APPENDIX 1

Antelope-Pardee 500-kV Transmission Project EIR/EIS

Alternatives Screening Report

Lead Agencies:
California Public Utilities Commission
USDA Forest Service, Angeles National Forest

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Appendix 1. Alternatives Screening Report

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1. Introduction

1.1 Purpose of Report

On December 9, 2004, Southern California Edison (SCE) submitted Application A.04-12-007 seeking authorization by the California Public Utilities Commission (CPUC) for a Certificate of Public Convenience and Necessity (CPCN) for the Antelope-Pardee 500-kilovolt (kV) Transmission Project (proposed Project). On January 11, 2005, SCE submitted a Special Use Application (SF 299) to the USDA Forest Service because the proposed transmission line would cross approximately 12.6 miles of National Forest System (NFS) lands in the Angeles National Forest (ANF). The proposed Project is described in detail in Section B.2 of the EIR/EIS. This document describes the alternatives screening analysis that has been conducted for the proposed Project, supplementing the information presented in Sections B.3 and B.4 of the EIR/EIS.

Alternatives to the proposed Project were suggested by SCE as part of the Proponent's Environmental Assessment (PEA), by the Tehachapi Collaborative Study Group (TCSG), by the EIR/EIS team, by the NEPA Lead Agency (USDA Forest Service), and during the Scoping period (June-July 2005) by the general public. The alternatives screening analysis was carried out in order to determine the range of alternatives that would be carried forward in the EIR/EIS. This report summarizes the screening of alternatives and provides a record of the screening criteria and results that were reached regarding alternatives carried forward for full EIR/EIS analysis. This report is intended to document: (1) the range of alternatives that have been suggested and evaluated; (2) the approach and methods used in screening the feasibility of these alternatives according to guidelines established under CEQA and NEPA; and (3) the results of the alternatives screening analysis (i.e., which alternatives are analyzed in the EIR/EIS).

This Alternatives Screening Report is incorporated as Appendix 1 to the EIR/EIS, providing the basis and rationale for whether an alternative has been carried forward for full evaluation in the EIR/EIS. For each alternative that was eliminated from further consideration, this document explains in detail the rationale for elimination. Since full consideration of the No Project Alternative is required by CEQA and NEPA, and must automatically be considered fully in the EIR/EIS, this report does not address this alternative (it is defined in Section B.4.6 of the EIR/EIS).

1.2 Background

Under Section 210 and 212 of the Federal Power Act (16 U.S.C. § 824 (i) and (k)) and Section 3.2 and 5.7 of the California Independent System Operator's (CAISO) Tariff, SCE is obligated to interconnect and integrate power generation facilities into its electric system. In addition, the 2001 National Energy Policy goals are to increase domestic energy supplies, modernize and improve our nation's energy infrastructure, and improve the reliability of the delivery of energy from its sources to points of use. Executive Order 13212 encourages increased production and transmission of energy in a safe and environmentally sound manner. According to Executive Order 13212, for energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects. The agencies shall take such actions to the extent permitted by law and regulations and where appropriate.

Based on SCE's obligation to integrate into its electrical system the future generation projects, including wind energy projects planned north of Antelope Substation, SCE determined that certain transmission line and substation facilities are required to be constructed between the Antelope and Pardee Substations.

To determine the range of reasonable alternatives, issues related to transmission needs were considered as a framework for development.

Transmission Options

Within the existing SCE transmission infrastructure, power is transmitted from the Big Creek area, where hydroelectric plants generate electricity, along the Big Creek Corridor passing through the Pardee and Vincent Substations and down into southern California. In addition, significant generation is located at Pastoria and also flows into the Antelope and Pardee substations. Based on information provided by SCE in its PEA, any additional wind generation in the Antelope Valley-Tehachapi region would result in a system overload, specifically thermal overload of the existing Antelope-Mesa 220-kV transmission line. As such, transmission options from Antelope must be explored to determine a means for transmitting electricity from future generation projects to the southern California market. Within this geographic area, this additional electricity could be delivered from the Antelope Substation to either the Vincent or Pardee Substations. It should be noted that once the additional power is transferred to the Vincent or Pardee Substations, the system has the ability to transfer power between Vincent and Pardee and other sites within southern California; however, power flow studies would need to be performed to determine if additional upgrades would be necessary to transfer power south from Vincent.

In addition to transmitting electricity north of Antelope via Antelope-Pardee or Antelope-Vincent, several transmission line options exist for accommodating the additional electricity. For example, SCE determined that a new 500-kV transmission line operated initially at 220-kV, equipped with a 220-kV line position at the Pardee Substation, and expansion of the Antelope Substation (i.e., the proposed Project) would prevent overloading of SCE's existing facilities. Based on this assessment, installation of a single 220-kV line would initially meet the transmission needs determined by SCE. Alternatively, a double-circuit 220-kV line would provide additional transmission capabilities and provide the flexibility of using proven technology for potential undergrounding of the transmission lines. The various transmission options, ranging from alternate transmission paths (Antelope-Pardee vs. Antelope-Vincent) to alternate transmission lines (500-kV, 220-kV, or 220-kV double-circuit) were explored as part of this Alternatives Screening Report.

1.3 Summary of the Proposed Project/Action

The proposed Project is described in detail in Section B of this EIR/EIS. The proposed Project would transmit the electricity generated north of Antelope Substation to the southern California market. The transmission line project, as proposed by SCE, includes:

- Installation of a new, approximately 25.6-mile-long 500 kV overhead transmission line (12.6 miles on NFS lands) between the existing Antelope and Pardee 220-kV substations. The line would utilize the existing Saugus-Del Sur right-of-way (ROW) except for small sections near the Antelope Substation and in the Haskell Canyon area northeast of the Pardee Substation. Approximately 119 existing 66-kV towers (86 towers are located on NFS lands) would be removed from the Saugus-Del Sur corridor.

- Expansion of the Antelope Substation to increase the substation rating from 220 kV to 500 kV, which would include a total of six new 220-kV circuit breakers, four line and eight bus dead-end structures, and fourteen 220-kV disconnect switches. New protective relay equipment would also be installed in a new Mechanical Electrical Equipment Room (MEER) adjacent to the existing Control Room. The expansion would be 1,145 feet by 1,185 feet with 205 feet by 300 feet being used for the 220 kV substation improvements.
- Relocation of three 1,000-foot-long segments of double-circuit 66-kV line currently located southwest of the Antelope Substation to a new 200-foot wide ROW. This would require replacement of 18, 70-foot-tall wood poles with 18 new 70-foot-tall light weight steel poles. New conductor will need to be installed along each line segment to facilitate these relocations.
- Termination of the Antelope-Pardee 500-kV transmission line into an existing switchrack position at the Pardee Substation will require the installation of two new 220-kV circuit breakers and four new 220-kV disconnect switches, as well as protective relaying.
- Construction of two telecommunication paths for redundancy purposes between the Antelope and Pardee substations. The primary path would use the existing SCE infrastructure, while the secondary path would be provided by Optical Ground Wire (OPGW) installed on all new transmission lines.
- Existing access and spur roads (approximately 10 miles) would be repaired, drainage structures would be installed, and approximately 20 new spur roads (approximately 1.7 miles) would be built.
- Approximately 24 new pulling locations, ten of which would be located on NFS lands, and 15 new splicing locations, 11 of which would be located on NFS lands, would be needed for use by the construction crews to pull and tension sock lines and conductors between towers.

2. Overview of Alternatives Evaluation Process

The range of alternatives in this report was identified through the CEQA/NEPA scoping process, and through supplemental studies and consultations that were conducted during the course of this analysis. The range of alternatives considered in the screening analysis encompasses:

- Alternatives identified by SCE and as subsequent refinements to the proposed route;
- Alternatives identified by the TCSG, which was formed by the CPUC to provide guidance to the Commission on how to proceed with transmission planning in the Tehachapi region;
- Alternatives identified by the EIR/EIS team as a result of the independent review of the alternatives and meetings with affected agencies and interested parties;
- Alternatives requested by the NEPA Lead Agency (USDA Forest Service); and
- Alternatives identified by the general public during the Scoping period (June-July 2005) held in accordance with CEQA requirements.

2.1 Alternatives Considered

In total, the alternatives screening process has culminated in the identification and screening of 15 potential alternatives or combinations of alternatives. These alternatives range from minor routing adjustments to SCE's proposed 500-kV project route, to entirely different transmission line routes, to alternate system voltages, and system designs. Each category is presented below. Section 3 presents detailed descriptions of each alternative and detailed explanations of why each was selected or eliminated.

