailers. Cranes, man-lifts, portable welding units, line trucks, and mechanic trucks would also be required. Construction would require an estimated 12 months with approximately 60 workers.

Site preparation work for the station would involve clearing and grading of access roads, clearing of the switchyard site, the cut and fill grading of the site, and placement and compaction of structural fill that would serve as a base for switching station facilities. The site would be graded to maintain current drainage patterns as much as possible. A 16-foot-wide paved road and a 100-foot by 100-foot gravel parking area would be required. The yard would be covered with crushed-rock aggregate. Native vegetation would be re-established where possible outside the switchyard fence.

Following site grading and development, reinforced concrete foundations would be installed to support the steel structures and electrical equipment and control facilities. It is estimated that 1,500 cubic yards of concrete would need to be delivered to the switching station site for the foundations. Foundation work would require approximately 180 trips to the site by 40-ton, 10-yard capacity concrete trucks over a 120-day working period. Subsequent to the foundation installation, trenches would be dug to facilitate placement of copper conductors for the station grounding mat.

Multiple transmission lines would be terminated into the switching station (i.e., the new and existing Barren Ridge – Haskell and Castaic – Haskell Canyon transmission lines) and would need support and require the installation of galvanized steel structures. An existing 115 kV transmission line may need to
be relocated around the proposed station. High-voltage bus work consisting of aluminum jumpers and tubing would be installed within the station.

1.2.5 Expansion of Existing Switching Station

LADWP proposes expansion of the existing Barren Ridge Switching Station to the east side by 235 feet by 500 feet, for a total station size of 485 feet by 500 feet (approximately 5.6 acres). The expansion area of the station would include electrical structures and equipment for the addition of transmission lines, a material staging area, roadway within the station, and a drainage area. The preliminary design layout for the station may be found in Appendix B. Refer to Figure 1-1 for the location of the existing switching station.

Expansion of the existing switching station would be very similar to the construction of the Haskell Canyon Switching Station as described above. Expansion would consist of preconstruction surveys, site preparation and grading, installation of reinforced concrete foundations, installation of electrical conduits for equipment power and control, and installation of structures and equipment.

Necessary pre-construction geotechnical on-site investigation would include two test pits excavated by a backhoe to investigate soil density and settlement, and four cone penetration test locations on-site to determine friction resistance for piers. The cone penetration test rig would be a small truck with a hydraulic ram assembly mounted on the back, which is used to push a 2.5-inch diameter cone into the ground to a depth up to 50 feet. Existing roads would be used to access the site.

It is estimated that 700 cubic yards of concrete would need to be delivered to the switching station site for the foundations. Foundation work would require approximately 80 trips to the site by 40-ton, 10-yard capacity concrete trucks over a 90-day working period. Equipment required for station construction would include graders and excavators, backhoes, drill rigs, water trucks, scrapers, sheep’s foot compactors, front end loaders, concrete trucks, trucks, and flatbed trailers. Cranes, man-lifts, portable-welding units, line trucks, and mechanic trucks would also be required. An estimated eight months with approximately 60 workers would be required to expand the station.

1.2.6 Project-Wide Mitigation Measures

To address potential impacts of the Proposed Project to multiple resource areas as discussed above, the following project-wide mitigation measure would be applied:

Three-Circuit Tower Mitigation (THREE-CIRCUIT) – A three-circuit lattice tower design would be implemented as described in Section 1.2.1 of this Technical Report, at the locations shown in Figure 1-7, Three-Circuit Tower Mitigation Map.

Helicopter Mitigation (HELICOPTER) – Helicopter Mitigation shall be implemented, as described in Section 1.2.1 of this Technical Report, in steep areas of the Angeles National Forest where access is limited. For Alternatives 1 and 2a, implementation would occur at the locations shown on Figure 8-2, Identified Helicopter Mitigation Map. During final design of the Project, areas other than those shown on Figure 8-2, including Alternatives 2 and 3, may potentially require helicopter construction of the towers. This determination would generally be made where tower sites have no existing access roads within 300 feet and slopes are greater than 25 percent. Final identification of these tower sites would be determined and agreed upon by USFS, BLM and LADWP.

1.2.7 Construction Work Force and Schedule

The NEPA Record of Decision and CEQA Notice of Determination (anticipated in the early part of 2012) must be made before construction could begin. Therefore, construction of the BRRTP is anticipated to
begin no sooner than summer 2012, with a target in-service date of early 2015. These dates are subject to change based on actual completion of design.

The following construction estimates were based on preliminary engineering and the number of workers and construction duration values are estimates; therefore, they are subject to change based on final engineering and design. The new double-circuit 230 kV transmission line from the Barren Ridge Switching Station to the proposed Haskell Canyon Switching Station would require 12.5 months and 134 workers. The installation of a 230 kV circuit on existing double-circuit towers from the Castaic Power Plant to the proposed Haskell Canyon Switching Station would require a month and a half and 35 workers. The upgrade and reconductoring of the existing BR-RIN would require eight months and 155 workers. The construction of a new 400-foot by 600-foot Haskell Canyon Switching Station would require 12 months and 60 workers. The expansion of the existing Barren Ridge Switching Station would require eight months and 60 workers.

The BRRTP components are anticipated to be constructed in the staggered sequence illustrated below in Tables 1-1 and 1-2. The construction of all Project components would take approximately two years and 447 total workers, with 173 workers at the peak of construction. Table 1-2 summarizes the BRRTP’s anticipated construction workforce and schedule based on the most current information available. To allow for any delays in the Project, three weeks of float time were included for the new 230 kV transmission line and reconductoring efforts, and an additional two weeks of float time were included for the stringing of the second circuit between Castaic Power Plant and Haskell Canyon.

**TABLE 1-1. ANTICIPATED CONSTRUCTION SEQUENCE**

<table>
<thead>
<tr>
<th>PROJECT COMPONENT</th>
<th>ANTICIPATED CONSTRUCTION SEQUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansion of Barren Ridge Switching Station</td>
<td>Weeks 8 – 73</td>
</tr>
<tr>
<td>New Haskell Canyon Switching Station</td>
<td>Weeks 1 – 67</td>
</tr>
<tr>
<td>New 230 kV Transmission Line</td>
<td>Weeks 42 – 113</td>
</tr>
<tr>
<td>Reconductor BR-RIN</td>
<td>Weeks 55 – 88</td>
</tr>
<tr>
<td>Addition of 230 kV Circuit</td>
<td>Weeks 51 – 56</td>
</tr>
</tbody>
</table>

**TABLE 1-2. CONSTRUCTION WORKFORCE AND SCHEDULE**

<table>
<thead>
<tr>
<th>PROJECT COMPONENT</th>
<th>CONSTRUCTION (START AND END WEEKS)</th>
<th>CONSTRUCTION DURATION (MONTHS)</th>
<th>TOTAL # OF WORKERS</th>
<th>PEAK # OF WORKERS AT ANY GIVEN TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansion of Barren Ridge Switching Station</td>
<td>8 – 73</td>
<td>15</td>
<td>60</td>
<td>38</td>
</tr>
<tr>
<td>New Haskell Canyon Switching Station</td>
<td>1 – 67</td>
<td>15.4</td>
<td>63</td>
<td>38</td>
</tr>
<tr>
<td>New 230 kV Transmission Line</td>
<td>42 – 113</td>
<td>16.5</td>
<td>134</td>
<td>131</td>
</tr>
<tr>
<td>Reconductor BR-RIN</td>
<td>55 – 88</td>
<td>9</td>
<td>155</td>
<td>120</td>
</tr>
<tr>
<td>Addition of 230 kV Circuit</td>
<td>51 – 56</td>
<td>1.5</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td><strong>ALL COMPONENTS</strong></td>
<td><strong>Weeks 1 – 113</strong></td>
<td><strong>26.1 months</strong></td>
<td><strong>447 Total Workers</strong></td>
<td><em><em>173</em> Peak Workers</em>*</td>
</tr>
</tbody>
</table>

*The value represents the total for the staggered construction of the Project components; it is not reflective of the sum of all the components.
2.0 Regulatory Framework

Fossils are classified as non-renewable scientific resources and are protected by various laws, ordinances, regulations and standards (LORS) across the country. Professional standards for the assessment and mitigation of adverse impacts to paleontological resources have been established by the Society of Vertebrate Paleontology (SVP) (1995). Pertinent LORS are summarized and discussed below. This paleontological study was conducted in accordance with the LORS which are applicable to paleontological resources within the study area and the professional standards and guidelines established by the SVP.

2.1 Federal

The American Antiquities Act of 1906 (6 USC 431-433), Establishes a penalty for disturbing or excavating any historic or prehistoric ruin or monument or object of antiquity on federal lands has a maximum fine of $500 or 90 days in jail.


The National Historic Preservation Act (Pub. L. 89-665; 80 Stat. 915, 16 U.S.C. 470 et seq.), Provides for the survey, recovery, and preservation of significant paleontological data when such data may be destroyed or lost due to a federal, federally licensed, or federally funded project.


The Paleontological Resources Preservation Act of March 2009: P.L. 111-011. First statute to preserve paleontological resources on USFS, BLM, and U.S Department of the Interior, Bureau of Reclamation (BOR) lands. This law essentially codifies collecting policies of federal land management agencies. It allows reasonable amounts of common invertebrate and plant fossils to be casually collected with negligible disturbance. In addition, it requires protection and preservation of uncommon invertebrate and plants and all vertebrate fossils, including imprints, molds, casts, etc.

Federal protection for scientifically significant paleontological resources applies to projects if any construction or other related project impacts occur on federally owned or managed lands, involve the crossing of state lines, or are federally funded.

2.2 State

The Guidelines for the Implementation of CEQA, as amended March 29, 1999 (Title 14, Chapter 3, California Code of Regulations: 15000 et seq.), Defines procedures, types of activities, persons, and public agencies required to comply with CEQA, and include as one of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section XIV, Part a) the following: “Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?”
Other state requirements for paleontological resource management are included in the Public Resources Code (Chapter 1.7), Section 5097.5 and 30244. 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.
3.0 PROJECT AREA OVERVIEW

3.1 NATURAL ENVIRONMENT IN THE STUDY AREA

The Project study area lies in a region of complex geology that straddles a major tectonic plate boundary between the North American lithospheric plate on the northeast and the Pacific lithospheric plate on the southwest. The modern plate boundary is formed by the San Andreas Fault Zone—a zone of deformation characterized by right-lateral strike-slip faulting of continental proportions. Geologic rock units of the southwestern block have been uplifted, forming the central portion of the Transverse Ranges, while the generally undeformed rock units of the northeastern block occupy an area of relatively low relief that forms the Antelope Valley portion of the Mojave Desert. Geologically, the Mojave Desert Province is characterized by broad alluvial basins that are being filled by sediments derived from the adjacent uplands (Tehachapi Mountains and Transverse Ranges). In Antelope Valley these alluvial deposits reach a thickness of 4,000 feet and have buried an older landscape eroded into Paleozoic metamorphic and sedimentary rocks and Mesozoic plutonic igneous rocks. Cenozoic sedimentary rocks also occur in this province, but have limited surface exposure primarily adjacent to the Garlock and San Andreas fault zones. Geologically, the Transverse Ranges Province is characterized by a series of generally east-west oriented mountain ranges separated by broad alluvial-filled valleys, narrow stream canyons, and major and minor faults. Rocks exposed in this portion of the Project study area are extremely diverse in origin and composition and include Precambrian and Paleozoic metamorphic and plutonic igneous rocks; Mesozoic metamorphic, plutonic, and sedimentary rocks; and Cenozoic marine and non-marine sedimentary rocks. The Mesozoic and Cenozoic sedimentary rocks contain a rich paleontological record that preserves portions of the last 75 million years of Earth history. Certain time intervals are especially well represented including the Cretaceous-Tertiary boundary (~65 Ma), the middle and late Miocene (~17 to 5 Ma), and the Pliocene and early Pleistocene (~4 to 1 Ma).

The following is a discussion of the general geology, paleontology, and distribution of the geologic rock units (formations) underlying the Project study area (Figure 3.1). A detailed inventory of geologic rock units for every tenth of a mile along the various proposed Project alternatives is provided in Appendix A.

3.1.1 Quaternary Alluvium

**General Geology:** Modern drainages contain unconsolidated stream and alluvial sediments of relatively recent age deposited by the permanent or ephemeral streams that flow in them. These sediments consist primarily of gravel, sand, and silt associated with the Santa Clara River and its tributaries (Oakeshott, 1958), as well as localized drainages and alluvial fans along the southern and northeastern borders of Antelope Valley (Dibblee, 1967). These deposits are assumed to be Holocene in age (0 to 10,000 years old). Quaternary alluvium is underlain by marine to terrestrial deposits of Tertiary to Cretaceous age in the Transverse Ranges Province (Oakeshott, 1958) and by terrestrial deposits of Quaternary and Tertiary age in the Mojave Desert Province (Dibblee, 1967).

**Paleontology:** Any organic remains (e.g., sub-fossils) preserved within the Quaternary alluvium are too young to be considered paleontological resources, because of the recent age of these deposits and their close association with modern drainages.\(^1\)

**Distribution:** Quaternary alluvium occurs over large portions of the study area including all of segments A (MP 0.0 to 13.2), B (MP 0.0 to 26.5), C (MP 0.0 to 21.7), F1 (MP 0.0 to 0.8), and F2 (MP 0.0 to 2.8), the northern portions of segments D (MP 0.0 to 16.7), E (MP 0.0 to 6.8), G (MP 0.0 to 3.7), H1 (MP 0.0 to 1.8), and I (MP 0.0 to 4.5), and minor portions of Segment H2 (MP 0.8 to 1.1 and MP 1.5 to 1.9).

---

\(^1\) Mile point
FIGURE 3-1. SUMMARY OF GEOLOGIC ROCK UNITS ALONG THE VARIOUS PROJECT ALTERNATIVES.

ANF=Angeles National Forest.
3.1.2 Older Alluvium

General Geology: Older alluvium consisting of poorly consolidated mudstones, sandstones, and cobble to boulder conglomerates deposited in ancient stream-channels and alluvial fans locally occur in the Study Area. In the Transverse Ranges the older alluvial deposits are primarily preserved as isolated, uplifted and eroded remnant terraces (Oakeshott, 1958), while in the Mojave Desert these deposits typically occur as locally faulted sequences of ancient alluvial fans (Dibblee, 1967). Older alluvial deposits vary in stratigraphic thickness from a few feet to as much as 200 feet (Oakeshott, 1958). During the windshield survey older alluvial deposits as observed in Green Valley consisted of poorly consolidated pebbly and gravelly sandstones overlying deeply weathered plutonic igneous rocks. Farther south along San Francisquito Creek localized older alluvium occurs in localized channels eroded into sedimentary rocks of the San Francisquito Formation. The geologic age of the older alluvium is not well constrained, but most likely ranges from early to late Pleistocene in age (Oakeshott, 1958).