2.1.1 Design Variations to the Proposed Project/Action

The following alternatives, which may be considered as mitigation measures to the proposed Project, are design variations to the proposed Project providing transmission capabilities between the Antelope and Pardee Substations:

- **Antelope-Pardee Forest Underground Alternative:** The USDA Forest Service requested SCE to evaluate undergrounding the proposed transmission line across NFS lands. This alternative would follow the proposed Project route, but would place the 500-kV transmission line underground through the ANF.
- **Antelope-Pardee Partial Underground Alternative:** This alternative would provide for placing the 500-kV transmission line underground in specific high-impact segments of the proposed route, including along Del Sur Ridge within ANF, to reduce visual impacts, conflicts with Forest Management activities (e.g., wildland fire suppression), and the potential for avian collision and/or electrocution, and within the City of Santa Clarita to reduce visual impacts to the community.
- **Antelope-Pardee 220-kV Single-circuit Partial Underground Alternative:** This alternative would consist of the construction of a new 220-kV transmission line between the Antelope and Pardee Substations rather than a 500-kV line, with lines placed underground in specific high-impact areas. The new 220-kV line would follow generally the same alignment as the proposed Project. Use of shorter 220-kV towers compared to the taller 500-kV towers could also reduce visual impacts.
- **Antelope-Pardee 220-kV Double-circuit Partial Underground Alternative:** This alternative would include a new double-circuit 220-kV line between the Antelope and Pardee Substations following generally the same alignment as the proposed Project, with lines placed underground in specific high-impact areas. The new double-circuit 220-kV line would meet the initial need for 220-kV and provide for some additional capacity in the future. Use of shorter 220-kV double-circuit towers compared to the taller 500-kV towers could also reduce visual impacts.
- **Antelope-Pardee Relocation of Towers off Del Sur Ridge (Mid-slope) Alternative:** This alternative would follow a similar route to the proposed Project, but would relocate most of the towers off the top of Del Sur Ridge, either to the east (towards Bouquet Canyon) or the west (towards San Francisquito Canyon) to reduce visual impacts, conflicts with Forest Management activities (e.g., wildland fire suppression), and the potential for avian collision and/or electrocution.
- **Antelope-Pardee – Single-Circuit 500-kV Towers Between Haskell Canyon and Pardee Substation:** This alternative was suggested by SCE in its PEA as Alternative 2. It includes constructing single-circuit 500-kV towers between Haskell Canyon and the Pardee Substation (mile 20.3 to 25.6) in the vacant position of the Pardee-Vincent 500-kV ROW, rather than constructing double-circuit 500-kV towers and removing the existing single-circuit 500-kV towers. This alternative would reduce construction impacts associated with removal of existing towers.
- **Antelope-Pardee – Tubular Steel Poles in the Antelope Valley and City of Santa Clarita Alternative:** During the public scoping meetings, some members of the public requested consideration of placing tubular steel poles along the Antelope Valley portion of the proposed Project route, as well as the portion within the City of Santa Clarita. A preference for tubular steel poles to reduced both visual and EMF impacts was expressed by nearby residents.
- **Antelope-Pardee – Re-routing of New ROW in Santa Clarita Alternative:** During the public scoping meeting on July 14, 2005, it was requested that SCE find a new parallel corridor to avoid the Veluzat Motion Picture Ranch and planned development in the Santa Clarita area. The film/TV

ranch was specifically concerned with possible interference with filming and the associated compromises in filming operations affecting the economic viability of the ranch.

2.1.2 Alternate Corridors

The following alternatives provide alternate corridors to the proposed Project for delivering power from future generation projects, including wind energy projects planned north of Antelope Substation, to the southern California market:

- **Parallel LADWP ROW Alternative:** This alternative was suggested by SCE in its PEA as Alternative 1. This alternative would provide a new 22.8-mile 500-kV line between the Antelope Substation and Haskell Canyon (2.3 miles longer than the corresponding portion of the proposed Project route). The last 5.1 miles to the Pardee Substation would coincide with the proposed Project route.
- **Antelope-Vincent 500-kV Line in Existing Antelope-Vincent Corridor Alternative:** This alternative would provide for the transmission of power from future generation projects, including wind energy projects planned north of Antelope Substation, while avoiding ANF by constructing a new 500-kV line from the Antelope Substation to the Vincent Substation within the existing Antelope-Vincent corridor.
- **Antelope-Vincent 500-kV Line in New Corridor Alternative:** This alternative would provide for the transmission of power from future generation projects, including wind energy projects planned north of Antelope Substation, while avoiding ANF. Two options were considered for siting a new 500-kV corridor between Antelope and Vincent Substations which minimize disruptions to existing land uses. Option A consists of a combination of overhead and underground construction, whereas Option B consists entirely of overhead construction.
- **Antelope-Vincent 220-kV Double-circuit in New Corridor Alternative:** This alternative would provide for the transmission of power from future generation projects, including wind energy projects planned North of Antelope Substation, while avoiding ANF. The same two options as for the Antelope-Vincent 500-kV Line in New Corridor Alternative were considered for siting a new 220-kV double-circuit corridor between Antelope and Vincent Substations.
- **Antelope-Pardee 500-kV Line in New Corridor Alternative:** This alternative would provide for the transmission of power from future generation projects, including wind energy projects planned north of Antelope Substation, while reducing the distance traversed within the ANF (on NFS lands), by constructing a new overhead 500-kV line between the Antelope and Pardee Substations. The transmission line would travel generally south from the Antelope Substation to the existing Pardee-Vincent transmission corridor, and then west to connect to the Pardee Substation.

2.1.3 Other Transmission Alternatives

The following alternatives would potentially provide for the transmission of electricity generated from future generation projects, including wind energy projects planned north of Antelope Substation, without requiring upgrades or a new corridor between Antelope-Pardee or Antelope-Vincent Substations.

- **Antelope-Mesa Replacement Alternative:** This alternative was considered by SCE as a result of the "PPM Energy Company Interconnection Study, Fairmont Wind Project System Impact Study" prepared by SCE in August 2003. The Antelope-Mesa 220-kV transmission line begins at the Antelope Substation and extends in a southerly direction for approximately 60 miles to the Mesa

Substation. This alternative would entail upgrading conductor and transmission towers on the entire Antelope-Mesa 220-kV line between the Antelope and Mesa Substations. The alternative would cross portions of both the Santa Clara/Mojave Rivers and Los Angeles River Ranger Districts of the ANF.

- **Big Creek-Fresno Phase-Shifted Tie:** As presented in Appendix B of the “Report of the Tehachapi Collaborative Study Group”, this alternative would establish a new interconnection point between the Pacific Gas & Electric (PG&E) and SCE systems. The proposal calls for connecting PG&E’s Gregg-Helms Pump Storage Plant transmission system with SCE’s Big Creek-Rector 220-kV lines at a new switching station. The switching station would include phase shifting devices in order to “push” power from the SCE system into the PG&E system. This would allow for the import of up to 300 MW of wind generation to the PG&E Fresno area.

2.2 Alternatives Screening Methodology

The evaluation of the alternatives identified above was completed using a screening process that consisted of three steps:

Step 1: Clarify the description of each alternative to allow comparative evaluation

Step 2: Evaluate each alternative using CEQA/NEPA criteria (defined below)

Step 3: Based on the results of Step 2, determine the suitability of the each alternative for full analysis in the EIR/EIS. If the alternative is unsuitable, eliminate it from further consideration.

In the final phase of the screening analysis, the advantages and disadvantages of the remaining alternatives were carefully weighed with respect to CEQA and NEPA criteria for consideration of alternatives. These criteria are discussed in the following section.

2.3 CEQA and NEPA Requirements for Alternatives

Both CEQA and NEPA provide guidance on selecting a reasonable range of alternatives for evaluation in an EIR and EIS. The CEQA and NEPA requirements for selection and analysis of alternatives are similar, thereby allowing the use of an alternatives screening and evaluation process that satisfies both State and federal requirements. The CEQA and NEPA requirements for selection of alternatives are described below.

2.3.1 CEQA

An important aspect of EIR preparation is the identification and assessment of reasonable alternatives that have the potential for avoiding or minimizing the impacts of a proposed Project. In addition to mandating consideration of the No Project Alternative, the State CEQA Guidelines (Section 15126.6(e)) emphasize the selection of a reasonable range of feasible alternatives and adequate assessment of these alternatives to allow for a comparative analysis for consideration by decision makers. The State CEQA Guidelines (Section 15126.6(a)) state that

> *An EIR shall describe a reasonable range of alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the*

comparative merits of the alternatives. An EIR need not consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decisionmaking and public participation.

In order to comply with CEQA's requirements, each alternative that has been suggested or developed for this project has been evaluated in three ways:

- Does the alternative accomplish all or most of the basic project objectives?
- Is the alternative feasible (from economic, environmental, legal, social, technological standpoints)?
- Does the alternative avoid or substantially lessen any significant effects of the proposed Project (including consideration of whether the alternative itself could create significant effects potentially greater than those of the proposed Project)?

2.3.1.1 Consistency with Project Objectives, Purpose, and Need

A project's statement of objectives (required by CEQA) and purpose of and need for action (required by NEPA) describe the underlying purpose of the project and the reasons for undertaking the project. The purpose and need statement is used to identify a range of reasonable alternatives to be analyzed in the EIR/EIS. To fulfill this requirement, the project proponent must define its objectives for the project and provide a description of the need for the project. SCE's stated purpose and need for the Antelope-Pardee 500-kV Transmission Project is presented below.

In addition, each Lead Agency has its own purposes to consider in evaluating a proposed project/action and the alternatives to the proposed project/action. An agency's statement of objectives and/or statement of purpose and need discusses the reason and need for that agency's action and explains what the agency is called upon to do, given its authority with respect to a project. CEQA (Guidelines Section 15124(b)) and NEPA (CFR Title 40 Section 1502.13) explain that an agency's statement of objectives or purpose and need should describe the underlying purpose of the proposed Project. Because each agency's jurisdiction is unique, the decision it is called upon to make is also unique, and thus each agency's statement of objectives or purpose and need is different. Therefore, the two Lead Agencies for the proposed Project have prepared their own purpose and need statements, which are described below following SCE's purpose and need.

The State CEQA Guidelines require the consideration of alternatives capable of eliminating or reducing significant environmental effects even though they may "impede to some degree the attainment of project objectives" (Section 15126.6(b)). Therefore, it is not required that each alternative meet all of the project objectives. Below is a description of the objectives, purpose, and need of the Applicant (SCE) and each of the Lead Agencies (CPUC and USDA Forest Service).

Southern California Edison (Applicant)

Accommodation of Local and Regional Potential for Power Generation

Under Sections 210 and 212 of the Federal Power Act (16 U.S.C. § 824 (i) and (k)) and Sections 3.2 and 5.7 of the California Independent System Operator's (CAISO) Tariff, SCE is obligated to interconnect and integrate power generation facilities into its electric system. Therefore, SCE needs to develop and maintain a reliable transmission network with adequate capacity to transmit electrical power from new generation sources to areas of electrical load or demand. For SCE, this entails transmission of electrical power from sources north, east, and south of the Los Angeles metropolitan area. Within and near the northern portion of SCE's service region, power is generated from gas-fired thermal power plants, hydroelectric plants, and wind farms. Wind is an increasingly important source of power in the Antelope Valley and Tehachapi areas, which offer geographic and climatic conditions that are conducive to power generation through wind farms. As a variety of power sources continue to develop and become operational in the Antelope Valley and Tehachapi areas, transmission capacity beyond that which is currently available will be required in order to supply customers in SCE's service region.

The SCE power grid is a complex network of generation, transmission, and distribution infrastructure. For instance, the existing corridor between Antelope Substation and Vincent Substation contains one 500-kV line (Midway-Vincent No. 3) and three 230-kV lines (Antelope-Vincent, Antelope-Mesa, and a non-SCE line). As this corridor proceeds south, it is joined by two 500-kV lines (Midway-Vincent No. 1 and No. 2). Use of the existing Antelope-Vincent corridor from the Antelope Substation to the Vincent Substation for provision of the necessary transmission capacity is not feasible, because the corridor is not wide enough to support the installation of an additional transmission line, unless an existing line is removed. Therefore, in order to transmit power from wind farms north of Antelope Substation, additional transmission capacity is needed south of the Antelope Substation. The proposed Project is needed to expand the SCE transmission grid and deliver power from current and future renewable power sources in the Antelope Valley and Tehachapi areas to SCE's high electrical demand areas further south.

Transmission of wind power from the Tehachapi and Antelope Valley areas is currently restricted by the existing Antelope-Mesa 220-kV transmission line, which is currently at capacity. This transmission line would overload with the addition of new power to the system, including that received from wind generation. Overloading of the Antelope-Mesa transmission line would cause widespread system stability and reliability issues. Meanwhile, there is ongoing development of wind power generation projects in the Tehachapi region, north of Antelope Substation. Despite the fact that the Antelope-Mesa transmission line would overload with the addition of new power, SCE must allow connection of any new wind projects to its system due to its obligations per FERC and CAISO, as described above. As of February, 2006, one active wind project called the PdV Wind Energy Project ("PdV") was in the application review process with Kern County. PdV would connect up to 300 MW of new power into SCE's system. SCE estimates that when the proposed Project is energized at 220 kV, it would allow for the connection of up to 350 MW of new power without overloading the Antelope-Mesa 220-kV line. It would accomplish this by providing the capacity to transmit power from the Antelope Substation to the Pardee Substation rather than directing more power to the Antelope-Mesa line.

According to SCE, the proposed Antelope-Pardee 500-kV Transmission Project is needed now to accommodate wind generation projects that have applications pending before Kern County or Los Angeles County, or that may submit applications in the near future. However, due to the location of the PdV Wind Energy Project and other potential wind generation projects in the Tehachapi Wind Resource Area, it is reasonably foreseeable that multiple wind generation projects will need to interconnect to the Antelope Substation to allow power to be delivered to load in the Los Angeles area. CAISO estimates that a total of 2,122 MW of wind energy generation facilities are currently in the planning stages for the Tehachapi and Mojave areas of Kern County (CAISO, 2006). The Project is needed to meet the demands of SCE customers south of Antelope Substation by increasing the capacity of the SCE system to a level that would accommodate proposed or planned wind energy projects.

Prevention of Overloading of Existing Transmission Facilities

Based on information provided by SCE in its PEA for the proposed Project, there is not sufficient capacity in the current transmission grid to safeguard the system from overload under increasing renewable power generation and loading. As load grows due to increased electrical demand and power is received from other sources of generation, transmission overloading would occur in the vicinity of the proposed Project. For instance, the Antelope-Mesa 220-kV transmission line could experience thermal overload if current power loads are increased, which is expected to occur as southern California's population continues to grow at current and projected rates. The proposed Project would reduce loading on the Antelope-Mesa 220-kV transmission line to within the allowable line conductor thermal limits. The proposed Project would also increase transmission capability south of the Antelope Substation and allow power generated in the Antelope Valley and Tehachapi areas to be safely transferred, thus serving system load on the SCE grid.

The proposed Project would initially be operated at 220-kV in order to meet current transmission needs associated with ongoing wind development. However, the line would be built to 500-kV standards so that as renewable power loads increase, future overloading of transmission facilities would be avoided. The CAISO, which manages transmission grid reliability for the State of California, has approved construction of the proposed Project using a 500-kV transmission line. The CAISO maintains that the use of 500-kV standards for the proposed Project will avoid the future need to construct and/or tear down and replace multiple 220-kV facilities with 500-kV facilities to meet growing power generation and transmission needs. As such, the design of the proposed transmission line must meet the CAISO 500-kV standard.

Compliance with Reliability Planning Criteria

Use of a common utility ROW, such as the Vincent-Antelope-Vincent corridor, triggers reliability planning criteria, including that developed by the CAISO, the Western Electricity Coordinating Council (WECC), and the North American Electric Reliability Council (NERC). These criteria require the potential loss of transmission lines (proposed and existing) to be analyzed. A transmission line could be lost (i.e., removed from service) due to a natural disaster, accident, or even intentional attack. To the extent that simultaneous loss of both lines occurs and creates a problem with respect to system reliability, SCE must automatically utilize acceptable mitigation measures, which are referred to collectively as a Remedial Action Scheme (RAS) or a Special Protection Scheme (SPS). If both of the existing Antelope-Vincent transmission lines were lost, other lines connected to the Antelope Substation would accept the power that was previously flowing on the lines that were lost.

Of particular concern in terms of reliability is the Antelope-Mesa 220-kV line, which is currently susceptible to overloading. As discussed, the Antelope-Mesa 220-kV transmission line is currently operating at capacity. According to SCE power flow studies, the addition of new power to the SCE system north of Antelope Substation would cause the Antelope-Mesa line to exceed its reliability (or capacity) rating for line conductor thermal limits (SCE, 2004, PEA page 2-2); steps must be taken to reduce the power flow on this line in order to maintain acceptable system reliability once new power from wind projects is connected to the system north of Antelope Substation. Reliability criteria require that for the loss of a single line, the system is designed such that there is no overloading on other lines. In the case where both Antelope-Vincent lines are lost, it would be necessary to reduce power flowing into the Antelope Substation from power generation plants such as Pastoria and Big Creek, as well as any other power generation sources that are connected to the Antelope Substation such as potential future wind projects. In addition, CAISO criteria limit the amount of generation reduction to not more than 1,400 MW, ensuring reliability for customers of the SCE grid. While the Antelope-Mesa line is currently within line conductor thermal limits for reliability, the addition of new power to the SCE system north of Antelope Substation would cause the Antelope-Mesa line to exceed thermal limits, forcing reduction of power generation from northern power plants and potential future wind development.

The integration of additional power generation sources into the existing SPS would be extremely complex in that it is based upon a number of different criteria (e.g., monitoring of various line loadings and generator levels) and is designed to limit reducing generation to situations only where certain line flows and other parameters are exceeded. The CAISO has stated in a letter to SCE "…due to high complexity of the existing and planned SPS in the Big Creek Corridor, any further expansion of the SPS should be very limited and will have to be approved by the California ISO…" Instead of undertaking extensive modifications to the SPS, SCE is planning a series of upgrades to increase transmission capacity, including the proposed Antelope-Pardee 500-kV Transmission Project. Upgrades to the Antelope-Mesa and Antelope-Vincent lines are expected in the future to provide further transmission capacity and to facilitate planned wind generation north of the Antelope Substation. The implementation of additional transmission capacity, such as that provided through the proposed Project, would create greater system reliability without altering the already complex SPS.

SCE Purpose and Need Summary. Per CPUC Decision 04-06-010, Ordering Paragraph No. 8, SCE is required to "…file an application seeking a certificate authorizing construction of the first phase of…transmission upgrades consistent with its 2002 [2003] conceptual study and the [Tehachapi Collaborative] study group's recommendation…" These transmission upgrades include the proposed Antelope-Pardee 500-kV Transmission Project. Additionally, SCE's purpose and need for the approval and implementation of the proposed Project is has two primary aspects, as follows:

1) Prevent overloading of the existing Antelope-Mesa transmission line by adding capacity between Antelope Substation and Pardee Substation.
    - Increased capacity is necessary to allow for the transmission of renewable wind power generated in the Antelope Valley and Tehachapi areas.
    - Wind power is being developed in the Antelope Valley and Tehachapi areas to increase the amount of energy delivered in California from renewable resources.
    - The amount of wind power generated by renewable resources is being increased in response to the California Renewables Portfolio Standard Program (SB 1078), which requires utilities to increase the amount of power generated from renewable sources.
2) Increase reliability of the SCE transmission grid by providing a new pathway to deliver power to load south of Antelope Substation from generation facilities located north of Antelope Substation. Existing transmission lines originating at SCE's ~~PG&E's~~ Big Creek hydroelectric generation facilities in Madera and Fresno Counties deliver power to Antelope Substation in Los Angeles County by connecting through SCE's Magunden Substation in Kern County. Currently, there is only one transmission corridor available to deliver power from Antelope Substation to areas of demand (load) to the south, including the Los Angeles metropolitan area. The proposed Project would increase system reliability by providing an additional pathway for power transmission south of Antelope Substation from power generated north of the substation, including future wind power delivered from the Tehachapi area.