Paleontology: Although no fossils are presently known from the older alluvium in the study area, similar deposits have produced significant remains of Pleistocene megafauna (e.g., ground sloth, mammoth, and mastodon) from sites elsewhere in Southern California (Jefferson, 1991).

Distribution: Deposits mapped as older alluvium have been mapped by Dibblee (1967) as erosional remnants of Pleistocene stream courses and alluvial fans in several portions of the study area including Segment E (MP 6.8 to 9.0), Segment G (MP 3.7 to 4.1, MP 7.8 to 8.9, MP 10.6 to 11.0, MP 16.1 to 17.6), Segment H1 (MP 1.8 to 2.3), and Segment I (MP 4.5 to 4.7, MP 8.3 to 8.8, portions of the segment between MP 14.8 and 16.0, MP 18.9 to 19.3, and MP 28.6 to 28.7).

3.1.3 Saugus Formation

General Geology: The Saugus Formation consists of 650 feet of poorly consolidated, coarse-grained sandstone and conglomerate that formed in fluvial and alluvial-fan paleoenvironments around the western end of the San Gabriel Mountains (Kew, 1924; Oakeshott, 1950, 1958). Hershey (1902) originally proposed the name “Saugus Division” for a series of alluvial deposits in Soledad Canyon near Saugus. Oakeshott (1958) later restricted the name “Saugus formation” to lower Pleistocene continental beds unconformably above the upper Pliocene Sunshine Ranch Member of the Pico Formation and lying with an angular unconformity below upper Pleistocene terrace deposits. Squires et al. (2006) continued this usage, although previous workers have placed marine deposits of the Pico Formation into the lower Saugus Formation (e.g., White, 1983; Groves, 1991a) (see White [1983] and Squires et al. [2006] for a discussion of the history of the stratigraphic nomenclature of the Pico and Saugus formations). As observed during the windshield survey, the Saugus Formation in the study area consists of flat-lying to gently dipping, non-marine strata including light red-brown, interbedded coarse-grained sandstones and pebble to cobble conglomerates. The age of the Saugus Formation is late Pliocene to early Pleistocene (~3 to 1.5 Ma). The Saugus Formation unconformably overlies different rock units depending on local geological conditions. In the Haskell Canyon area (segments G and J) the Saugus Formation overlies steeply dipping strata of the Castaic and Mint Canyon formations of Miocene age (Dibblee, 1996). Locally, the Saugus Formation is unconformably overlain by older alluvial deposits of late Pleistocene age (Oakeshott, 1958).

Paleontology: The Saugus Formation contains very fossiliferous marine deposits, as well as terrestrial deposits that locally contain fossil vertebrates. Marine fossils from the Saugus Formation include bryozoans, brachiopods, crabs, barnacles, gastropods, bivalves, echinoids, fish, and trace fossils (Eldridge and Arnold, 1907; Kew, 1924; Grant and Gale, 1931; Winterer and Durham, 1962; Squires and White, 1983; Groves, 1991a; Govean, 1993). Fossil bony fish include sheepshead (Semicossyphus pulcher), barracuda (Sphyraena sp.), and banjo fish (Rhinobatos sp.) (Govean, 1993). Terrestrial vertebrate fossils include terrapins, tortoises, and lizards, as well as land mammals, such as extinct rabbit, gopher, pack rat, dog, cat, mastodon, tapir, horse, peccary, camel, deer, and bison in the areas of the city of Santa Clarita and the San Fernando Valley (Winterer and Durham, 1954, 1962). Fossil land mammals have also been
found elsewhere in the Saugus Formation; most notably extinct rabbit, gopher, pack rat, mammoths, horse, and llama of Irvingtonian-land-mammal age in Moorpark, California (Wagner et al., 2007).

Distribution: The Saugus Formation within the study area occurs along Segment D (MP 46.6 to 46.7, 47.3 to 47.4, and 47.5 to 47.6), Segment G (MP 19.1 to 20.9), Segment J (portions of the segment between MP 0.4 and 3.1), and Segment K (portions of the segment between MP 1.6 and 14.3).

3.1.4 Anaverde Formation

General Geology: The Anaverde Formation as exposed along the San Andreas Fault Zone in Leona Valley and Anaverde Valley consists of about 1,500 feet of terrestrial and fluvial sedimentary rocks (Wallace, 1949; Dibblee, 1967). Wallace (1949) formally named and mapped the Anaverde Formation after the Anaverde Valley and subdivided it into three distinct facies including a gray-white arkosic sandstone and cobble conglomerate facies, a gray, clay shale facies, and a diorite-clast breccia facies. The formation is locally deformed by faulting and overlies and is in fault contact with pre-Tertiary rocks (Dibblee, 1967). The Anaverde Formation is believed to be of late Miocene to early Pliocene age (~ 6 to 5 Ma) (Savage et al., 1954).

Paleontology: Fossils are rare in the Anaverde Formation (Dibblee, 1967), but include a significant fossil flora collected from the sandstone-cobble conglomerate facies of the formation as exposed in the northwestern end of Anaverde Valley (Wallace, 1949; Axelrod, 1950). Axelrod (1950) described 21 species of fossil plants from this area (UCMP Locality P4139) including willow (Salix), pine (Pinus), aspen (Populus), oak (Quercus), laurel (Persea), sumac (Rhus), crab apple (Peraphyllum), kidneywood (Eysenhardtia), soapberry (Sapindus), ceanothus (Ceanothus), buckthorn (Rhamnus), sycamore (Platanus), and serviceberry (Amelanchier).

Distribution: The Anaverde Formation is confined to the San Andreas Fault Zone and occurs within the study area along Segment G (MP 5.6 to 5.9), Segment H2 (MP 1.1 to 1.5), and Segment I (MP 7.9 to 8.3).

3.1.5 Pico Formation

General Geology: The Pico Formation in the eastern Ventura Basin is characterized by up to 18,000 feet of deep water marine sedimentary rocks that grade into shallow-marine deposits near the top of the formation (Squires et al., 2006). Kew (1924) named the Pico Formation for exposures in the vicinity of Pico Canyon and described it as of marine origin and consisting of both fine-grained and coarse-grained sandstone with interbeds of conglomerate. According to Squires et al. (2006), the Pico Formation in the eastern Ventura Basin consists of middle to upper bathyal, muddy siltstone deposits that are overlain by wave-dominated-deltaic, sandstone and conglomerate deposits. Oakeshott (1958) divided the Pico Formation in the San Fernando Quadrangle into three members: the Lower Pico Member, which consists of about 700 feet of brownish siltstone, sandstone, and conglomerate that formed in a marine paleoenvironment; the Upper Pico Member, which consists of a few hundred feet of light brownish sandstone and conglomerate that formed in brackish to continental paleoenvironments; and the Sunshine Ranch Member, which consists of 1300 feet of sandy mudstone, sandstone, gravel, and conglomerate with thin white limestone beds that formed in fluvial and lacustrine paleoenvironments. Only the Sunshine Ranch Member has been mapped within the Soledad Basin (Oakeshott, 1958). The Pico Formation in the Valencia area of the Soledad Basin is late Pliocene in age (~3 Ma), based on benthic foraminifera and mollusks (Squires et al., 2006). The Pico Formation conformably overlies the marine Towsley Formation of late Miocene to Pliocene age in the Valencia area of the Soledad Basin (Squires et al., 2006). The Pico Formation is unconformably overlain by the non-marine Saugus Formation of early Pleistocene age (Oakeshott, 1958). However, in the Valencia area, the Pico Formation laterally interfingers with braided-stream deposits of the Saugus Formation (Squires et al., 2006).

Paleontology: The Pico Formation is rich with marine fossils that include abundant encrusting calcareous algae, foraminifera, sponges, marine worms, bryozoans, brachiopods, crabs, barnacles, mollusks,
echinoids, sharks, bony fish, pinnipeds, and cetaceans (Eldridge and Arnold, 1907; English, 1914b; Kew, 1924; Kellogg, 1929; Grant and Gale, 1931; Winterer and Durham, 1962; Squires and White, 1983; Groves, 1991a, 1991b; Squires et al., 2006). Terrestrial fossils have also been found in the Pico Formation, such as pine (*Pinus* sp.), oak (*Quercus* sp.), bird, and small cat (Winterer and Durham, 1962; Squires et al., 2006; unpublished UCMP data).

**Distribution:** The Pico Formation has a very limited distribution in the study area and is confined to Segment K (MP 11.1 to 11.2).

### 3.1.6 Castaic Formation

**General Geology:** The Castaic Formation is a marine sedimentary rock unit consisting of 7000 feet of interbedded mudstone, siltstone, sandstone, and conglomerate that formed in a shallow-marine embayment northeast of the San Gabriel Fault at the eastern end of the Ventura Basin (Stanton, 1960, 1966, 1982). Crowell (1954) named the Castaic Formation for the lowest marine unit in the Ridge Basin sedimentary sequence. It is aerially restricted to the southern Ridge Basin and northwestern part of the Soledad Basin (Stanton, 1966; Cooper, 1977). As observed during the windshield survey, the Castaic Formation in the study area consists of thickly bedded gray, fine-grained sandstones interbedded with blue-gray siltstones and shales and red-brown, coarse-grained sandstones. The age of the Castaic Formation is late Miocene to early Pliocene (~6 to 5 Ma), based on benthic foraminifers (McDougall, 1982). The Castaic Formation unconformably overlies strata of the Mint Canyon, Vasquez, and San Francisquito formations (Stanton, 1982). Locally, the Castaic Formation is overlain by strata of the Towsley and Saugus formations and conformably by sedimentary rocks of the Ridge Basin Group (Stanton, 1982).

**Paleontology:** A diverse assemblage of fossil marine invertebrates, dominated by gastropods and bivalves, has been collected from the Castaic Formation (Skolnick and Arnal, 1959; Stanton, 1960, 1966, 1982; McDougall, 1982; Govean, 1993). Invertebrate fossils include foraminifers, sponges, bryozoans, barnacles, crustaceans, brachiopods, mollusks, and echinoids. Fossil marine vertebrates are rare, but include sharks, rays, bony fish, and marine mammals (Stanton, 1966; Welton and Link, 1982). Other fossils found in the Castaic Formation include fossil wood and leaves (Govean, 1993). During the field survey fossils were observed at several locations within strata of the Castaic Formation and included oxidized plant fragments, carbonized wood, and internal and external molds of marine mollusks.

**Distribution:** The Castaic Formation is well exposed within the study area and occurs along Segment D (majority of segment between MP 37.5 and 48.2), Segment H2 (MP 17.0 to 17.1), Segment I (MP 29.6 to 31.9), Segment J (majority of the segment between MP 0.0 and 12.0), and Segment K (portions of the segment between MP 0.0 and 1.6).

### 3.1.7 Towsley Formation

**General Geology:** The Towsley Formation consists of up to 4,000 feet of petroliferous marine sedimentary rocks exposed on the north slope of the Santa Susana Mountains (Winterer and Durham, 1954). In the eastern part of its area of outcrop in the Elsmere Canyon and Grapevine Canyon area, only the middle portion of the formation is preserved. Here, the Towsley Formation is about 300 feet thick and consists of a lower unit composed of siltstone, sandstone, and conglomerate and an upper unit composed of light brown siltstone and fine sandy siltstone with a thick tongue of coarse-grained sandstone and pebble conglomerate (Kern, 1973). The Towsley Formation is late Miocene to early Pliocene in age (~6 to 5 Ma) and was deposited in the easternmost portion of the Ventura Basin. The formation overlies and interfingers with the Modelo Formation of early late Miocene age and is overlain and interfingers with the Pico Formation of late Pliocene age (Winterer and Durham, 1962; Kern, 1973).

**Paleontology:** The Towsley Formation contains locally diverse assemblages of marine fossils that include foraminifera, bryozoans, brachiopods, marine worms, crabs, mollusks, echinoids, shark (*Isurus hastalus*),
Cetacean, sirenian (*Dusisiren jordani*), and walrus (*Imagotaria downsi*) (Eldridge and Arnold, 1907; English, 1914a, 1914b; Kew, 1924; Grant and Gale, 1931; Winterer and Durham, 1954, 1962; Oakeshott, 1958; Kern, 1973; Repenning and Tedford, 1977; Domning, 1978, 1979; unpublished LACM data; unpublished UCMP data). The marine deposits exposed in the Elsmere Canyon area are particularly rich in marine fossils (Kern, 1973). Fossils of marine mammals and land mammals have also been found in the Towsley Formation as exposed in Elsmere Canyon and include walrus (cf. *Pontolis* sp.) camel (cf. *Procamelus*) and tapir (English, 1914a; unpublished UCMP data).

**Distribution:** The Towsley Formation is only exposed along Segment K (MP 9.1 to 11.1, MP 14.3 to 14.4, and MP 15.4 to 15.5) in the study area.

### 3.1.8 Hungry Valley Formation

**General Geology:** The Hungry Valley Formation consists of up to 4,500 feet of interbedded conglomerate, sandstone, siltstone, and mudstone strata that formed in braided stream, flood plain, alluvial fan, fluvial-deltaic, and lacustrine paleoenvironments (Crowell, 1982; Link, 2003). The formation crops out in the northern portion of Ridge Basin, west and south of the San Andreas Fault and is divisible into two informal members. The lower member consists of ~3,300 feet of alternating gray, indurated sandstone and mudstone and orange to tan, coarse-grained, loosely consolidated sandstone and conglomerate with interbedded reddish and greenish mudstone. The upper member consists of ~1,300 feet of brown, massive, well indurated conglomerate containing clasts of gneiss, quartz diorite, volcanics, and marble. The Hungry Valley Formation is early Pliocene in age (~5 Ma) and overlies sedimentary rocks of the Ridge Route Formation and Peace Valley Formation. To the east the Hungry Valley Formation directly overlies crystalline basement rocks.

**Paleontology:** Important paleontological resources are known from the group and include fossil plants (Axelrod, 1982), freshwater mollusks (Young, 1982), fish (Bell, 1973), and terrestrial vertebrates (Miller and Downs, 1974 and Welton and Link, 1982). The fossil mammal assemblage includes cat, tapir, horse, rhinoceros, llama, camel, pronghorn, elephant, and sloth.

**Distribution:** The Hungry Valley Formation within the study area only occurs in isolated outcrops along Segment D near the Interstate 5/ State Route 138 interchange (MP 22.4 to 22.7).