- Use of a common utility ROW triggers reliability planning criteria implemented by the CAISO, the Western Electricity Coordinating Council (WECC), and the North American Electric Reliability Council (NERC) which require the potential loss of transmission lines (proposed and existing) to be analyzed.
- Instead of undertaking extensive modifications to the already complex SPS, or Special Protection Scheme, SCE is planning a series of system upgrades, including the proposed Project, which would increase overall reliability of the grid and ensure compliance with the reliability planning criteria mentioned above.

California Public Utilities Commission (CEQA Lead Agency)

The CPUC is charged with the regulation of Investor-Owned Utilities (IOUs), such as SCE. Under CEQA, the CPUC is the lead agency for the proposed Project and must assure compliance with CEQA. Prior to taking action to approve SCE's application for a CPCN for the proposed Project, the CPUC must also determine that the proposed Project is consistent with the CPUC's purpose and objectives for granting CPCNs, including, where applicable, compliance with CPUC General Order 131-D. This order states that no electric public utility shall construct electric transmission line facilities designed for operation at 200 kV or more without the CPUC having first found that the facilities are necessary "to promote the safety, health, comfort, and convenience of the public, and that they are required by the public convenience and necessity."

In addition, the CPUC seeks to facilitate the achievement of the State of California's goals for the distribution of renewable energy generated by IOUs operating within California. As a crucial step in fulfilling this purpose, the CPUC must explore possibilities for the removal of constraints on the transmission of electricity from its point of generation to its point of use. In addition, the CPUC must attempt to further the implementation of other State policies and programs related to power generation and transmission. Following is a discussion of factors leading to the CPUC's purpose and objectives for seeking the implementation of the proposed Project.

Senate Bill 1038 (SB 1038). SB 1038 took effect January 1, 2003, and is codified in the Public Utilities Code (PUC) and Public Resources Code (PRC). This bill required the California Energy Commission (CEC) to submit a comprehensive renewable electricity generation resource plan to the California State Legislature (Legislature), describing the potential renewable resources available in California, and also to develop a plan to increase the annual amount of electricity generated from renewable resources. In addition, the bill required the CPUC to prepare and submit to the Legislature a comprehensive transmission plan (Plan) for renewable electricity generation facilities which would provide for the rational, orderly, and cost-effective expansions of transmission facilities that may be necessary to facilitate the development of renewable electricity generation facilities identified in the CEC's renewable electricity generation resource plan. The Plan was submitted to the Legislature on December 1, 2003, pursuant to PUC Section 383.6. The Plan has two sections: a policy text that describes key issues emerging from the development of the Plan, and a Transmission Plan detailing the transmission line and substation additions and modifications necessary to attain the legislative target of 20 percent renewable power generation by 2017 (see SB 1078, below).

Senate Bill 1078 (SB 1078). California Renewables Portfolio Standard Program. The Renewables Portfolio Standard (RPS) was established in 2002 by Senate Bill 1078 (SB 1078). Pursuant to SB 1078, the RPS requires investor-owned utilities, including retail sellers of electricity such as SCE, to increase their sale of electricity produced by renewable energy sources (such as wind) by at least one percent per year, achieving 20 percent by 2017 (at the latest). Subsequent to the RPS, the CPUC, the CEC, and the

Consumer Power and Conservation Financing Authority (CPA - which is now defunct) adopted the Energy Action Plan (EAP). The EPA established a target of 20 percent renewables by 2010 (CEC, 2003), which is a more aggressive goal than the previous SB 1038 goal of 20 percent by 2017.

Wind Generation in the Antelope Valley-Tehachapi Region. The unique geography of the region has made the Antelope Valley and Tehachapi areas one of the world's leading wind energy centers (Tehachapi Central, 2005). Prevailing northwesterly winds blow through passes in the Tehachapi Mountains that connect the San Joaquin Valley with the Mojave Desert. As a result of the regional geography, tax incentives, and favorable legislation in the wake of the 1970s energy crisis, California became the first state to develop large wind farms in the early 1980s. Upgrades (such as the proposed Project) to the SCE transmission grid are necessary in order to maximize benefits from continuing regional development of power generation such as renewable wind power.

According to the California Energy Commission's 2005 Integrated Energy Policy Report (IEPR), "California needs major investments in new transmission infrastructure to interconnect with remote renewable resources in the Tehachapi and Imperial Valley areas, without which it will not be able to meet its RPS targets" (CEC, 2005). RPS, or Renewable Portfolio Standard, targets are required by Public Utilities Code Section 399.14. The IEPR further explains that the "Tehachapi area transmission projects" proposed by SCE and including the Antelope-Pardee Transmission Project are critical in order to facilitate the development of renewable energy resources required by the State RPS targets. Notably, the IEPR recommends that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously."

SCE Renewable Conceptual Transmission Plan. SCE developed the first version of its Renewable Conceptual Transmission Plan (RCTP) in accordance with the "Scope of Work" described by the CPUC in a March 27, 2003, ruling (Proceeding I0011001). The plan describes all SCE conceptual transmission upgrades and their estimated costs that are needed to connect potential renewable energy resources in the SCE and Imperial Irrigation District territories. The identified upgrades would allow the congestion-free interconnection of up to 470 MW of renewable resources in 2005, and up to 1,755 MW of renewable resources by 2008, and up to 4,220 MW of renewable resources by 2017. The proposed Project is the initial transmission upgrade described in the RCTP and part of the first phase of upgrades referenced in CPUC Decision 04-06-010, Ordering Paragraph No. 8, which orders SCE to submit an application to the CPUC to authorize construction of these upgrades (see SCE discussion above).

Federal Energy Regulatory Commission (FERC) Transmission Rate Limits on California Wind Projects. On July 1, 2005, FERC approved SCE's request for rolled-in rate treatment for, among others components, the transmission segment of the proposed Project, thus granting SCE's request to allow SCE to recover 100 percent of costs for the proposed Project (112 FERC 61,014, Docket No. EL05-80-000). FERC allowed recovery of costs for the proposed Project because it provides "…network upgrades to existing high-voltage transmission lines that can be fully integrated with the existing transmission network for the benefit of transmission ratepayers" (Stanfield, 2005).

California Independent System Operator (CAISO). The CAISO was established in 1998 to plan and operate a reliable electricity grid for California, provide non-discriminatory electric transmission services, and facilitate investment in electric transmission and generation infrastructure. The CAISO is a non-profit corporation that is chartered by the State of California and regulated by the FERC. As part of an overall grid planning process, the CAISO studies and approves new transmission proposals. Per the CAISO Tariff, Section 3.2 (Transmission Expansion) and Section 5.7 (Interconnection of New

Facilities to the ISO Controlled Grid), SCE is obligated to interconnect and integrate power generation facilities into its electric system.

CAISO Management considered SCE's proposed Antelope Transmission Project, which includes the proposed Project as well as other future transmission upgrades in the Antelope Valley, and recommended approval of the Project to the CAISO Board of Governors. On July 29, 2004, the Board of Governors accepted CAISO Management's recommendation and moved to: (1) Approve the proposed Project (in addition to other segments of the Antelope Transmission Project) as an initial step towards developing a longer-term transmission solution to connect several thousand MWs of potential wind generation in the Tehachapi area of the CAISO-controlled grid; and (2) Direct SCE to proceed with the design and environmental permitting activities necessary to construct the proposed Project to 500-kV standards.

CPUC Decision 04-06-010. The CPUC issued this decision on the transmission needs in the Antelope Valley and Tehachapi areas identifying potential power generation in this area to be several thousand MWs. CPUC Decision 04-06-010 mandated the convening of a collaborative study group to develop a comprehensive development plan for the phased expansion of transmission capabilities in the Tehachapi area. Subsequently, the Tehachapi Collaborative Study Group (TCSG) was formed with coordination by the CPUC, assistance from the CAISO, and with the participation of the IOUs (such as SCE), wind-power developers, and other stakeholders.

The CEC's Renewable Resources Report Finding of Fact No. 18 found that the "magnitude and concentration" of renewable resources justified a "first phase of Tehachapi transmission upgrades" to facilitate achievement of the goals under PUC Section 399.14. As a result, CPUC Decision 04-06-010, Ordering Paragraph No. 8, required SCE to "file an application seeking a certificate authorizing construction of the first phase [i.e., the proposed Project] of Tehachapi transmission upgrades consistent with its 2002 [2003] conceptual study and the [Tehachapi Collaborative] study group's recommendation…" The Final Report produced by the TCSG in 2005 identified four possible transmission phases (including the proposed Project) for integrating several thousand MWs of potential renewable energy generation from the Tehachapi region. The "first phase" of these transmission upgrades mentioned in CPUC Decision 04-06-010, Ordering Paragraph 8, includes SCE's proposed Project.

CPUC Purpose and Objectives Summary. The CPUC's primary purpose and objective in approving the proposed Project is to facilitate the distribution of renewable energy within the State of California.

- The Tehachapi area is considered the largest wind resource area in the State and, therefore, both federally-regulated and State-regulated utilities have focused on the development of wind projects in this area.
- Per the State of California EAP, the State's RPS goal is to achieve power transmission of 20 percent renewable energy by 2010. As a crucial step in fulfilling this purpose, the CPUC must explore possibilities for the removal of constraints on the transmission of electricity from its point of generation to its point of use.
- The CPUC must attempt to further the implementation of other State policies and programs related to power generation and transmission, with specific regard to the potential wind energy available in the Antelope Valley-Tehachapi Region.

USDA Forest Service (NEPA Lead Agency)

The proposed Project route traverses approximately 12.6 miles of NFS lands within the ANF (Forest Service) and would replace existing transmission facilities within an established utility corridor. SCE must obtain approval through a Special Use authorization from the Forest Service in order to construct the proposed Project on NFS lands.

Purpose of Action. Executive Order 13212 encourages increased production and transmission of energy in a safe and environmentally sound manner (CEQ, 2001). According to Executive Order 13212, for energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects. The agencies shall take such actions to the extent permitted by law and regulations and where appropriate.

The Forest Service's purposes (objectives) in authorizing the proposed Project are the following:

- Minimize adverse environmental effects to NFS land, such as impacts to the following resources: visual, biological, cultural, air, soil, and water, among others as applicable (Forest Plan, Part 1, pp. 38 and 47; Part 2, pp. 7, 32, 35, 69, and 79);
- Minimize the effects of urbanization, or negative effects to open space and natural settings, on the ANF (Forest Plan, Part 2, pp.35, 67-70);
- Ensure that future Forest Management activities such as fire fighting, among others, are not detrimentally affected by the location and/or design of the proposed Project (Region 5 Supplement FSM 2726.43; Forest Plan, Part 1, p. 19; Part 2, p. 37); and
- Ensure that the location of the transmission line on NFS lands maximizes future utility needs (Forest Plan, Part 2, p. 121; Part 3, p. 59).

The Forest Service may deny authorization for special uses for a number of different reasons, such as if "the proposed use would be inconsistent or incompatible with the purpose(s) for which the lands are managed, or with other uses," or the proposed use "would not be in the public interest" (36 CFR 251.5). In order to authorize SCE to occupy and use NFS lands for the proposed Project, the Forest Service must change incompatible management direction in the Forest Plan so that all actions occurring on NFS lands are consistent with the Forest Plan, per 36 CFR 219.10(e): "…the Forest Supervisor [must]…ensure that, subject to valid existing rights, all…instruments for occupancy and use…are consistent with the [forest] plan."

Need for Action. Pursuant to the Federal Land Policy and Management Act (FLPMA) of 1976 (as amended), the Forest Service's need for action is to respond to an application from SCE for a Special Use authorization to construct, maintain, and use a transmission line (and ancillary improvements) through the Santa Clara/Mojave Rivers Ranger District of the ANF. The Forest Service will consider the application for use of NFS lands to ensure that the proposed Project is in the public interest and is appropriate based on the governing land management plan. The FLPMA provides the authority to the Secretary of Agriculture (Forest Service) to issue, renew, or grant authorizations to occupy, use, or traverse NFS lands for the generation, transmission, and distribution of electrical power (43 U.S.C. 1761). The proposed Project would interconnect and integrate energy generated in the Antelope Valley and Tehachapi areas into SCE's electrical system, including wind generation projects currently being planned or expected further in the future.

The Forest Service is required (under 36 CFR 219.10) to review all site-specific projects, including authorized uses of the land, to ensure they are consistent with the 2005 ANF Land Management Plan ("Forest Plan"), per the National Forest Management Act (NFMA) (16 U.S.C 1600-1614, as amended). A Special Use authorization cannot be issued to SCE without first ensuring its consistency with the Forest Plan (through improvement in design and/or Forest Plan amendment). Any proposed amendments to the Forest Plan pertaining to this Project will be included as part of the need for action and included in the appropriate alternatives analyzed in the EIR/EIS. The Forest Plan amendments must be completed before Special Use authorization(s) can be issued to the Applicant (SCE) for the proposed Project or a Project alternative.

Necessary amendments to the Forest Plan will be made using the amendment process defined in the Forest Service Manual 1920 and Forest Service Handbook 1909.12, following all "appropriate public notification and satisfactory completion of NEPA procedures." The decision by the Forest Service to approve or deny Forest Plan amendments associated with the proposed Project and each of the proposed alternatives in this EIR/EIS will be based, in part, on the findings of the impact analyses reported in this EIR/EIS and also on the NFMA determination of the consistency of the proposed use with the parameters specified in the Forest Plan.

USDA Forest Service Purpose and Need Summary. The purpose and need for action by the USDA Forest Service is to respond to SCE's request for a Special Use authorization to construct the proposed Project on NFS lands through the ANF and ensure the Project is in compliance with the Forest Plan. The purposes (objectives) are to minimize adverse impacts on NFS lands and minimize adverse impacts to Forest Management activities.

Purpose, Need, and Objectives Summary

As previously described, the jurisdiction of each decision-making agency associated with the proposed Project is unique from one another. Therefore, each agency's statement of objectives or purpose and need is also unique. In summary, the combined objectives, purpose, and need for the proposed Project as defined by SCE, the CPUC, and the USDA Forest Service include the following:

- Respond to applications from SCE to the CPUC and Angeles National Forest (ANF).
- Facilitate the distribution of renewable wind energy from the Antelope Valley-Tehachapi region and accommodate the area's potential for renewable power generation in order to achieve the State of California RPS goal of 20 percent renewables by 2010.
- Prevent overloading of existing transmission facilities in the SCE grid, specifically the Antelope-Mesa 220-kV transmission line.
- Comply with reliability planning criteria defined by the CAISO, WECC, and NERC, as well as other State policies and programs related to power generation and transmission.
- Minimize disturbance to NFS lands while ensuring the continuation of future USDA Forest Service activities in the ANF, such as wildland fire suppression and natural resources protection.

2.3.1.2 Feasibility

The State CEQA Guidelines (Section 15364) define feasibility as:

> . . . *capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.*

The alternatives screening analysis is largely governed by what CEQA terms the "rule of reason," meaning that the analysis should remain focused, not on every possible eventuality, but rather on the alternatives necessary to permit a reasoned choice. Furthermore, of the alternatives identified, the EIR is expected to fully analyze those alternatives that are feasible, while still meeting most of the project objectives.

According to the State CEQA Guidelines (Section 15126.6(f)(1)), among the factors that may be taken into account when addressing the feasibility of alternatives include site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or other regulatory limitations, jurisdictional boundaries, and proponent's control over alternative sites in determining the range of alternatives to be evaluated in the EIR. For the screening analysis, the feasibility of potential alternatives was assessed taking the following factors into consideration:

- **Economic Feasibility.** Is the alternative so costly that implementation would be prohibitive?
- **Legal Feasibility.** Do legal protections on lands preclude or substantially limit the feasibility of permitting a high-voltage transmission line? Do regulatory restrictions substantially limit the feasibility or successful permitting of a high-voltage transmission line? Is the alternative consistent with regulatory standards for transmission system design, operation, and maintenance?
- **Technical Feasibility.** Is the alternative feasible from a technological perspective, considering available technology? Are there any construction, operation, or maintenance constraints that cannot be overcome?

The State CEQA Guidelines require consideration of alternatives capable of eliminating or reducing significant environmental effects even though they may "impede to some degree the attainment of project objectives or would be more costly" (Guidelines Section 15126.6(b)).

Potential to Eliminate Significant Environmental Effects

A key CEQA requirement for an alternative is that it must have the potential to "avoid or substantially lessen any of the significant effects of the project" (State CEQA Guidelines Section 15126.6(a)). At the screening stage, it is not possible to evaluate all of the impacts of the alternatives in comparison to the proposed Project with absolute certainty, nor is it possible to quantify impacts. However, it is possible to identify elements of an alternative that are likely to be the sources of impact and to relate them, to the extent possible, to general conditions in the subject area.

Table Ap.1-1 presents a summary of the potential significant effects of the proposed Project. This impact summary was prepared prior to completion of the EIR/EIS analysis, so it may not be complete in comparison to the detailed analysis that will be included in the EIR/EIS. The impacts stated below are based on a preliminary assessment of potential project impacts and were used to determine whether an alternative met the CEQA requirement to reduce or avoid potentially significant effects of the proposed Project.

Table Ap.1-1. Summary of Preliminary Significant Impacts of the Proposed Project/Action

Issue Area	Impact
Air Quality	• Construction dust and equipment emissions violating SCAQMD"s ambient air quality standards for NOx • Non-compliance with federal General Conformity requirements
Biological Resources	• Impacts on avian species • Temporary disturbance of habitat during construction • Permanent loss of habitat for tower pads and access roads • Degradation of plant species that provide habitat for biological resources • Wildlife disturbance • Construction noise and air quality disturbances to wildlife • Potential to spread noxious weeds
Cultural Resources	• Potential construction disturbance to recorded and/or unknown cultural and historic resources • Potential non-compliance with the Forest Plan regarding historic and archaeological resources
Geology, Soils, and Paleontology	• Slope instability due to project grading and structure pads • Transmission line could be damaged by surface fault ruptures at crossings of active faults • Buried tower foundations could be damaged by corrosive soils • Impacts to towers from landslides, liquefaction, settlement, lateral spreading, expansive soils, and/or surface cracking resulting from ground shaking
Environmental Contamination	• Possible existing contamination in urban areas • Worker and public exposure to contaminated soil or groundwater during excavation
Fire Safety	• Exposure of people or property to increased fire hazard • Obstruction of emergency evacuation pathways or interfere with emergency response plans • Increased risk to fire fighters
Hydrology and Water Quality	• Construction-related erosion or degradation of water quality through sedimentation • Construction related groundwater depletion
Land Use and Recreation	• Conflicts with the land use and recreation policies of the Forest Plan and local General Plans and Area Plans • Physical land use disturbances and conflicts with existing uses • Conflicts with agricultural uses • Conflicts with Forest Management activities (e.g., wildland fire suppression) in ANF • Conflicts with the recreational resources of the ANF
Noise	• Noise levels in violation of applicable standards • Short-term noise from construction activity on sensitive land uses • Continuous operational noise from transformers and/or transmission line corona
Public Services	• Possible preclusion of emergency access during construction
Socioeconomics	• Short-term decrease in revenues for some local businesses during construction • Potential increase in revenues for some local businesses due to local spending associated with Project construction • Substantially decrease property values along the Project alignment.
Transportation and Traffic	• Short-term closures of highways and roads during construction • Short-term construction disturbance to pedestrian/bicycle/vehicular traffic, public transit, property access, and/or emergency response vehicles • Construction staging areas may result in short-term elimination of limited parking in the ANF • Potential for off highway vehicle (OHV) trespass from new road construction
Utility and Service Systems	• Conflicts with other overhead and underground utilities during construction and excavation • Potential policy inconsistencies with encroachment permits from affected jurisdictions