### 3.1.9 Ridge Route Formation

**General Geology:** The Ridge Route Formation was named by Clements (1929) for outcrops along the old Ridge Route between Templin Highway and Liebre Mountain (Link, 1982). As defined by Link (1982) the Ridge Route Formation consists of up to 30,000 feet of interbedded conglomeratic sandstone, sandstone, and mudstone strata that formed in alluvial fan, braided stream, and deltaic paleoenvironments (Crowell, 1982; Link, 2003). The formation crops out throughout the eastern portion of Ridge Basin where it is well exposed in roadcuts along the Old Ridge Route. These roadcuts display well stratified sequences of northwest dipping sedimentary rocks consisting of beds of pebble to boulder conglomerate alternating with beds of white to red massive to cross-bedded sandstone. To the west five distinct sandstone and conglomerate tongues of the Ridge Route Formation extend across the basin to interfinger with coarse angular conglomerates of the Violin Breccia (Link, 1982). In ascending order these sandstone tongues include the Marple Canyon Member, Fisher Spring Member, Frenchman Flat member, Piru Gorge member, and Apple Canyon Member of the Ridge Route Formation (Link, 2003). The Ridge Route Formation also interfingers to the west with deltaic and lacustrine sandstones, mudstones, and shales of the Peace Valley Formation. Both formations are late Miocene to early Pliocene in age (~8.4 to 5 Ma) and underlie sedimentary rocks of the Hungry Valley Formation.

**Paleontology:** Important paleontological resources are known from the various members of the Ridge Route Formation and include fossil plants (Axelrod, 1982), freshwater ostracods (Forester and Brouwers, 1982), mollusks (Young, 1982), and fish (Bell, 1973), and terrestrial vertebrates (Miller and Downs, 1974...
and Welton and Link, 1982). The land mammal fossil assemblage includes horse, rhinoceros, and ground sloth.

**Distribution:** The Ridge Route Formation within the study area crops-out extensively along Segment D near from the Interstate 5/ State Route 138 interchange to Castaic Lake (MP 23.0 to 30.4, MP 30.5 to 30.7, MP 30.8 to 31.9, MP 32.1 to 34.5, and MP 36.4 to 37.5).

### 3.1.10 Peace Valley Formation

**General Geology:** The Peace Valley Formation was named by Crowell (1982) for outcrops in Peace Valley along Highway 99 between Templin Highway and Hungry Valley Road (Crowell, 1982). As defined by Link (1982) and Smith (1982) the Peace Valley Formation consists of up to 16,000 feet of interbedded mudstone and shale strata with minor interbeds of sandstone, siltstone, and carbonate that formed in deltaic and lacustrine paleoenvironments (Crowell, 1982; Link, 2003). The formation crops out throughout the western portion of Ridge Basin where it is well exposed in large roadcuts along Interstate 5 south of Coyote Canyon. These roadcuts display well stratified sequences of northwest dipping sedimentary rocks consisting of beds of shale alternating with beds of massive claystone and sandstone. Five distinct shale and siltstone members of the Peace Valley Formation have been recognized that broadly interfinger to the east with the fluvial and deltaic strata of the coeval Ridge Route Formation. In ascending order these members include the Paradise Ranch Member, Osito Canyon Member, Cereza Peak Member, Posey Canyon Member, and Alamos Canyon Member of the Peace Valley Formation (Smith, 1982; Link, 2003). The Peace Valley Formation also interfingers to the west with coarse-grained alluvial fan deposits of the Violin Breccia. The Peace Valley Formations is late Miocene to early Pliocene in age (~8.4 to 5 Ma) and underlies sedimentary rocks of the Hungry Valley Formation.

**Paleontology:** Important paleontological resources are known from the various members of the Peace Valley Formation and include fossil plants (Axelrod, 1982), freshwater mollusks (Young, 1982) and fish (Bell, 1973; Welton and Link, 1982), and terrestrial vertebrates (Miller and Downs, 1974 and Welton and Link, 1982). The Peace Valley Formation terrestrial vertebrate fossil assemblage includes tortoise, cat, proboscidean, horse, camel, and pronghorn.

**Distribution:** The Peace Valley Formation within the study area crops-out in isolated patches along Segment D between Posey Canyon and Castaic Lake (MP 30.4 to 30.5, MP 30.7 to 30.8, MP 31.9 to 32.1, and MP 34.5 to 36.4).

### 3.1.11 Oso Canyon Formation

**General Geology:** The Oso Canyon Formation consists of up to 5,500 feet of interbedded fanglomerate, conglomerate, sandstone, and siltstone that formed in fluvial paleoenvironments adjacent to a shallow marine embayment (Dibblee, 1967; Crowell, 2003). The formation is exposed at the western end of the Antelope Valley, where it has been deformed by faulting associated with the San Andreas Fault Zone (Dibblee, 1967). Fanglomerates in the formation consist of poorly sorted massive beds of subrounded pebbles, cobbles and boulders derived from granitic and volcanic igneous rocks exposed in the surrounding mountains. The conglomerates, sandstones, and siltstones are well bedded and interfinger to the west with sandstones and shales of the marine Quail Lake Formation (Dibblee, 1967; Crowell, 2003). The Oso Canyon Formation is considered to be late Miocene in age (~10 Ma) based on its stratigraphic relationships with the Quail Lake Formation (Dibblee, 1967).

**Paleontology:** Although fossils have not been reported from the Oso Canyon Formation, its sedimentary origin and fluvial paleoenvironments indicate a strong but unproven potential for producing fossil remains.

**Distribution:** The Oso Canyon Formation within the study area only occurs in isolated outcrops along Segment D (MP 16.7 to 17.2 and MP 17.8 to 18.1).
3.1.12 **Quail Lake Formation**

**General Geology:** The Quail Lake Formation (Santa Margarita Formation of Wiese, 1950) consists of 1,000 feet of gray white, medium- to coarse-grained sandstones and dark brown to black thinly bedded shales that formed in nearshore marine paleoenvironments in the eastern Ventura Basin (Dibblee, 1967). Sandstones are regularly bedded and grade laterally into pebble and cobble conglomerates containing clasts of granitic and volcanic igneous composition (Crowell, 1952). To the northeast, the conglomeratic sandstones of the Quail Lake Formation grade into fluvial red and green sandstones, siltstones and fanglomerates of the Oso Canyon Formation. The Quail Lake Formation is thought to be late Miocene in age (~10 Ma) based on contained marine molluscan and echinoid fossils (Wiese, 1950; Crowell, 1952).

**Paleontology:** The Quail Lake Formation is one of the few marine rock units exposed in the Mojave Desert. Wiese (1950) reported molluscan fossils (oysters, scallops and moon snails) and echinoderms (sand dollars), as well as marine vertebrates (sharks) from the formation. Of special note is the common occurrence of the giant oyster, *Crassostrea titan*, a species characteristic of the Santa Margarita Formation in the San Joaquin Valley. Crowell (1952) reported similar fossils from Quail Lake Formation including additional species of marine clams and snails.

**Distribution:** The Quail Lake Formation in the study area is confined to the portion of Segment D adjacent to Quail Lake (MP 17.2 to 17.5).

3.1.13 **Monterey/Modelo Formation**

**General Geology:** The Monterey Formation (Modelo Formation of Oakeshott, 1958; Winterer and Durham, 1962) consists of 500 feet of tan to gray diatomaceous shale, silty shale, sandstone, and conglomerate that formed in open-marine paleoenvironments in the eastern Ventura Basin (Dibblee and Ehrenspeck, 1991). A basal, cobble conglomerate a few feet thick lies at the base of the Monterey/Modelo Formation in the Soledad Basin (Oakeshott, 1958). The majority of the remaining formation consists of fine- to coarse-grained sandstone with interbedded shale near the top of the formation (Oakeshott, 1958). The Monterey/Modelo Formation is middle to early late Miocene in age (~13 to 10 Ma) in the eastern Ventura Basin (Oakeshott, 1958). The Monterey/Modelo Formation overlies the non-marine Mint Canyon Formation of middle Miocene age and is in turn, overlain by the marine Towsley Formation of late Miocene to early Pliocene age (Oakeshott, 1958).

**Paleontology:** The Monterey/Modelo Formation in the eastern part of the Ventura Basin, as well as in the Soledad, and Los Angeles basins contains locally abundant marine fossils including foraminifers, bivalve mollusks (e.g., *Delectopecten* sp.), gastropod mollusks, echinoids, fish, and cetaceans (*Mixocetus elysi*, *Pithanodelphis nasalis*) (Kellogg, 1934; Daviess, 1942; Winterer and Durham, 1962; Bussino and Barnes, 1984; Barnes, 1985). Land vertebrates, such as birds (*Phalacrocorax femoralis*), have also been recovered from this rock unit in the study area (Miller, 1929).

**Distribution:** The Monterey/Modelo Formation in the study area is confined to the southern terminus of Segment K (MP 14.4 to 15.4).

3.1.14 **Mint Canyon Formation**

**General Geology:** The Mint Canyon Formation consists of 4,500 feet of claystone, siltstone, conglomeratic sandstone, conglomerate, and sedimentary breccia that formed in deltaic, fluvial, and lacustrine paleoenvironments (Oakeshott, 1950, 1958; Winterer and Durham, 1962; Hall, 2007; Kew, 1923). The formation is divided into a “Lower variegated member” and an “Upper gray member” that both contain vertebrate faunas of different ages (Durham et al., 1954). Sediments in the Mint Canyon Formation were derived from the Sierra Pelona, San Gabriel Mountains, and Mojave Desert and deposited in broad valleys, flood plains, and small intermittent lakes across folded and faulted strata of the Vasquez Formation and the marginal crystalline rocks of the Soledad Basin (Oakeshott, 1958). Although the Mint
Canyon Formation is only present within the eastern Ventura and Soledad basins, the same clast types within the Caliente Formation indicate that the latter formation should be considered a part of the Mint Canyon Formation. This interpretation suggests that the Caliente Formation has been offset from the Mint Canyon Formation by at least 70 km of right-lateral displacement along the San Gabriel Fault (Ehlert, 2003). As observed during the field survey, the Mint Canyon Formation in the study area consists of thickly interbedded, light gray to pinkish strata including pebble conglomerates, coarse-grained pebbly sandstones, and massive sandy siltstones. The Mint Canyon Formation is most likely middle to late Miocene in age (14 to 11 Ma), based on fossil land mammals that indicate Barstovian to Clarendonian North American land mammal ages. The Mint Canyon Formation unconformably overlies strata of the non-marine Tick Canyon Formation of early Miocene age. It is unconformably overlain by the marine Monterey/Modelo Formation of middle to early late Miocene age (Oakeshott, 1958), the Castaic Formation of late Miocene to early Pliocene age (Dibblee, 1996a), and the Saugus Formation of late Pliocene to early Pleistocene age (Dibblee, 1996b).

Paleontology: The Mint Canyon Formation has produced large and diverse fossil assemblages of plants (Axelrod, 1940; Mount, 1971), freshwater mollusks and ostracods (Kew, 1924; Oakeshott, 1958; Mount, 1971), turtle (Clemmys sp.; Maxson, 1930), and land mammals that include rabbit, dog, peccary (Prosthennops sp.), rhinoceros, camel (Alticamulus sp.), pronghorn antelope (Merycodus necatus), three genera of horse (Merychippus intermontanus, M. sumani, Protohippus sp., Hipparion mohavense, Pliohippus sp. cf. P. fossulatus), and mastodon (Kew, 1924; Maxson, 1928, 1930; Stirton, 1933, 1939; Savage et al., 1954; Kelly, 1998). Thin lacustrine and fluviatile interbeds contain freshwater gastropods (Paludestrina imitator, cf. Helminthoglypta sp.), bivalves (Amnicola sp.), and ostracods (Kew, 1924; Oakeshott, 1958; Mount, 1971). Local tuff beds contain fossil leaves that represent an oak-savanna community whose nearest related modern equivalent species now occur in southern California, southern Arizona, and northern Mexico (Axelrod, 1940; Wallace, 1940). These fossil leaves were derived from at least four habitats: lake-border and riparian, savanna, woodland, and chaparral (Axelrod, 1940). Although no fossils were observed in Mint Canyon Formation strata during the field survey, the results of the record search indicate several recorded fossil collecting localities (LACM and UCMP) in the Vasquez and Bouquet canyon portions of the study area.

Distribution: The Mint Canyon Formation within the study area occurs along Segment D (MP 47.4 to 47.5 and MP 47.6 to 47.8), Segment G (MP 20.8 to 21.2), Segment H2 (MP 15.4 to 17.0), Segment I (portions of the Segment between MP 24.6 and 31.6), Segment J (MP 0.2 to 0.6), and Segment K (MP 0.2 to 1.1).

3.1.15 Tick Canyon Formation

General Geology: The Tick Canyon Formation consists of 600 feet of reddish sandstone, siltstone, and claystone, as well as gray, tan, and reddish conglomerate that formed in fluvial and lacustrine paleoenvironments (Oakeshott, 1958). Jahns (1939) designated the lowest few hundred feet of the Mint Canyon Formation as the “Tick Canyon Formation” on the basis of a fossil vertebrate fauna that was distinctly older than the faunas of the overlying Mint Canyon strata. The base of the Tick Canyon Formation consists of 100 feet of grayish to brown fanglomerate that contains poorly sorted and loosely consolidated fragments of various sizes of up to a foot or more in diameter (Oakeshott, 1958). Most of the clasts consist of granite, vasquez-like basalt, and anorthosite (Oakeshott, 1958). The basal fanglomerate is overlain by reddish sandstone, mudstone, and siltstone with some interbedded yellowish and green siltstone and thin interbeds of conglomerate (Oakeshott, 1958). As observed during the windshield survey, the Tick Canyon Formation in the study area consists of pinkish red sandstones and siltstones. The Tick Canyon Formation is mostly early Miocene in age (late Arikareean to Hemingfordian North American land mammal ages; 24.15 to 15.90 Ma), based on the fossil land mammals (Hall, 2007). The Tick Canyon Formation unconformably overlies the non-marine Vasquez Formation of Oligocene to early Miocene age and is unconformably overlain by the non-marine Mint Canyon Formation of middle Miocene age (Jahns, 1939).
Paleontology: Fossils are rare in the Tick Canyon Formation, but include important land mammal fossils, such as heteromyid rodents, rabbits (*Archaeolagus acaricolus*), slender-limbed oreodonts (*Merychys calaminitus*), camelids (*Miolabis californicus*), and horses (*Parahippus maxsoni*) (Jahns, 1939, 1940; Reeder, 1960; Whistler, 1967). A fossil hawk (*Miohierax stocki*) has also been recovered from strata of the Tick Canyon Formation (Howard, 1944). Although no fossils were observed in Tick Canyon Formation strata during the windshield survey, the results of the record search indicate several recorded fossil collecting localities (LACM) in the Vasquez Canyon portion of the study area.

Distribution: The Tick Canyon Formation within the study area only occurs along Segment I (MP 24.4 to 24.6).