Table Ap.1-1. Summary of Preliminary Significant Impacts of the Proposed Project/Action	
Issue Area	Impact
Visual Resources	• Visual effects would be evident in High Scenic Integrity Objective (SIO) areas, and/or would not remain visually subordinate to the landscape character in Moderate SIO areas of the ANF, as established and mapped in the Forest Plan • Substantial adverse effect on a scenic vista on State, County, City, or private lands, especially on private lands of Veluzat Motion Picture Ranch • Scenic resources of a State scenic highway would be substantially damaged • Existing visual character and quality of the site and its surroundings would be substantially degraded • New light or glare would adversely affect day or nighttime views • Inconsistent with applicable County or City regulations, plans, policies, goals, or standards applicable to the protection of visual resources

Reliability

In addition to the above feasibility considerations, the reliability of the transmission system must also be considered. Planning criteria developed by the CAISO, Western Electricity Coordinating Council (WECC), and the North American Electric Reliability Council (NERC), requires the loss of a single transmission line to be analyzed (N-1). For this case, the reliability criteria do not allow unplanned load interruption following the loss of a single transmission line. Furthermore, for the case where multiple lines of the same voltage originating from the same source are placed in a common ROW, the reliability criteria require the loss of up to two transmission lines be analyzed (N-2). For the situation where two lines are lost, the CAISO criteria limit the amount of generation drop or reduction to not more than 1,400 MW.

2.3.2 NEPA

Per the Council on Environmental Quality (CEQ) NEPA Regulations (40 C.F.R. 1502.14), the EIS must present the environmental impacts of the proposed action and alternatives in comparative form, defining the issues and providing a clear basis for choice by decision makers and the public. The alternatives section shall:

a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

c) Include reasonable alternatives not within the jurisdiction of the lead agency.

d) Include the alternative of no action.

e) Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.

f) Include appropriate mitigation measures not already included in the proposed action or alternatives.

The CEQ has stated that "[r]easonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense rather than simply desirable from the standpoint of the applicant" (CEQ, 1983).

In order to comply with NEPA's requirements, each alternative that has been suggested or developed for this project has been evaluated in two ways (Bass et. al., 2001):

- Does the alternative meet the statement of purpose and need?
- Is the alternative feasible?

2.3.2.1 Consistency with Purpose and Need

CEQA (State CEQA Guidelines Section 15124[b]) and NEPA (CFR Title 40 Section 1502.13) both explain that an agency's statement of objectives or purpose and need should describe the underlying purpose of the proposed project and reasons to which an agency is responding. For the proposed Project, the Applicant (SCE) and the two Lead Agencies (CPUC and USDA Forest Service) each has a unique jurisdiction and therefore unique objectives or purpose and need, which are described in Section 2.3.1.1, above, and include the following:

- SCE's purpose and need for the approval and implementation of the proposed Project is to accommodate local and regional potential for power generation, while also preventing the overloading of the existing Antelope-Mesa transmission line and complying with reliability planning criteria. Per CPUC Decision 04-06-010, Ordering Paragraph No. 8, SCE is required to "...file an application seeking a certificate authorizing construction of the first phase of...transmission upgrades consistent with its 2002 [2003] conceptual study and the [Tehachapi Collaborative] study group's recommendation…"
- The CPUC's primary purpose and objectives in approving the proposed Project is to facilitate the achievement of the State of California's goals for the distribution of renewable energy generated by IOUs operating within California. As a crucial step in fulfilling this purpose, the CPUC must explore possibilities for the removal of constraints on the transmission of electricity from its point of generation to its point of use. In addition, the CPUC must attempt to further the implementation of other State policies and programs related to power generation and transmission.
- The purpose and need for action by the USDA Forest Service is to respond to SCE's request for a Special Use authorization to construct the proposed Project through NFS lands, while complying with the 2005 ANF Land Management Plan direction. In order to authorize SCE to occupy and use NFS lands for the proposed Project, the Forest Service must change incompatible management direction in the Forest Plan so that all actions occurring on NFS lands are consistent with the Forest Plan, per 36 CFR 219.10(e).

In summary, the combined purpose and need of the proposed Project is to: (1) accommodate local and regional potential for power generation by facilitating the distribution of renewable energy; (2) prevent overloading of existing transmission facilities; (3) comply with reliability planning criteria and other State policies and programs related to power generation and transmission; and (4) minimize adverse effects on NFS lands, minimize adverse effects to Forest Management activities, and comply with 2005 ANF Land Management Plan direction.

2.3.2.2 Feasibility

The environmental consequences of the alternatives, including the proposed action, are to be discussed in the EIR/EIS per CEQ NEPA Regulations (40 C.F.R. 1502.16). The discussion shall include "Possible conflicts between the proposed action and the objectives of Federal, regional, State, and local land use plans, policies and controls for the area concerned." Other feasibility factors to be considered may include cost, logistics, technology, and social, environmental, and legal factors (Bass et. al., 2001). The feasibility factors are substantially the same as described for CEQA in Section 2.3.1.2, above.

2.3.3 Summary of CEQA and NEPA Screening Methodology

Unlike CEQA's requirements, NEPA does not screen out alternatives based on avoiding or lessening significant environmental effects. However, to assure that the alternatives considered for the EIR/EIS would meet the requirements of both CEQA and NEPA, a reasonable range of alternatives has been considered and evaluated as to whether or not the alternatives meet (1) most of the project objectives/purpose and need, (2) are considered feasible, and (3) would avoid or substantially lessen any significant effects of the proposed Project.

3. Alternative Descriptions and Determinations

3.1 Introduction

The alternatives presented in this section range from minor routing adjustments to SCE's proposed 500-kV project route, to entirely different transmission line routes, to alternative system voltages, and system designs, as well as non-wires alternatives. After initial screening, if a potential alternative was unable to meet the project objectives, purpose, and need; proven infeasible; or if it did not appear to reduce or avoid potentially significant impacts of the proposed Project without creating other significant impacts of its own, then it was eliminated from full evaluation. The alternatives that have been determined to meet the CEQA/NEPA alternatives screening criteria have been retained for full analysis in the EIR/EIS.

Section 3.2 addresses design variations to the proposed Project; all of these alternatives connect the Antelope and Pardee Substations. Section 3.3 discusses transmission alternatives that would be routed along a new corridor or an existing corridor, other than the proposed Project. These alternatives originate at the Antelope Substation and end at the Vincent Substation. Finally, other transmission system alternatives are evaluated in Section 3.3. The No Project/Action Alternative, because it must be considered in an EIR/EIS, is described in the EIR/EIS and is not discussed in this appendix. All figures referenced in the discussion below are provided at the end of this report.

3.2 Design Variations to the Proposed Project/Action

Each of the following alternatives is located within or along the proposed Project alignment from Antelope Substation to Pardee Substation. Unless specified in alternatives descriptions, alternatives involve the 500-kV line as described for the proposed Project. The discussions below explain the reasons for elimination or retention for full analysis for each potential alternative.

3.2.1 Antelope-Pardee Forest Underground Alternative

General Considerations for Underground Transmission Lines

Before describing each of the various underground cable systems available under Alternative Description below, this section briefly discusses the elements of a typical underground cable and their purposes. The discussion has been taken from the "Technology and Environmental Assessment Guide on Underground HV Power Transmission (Year 2000 Update)" report prepared by R.W. Beck for the CPUC as part of the Tri-Valley Capacity Increase Project Draft EIR, Appendix 2 (Application No. 99-11-025).

Figure 1A shows the cross-section of a typical high-voltage transmission cable. Most of the elements of all cable types are shown, although great variations exist among different cable designs. Each of the cable elements is discussed below, proceeding outwards from the cable center.

Conductor. The conductor is that part of the cable which is energized at the circuit voltage and which carries the load current. Typically, the conductors for cables are stranded copper or aluminum which can be arranged in several different ways (concentric, segmented) depending on the cable type and conductor size.

Historically, aluminum has enjoyed a price advantage over copper; aluminum, on the other hand, has only about 63 percent the conductivity of copper. Any advantage in conductor cost that aluminum might enjoy is offset by greater overall dimensions to accommodate the larger cross-section area. The cost of solid dielectric insulated copper cable will exceed that of an electrically equivalent aluminum cable by as little as 10 percent, and given its inherent advantages, copper is usually specified by utilities for large power high-voltage underground transmission systems.