### 3.1.16 Vasquez Formation

General Geology: The Vasquez Formation consists of 8,800 feet of terrestrial sedimentary and volcanic rocks of Oligocene to early Miocene age (Oakeshott, 1958; Dibblee, 1967; Hendrix and Ingersoll, 1987). Sharp (1936) named and described these rocks as the “Vasquez series,” after the very prominent outcrops at Vasquez Rock in Aqua Dulce. The Vasquez Formation represents both the earliest and the thickest sedimentary accumulation within the Tertiary Soledad Basin (Hendrix and Ingersoll, 1987; Hendrix, 1993). Included sedimentary rocks consist of interbedded sandstones, shales, mudstones, siltstones, breccias, and conglomerates deposited in alluvial fan, fluvial, and lacustrine paleoenvironments (Oakeshott, 1958; Hendrix and Ingersoll, 1987; Hall, 2007). Very coarse-grained clastic sediments, with marked angularity of grains, and indistinct bedding, locally derived from the underlying crystalline rocks, make up a large part of the formation; although well-bedded, indurated, coarse-grained sandstone and thin bedded, lake-deposited shale and siltstone are locally prominent (Oakeshott, 1958). The base of the Vasquez Formation consists of about 40 feet of reddish-brown conglomerate. The basal conglomerate is overlain by about 400 feet of reddish-brown, coarse-gained sandstone with shale interbeds and minor lenses of conglomerate (Oakeshott, 1958). These strata are overlain by about 60 feet of very coarse fanglomerate, which in turn is overlain by up to 3800 feet of basalt flows and sills. The basalt flows are overlain by 4,500 feet of coarse-grained sandstone with conglomerate and shale interbeds (Oakeshott, 1958). The formation also contains volcanic flows of black and reddish vesicular basalt and andesite, beds of purplish breccia, and minor beds of lithic tuff (Oakeshott, 1958). The Vasquez Formation was mildly folded, faulted, and eroded before sedimentary rocks of the overlying Tick Canyon Formation were deposited (Oakeshott, 1958). As observed during the windshield survey, the Vasquez Formation in the study area consists of deep purplish red, very well indurated, coarse-grained sandstones and pebble conglomerates. Radiometric dates from basalt flows provide an age of 25.6 to 23.6 Ma (late Oligocene to early Miocene), which is consistent with biochronological age estimates based on rare land mammal fossils (Arikareean to Hemingfordian; 29 to 22.5 Ma) (Hall, 2007). The Vasquez Formation nonconformably overlies anorthosite and gneiss of Precambrian age and is unconformably overlain by the non-marine Tick Canyon Formation of early Miocene age.

Paleontology: Fossils are extremely rare in the Vasquez Formation; but, according to Hall (2007), at least one fossil of the extinct horse *Merychippus* has been found in the formation. However, no reports were found of this purported discovery in the peer-reviewed literature. No fossils were observed in exposures of this rock unit during the windshield survey and there are no recorded fossil collecting localities reported from this rock unit in the institutional record search.

General Geology: The Vasquez Formation within the study area only occurs along Segment G (MP 13.8 to 13.9).

### 3.1.17 San Francisquito Formation

Introduction: The San Francisquito Formation consists of over 13,000 feet of shale, sandstone, and conglomerate that formed in a variety of marine settings including sandy intertidal, subtidal, continental shelf, slope, and submarine-fan paleoenvironments (Johnson, 1952; Dibblee, 1967; Kooser, 1980, 1982;
Kirby, 1991). Dibblee (1967) formally named, described, and mapped the San Francisquito Formation based on good exposures of this rock unit in San Francisquito Canyon. Sage (1975), Kooser (1980, 1982), and Kirby (1991) later provided more detailed stratigraphic descriptions of the San Francisquito Formation. As observed during the windshield survey, the San Francisquito Formation in the study area consists of well indurated, light gray to brown, medium-grained, gravelly sandstones, as well as interbedded sequences of thinly bedded fine-grained sandstones and shales. The San Francisquito Formation ranges in age from late Cretaceous (Maastrichtian, ~70 Ma) to Paleocene (~60 Ma) (Kooser, 1980, 1982; Saul, 1983; Kirby, 1991). Kirby (1991) determined that the San Francisquito Formation is conformable across the Cretaceous/Tertiary boundary at Warm Springs Mountain. The San Francisquito Formation nonconformably overlies granodiorite and gneiss of Mesozoic age and locally is unconformably overlain by strata of the Vasquez Formation, the Mint Canyon Formation, and/or the Castaic Formation.

**Paleontology:** The San Francisquito Formation in the San Francisquito Canyon area contains very diverse fossil assemblages of shallow-marine invertebrate fossils, which includes corals, brachiopods, gastropods, bivalves, ammonites (*Diplomoceras* sp.), and sharks (Dickerson, 1914; Kooser, 1980, 1982; Saul, 1983; Popenoe and Saul, 1987; Squires et al., 1989; Kirby, 1991; Kirby and Saul, 1995; Squires and Saul, 2006, 2007). Elsewhere in southern California, near Cajon Pass, a fossil plesiosaur has been found in the San Francisquito Formation (Kooser, 1985; Lucas and Reynolds, 1993). During the windshield survey trace fossils were observed at several locations within strata of the San Francisquito Formation and included cylindrical burrows made by infaunal marine invertebrates. The institutional record search found numerous recorded fossil collecting localities (LACM) in the Study Area.

**Distribution:** The San Francisquito Formation within the study area only occurs along Segment G (MP 12.4 to 13.8).

### 3.1.18 Plutonic Igneous Rocks

**General Geology:** Plutonic igneous rocks of Mesozoic and Paleozoic age occur in several areas in the western San Gabriel Mountains region. Plutonic rocks in the study area include granodiorite and granite. The granodiorite consists of gray, medium- to coarse-grained plutonic rocks with closely related variants ranging from quartz diorite to granite (Oakeshott, 1958). The granitic rocks consist predominantly of tan to pink, fine- to medium-grained, biotite-muscovite granite with certain portions porphyritic, others pegmatitic and aplitic, and much of it gneissoid (Oakeshott, 1958). These rocks probably underlie the entire Soledad Basin north and northwest of the Soledad and Pole Canyon fault zones (Oakeshott, 1958). The plutonic rocks in the study area are believed to be related to and essentially correlative with similar rocks of late Jurassic to Cretaceous age elsewhere in the Transverse and Peninsular ranges, the Mojave Desert, and the Sierra Nevada mountain range (Oakeshott, 1958).

**Paleontology:** Because of the extremely high temperatures and pressures associated with the magmatic origin of the plutonic igneous rocks in the study area, no fossils are expected in these rocks.

**Distribution:** Plutonic igneous rocks within the study area occur along Segment G (major portions of the Segment between MP 4.2 and 11.8), Segment H1 (MP 2.2 to 2.6), Segment H2 (MP 1.9 to 5.4), and Segment I (MP 4.7 to 5.1, MP 18.4 to 18.9, and MP 19.3 to 21.5).

### 3.1.19 Mendenhall Gneiss

**General Geology:** The Mendenhall Gneiss is a blue, quartz-feldspar-rich gneiss that has been intruded by anorthosite-gabbro rocks, all of Precambrian age (Oakeshott, 1958). Oakeshott (1958) named and described the Mendenhall Gneiss after the Mendenhall Peak, where it is well exposed. It is overlain nonconformably by the Mint Canyon Formation of early Miocene age in Sand Canyon (Oakeshott, 1958).
Paleontology: No fossils are expected in the gneiss because of the extreme temperatures and pressures associated with the metamorphic origin of these rocks.

Distribution: Rocks mapped as gneiss occur along Segment G (MP 6.4 to 7.7, MP 10.7 to 10.9, and MP 11.8 to 12.3) and Segment I (MP 18.2 to 18.4 and MP 21.5 to 24.4).

3.1.20 Pelona Schist

General Geology: The Pelona Schist is primarily composed of about 7,500 feet of bluish-gray schist that was metamorphosed from clastic and pyroclastic sedimentary rocks (Muehlberger and Stanton Hill, 1958; Oakeshott, 1958; Dibblee, 1967). Hershey (1902) named and described the metamorphic rocks that crop out along the Sierra Pelona Ridge as the “Pelona schist series” (Oakeshott, 1958). The most common rock types include greenish-gray mica-chlorite-albite schist, green actinolite-albite schist with albite porphyroblasts, quartz-biotite schist, quartzite, and actinolite-talc schist (Oakeshott, 1958). These rocks are strongly foliated and contain minerals that are characteristic of the low temperature green-schist facies of metamorphism (Oakeshott, 1958). The Pelona Schist is Precambrian in age (Muehlberger and Stanton Hill, 1958).

Paleontology: No fossils are expected in the Pelona Schist because of the extreme temperatures and pressures associated with the metamorphic history of these rocks.

Distribution: Outcrops of the Pelona Schist occur over large portions of Segment G (MP 5.1 to 5.4, MP 14.0-16.1, and MP 17.6 to 19.2), Segment H2 (MP 0.1 to 0.8 and MP 5.4 to 15.4), and Segment I (MP 5.1 to 7.8, 8.4 to 14.8, and 15.0 to 18.2).
4.0 Inventory Methods

The goal of the paleontological resources inventory was to identify, describe, and map existing paleontological resources within the study area and to evaluate the level of resource significance for each. The inventory relied on a review of relevant published geologic reports (Kew, 1924; Dibblee, 1967; and Crowell, 2003), privately published geologic mapping from the Dibblee Foundation (Dibblee and Ehrenspeck 1991, 1996a, 1996b, 1996c, 1997a, 1997b, 1997c; and Dibblee and Minch, 2002); unpublished environmental technical reports (Hulbert, 2004); and museum paleontological site records (Natural History Museum of Los Angeles County, Invertebrate Paleontology Section-LACMIP, San Diego Natural History Museum-SDNHM, and University of California, Museum of Paleontology-UCMP). This approach was followed in recognition of the direct relationship between paleontological resources and the geologic formations within which they occur. Knowing the geology of a particular area and the documented fossil productivity of the formations occurring in that area, it is possible to make reasonable predictions about where fossils will, or will not, be encountered.

The results of the literature, institutional record, and field survey portions of the inventory were incorporated with GIS layers of Project milepost delineations to estimate the linear coverage of individual geologic formations along specific Project segments. These data were then summarized in a paleontological resource table (Appendix A). Following this, paleontological resource sensitivity values were determined for each formation and the relative resource value of each Project segment quantified based on the linear distribution (i.e., mileage) as summarized in Appendix A.

Windshield surveys were conducted during September and October 2008 along the southern portion of the study area (segments F, G, H, and I, as well as portions of B, E, and K) to verify geologic mapping and results of the literature and previous institutional record surveys. The survey was primarily conducted along LADWP access roads, but also involved some portions of public roads. During the survey work, selected bedrock outcrops were examined to determine paleontological sensitivity of geologic rock units occurring in the study area.

The proposed BRRTP area of potential physical disturbance is defined as land within 250 feet of the assumed centerlines of proposed and existing transmission lines; land likely to be disturbed during construction of the new Haskell Canyon Switching Station; plus ancillary areas. Ancillary areas, most of which have not yet been defined, include, but are not limited to, staging areas, access and spur roads, and pulling and tensioning sites.
5.0 **AFFECTED ENVIRONMENT**

The affected environment as it pertains to paleontological resources includes not only actual fossil remains collected at specific locations, but also the collecting localities themselves, as well as the geologic formations containing those localities. In this light, a particular geologic rock unit (i.e., formation) can be considered to represent a proxy for all possible paleontological resources (i.e., fossils) entombed and preserved in that formation. Further, although fossils may not have been previously collected from a geologic formation in a given area, the fact that fossils have been recovered from that same formation in other areas where it crops-out is taken as an indication of the potential of that formation to preserve similar fossils wherever it occurs.
6.0 IMPACT ASSESSMENT

Environmental impacts can be positive (beneficial) or negative (adverse) as a primary result of an action (direct) or as a secondary result of an action (indirect), and can be permanent or long-lasting (long-term), or temporary and of short duration (short-term). Impacts can vary in degree or magnitude from no change, to slightly discernible change, to a complete change in the environmental condition or system (intensity). Impact significance is determined by judging whether the action exceeds specific thresholds.

For paleontological resources, earthwork operations (e.g., mass grading, trenching, and boreholes) that cut into sedimentary rock units containing, or potentially containing, fossils would impact those same fossils as they are unearthed. These excavation-related direct impacts can be beneficial by creating short-term opportunities to recover previously buried and undiscovered fossils. Conversely, these impacts can be adverse by causing the permanent destruction of the same previously buried and undiscovered fossils. Impact magnitude is directly correlated with the scale of the proposed earthwork (e.g., large scale mass grading operations to construct the new switching station will create a permanent and complete change to a fossil-bearing stratum [rock layer] that is graded away, while small scale and very localized footing boreholes would create a permanent but slight change to a fossil-bearing stratum that is being bored through). Construction of new access roads has the possibility to create indirect beneficial impacts by increasing access for paleontologists to previously unexplored areas where new fossil discoveries can be made. On the other hand, these same access roads can create indirect adverse impacts by increasing opportunities for unregulated “pot hunting” of potentially significant paleontological resources.

6.1 SIGNIFICANCE CRITERIA

The proposed Project has been evaluated with respect to its potential impacts on paleontological resources. Paleontological resources that may be affected by construction of the BRRTP are confined to those geologic rock units consisting of sedimentary rocks of late Mesozoic and Cenozoic age. Assessment of the significance of potential Project impacts on these resources is based on the resource sensitivity of individual rock units as well as the proposed action (e.g., grading of new access roads vs. rehabilitation of existing access roads; excavation of building pads for the new switching station vs. rehabilitation of the existing switching station; excavation of foundation pads for new transmission structures vs. reconductoring of existing structures; and excavation of new pulling stations vs. passive suspension of transmission lines between adjacent transmission structures).

Impact or ground disturbance has been modeled for the BRRTP using a series of Ground Disturbance Categories (GDC) that include the following: GDC 1 – ground disturbance associated with use of existing improved roads or agricultural land; GDC 2 – ground disturbance associated with use of existing access roads that require improvements; GDC 3 - ground disturbance associated with construction of a new road on flat terrain (0-10% slope); GDC 4 - ground disturbance associated with construction of a new access road on sloping terrain (10-20% slope); GDC 5 - ground disturbance associated with construction of a new access road on steep terrain (20-30% slope); GDC 6 - ground disturbance associated with construction of a new access road on very steep terrain (>30% slope); and GDC H - ground disturbance associated with use of helicopters to supply construction crews and transport tower components (see Appendix A).

6.2 SENSITIVITY VALUES

The following levels of paleontological resource sensitivity are rated for individual formations and recognize the important relationship between fossils and the geologic formations within which they are entombed. These sensitivity values are summarized for each Project segment in Appendix A.

Maximum Sensitivity: Maximum 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. The following rock units known to occur within the study area are assigned a maximum paleontological resource sensitivity:

- Saugus Formation
- Anaverde Formation
- Pico Formation
- Hungry Valley Formation
- Peace Valley Formation
- Ridge Route Formation
- Castaic Formation
- Quail Lake Formation
- Towsley Formation
- Monterey/Modelo Formation
- Mint Canyon Formation
- Tick Canyon Formation
- San Francisquito Formation

**Major/Undetermined Sensitivity:** Major/undetermined sensitivity is assigned to geologic formations known to contain paleontological localities with moderately well- to poorly-preserved, common elsewhere, or stratigraphically long-ranging fossil material. The major sensitivity category is also applied to geologic formations that are judged to have a strong, but unproven potential for producing important fossil remains. The following rock units known to occur within the study area are assigned a major/undetermined paleontological resource sensitivity:

- Older alluvium
- Oso Canyon Formation
- Vasquez Formation

**Minor Sensitivity:** Minor 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, minor sensitivity formations produce poorly-preserved invertebrate fossil remains in low abundance. Due to the young age and oxidized nature of the Quaternary alluvial deposits mapped within the study area, these surficial sedimentary deposits are considered to have little potential to yield scientifically significant fossils and are assigned a minor resource sensitivity.

**Zero Sensitivity:** Zero sensitivity is assigned to geologic formations that are entirely igneous in origin or have undergone high grade metamorphism, and therefore have no potential for producing fossil remains. The following rock units known to occur within the study area have no paleontological resource sensitivity:

- Plutonic igneous rocks
- Gneissic rocks
- Pelona Schist

### 6.3 IMPACT LEVELS

The following definitions have been provided regarding significance criteria used for evaluation of impacts to paleontological resources. Significance is defined as a measure of probable adverse response of a resource to direct and indirect impacts associated with the construction, operation, and maintenance of Project components. It is important to emphasize that determination of impact significance considers both the resource sensitivity of an area as well as the level of ground disturbance proposed for that area. For paleontological resources, these factors are summarized below in Table 6-1, which categorizes initial impacts as either high, moderate, or low, based upon the following general characteristics.

High – A high level of impact to paleontological resources would result if the construction, operation, or maintenance of the proposed Project would cause a significant or substantial ground disturbance (GDC 4 and greater) or other adverse change to paleontological resources defined as having maximum sensitivity.
Moderate – A moderate impact to paleontological resources would result if the construction, operation, or maintenance of the proposed Project would potentially cause ground disturbance (GDC 3 or greater) or other adverse change to the condition of paleontological resources defined as having major/undetermined sensitivity. Moderate impacts would also occur where construction, operation, or maintenance of the proposed Project would result in minor or minimal ground disturbance (GDCs 2 and 3) or other adverse change at or near paleontological resources defined as maximum sensitivity.

Low – A low impact to paleontological resources would result if the construction, operation, or maintenance of the proposed Project would potentially cause any amount of ground disturbance or other adverse changes to paleontological resources that have been defined as having minor sensitivity.

No Identifiable Impact - No identifiable impact would be indicated where no measurable or suspected adverse impact would occur to any paleontological resources. These include areas that are underlain by igneous or metamorphic rock units.

**Table 6-1. Impact Matrix Comparing Paleontological Resource Sensitivity and Ground Disturbance.**

<table>
<thead>
<tr>
<th>Resource Sensitivity</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Major/Undetermined</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Minor</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Zero</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**6.4 Mitigation Planning**

As summarized above and itemized in Table 6-1, construction of the Project would result in high and moderate levels of impact to paleontological resources with Major/Undetermined and Maximum resource sensitivity. These significant initial impacts can be reduced to a low residual level through the sequential implementation of the following mitigation measures:

**PR-1: A qualified paleontologist/principal investigator shall be retained by LADWP to develop and implement a paleontological resource mitigation plan (PMTP).** A qualified paleontologist is defined as an individual with a MS or Ph.D. in paleontology or geology who is experienced with paleontological procedures and techniques, who is knowledgeable in the geology and paleontology of the Project area, and who has worked as a paleontological mitigation project supervisor for at least one year. The qualified paleontologist shall attend relevant pre-construction meetings to consult with grading and excavation contractors concerning excavation schedules, paleontological field techniques, and safety issues. The PMTP shall be based on Society of Vertebrate Paleontology (SVP) guidelines and meet all regulatory requirements. The PMTP shall identify construction impact areas of major/undetermined to maximum sensitivity for encountering significant resources and the depths at which those resources are likely to be encountered. Preconstruction surveys of these areas shall be conducted prior to commencement of construction activities. The PMTP shall outline a coordination strategy to ensure that a qualified paleontological monitor would conduct full-time monitoring of all ground disturbance in sedimentary rocks determined to have a major/undetermined to maximum sensitivity. Sedimentary rocks of low, marginal, and undetermined sensitivity shall be monitored on a part-time basis (as determined by the qualified paleontologist). Geologic rock units with zero sensitivity would not require paleontological monitoring. The PMTP shall detail the significance criteria to be used to determine which resources would be avoided or recovered for their data potential. The PMTP shall also detail methods of recovery,
preparation and analysis of specimens, final curation of specimens at a federally accredited repository, data analysis, and reporting. The PMTP shall specify that all paleontological work undertaken by the Applicant on public land shall be carried out by qualified paleontologists with the appropriate current permits, including, but not limited to a Paleontological Resources Use Permit (for work on public lands administered by BLM). Notices to proceed would be issued by the BLM, CPUC, and other agencies with jurisdiction, following approval of the PMTP.

PR-2: A paleontological monitor shall be retained on a full-time basis to monitor Project-related construction excavations (e.g., road grading, switching station mass grading, and tower footing boreholes and pad construction) in areas underlain by paleontological resources of maximum and major sensitivity. Project-related construction excavations in areas underlain by paleontological resources of undetermined sensitivity shall be monitored on a part-time basis, while Project-related construction excavations in areas underlain by paleontological resources of minor or zero sensitivity would not require any monitoring. A qualified paleontological monitor shall have a B.S. in geology or paleontology and have at least one year experience in the collection and salvage of fossil materials. The paleontological monitor shall work under the direction of the qualified paleontologist.

PR-3: Prior to the initiation of construction or ground-disturbing activities, all construction personnel shall be trained regarding the recognition of possible subsurface paleontological resources and protection of all paleontological resources during construction. Training shall inform all construction personnel of the procedures to be followed upon the discovery of paleontological resources. All personnel shall be instructed that unauthorized collection or disturbance of protected fossils on or off the right-of-way will not be allowed.

PR-4: When fossils are discovered, the qualified paleontologist (or paleontological monitor) shall recover them. In most cases fossil salvage activities can be completed in a short period of time. However, some fossil specimens (such as a complete large mammal skeleton) may require an extended salvage period. In these instances the paleontologist shall be allowed to temporarily direct, divert, or halt earthwork to allow recovery of fossil remains in a timely manner. At each fossil discovery site field data forms shall be prepared to document the geographic, geologic, stratigraphic, and taphonomic aspects of the discovery. Because of the potential for the recovering of small fossil remains, such as isolated mammal teeth, as determined by a qualified paleontologist, it may be necessary to collect bulk samples (up to 6,000 pounds) of sedimentary rock matrix. This bulk matrix sample shall then be tested by screenwashing a 200 pound subsample to determine the presence and relative abundance of identifiable microfossils. If positive results are obtained, the entire sample shall be screenwashed.

PR-5: To the extent feasible, fossil remains collected during monitoring and salvage shall be cleaned, repaired, sorted, and cataloged as part of the mitigation program. Prepared fossils, along with copies of all pertinent field notes, photos, and maps, shall be deposited in a federally accredited repository for both vertebrate and invertebrate fossils such as the Natural History Museum of Los Angeles County or the Museum of Paleontology at the University of California, Berkeley. Funds for curation will be the responsibility of LADWP. The Project qualified paleontologist shall be authorized to submit fossils with accompanying deeds of gift for curation on behalf of LADWP. Donation of the fossils shall be accompanied by financial support for initial specimen storage (costs vary for individual institutions). A final summary report shall be completed 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.
7.0 **IMPACT RESULTS**

Table 7.1 summarize the ROW mileage for initial impacts and paleontological resource sensitivity in regards to the Project components (new 230 kV transmission line [segments], new 230 kV circuit, reconductoring of the existing transmission line, new switching station, and expansion of existing switching station) and land management agency (BLM, NFS) and will be discussed further in the following sections.

### 7.1 NEW 230 KV TRANSMISSION LINE

#### 7.1.1 Segment A

Construction of the new 230 kV transmission line along Segment A would traverse 13.2 miles of sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation.

#### 7.1.2 Segment B

Construction of the new 230 kV transmission line along Segment B would traverse 26.5 miles of sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation.

#### 7.1.3 Segment C

Construction of the new 230 kV transmission line along Segment C would traverse 21.7 miles of sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation.

#### 7.1.4 Segment D

Construction of the new 230 kV transmission line along Segment D would traverse 43 miles of sedimentary deposits defined as having minor, major/undetermined, and maximum sensitivity (see Table 7.1 and Appendix A). In addition, 0.9 of a mile of this segment crosses areas underlain by plutonic igneous rocks with zero resource sensitivity. 21.3 miles of Segment D traverse sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation. 1.1 miles of this segment cross sedimentary deposits of the Oso Canyon Formation. This rock unit was deposited during the late Miocene (~10 Ma) and, although not proven to contain fossils, its sedimentary origin and fluvial paleoenvironments indicate a strong but unproven (i.e., undetermined) potential for producing fossil remains. Ground disturbance estimates for these areas of undetermined sensitivity are only levels 1 and 2, indicating low initial impacts and thus not requiring mitigation. 20.6 miles of Segment D traverse sedimentary deposits of the Saugus Formation (fluvial and alluvial fan deposits of late Pliocene to early Pleistocene age; ~3 to 1.5 Ma), the Hungry Valley Formation (fluvial, deltaic, and lacustrine deposits of early Pliocene age; ~5 Ma), the Castaic Formation (marine sandstones of late Miocene to early Pliocene age; ~6 to 5 Ma), the Ridge Route Formation (alluvial fan, fluvial, and deltaic deposits of late Miocene to early Pliocene age; ~8.4 to 5 Ma), the Peace Valley Formation (deltaic and lacustrine deposits of late Miocene to early Pliocene age; ~8.4 to 5 Ma), the Quail Lake Formation (marine sandstones of late Miocene age; ~10 Ma), and the Mint Canyon Formation (deltaic, fluvial, and lacustrine deposits of middle to late Miocene age; ~14 to 11 Ma). All of these rock units are known to produce significant paleontological resources and are defined as having maximum sensitivity. Ground disturbance estimates for certain areas of maximum sensitivity are only level 1, indicating low initial impacts and no required mitigation. However, there are also areas of maximum sensitivity where ground disturbance estimates
range from level 2 to 6 (i.e., moderate to high initial impacts) and these impacts would require mitigation. All of these potential moderate to high impacts can be reduced to low residual impacts through adoption of appropriate mitigation measures (see Mitigation Measures PR-1 through PR-5).

7.1.5  **Segment E**

Construction of the new 230 kV transmission line along Segment E would traverse 9.7 miles of sedimentary deposits defined as having minor and major/undetermined sensitivity (see Table 7-1 and Appendix A). In addition, 0.8 of a mile of this segment crosses areas underlain by plutonic igneous rocks with zero resource sensitivity. 7.5 miles of Segment E traverses sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation. 2.2 miles of this segment cross sedimentary deposits of Quaternary alluvium. These deposits accumulated during the Pleistocene (~1.8 to 0.01 Ma) and, although not proven to contain fossils, their sedimentary origin indicate a strong but unproven (i.e., undetermined) potential for producing fossil remains. Ground disturbance estimates for these areas of undetermined sensitivity are only levels 1 and 2, indicating low initial impacts and thus, not requiring mitigation.

7.1.6  **Segment F**

Construction of the new 230 kV transmission line along segments F1 and F2 would traverse 4 miles of sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity and impacts to paleontological resources defined as having only minor sensitivity (see Table 7-1 and Appendix A). These impacts are not significant and would not require mitigation.

7.1.7  **Segment G**

Construction of the new 230 kV transmission line along Segment G would traverse 11.1 miles of sedimentary deposits defined as having minor, major/undetermined, and maximum sensitivity (see Table 7-1 and Appendix A). In addition 10.1 miles of this segment cross areas underlain by plutonic igneous rocks and metamorphic rocks (including the Pelona Schist) with zero resource sensitivity. 3.7 miles of Segment G traverse sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation. 4.5 miles of this segment cross sedimentary deposits of Quaternary alluvium (fluvial and alluvial fan deposits of Pleistocene age; ~1.8 to 0.01 Ma), the Vasquez Formation (alluvial fan, fluvial, and deltaic strata of late Oligocene to early Miocene age; ~26 to 22 Ma), and the San Francisquito Formation (marine sedimentary rocks of late Cretaceous to early Paleocene age ~70 to 60 Ma). Although not proven to contain fossils, the sedimentary origin of Quaternary alluvium and the Vasquez Formation indicates a strong but unproven (i.e., undetermined) potential for producing fossil remains. The San Francisquito Formation is defined as having major paleontological resource sensitivity. Ground disturbance estimates for these areas of major/undetermined sensitivity are only levels 1 and 2, indicating low initial impacts and thus, not requiring mitigation. 2.3 miles of Segment G traverses sedimentary deposits of the Saugus Formation (fluvial and alluvial fan deposits of late Pliocene to early Pleistocene age; ~3 to 1.5 Ma), the Anaverde Formation (terrestrial and fluvial deposits of late Miocene to early Pliocene age ~6 to 5 Ma), and the Mint Canyon Formation (deltaic, fluvial, and lacustrine deposits of middle to late Miocene age; ~14 to 11 Ma). All of these rock units are known to produce significant paleontological resources and are defined as having maximum sensitivity. Ground disturbance estimates for certain areas of maximum sensitivity are only level 1, indicating low initial impacts and no required mitigation. However, there are also areas of maximum sensitivity where ground disturbance estimates range from level 2 to 4 (i.e., moderate initial impacts) and these impacts would require mitigation. These potential moderate impacts can be reduced to low residual impacts through adoption of appropriate mitigation measures (see Mitigation Measures PR-1 through PR-5).
### Table 7-1. Mileage for Initial Impacts and Paleontological Resource Sensitivity

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Initial Impacts</td>
<td>Low Initial Impacts</td>
<td>Low Initial Impacts</td>
<td>Moderate Initial Impacts</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>BLM</td>
<td>FS</td>
<td>All</td>
</tr>
<tr>
<td>Segment A</td>
<td>13.2</td>
<td>4.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment B</td>
<td>26.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment C</td>
<td>21.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment D</td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment E</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment F1</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment F2</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment G</td>
<td>10.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment 2a</td>
<td>6.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment H1</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment H2</td>
<td>14.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment I</td>
<td>18.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>115th Street</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New 230 kV</td>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconductoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haskell SS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barren Ridge SS</td>
<td></td>
<td></td>
<td>Entire</td>
<td></td>
</tr>
</tbody>
</table>
FIGURE 7-1. INITIAL IMPACTS

Legend

Paleontology Initial Impact
New 230kV Transmission Line

High Impact
Moderate Impact
Low Impact
No Impact
Mile Marker
Other Project Component

Pacific Crest Trail
Aqueduct
Lake or pond
City Boundary
State of California
USDI Bureau of Land Management
USDA Forest Service
US Department of Defense

LADWP/Barren Ridge Renewable Transmission Project

Paleontology Initial Impacts

ANAP 032-030 (PER-02) LADWP (MARCH 2011) SB 115244

POWER ENGINEERS, INC.
PALEONTOLOGICAL RESOURCES ASSESSMENT REPORT

FIGURE 7-1. INITIAL IMPACTS

Legend

Paleontology Initial Impact
New 230kV Transmission Line

High Impact
Moderate Impact
Low Impact
No Impact
Mile Marker
Other Project Component

Pacific Crest Trail
Aqueduct
Lake or pond
City Boundary
State of California
USDI Bureau of Land Management
USDA Forest Service
US Department of Defense

LADWP/Barren Ridge Renewable Transmission Project

Paleontology Initial Impacts

ANAP 032-030 (PER-02) LADWP (MARCH 2011) SB 115244
THIS PAGE INTENTIONALLY LEFT BLANK
7.1.8  **Segment 2a**

Construction of the new 230 kV transmission line along Segment 2a would traverse 0.4 miles of sedimentary deposits defined as major/undetermined (see Table 7-1 and Appendix A). In addition, 6.1 miles of this segment cross areas underlain by plutonic igneous rocks and metamorphic rocks with zero resource sensitivity. About 0.4 miles of this segment cross sedimentary deposits of Quaternary older alluvium (fluvial and alluvial fan deposits of Pleistocene age; ~1.8 to 0.01 Ma). Although not proven to contain fossils, the sedimentary origin of Quaternary older alluvium indicates a strong but unproven (i.e., undetermined) potential for producing fossil remains. Ground disturbance estimates for certain areas of major/undetermined sensitivity are only level 2, indicating low initial impacts and no required mitigation. However, there are also areas of major/undetermined sensitivity where ground disturbance estimates are level 4 (i.e., moderate initial impacts) and these impacts would require mitigation. These potential moderate impacts can be reduced to low residual impacts through adoption of appropriate mitigation measures (see Mitigation Measures PR-1 through PR-5).