Conductor Shield. The conductor shield is used with solid dielectric and paper-insulated cables to smooth the electrical stress distribution at the conductor-insulation interface. Typically, this is a layer of semi-conducting polyethylene about 1 to 2 millimeters thick or metallized carbon paper. This conductor shield diminishes the adverse impact of conductor surface imperfections which, as points of electrical stress concentration, can act as initiating sites for the growth of insulation "trees."

Insulation. Insulation, the most critical cable component, isolates the energized conductor from electrical ground and the environment. Research and development efforts to achieve the goals of prolonging cable useful life and extending operating limits focus on maintaining insulation electrical and thermomechanical integrity. The several variations of cable design basically differ in their insulation materials and approaches to insulation. The most common insulation materials can be classified as solid dielectric (polyethylene [PE], cross-linked polyethylene [XLPE], and ethylene propylene rubber [EPR]), oil-impregnated paper, and gas, usually sulfur hexafluoride (SF6) or nitrogen. The choice of insulation, and essentially cable system type, is essentially a compromise as with few exceptions no proven insulation material/cable type is superior to all others in a cost-effective way for every application. The very existence in many cases of several different cable types on the same utility's network attests to this. Insulation type is most often the determining factor in the definition of operating limits of cable types.

Insulation (Outer) Shield. The insulation shield has a two-fold purpose, namely to smooth electrical stress distribution and carry fault current. A layered approach is commonly employed using a semi-conducting layer to distribute electrical stress and a layer of copper (tape, wires, or corrugated) to handle fault current.

Sheath. The sheath imparts mechanical strength to the cable as well as protection from the environment and provides a moisture barrier. In some cable designs the sheath is also called on to carry fault current or act as the ground return for relay circuits. The most important sheath materials are lead and aluminum, the latter sometimes corrugated for flexibility and additional strength. Lead and lead alloys have been the most popular sheath materials due to their ease of manufacture (i.e., by extrusion onto the cable at low temperature and pressure). However, lead alloy sheaths add enormously to the cable weight and are highly prone to metal fatigue due to cyclic loading and vibrations. Lead alloys also have poor elasticity and creep characteristics which can lead to permanent deformation due to circuit loading and oil pressure variations. Lead alloy sheaths, therefore, often require reinforcements in the form of non-magnetic metallic tapes. Aluminum sheaths have weight and mechanical property advantages over lead.

Protective Jackets and Armoring. Protective jackets are frequently incorporated in cable designs to further protect the cable from mechanical or chemical damage from the environment and water ingress. The most common materials used for extruded jackets are polyethylene, polyvinyl chloride (PVC) and neoprene. Armoring, in the form usually of helically-wound galvanized or stainless steel wires or tape, is applied to provide reinforcement of the cable and most importantly in submarine cables, protection from damage caused by anchors, trawlers, movement of the cable due to water currents, and rocky sea bottom profiles on which the cable can be suspended.

General Cable Operating Principles. The overriding goal in cable system design is to preserve the electrical strength integrity of cable insulation. Insulation degradation, reduction of useful life, and possible total breakdown are accelerated by operation of the cable at elevated temperatures. Therefore, cable systems are generally designed to limit cable temperature to 70 to 90 degrees Celsius under continuous, full-load current.

Designing a cable system for a maximum operating temperature entails a rigorous analysis of the cable heat balance (using IEC 287 guidelines, a finite-element analysis, or Neher-McGrath method). Heat generated in the cable must be dissipated to the environment at a rate sufficient to prevent temperature buildup beyond established design limits. The heat generated in a cable is contributed by many sources, the most important being:

- Ohmic losses in the conductor due to load current
- Dielectric losses in the insulation
- Ohmic losses in the shields or sheaths due to eddy currents or circulating currents
- Magnetization and hysteresis losses in magnetic pipe materials (in HPFF systems) or steel armored cables.

Each of these heat sources can constitute a significant part of the total heat generated. In addition, external heat sources, such as steam pies, can further reduce allowable ampacity and should be investigated during the design phase.

A characteristic of underground transmission cables is that they have a “capacitive effect” and can require significant charging current that results in power losses. This effect increases with cable length and there is a theoretical length at which the useful power supplied is nil. This charging current also results in the reactive VARs that need to be absorbed by the electric system. This can be remedied by installing reactive compensation such as shunt reactors. The need for reactive compensation is unique to each installation based on its specific parameters of cable size, distance, voltage, current, etc.

An additional issue for underground cables particularly for EHV systems at 345 kV and above relates to how these cables behave under electric system disturbances. Again any impacts on system stability would need to be evaluated on the specifics of each installation.

Below is a discussion each of the four individual underground transmission technologies.

High-Pressure Fluid-Filled (HPFF) Cables

This type of system, which is also called pipe-type or high-pressure oil-filled system, has historically been the most commonly used transmission cable in the United States, accounting for approximately 80 percent of the existing underground transmission lines in this country. An individual typical high-pressure fluid-filled cable cross section is shown in Figure 1B.

In this design, the three high-voltage cables are contained in a coated and cathodically protected steel pipe. The pipe provides mechanical protection, prevents the ingress of moisture, and is a pressure vessel for maintaining the 200 pounds per square inch gage (psig) nominal operating pressure on the dielectric fluid that surrounds the cables in the pipe. Both mineral (petroleum base) oils and synthetic dielectric fluids have been used for the pipe filling fluid. Currently, however, HPFF cable systems use synthetic fluids because of their superior electrical characteristics. These synthetic fluids are either polybutene or alkylbenzene or a mixture of both. The primary function of the high pressure dielectric fluid surrounding the cables is to ensure that there are no electrical discharges in the oil impregnated paper insulation. This is due to the fact that the high pipe pressure causes any gas voids in the insulation to be compressed and eventually absorbed by the dielectric fluid.

A pressurizing plant is required to maintain dielectric fluid pressure and accommodate pipe volume changes under all load conditions. Therefore, the fluid reservoir in the pressurization unit (sometimes called pumping plant) must be sized so that it can accommodate the dielectric fluid which flows back into it from the cable pipe when the cable is operating at maximum operating temperature. On the other hand, in low temperature situations, the reservoir must contain some reserve fluid when the cable is at its lowest temperature and the dielectric fluid flows back into the line pipe. A source of power must be available for each of the required pressurization plants separate from the primary cable system.

This cable type requires the most intensive construction process due to the combination of its shorter splicing interval with the associated underground splicing vaults, and the need for above grade pressurization plants. The construction sequence would consist of opening a trench 4 to 5 feet deep and 3 to 5 feet wide. Continuous open trench sections could reach 200 feet in length at any given time. Next, steel pipe sections about 40 feet long would be placed in the trench and the pipe sections would be welded together. The trench would then be backfilled using either concrete, soil, or more typically a special thermal backfill to aid in dissipating heat from the cables.

Underground splicing vaults would be constructed along the trench alignment. The maximum distance between splicing vaults, typically between 1,200 and 1,800 feet, is determined by the amount of cable stored on a transportation spool or the maximum pulling tension that may be placed on the cables when they are pulled into the pipe. These concrete vaults would consist of an underground room approximately 10 feet wide by 10 feet deep by 35 feet long, or 3,500 cubic feet.

Once the pipe/trench system is complete, the transmission cables would be pulled into the pipe sections between vaults and would be spliced together and the pipe system would be sealed. Finally the insulating fluid would be pumped into the pipe to complete the installation. Separate from the cable/trench system, fluid pressure stations would be required at each end of the line (at a minimum) to accommodate fluid fluctuations from temperature caused expansion and contraction and to maintain a high fluid pressure of around 200 psig.

Excavation and construction equipment would require access along the entire trench distance resulting in an additional ground surface disturbance area estimated to be 10 to 15 feet wide. Following construction, this area would remain as an access to the vaults for cable and splice monitoring.

There are two key maintenance items for this type of cable system that would be necessary to ensure that it would operate reliably. First, the fluid pressurization plant must be monitored on a real-time basis with telemetry. This may also require a redundant communication path for gauges and alarms. It must also be checked on a routine basis to make sure that there are no fluid leaks, and that the controls and equipment are functioning properly. The second important maintenance item would be checking that the cathodic protection rectifier and corrosion protection coating are functioning properly. The cathodic protection would typically be monitored on a quarterly basis.

In summary, HPFF underground transmission systems have the following features:

- Proven to be a very reliable system since it was first developed over 50 years ago.
- Oil-impregnated paper tape construction is more forgiving of minor manufacturing defects than solid dielectric insulation systems.
- Short duration of open trench for welding and burying the cable pipe.
- Steel pipe enclosing the cables offers mechanical protection with no added cost.
- Steel pipe facilitates removal and replacement of the cable if necessary.
- Self-cooled power transmission capability is increased by cooling and circulating the dielectric fluid inside of the pipe.
- Domestic cable supply up to 500 kV and domestic-made PPP cable has passed industry tests for 765 kV.
- External magnetic field is significantly lower than other forms of high voltage transmission.

Self-Contained Fluid-Filled (SCFF)

This type of cable, which is sometimes simply called self-contained cable, would consist of three independent cables. The cable for each of the three phases would consist of a hollow conductor, which would be filled with dielectric fluid, high quality kraft paper (or paperpolypropylene-paper [PPP]) insulation, outer shielding, and a lead or aluminum sheath which would be covered by a plastic (polyethylene or PVC) jacket. In this construction the metallic sheath would serve both as a hermetic moisture seal, and as a pressure containment vessel. In the case of lead, bronze tapes are frequently required to strengthen the lead sheath and to keep it from deforming due to the cable pressure. The thickness of the oil impregnated paper insulation would be approximately the same as used for HPFF cables described above. SCFF cables systems use low viscosity synthetic cable dielectric fluids, typically alkylbenzene.