7.1.9  **Segment H**

Construction of the new 230 kV transmission line along Segment H1 would traverse 2.4 miles of sedimentary deposits defined as having minor and major/undetermined sensitivity (see Table 7-1 and Appendix A). In addition, 0.4 of a mile of this segment crosses areas underlain by plutonic igneous rocks and metamorphic rocks (including the Pelona Schist) with zero resource sensitivity. Two miles of Segment H1 traverse sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation. About 0.4 of a mile of this segment crosses sedimentary deposits of Quaternary older alluvium (fluvial and alluvial fan deposits of Pleistocene age; ~1.8 to 0.01 Ma). Although not proven to contain fossils, the sedimentary origin of Quaternary older alluvium indicates a strong but unproven (i.e., undetermined) potential for producing fossil remains. Ground disturbance estimates for these areas of major/undetermined sensitivity are only levels 1 and 2, indicating low initial impacts and thus, not requiring mitigation.

Construction of the new 230 kV transmission line along segment H2 would traverse 2.9 miles of sedimentary deposits defined as having minor and maximum sensitivity (see Table 7-1 and Appendix A). In addition, 14.2 miles of this segment cross areas underlain by plutonic igneous rocks and metamorphic rocks (including the Pelona Schist) with zero resource sensitivity. About 0.8 of a mile of Segment H2 traverses sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation. 2.3 miles of this segment cross sedimentary deposits of the Castaic Formation (marine sandstones of late Miocene to early Pliocene age; ~6 to 5 Ma), the Anaverde Formation (terrestrial and fluvial deposits of late Miocene to early Pliocene age; ~6 to 5 Ma), and the Mint Canyon Formation (deltaic, fluvial, and lacustrine deposits of middle to late Miocene age; ~14 to 11 Ma). All of these rock units are known to produce significant paleontological resources and are defined as having maximum sensitivity. Ground disturbance estimates for areas of maximum sensitivity range from level 2 to 6 (i.e., moderate to high initial impacts) and these impacts would require mitigation. These potential moderate impacts can be reduced to low residual impacts through adoption of appropriate mitigation measures (see Mitigation Measures PR-1 through PR-5).

7.1.10  **Segment I**

Construction of the new 230 kV transmission line along Segment I would traverse 16.3 miles of sedimentary deposits defined as having minor, major/undetermined, and maximum sensitivity (see Table 7-1 and Appendix A). In addition, 18.4 miles of this segment cross areas underlain by plutonic igneous rocks and metamorphic rocks (including the Pelona Schist) with zero resource sensitivity. Nine miles of Segment I traverse sedimentary deposits of Quaternary alluvium. Because these deposits accumulated
relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation. About 1.3 miles of this segment crosses sedimentary deposits of Quaternary older alluvium (fluvial and alluvial fan deposits of Pleistocene age; ~1.8 to 0.01 Ma). Although not proven to contain fossils, the sedimentary origin of Quaternary older alluvium indicates a strong but unproven (i.e., undetermined) potential for producing fossil remains. Ground disturbance estimates for these areas of major/undetermined sensitivity are only levels 1 and 2, indicating low initial impacts and thus, not requiring mitigation. About six miles of this segment crosses sedimentary deposits of the Castaic Formation (marine sandstones of late Miocene to early Pliocene age; ~6 to 5 Ma), the Anaverde Formation (terrestrial and fluvial deposits of late Miocene to early Pliocene age ~6 to 5 Ma), the Mint Canyon Formation (deltaic, fluvial, and lacustrine deposits of middle to late Miocene age; ~14 to 11 Ma), and the Tick Canyon Formation (fluvial and lacustrine deposits of early Miocene age; ~24 to 16 Ma). All of these rock units are known to produce significant paleontological resources and are defined as having maximum sensitivity. Ground disturbance estimates for areas of maximum sensitivity range from level 2 to 6 (i.e., moderate to high initial impacts) and these impacts would require mitigation. These potential moderate impacts can be reduced to low residual impacts through adoption of appropriate mitigation measures (see Mitigation Measures PR-1 through PR-5).

7.1.11 115th Street
Construction of the new 230 kV transmission line along 115th Street would traverse 4.5 miles of sedimentary deposits defined as having minor and major/undetermined (see Table 7-1 and Appendix A). In addition, 0.3 of a mile of this segment crosses areas underlain by plutonic igneous rocks with zero resource sensitivity. About 3.3 miles of this segment traverse sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation. About 1.2 miles of this segment cross sedimentary deposits of Quaternary older alluvium (fluvial and alluvial fan deposits of Pleistocene age; ~1.8 to 0.01 Ma). Although not proven to contain fossils, the sedimentary origin of Quaternary older alluvium indicates a strong but unproven (i.e., undetermined) potential for producing fossil remains. Ground disturbance estimates for these areas of major/undetermined sensitivity are only levels 1 and 2, indicating low initial impacts and thus, not requiring mitigation.

7.2 NEW 230 KV CIRCUIT
Construction of the new 230 kV circuit along Segment J would occur in areas underlain by paleontological resources defined as having minor and maximum sensitivity (see Table 7-1). However, because no ground disturbance activities are proposed for this Project element, there would be no significant impacts to paleontological resources and no requirement for mitigation.

7.3 RECONDUCTORING
Reconductoring along Segment K would occur in areas underlain by paleontological resources defined as having minor, major/undetermined, and maximum sensitivity (see Table 7-1 and Appendix A). However, because no ground disturbance activities are proposed for this Project element, there would be no significant impacts to paleontological resources and no requirement for mitigation.

7.4 NEW HASKELL CANYON SWITCHING STATION
Construction of the new Haskell Canyon Switching Station would occur in an area underlain by sedimentary deposits of the Saugus Formation (fluvial and alluvial fan deposits of late Pliocene to early Pleistocene age; ~3 to 1.5 Ma), the Castaic Formation (marine sandstones of late Miocene to early Pliocene age; ~6 to 5 Ma), and the Mint Canyon Formation (deltaic, fluvial, and lacustrine deposits of middle to late Miocene age; ~14 to 11 Ma). These rock units are known to produce significant
paleontological resources and are defined as having maximum sensitivity. Ground disturbance estimates for areas of maximum sensitivity range from level 2 to 6 (i.e., moderate to high initial impacts) and these impacts would require mitigation. These potential moderate impacts can be reduced to low residual impacts through adoption of appropriate mitigation measures (see Mitigation Measures PR-1 through PR-5).

7.5 EXPANSION OF BARREN RIDGE SWITCHING STATION

The proposed expansion of the existing Barren Ridge Switching Station would occur in an area underlain by sedimentary deposits of Quaternary alluvium. Because these deposits accumulated relatively recently, they are defined as having only minor sensitivity; impacts are not significant and would not require mitigation.
8.0 ALTERNATIVES

NEPA and CEQA both require consideration of a reasonable range of alternatives to the Proposed Action that would feasibly attain most of the basic objectives of the Project, but avoid or substantially lessen any of the significant or adverse effects of the Project.

8.1 DEVELOPMENT OF ALTERNATIVES

A range of alternatives were identified through a siting analysis, the scoping process, and supplemental studies and consultations. A full discussion of alternatives development can be found in the Alternatives Development Report (POWER 2010).

The regional siting analysis identified nine routing opportunities (Segments A through I) for the new 230 kV transmission line between Barren Ridge Switching Station and the proposed Haskell Canyon Switching Station. Some of the routing opportunities or segments were adjusted or modified based on public input and preliminary environmental review, and preliminary electrical system studies. Each of the segments are discussed in detail, including impact analysis, in Section 7.0 of this report. Several of these segments were not used in the formation of alternatives as discussed below.

Segment E was recommended for elimination from analysis in the EIS/EIR. The Segment would require an additional 6.5 miles of transmission line in comparison to the Proposed Action and would not significantly reduce or avoid impacts to air quality, biological, cultural, visual, and water resources. Segment H was also recommended for elimination, due to increased impacts to air quality and noise, along with safety concerns, related to helicopter construction. Cumulative effects for the Project would also increase because of the further disturbance of revegetated and rehabilitated areas and potential for impacts from three transmission line projects in the same vicinity.

Eight routing opportunities (Segments A, B, C, D, F, G, 2a and I) were combined to create end-to-end routing alternatives for the proposed double-circuit 230 kV transmission line between Barren Ridge Switching Station and the proposed Haskell Canyon Switching Station. In addition to routing segments, each alternative discussed within this section would include other Project components as discussed earlier within this report. These include the addition of a new circuit on existing towers between Castaic Power Plant and Haskell Canyon, reconductoring of the existing BR-RIN transmission line, construction of a new Haskell Canyon Switching Station, and expansion of the existing Barren Ridge Switching Station. Impact assessment and impact results for each of the other Project components listed above, and which are common to each of the alternatives, are described in Section 7.0. Descriptions and impact assessment of the routing alternatives follow in the sections below.

8.2 ALTERNATIVES DESCRIPTION

The following alternatives were identified as a reasonable range of alternatives to the Project that would feasibly attain most of the basic objectives of the Project, but avoid or substantially lessen any of the significant or adverse effects of the Project.

8.2.1 Action Alternatives

In addition to a new double-circuit 230 kV transmission line between the Barren Ridge and Haskell Canyon switching stations, whose route would vary among the action Alternatives, the four action Alternatives would include the following common components: the expansion of the existing Barren Ridge Switching Station, construction of a new Haskell Canyon Switching Station, reconductoring of the existing 230 kV transmission line from the Barren Ridge Switching Station to Rinaldi Substation, and the addition of a new 230 kV circuit on existing towers between the Castaic Power Plant and Haskell Canyon Switching Station. Refer to Figure 8-1.
**FIGURE 8-1. ACTION ALTERNATIVES**

**Proposed Action and Alternatives**

Alternative Routes for 230 kV Transmission Line
- Alternative 1
- Alternative 2 - Proposed Action
- Alternative 2a
- Alternative 3

A - K Original Segment Labels

Project Components Applicable for each Alternative
- New 230 kV Circuit
- Reconductoring of Existing 230 kV Transmission Line (Barren Ridge - Rinaldi)
- Expansion of Existing Switching Station
- New Switching Station

**BARREN RIDGE RENEWABLE TRANSMISSION PROJECT**
Alternative 1 (Segments A, C, and D)

The Alternative 1 230 kV double-circuit transmission line comprises the preliminary routing Segments A, C, and D, and is the longest Alternative, at 83 miles long. It would run from the Barren Ridge Switching Station to the unincorporated community of Mojave, while paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI transmission lines. It would continue south-southwest to parallel the Los Angeles Aqueduct to Lancaster Road, where it would travel west to the I-5 utility corridor. It would then run southeast along LADWP’s existing Castaic – Rinaldi corridor to the proposed Haskell Canyon Switching Station.

Helicopter Mitigation

Within the ANF where the terrain is steep and access is limited, the USFS would require that the new double-circuit 230 kV structures be constructed with the use of helicopters (such as the Hughes 500 or Bell 212, or Sikorsky Skycrane). Refer to Figure 8-2, the Identified Helicopter Mitigation Locations Map, which illustrates the identified locations for this mitigation. The use of helicopters for the construction of transmission tower structures would eliminate the need for new access roads to structure locations, and would therefore minimize land disturbance associated with crane pads, structure laydown areas, and the trucks and tractors used for delivery of structures to sites. However, the following site and ground disturbing construction activities would be required to construct the new transmission line within the identified helicopter construction areas: portable landing pads, helicopter fly yards/staging areas, tower structure vegetation clearing, guard structures at major crossings, wire stringing sites, pullouts, and temporary access roads.
FIGURE 8-2. IDENTIFIED HELICOPTER MITIGATION LOCATIONS

Helicopter Mitigation

Alternative Routes for 230kV Transmission Line
- Alternative 1
- Alternative 2 - Proposed Action
- Alternative 2a
- Alternative 3

Helicopter Mitigation Proposed (by tenth mile)

Project Components Applicable for each Alternative
- New 230kV Circuit
- Reconductoring of Existing 230kV Transmission Line (Barren Ridge - Rinaldi)

BARREN RIDGE RENEWABLE TRANSMISSION PROJECT
Alternative 2 (Segments A, B, and G) – LADWP’s Proposed Action

Alternative 2, LADWP’s Proposed Action, comprises Segments A, B, and G and is 61 miles long. It begins at the Barren Ridge Switching Station and runs south, paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI transmission lines. It travels south from the unincorporated community of Mojave, California through the Antelope Valley and approximately one mile east of the Antelope Valley California Poppy Reserve before continuing onto National Forest System lands and ending at the proposed Haskell Canyon Switching Station. The entire route would remain within designated utility corridors and would parallel existing transmission lines. Refer to Section 1.2, Project Description, for a full description of this Alternative.

Alternative 2a (Segments A, B, G and 2a)

The 230 kV double-circuit transmission line in Alternative 2a comprises the preliminary routing Segments A, B, and G, but includes a re-route (Segment 2a) avoiding the unincorporated community of Green Valley. It is 63 miles long and would be very similar to the Proposed Action (Alternative 2), with 56 miles of the same alignment. Alternative 2a would begin at the Barren Ridge Switching Station and run south, paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI transmission lines. It would travel south from the unincorporated community of Mojave through the Antelope Valley and approximately one mile east of the Antelope Valley California Poppy Reserve before continuing onto NFS lands and ending at the proposed Haskell Canyon Switching Station. The route would remain within designated utility corridors and would parallel existing transmission lines, with the exception of the nearly seven miles that would be routed around the unincorporated community of Green Valley. Segment 2a would create a new utility corridor through the ANF. The re-route would rejoin Segment G south of the unincorporated community of Green Valley before continuing south and ending at the proposed Haskell Canyon Switching Station.

Three-Circuit Tower Mitigation

In areas where there are ROW expansion constraints and where LADWP has existing 230 kV transmission lines, LADWP is proposing to construct three-circuit towers to carry the existing BR-RIN circuit and two new BR-HC circuits. This would avoid various impacts including the acquisition of residential property in the unincorporated communities of Willow Springs (milepost 27.1 to 27.6) and Elizabeth Lake and Green Valley (milepost 44.6 to 46 and milepost 50.8 to 51.7). This mitigation would be utilized in the same areas that were identified for Three-Circuit Tower Mitigation for the Proposed Project, with the exception of approximately five miles through the unincorporated community of Green Valley, which would not utilize this mitigation. These areas are illustrated in 1-7, the Three-Circuit Tower Mitigation Map.

Helicopter Mitigation

Within the ANF where the terrain is steep and access is limited, the USFS would require that the new double-circuit 230 kV structures be constructed by the use of helicopter. Refer to Figure 8-2, Identified Helicopter Mitigation Locations, which illustrates the identified locations for this mitigation. The use of helicopters for the construction of transmission tower structures would eliminate the need for new access roads to structure locations, and would therefore minimize land disturbance associated with crane pads, structure laydown areas, and the trucks and tractors used for delivery of structures to sites. However, the following site and ground disturbing construction activities would be required to construct the new transmission line within the identified helicopter construction areas: portable landing pads, helicopter fly yards/staging areas, tower structure vegetation clearing, guard structures at major crossings, wire stringing sites, pullouts, and temporary access roads. The estimated sizes of these auxiliary sites (temporary and permanent) and additional construction information is detailed above in the description of the Proposed Action (Alternative 2) and in Appendix B.
Alternative 3 (Segments A, B, F, and I)
The proposed 230 kV double-circuit transmission line in Alternative 3 comprises preliminary routing Segments A, B, F, and I. It is 76 miles long and would begin at the Barren Ridge Switching Station and run south, paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI lines. It would travel south from the unincorporated community of Mojave through the Antelope Valley and approximately one mile east of the Antelope Valley California Poppy Reserve before continuing southeast past SCE’s Antelope Substation. The route would then travel toward the city of Palmdale, parallel to SCE’s existing high-voltage transmission lines. It would make a sharp turn to the south to parallel LADWP’s existing Victorville – Rinaldi 500 kV and Adelanto – Rinaldi 230 kV transmission lines. This Alternative would then parallel these transmission lines west, crossing two miles of the ANF. The Alternative would then parallel LADWP’s 500 kV PDCI line north to the proposed Haskell Canyon Switching Station.

Three-Circuit Tower Mitigation
In areas where there are ROW expansion constraints and where LADWP has existing 230 kV transmission lines, LADWP is proposing to construct three-circuit towers to carry the existing BR-RIN circuit and two new BR-HC circuits. This would avoid various impacts including the acquisition of residential property in the unincorporated communities of Willow Springs (milepost 27.1 to 27.6). Please refer to the small inset map on Figure 1-7.

Avenue L Re-route
To avoid acquisition of private property, a portion of Alternative 3 from mile marker 45.2 to 46.7 was moved to parallel a smaller distribution line south along 90th Street West and then east along West Avenue “L.” Refer to Figure 8-3, Avenue L Re-route on Alternative 3.
FIGURE 8-3. AVENUE L RE-ROUTE ON ALTERNATIVE 3
8.2.2 **No Action Alternative**

Under the No Action Alternative, the construction of a new 230 kV transmission line, the addition of a new circuit on existing structures from Haskell Canyon to the Castaic Power Plant, the reconductoring of the existing BR-RIN transmission line, the construction of a new Haskell Canyon Switching Station, and the expansion of the existing Barren Ridge Switching Station would not occur. LADWP currently maintains an estimated 147 miles of existing access roads in the Project area, 97 of which are located within the ANF. Current, on-going operation and maintenance activates for existing facilities in the Project area would continue. The EIS/EIR must address the resulting environmental effects from taking no action and compare them to the effects of permitting the Proposed Action or an Alternative to the Proposed Action.

8.3 **IMPACT RESULTS—ROUTING ALTERNATIVES**

8.3.1 **Alternative 1 (Segments A, C, and D)**

Alternative 1, which includes segments A, C, and D, has the potential to create significant impacts to paleontological resources with maximum sensitivity occurring along a 25-mile section of the southern portion of Segment D between MP 22.4 and the proposed Haskell Canyon Switching Station. A total of 8 miles of this segment are slated for helicopter construction of lattice towers and all this mileage is underlain by rock units having maximum sensitivity (7.7 miles of Ridge Route Formation and 0.7 miles of Peace Valley Formation). Because of steep terrain in these areas, ground disturbance would likely create initial impacts to paleontological resources that would also require mitigation. As summarized in Table 7-1, these significant impacts include a total of 13.1 miles of moderate initial impacts and 1.2 miles of high initial impacts. In addition, construction of the proposed Haskell Canyon Switching Station has the potential to create significant impacts to paleontological resources with maximum sensitivity occurring within the footprint of the new switching station. In contrast, expansion of the existing Barren Ridge Switching Station would not create any significant impacts to paleontological resources, nor would reconductoring of the existing Barren Ridge-Rinaldi transmission line or the stringing of new lines between Haskell Canyon Switching Station and the Castaic Power Plant. Construction of Alternative 1 would avoid potential significant impacts to paleontological resources occurring along segments G and I. Portions of these two segments are underlain by geologic rock units known to contain fossil remains of Miocene land mammals.

8.3.2 **Alternative 2 (Segments A, B, and G)—LADWP’s Proposed Action**

Alternative 2, which includes segments A, B, and C, has the potential to create significant impacts to paleontological resources with maximum sensitivity occurring along a short, 2-mile section of the southern portion of Segment G between MP 19.2 and 21.2. As summarized in Table 7-1, these significant impacts include a total of 2.2 miles of moderate initial impacts. In addition, construction of the proposed Haskell Canyon Switching Station has the potential to create significant impacts to paleontological resources with maximum sensitivity occurring within the footprint of the new switching station. In contrast, expansion of the existing Barren Ridge Switching Station would not create any significant impacts to paleontological resources, nor would reconductoring of the existing Barren Ridge-Rinaldi transmission line or the stringing of new lines between Haskell Canyon Switching Station and the Castaic Power Plant. Construction of Alternative 2 would avoid potential significant impacts to paleontological resources occurring along segments D and I. Portions of these two segments are underlain by geologic rock units known to contain fossil remains of Miocene land mammals.

8.3.3 **Alternative 2a (Segments A, B, G, and 2a)**

Alternative 2a, which bypasses the unincorporated community of Green Valley, has the potential to create significant impacts to paleontological resources with major/undetermined sensitivity occurring along a short, 0.3-mile section between MP 6.0 and 6.3. A total of 4 miles of this segment are slated for helicopter
construction of lattice towers and all this mileage is underlain by rock units having zero resource sensitivity. As summarized in Table 7-1, these significant impacts include a total of 0.3 miles of moderate initial impacts. Construction of Alternative 2a would avoid potential significant impacts to paleontological resources occurring along segments D and I. Portions of these two segments are underlain by geologic rock units known to contain fossil remains of Miocene land mammals.

8.3.4 Alternative 3 (Segments A, B, F, and I)

Alternative 3, which includes segments A, B, F, and I, has the potential to create significant impacts to paleontological resources with maximum sensitivity occurring along short, 3.4-mile and 2.7-mile sections of the southern portion of Segment I between MP 24.4 and 27.8 and MP 29.2 and 31.9, respectively. As summarized in Table 7-1, these significant impacts include a total of 5.2 miles of moderate initial impacts and 0.2 of a mile of high initial impacts. In addition, construction of the proposed Haskell Canyon Switching Station has the potential to create significant impacts to paleontological resources with maximum sensitivity occurring within the footprint of the new switching station. In contrast, expansion of the existing Barren Ridge Switching Station would not create any significant impacts to paleontological resources, nor would reconductoring of the existing Barren Ridge-Rinaldi transmission line or the stringing of new lines between Haskell Canyon Switching Station and the Castaic Power Plant. Construction of Alternative 3 would avoid potential significant impacts to paleontological resources occurring along segments D and G. Portions of these two segments are underlain by geologic rock units known to contain fossil remains of Miocene land mammals.

8.4 NO ACTION ALTERNATIVE

The No Action Alternative would avoid potential impacts to paleontological resources by eliminating all proposed construction activities along individual Project segments.

8.5 CUMULATIVE EFFECTS

Cumulative effects to paleontological resources are those effects that result from impacts of the BRRTP when incrementally added to impacts of other past, present, and/or future projects. Analysis of cumulative effects places project-specific impacts into a broader context that takes into account the full range of impacts to paleontological resources by projects taking place over a given space and time.

8.5.1 Cumulative Projects List – Major Present and Reasonably Foreseeable Future Actions

The cumulative projects list is used to provide a general context for the cumulative effects. This list includes present and reasonably foreseeable future actions in the Project vicinity that have the potential to combine with the Proposed Action or Alternatives. While a distinct impact area for cumulative impacts and specific present and reasonably foreseeable actions is determined individually for each resource area, collectively, the projects listed below represent the major known and anticipated activities that may occur in the general Project area. The Cumulative Projects Map (Figure 8-4) illustrates the location of energy infrastructure and other major projects in reference to the Proposed Action and Alternatives.

As the project list comprises projects in various stages of planning and development, it is likely that some of these projects would be completed as currently proposed while others would not. To be conservative, the cumulative analysis assumes that all projects listed would be built and in operation during the operating lifetime of the proposed Project. The list was developed in consultation with the following agencies:

- USFS – Angeles National Forest (ANF)
- BLM – Ridgecrest Field Office
- BLM – Palm Springs Field Office
- United States Air Force – Edwards Air Force Base
- Kern County – Planning Department
- Los Angeles County – Department of Regional Planning
- City of California City
- City of Lancaster
- City of Palmdale
- City of Santa Clarita
- City of Los Angeles
- City of San Fernando
- LADWP
Figure 8-4. Cumulative Projects

Cumulative Projects

BRRTA Proposed Action Components
- Alternative Route for new 230kV Transmission Line
- New 230kV Circuit
- Reconductoring of Existing 230kV Transmission Line
- Expansion of Existing Switching Station
- New Switching Station

Additional Projects
- Transmission Line and Substation Expansion
- ATP - Antelope Transmission Project
- TRIP - Tehachapi Renewable Energy Project
- Transportation or Public Facility
- Solar Generation
- Wind Generation
- Mixed Solar and Wind Generation

North Sky River Wind Project
Ridge Rider Solar Park
Pine Canyon Wind Project
Pine Tree Wind Project & Pine Tree Solar Project
Alta East Wind Project
Sand Canyon Wind Project
Clearview Wind Project
Windstar Wind Project
Alta Wind Energy Project
Palomar Wind Project
Morgan Hills Wind Project
Catalina Renewable Energy Project

PV Wind Project
Cottonwood Substation
Pacific Wind Energy Project
White Sands Wind Project
Antelope Valley Wind Energy Project
Water Bank Project

Antelope Valley Solar
AV Solar Ranch One

PROPOSED HASKELL CANYON SWITCHING STATION

CASTAIC POWER PLANT

Pacific Pipeline Storm Relocation

BARREN RIDGE RENEWABLE TRANSMISSION PROJECT
THIS PAGE INTENTIONALLY LEFT BLANK
Energy Infrastructure Projects

Transmission Projects

**Antelope Transmission Project** – Construction of Southern California Edison’s (SCE) proposed Antelope Transmission Project is underway and is proceeding in three sequential segments. Construction of Segments 1, 2 and 3A have been completed. Construction of Segment 3B, from Windhub Substation to and including Highwind Substation, has not started and no schedule has been developed by SCE (California Public Utilities – Current Projects).

Segment 1, Antelope – Pardee 500 kV Transmission Line, involved the construction of a new 25.6-mile transmission line between SCE’s existing Antelope Substation in the city of Lancaster and SCE’s existing Pardee Substation in Santa Clarita, with modifications to and/or expansion of the substations. The line was constructed in an existing SCE 66 kV transmission line right-of-way (ROW) for 23 miles, and within a new ROW for 18 miles. The line is initially energized to 220 kV to serve existing energy demand and can be upgraded to 500 kV to accommodate future needs.

Segment 2, Antelope – Vincent 500 kV Transmission Line, consists of a new 17.8 mile transmission line between the Antelope Substation and SCE’s existing Vincent Substation near Acton. Similar to Segment 1, the line would initially be energized at 220 kV and upgraded to meet future needs.

Segment 3, Antelope – Tehachapi Transmission Line, consists of two phases. The first phase, 3A, would involve the construction of a new 26.1-mile 500 kV transmission line between the Antelope Substation and a proposed new substation in the vicinity of the unincorporated community of Mojave (Substation 1). Similar to Segments 1 and 2, this line would be initially energized at 220 kV and upgraded to meet future needs. The second phase, 3B, would involve the construction of a new 9.4-mile 220 kV transmission line from the proposed Substation 1 to a proposed new substation in the Monolith area (Substation 2).

**Tehachapi Renewable Transmission Project (TRTP)** – SCE is proposing to construct the TRTP, which would involve new and upgraded transmission infrastructure along 173 miles of new and existing rights-of-way, in southern Kern County, portions of Los Angeles County including the ANF, and the southwestern portion of San Bernardino County. Stated objectives for the project include providing the electrical facilities necessary to integrate levels of wind generation in excess of 700 MW and up to 4,500 MW in the Tehachapi Wind Resource Area (California Public Utilities – Current Projects).

The environmental review process for the project is currently underway. Construction began in April 2010 on approved sections. Project construction is estimated to be completed in 2015.

The project is composed of Segments 4 through 11, with Segments 4 through 8 and Segments 10 and 11 being transmission facilities, and Segment 9 being the addition and upgrade of substation facilities. Proposed transmission lines would be constructed primarily within existing rights-of-way. Major project components include:

- Constructing two new single-circuit 220 kV transmission lines within 4 miles of new ROW between the Cottonwood Substation and proposed Whirlwind Substation (Segment 4);
- Constructing a new single-circuit 500 kV transmission line within 16 miles of new ROW between the Antelope Substation and proposed Whirlwind Substation (Segment 4);
- Rebuilding 18 miles of the existing Antelope – Vincent and Antelope – Mesa 220 kV transmission lines to 500 kV standards within existing ROW between the Antelope and Vincent Substations (Segment 5);
- Rebuilding 27 miles of the existing Antelope – Mesa 220 kV transmission line and 5 miles of the existing Rio Hondo – Vincent 220 kV transmission line to 500 kV standards between the Vincent Substation and the southern boundary of the ANF (Segment 6);
- Rebuilding 16 miles of the existing Antelope – Mesa 220 kV transmission line to 500 kV standards between the southern boundary of the ANF and Mesa Substation (Segment 7);
- Rebuilding 33 miles of the existing Chino – Mesa 200 kV transmission line to 500 kV standards between a point 2 miles east of the Mesa Substation and the Mira Loma Substation (Segment 8);
- Rebuilding 7 miles of the existing Chino – Mira Loma No. 1 220 kV transmission line from single-circuit to double-circuit structures (Segment 8);
- Constructing a new 500/220 kV Whirlwind Substation 4 to 5 miles south of the Cottonwood Substation (Segment 9);
- Upgrading the existing Antelope, Vincent, Mesa, Gould, and Mira Loma Substations to accommodate new transmission line construction and system compensation elements (Segment 9);
- Constructing a new single-circuit 500 kV transmission line within 17 miles of new ROW between the Windhub Substation and proposed Whirlwind Substation (Segment 10);
- Rebuilding 19 miles of existing 220 kV transmission line to 500 kV standards in existing ROW between the Vincent and Gould Substations (Segment 11);
- Adding a new 220 kV circuit between the Mesa and Gould Substations on the vacant side of the existing Eagle Rock – Mesa 220 kV transmission line double circuit structures (Segment 11); and
- Installing associated telecommunications infrastructure.

**Generation Projects**

Numerous wind and solar generation projects are in various stages of planning and development within the Project vicinity. Projects considered include the projects currently undergoing environmental review or projects that have been recently approved. Table 8-1 below summarizes the major known projects and their current status as of April 2011 (County of Kern Environmental Documents and AV Solar Ranch One).

**Table 8-1. Proposed Generation Projects in the Project Vicinity**

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Project Type</th>
<th>Approximate Generation</th>
<th>Area (acres)</th>
<th>Location</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alta East Wind Project</td>
<td>Wind</td>
<td>300 MW</td>
<td>3,660</td>
<td>Kern County</td>
<td>Application to Kern County deemed complete on Aug. 2010</td>
</tr>
<tr>
<td>Alta Wind Energy Center</td>
<td>Wind Turbine</td>
<td>800 MW</td>
<td>9,175</td>
<td>Kern County</td>
<td>Approved by Kern County Dec. 2009</td>
</tr>
<tr>
<td>Alta-Oak Creek Mojave Project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antelope Valley Solar Project</td>
<td>Solar Photovoltaic</td>
<td>650 MW</td>
<td>5,698</td>
<td>Kern County</td>
<td>Draft EIR released April 2011</td>
</tr>
<tr>
<td>AV Solar Ranch One</td>
<td>Solar Photovoltaic</td>
<td>230 MW</td>
<td>21,000</td>
<td>Los Angeles County</td>
<td>Final EIR completed Aug. 2010</td>
</tr>
<tr>
<td>Avalon Wind Project</td>
<td>Wind</td>
<td>255 MW</td>
<td>10,000</td>
<td>Kern County</td>
<td>Application to Kern County deemed complete on July 2010</td>
</tr>
<tr>
<td>Beacon Solar Energy Project</td>
<td>Concentrated Solar</td>
<td>250 MW</td>
<td>2,012</td>
<td>Kern County</td>
<td>Application for Certification approved Aug. 2010</td>
</tr>
</tbody>
</table>
There are also plans in various stages of development to establish additional wind and solar energy projects on BLM land in the Project vicinity. The submission of an application to BLM is a preliminary step in the project planning process, but not all applications ultimately result in successful project development. Below is a list of current applications for wind and solar energy generation projects in the Project vicinity submitted to BLM’s Ridgecrest Field Office as of February 2010 (U.S. Department of the Interior, Bureau of Land Management – Renewable Energy).

### Table 8-2. BLM Ridgecrest Office Applications for Wind and Solar Energy Generation Projects in the Project Vicinity.

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Applicant</th>
<th>Date Application Received, ROW Grant Issued, Last Amended Date</th>
<th>Approximate Area (Acres)</th>
<th>Project Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>CACA 46978</td>
<td>Sean Roberts, Renewable Land LLC</td>
<td>7/1/04</td>
<td>528</td>
<td>Pending Wind</td>
<td>Mojave</td>
</tr>
</tbody>
</table>
Other Major Projects

Transportation and Public Facilities

California High Speed Rail – This project proposes a ±700-mile high speed rail line from Sacramento to San Diego. The Statewide Programmatic EIS/EIR was completed in 2005, and the Bay Area to Central Valley High-Speed Train Program EIS/EIR was completed in 2008. Multiple second-tier project-level environmental documents (with preliminary engineering design) are currently underway (California High Speed Rail Authority).

Pacific Pipeline Storm Relocation Project and Access Road Repairs – Pacific Pipeline is proposing to relocate several miles of crude oil pipeline to more stable ground within the ANF. Project implementation was expected in November 2010 (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

Antelope Valley Water Bank Project – This project proposes to develop facilities to store and recharge imported surface water and associated delivery and distribution pipelines. The 13,440-acre facility area would be bounded by the Kern/Los Angeles County border line (also known as Avenue A) to the south and Rosamond Boulevard to the north, and between 170th Street West and 100th Street West in unincorporated Kern County (U.S. Department of the Interior, Bureau of Reclamation – Mid-Pacific Region).

Soledad Canyon Cemex Project – The Soledad Canyon Cemex project would be a 56-million-ton sand and gravel mining project in the Soledad Canyon area. The BLM approved the project with mitigating measures in 2000, and the Interior Board of Land Appeals affirmed that decision in 2002. A City of Santa Clarita challenge to the US Supreme Court was denied in 2006. This project is pending development with ongoing challenges and delays (Cemex United States).

Community Development

Centennial, California – The proposed project site consists of 12,000 acres located one mile east of Interstate 5 (I-5) and adjacent to State Highway 138 in Los Angeles County. The project would include a specific plan and subdivision entitlements (i.e., tract maps and conditional use permits) for a master
planned community. The specific plan proposes a maximum of 23,000 dwelling units and 14 million total square feet of non-residential development of employment areas (12,233,390 square feet) and retail serving centers (1,986,336 square feet), anticipated to be built over approximately 20 years, with build-out expected in 2030. If the project is approved by Los Angeles County, it is estimated that the non-residential development may generate approximately 31,000 jobs. The draft Specific Plan for the unincorporated community of Centennial was submitted to Los Angeles County in February 2003 and is currently being reviewed by the county (Centennial, California).

Maintenance and Landscape Management Projects

Bouquet Canyon Road Realignment – Los Angeles County Department of Public Works is proposing to straighten some sections of Bouquet Canyon Road and to raise the road surface by approximately nine feet. A Memorandum of Understanding between ANF and Los Angeles County is currently under development to initiate the project (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

San Francisquito Road Rehabilitation and Sediment Disposal Site – Los Angeles County Department of Public Works is proposing a road realignment and new bridge along San Francisquito Road within the ANF and to use eight acres of Forest land as a spoils site in support of construction activities. Public Scoping began in June 2007, and a decision was expected in September 2010 (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

Old Ridge Route Storm Damage Repair – USFS is proposing to repair and provide maintenance to seven storm-damaged locations along the Old Ridge Route in ANF. A decision on the project is expected in late 2010 (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

Livestock Grazing Allotments – BLM currently authorizes both cattle and sheep grazing on 11 grazing allotments in and around the project area. The livestock are authorized with 10 year permits/leases and yearly authorizations. These allotments encompass over one half million acres of BLM-managed lands. The number of livestock grazed each year depends upon weather conditions. The majority of the livestock are sheep. The number of sheep average around thirty thousand head. Three of the allotments support several thousand head of cattle (Harris 2010).

Tule Ridge/South Portal Fuels Reduction Project – USFS proposes fuels reduction and re-establishment of a fuel break to provide protection to unincorporated community of Green Valley. The project would also enhance wildlife for mammals and birds (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

Jupiter Fuelbreak Project – USFS proposes to re-establish an existing fuel break that begins southwest of the unincorporated community of Green Valley and travels east, bisecting Jupiter Mountain, before heading south to Bouquet Reservoir.

Santa Clara/Mojave River Rangers District Plantation Maintenance Project – The proposed project would consist of vegetation maintenance at 13 plantations located within the ANF in order to reduce wildfire risk, and improve wildlife habitat and the vitality of individual remaining trees. Proposed actions include removal of dead trees, thinning of live trees, pruning, removing weeds, and planting for reforestation where necessary. This action was approved by the District Ranger in January 2010 (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

Lake Hughes Plantation Restoration Project – The proposed project would restore unauthorized off-highway vehicle trails at the Christian and Taylor Plantations located within the ANF in order to reduce soil erosion, the spread of weeds, destruction of native plants, soil compaction, and wildlife habitat loss. Proposed actions include recontouring and decompacting soils, reseeding with native species, and
reinforcing check dams. The project was approved by the District Ranger in 2009 and scheduled for implementation in January 2010 (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

Bouquet and San Francisquito Habitat Improvement Project – The project proposes invasive species removal in Bouquet and San Francisquito Canyons (Forest Service Schedule of Proposed Actions for the Angeles National Forest).

Local Projects

In conjunction with the major projects listed above, a summary of local foreseeable projects within the study area that could contribute to cumulative effects are summarized in the table below. These proposed projects were gathered from applications to the planning departments of the various jurisdictions and have been categorized by project type.

### Table 8-3. Proposed Local Projects in the Project Vicinity.

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Kern County</th>
<th>Los Angeles County</th>
<th>City of California City</th>
<th>City of Palmdale</th>
<th>City of Lancaster</th>
<th>City of Santa Clarita</th>
<th>City of Los Angeles</th>
<th>City of San Fernando</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential (may include multiple units)</td>
<td>1</td>
<td>96</td>
<td>0</td>
<td>14</td>
<td>93</td>
<td>10</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Multi Family Residential (may include multiple units)</td>
<td>28</td>
<td>9</td>
<td>0</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Schools</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Religious Uses</td>
<td>10</td>
<td>7</td>
<td>0</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Recreational Facilities</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Public Facilities – police, fire, library, correctional</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Commercial/ Office Development</td>
<td>40</td>
<td>33</td>
<td>0</td>
<td>96</td>
<td>6</td>
<td>21</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Hotels/Motels</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Medical/Care Facilities</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Industrial Facilities</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mining Operations</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RV Facilities</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Animal Facilities</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aviation Facilities</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non-Commercial Energy Facilities</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1 Projects listed for Los Angeles County include all projects that could contribute to cumulative effects within the following County Districts: Antelope Valley West, Bouquet Canyon, Castaic Canyon, Chatsworth, Lancaster, Leona Valley, Mount Gleason, Newhall, North Palmdale, Palmdale, Quartz Hill, Sand Canyon, Soledad. Some identified projects included may be outside of the study area.

2 Projects listed for the City of Palmdale include all projects that could contribute to cumulative effects within the City. Some identified projects included may be outside of the study area.

#### 8.5.2 Cumulative Impacts

Overall, foreseeable projects on federal, State, county, city, and private land would probably encompass over 89,000 acres of development, although the extent of ground disturbance within each project footprint would vary widely, as would the potential for adverse effects to paleontological resources. Table 8-4 briefly summarizes the ranges of factors within different types of projects that could affect paleontological resources.
A cursory review of the major pending projects reveals that few directly overlap with the various proposed BRRTP Alternatives. Further, when considering only those portions of the BRRTP Alternatives where moderate and/or high initial impacts to paleontological resources of major or maximum sensitivity are likely, it appears that only Alternative 1 has the potential for significant cumulative effects. In addition, although the potential to encounter paleontological resources along portions of all three Project Alternatives is considered high, standard conditions for monitoring and fossil recovery pertaining to paleontological resources that may be unearthed during construction of any ongoing or future projects in the area would minimize potential cumulative impacts to a level that is considered less than significant.
9.0 References


White, D. R. 1983. Shoreface to lagoonal facies of the marine Pliocene lower Saugus Formation, northern Simi Valley, California. In, Squires, R. L. and Filewicz, M. V. (eds.), Cenozoic geology of the


## 10.0 ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternating Current</td>
</tr>
<tr>
<td>ANF</td>
<td>Angeles National Forest</td>
</tr>
<tr>
<td>BLM</td>
<td>Bureau of Land Management</td>
</tr>
<tr>
<td>BR-RIN</td>
<td>Barren Ridge – Rinaldi Transmission Line</td>
</tr>
<tr>
<td>BRRTP</td>
<td>Barren Ridge Renewable Transmission Project</td>
</tr>
<tr>
<td>CEQ</td>
<td>Council on Environmental Quality</td>
</tr>
<tr>
<td>CEQA</td>
<td>California Environmental Quality Act</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>EIR</td>
<td>Environmental Impact Report</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>Forest Service</td>
<td>U.S. Department of Agriculture, Forest Service</td>
</tr>
<tr>
<td>IP</td>
<td>Invertebrate Paleontology</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>LACM</td>
<td>Natural History Museum of Los Angeles County</td>
</tr>
<tr>
<td>LADWP</td>
<td>Los Angeles Department of Water and Power</td>
</tr>
<tr>
<td>Ma</td>
<td>mega annum (million years ago)</td>
</tr>
<tr>
<td>MP</td>
<td>Mile Post</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NFMA</td>
<td>National Forest Management Act</td>
</tr>
<tr>
<td>NFS</td>
<td>National Forest System</td>
</tr>
<tr>
<td>PDCI</td>
<td>Pacific Direct Current Intertie</td>
</tr>
<tr>
<td>ROW</td>
<td>Right-of-Way</td>
</tr>
<tr>
<td>SCE</td>
<td>Southern California Edison</td>
</tr>
<tr>
<td>SDNHM</td>
<td>San Diego Natural History Museum</td>
</tr>
<tr>
<td>TRTP</td>
<td>Tehachapi Renewable Transmission Project</td>
</tr>
<tr>
<td>TSP</td>
<td>Tubular Steel Pole</td>
</tr>
<tr>
<td>UCMP</td>
<td>University of California, Museum of Paleontology</td>
</tr>
<tr>
<td>USDA</td>
<td>U.S. Department of Agriculture</td>
</tr>
</tbody>
</table>