This cable type can be placed in duct bank or can be placed using direct burial. Duct bank installations are more common in developed suburban or urban areas to avoid long lengths of open trench and to facilitate routing around other underground utilities. Since elevation changes along the cable route can significantly affect the fluid pressure, fluid reservoirs and stop joints would be required along the length of the cable circuit (typically at each splice location) to segregate the cable into several hydraulic zones. If the cable route is relatively level, then the distance between fluid reservoirs would be dictated by the pressure drop along the fluid duct during expansion and contraction of the fluid during temperature excursions. In no case, should the pressure be allowed to drop below a minimum level (10 or 15 psig) nor should it be allowed to increase above the maximum allowable pressure determined by the hoop strength of the sheath. As in the case of HPFF cables, SCFF cables would be designed with quite high electrical stresses and the cable dielectric fluid must be pressurized to suppress ionization – otherwise an electrical breakdown would occur.

The construction sequence would consist of opening a trench 4 to 5 feet deep and 3 to 5 feet wide. Cable splicing pits of dimensions similar to a cable vault are excavated along the trench alignment at intervals dictated by the length of cable that can be fabricated and shipped on one reel. Continuous open trench sections would be at least as long as the cable contained on a single reel which could reach 1,800 feet in length at any given time. Next, the cables would be laid into the open trench and the trench would then be backfilled with either soil or more typically a special thermal backfill to aid in dissipating heat from the cables. Often a lean concrete cap would be placed a few feet below grade for the entire trench section as mechanical protection from dig-ins.

The cable sections would be joined together in the pits once two consecutive cable sections are in place. The joint pits would have a concrete base and would require a temporary all-weather cover (tent or portable building) for a clean, controlled environment while the cables are being joined. The cable joints would be sealed in waterproof casing and the pit would be backfilled.

SCFF cable would include insulating fluid and would operate at pressure of 75 psig. Stop joints that sectionalize the cable would be used to limit fluid pressure as well as the amount of fluid that would be lost in the event of a cable breach. Fluid reservoirs would be required along the cable sections to allow for expansion and contraction of the fluid. These fluid reservoirs would be located as frequently as stop joints.

Excavation and construction equipment would require access along the entire trench distance resulting in an additional permanent ground surface disturbance area estimated to be 10 to 15 feet wide. Following construction this area would remain for access along the cable and to the fluid reservoirs.

In summary, SCFF underground transmission systems have the following features:

- Good long-term reliability.
- Higher rating than pipe-type cables, if directly buried.
- Domestic supply available.
- Dielectric fluid is present, but in smaller quantities than HPFF cables.

Solid Dielectric (XLPE) Transmission Cables

This type of cable, which is also called extruded dielectric cable, would consist of three independent cables. An individual typical solid dielectric cable cross section is shown in Figure 1C. The cable for each of the three phases would consist of a stranded copper or aluminum conductor, and extruded semi-conducting conductor shield, the electrical cable insulation (usually cross-linked polyethylene, XLPE), and extruded semi-conducting insulation shield, a metallic shield or sheath, and a plastic jacket. Solid dielectric transmission cables are frequently manufactured with a lead sheath or some other form of radial moisture seal to prevent the exposure of the cable insulation to water. While solid dielectric transmission cables have been in operation successfully for many years in some areas without such a moisture seal, it is generally accepted that the long-term reliability of solid dielectric cables would be enhanced by the use of a moisture barrier. This is particularly true for solid dielectric cables for the higher transmission voltages. Other optional features of this type of cable would be longitudinal water blocking of the conductor and between the cable core and the metallic sheath. This longitudinal water proofing would limit the amount of cable that would be contaminated with water in the case of a “dig in” or in the case of a cable fault.

Although ethylene propylene rubber (EPR) insulation has been used for some transmission class solid dielectric cables, XLPE insulation has been used exclusively for solid dielectric cables with system voltages above 138 kV. Consequently, all future references to solid dielectric cable in this document would be synonymous with XLPE-insulated extra high voltage (EHV) transmission cables.

Solid dielectric transmission cables would be manufactured with insulation thicknesses that are from 1.5 to 2 times those of oil-impregnated paper insulation. However, the thickness of XLPE insulation used for a given system voltage has decreased over time with improvements in the cable materials and manufacturing technology.

This cable type can be placed in duct bank or can be placed using direct burial. Duct bank installations would be more common in developed suburban or urban areas to avoid long lengths of open trench and to facilitate routing around other underground utilities. The trench construction for XLPE cables would be similar to SCFF installations described above. However, XLPE cable joints would be more complex even with direct burial of the cable; splicing vaults are typically used to house these critical elements. Splicing vaults, one for each set of cables, would be buried every 1,200 to 1,800 feet. Each vault would measure approximately 10 feet wide by 10 feet deep by 35 feet long, or 3,500 cubic feet.

As with other types of transmission cables, one of the fundamental requirements for reliable operation of this type of cable system is to avoid electrical breakdown in the insulating materials. This is accomplished by very close manufacturing control to eliminate any contaminants or voids in the cable insulation. Also, the semi-conducting layers must be manufactured with very smooth surfaces or discharges may occur at these locations.

In summary, XLPE underground transmission systems have the following features:

- No dielectric fluid or pressurizing equipment is required.
- Insulation dielectric losses are significantly lower than for oil/paper insulation.
- Charging current or volt-amperes reactive (VAR) generated by the cable are significantly less than oil/paper insulation.
- Circuit restoration is quicker and often simpler than for HPFF systems.
- Current ratings are generally higher for than oil-impregnated transmission cables at system voltages at 220 kV and above.
- Cable system design, operation, and maintenance are less complex than systems with pressurized dielectric fluid.

Compressed Gas Insulated Transmission Lines (CGTL)

The compressed-gas insulated transmission line has primarily been used in applications where high power transfer would be required, such as short dips in overhead lines or relatively short substation connections (get-aways) to overhead lines.

This type of underground transmission system has been developed with two different configurations. In the three-conductor configuration the three high voltage conductors would be contained in a single cylindrical aluminum enclosure. In isolated phase systems the high voltage conductors for each of the three phases would be contained in separate cylindrical aluminum enclosures. In both cases epoxy spacer insulators would support the high voltage conductor(s) inside of the enclosures that are filled with sulfur hexaflouride (SF6) or a mixture of SF6 and nitrogen (N2) gases. The first CGTL systems were designed with SF6 gas at pressures from 40 to 60 psig. More recent systems of this type have reduced the SF6 content to 20 percent with the remainder being nitrogen. This change in the insulating gas was due to a combination of increasing cost for the SF6 gas and environmental concerns (depletion of the earth's ozone layer).

The compressed gas-insulated lines would typically be manufactured in straight rigid sections ranging in length from 40 to 60 feet with field welds required to connect the enclosures for adjacent sections. The aluminum enclosure (typically about 19 inches in diameter for a system voltage of 220 to 275 kV) would be coated with corrosion protection for applications where the three enclosures would be directly buried.

The CGTL can be installed in concrete-covered trenches, directly buried, or installed in tunnels. The primary application for this type of underground transmission would be the transfer of large amounts of power at system voltages up to 500 kV. The ampacity rating of CGTL transmission systems would be in the order of 3,000 to 5,000 amperes or 1,140 to 1,900 MVA at a system voltage of 220 kV.

In summary, CGTL underground transmission systems have the following features:

- Power transfer capabilities are significantly higher than those for other types of underground transmission.
- Relatively simple system design.
- Relatively low magnetic field levels.
- Charging current or VAR generated by the cable is significantly less than all other types of underground transmission systems.
- Dielectric losses (no-load losses) are very low compared to oil/paper cable systems.

Alternative Description

As stated in SCE's PEA, the USDA Forest Service requested SCE to evaluate undergrounding the proposed transmission line across NFS lands in the ANF. As a result, the Antelope-Pardee Forest Underground Alternative was developed, which would utilize underground construction in place of the proposed overhead line construction from Mile 5.7 to Mile 18.6 (12.9 miles, of which 12.6 miles would be on NFS lands) following generally the same route as the proposed Project (see Figure 9). Since CAISO approved construction of the Antelope-Pardee transmission line to 500-kV design and construction standards to avoid constructing and tearing down multiple 220-kV transmission lines, underground construction must meet the requirement for initial operation at 220 kV and final operation at 500 kV.

For the Antelope-Pardee Forest Underground Alternative, insulated power cables would be placed underground along the transmission line alignment through NFS lands in the ANF. There are four underground technologies for 500 kV that are commercially available: High-Pressure Fluid (HPFF) Cables; Self-Contained Fluid-Filled (SCFF); Solid Dielectric (XLPE) Transmission Cables; and Compressed Gas Insulated Transmission Lines (CGTL). Each technology is described above. A transition station, approximately 80 feet high and with a footprint of approximately 2 to 3 acres, would be required at each end of the underground segment to transfer the 500-kV transmission lines from overhead to underground and vice versa. For the HPFF cable option, additional space would be required at the transition station for the fluid pressurization equipment.

Similar to the proposed Project, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

In order to be comparable to the proposed Project, underground construction options must meet the project objectives for initial operation at 220 kV to accommodate the local and regional potential for power generation, and final operation at 500 kV to accommodate the future distribution of renewable energy and prevent overloading of existing transmission facilities. This alternative would provide infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to customers of the SCE transmission grid, through the installation of a 500-kV line. However, underground construction of the transmission line for 12.9 miles through ANF, of which 12.6 miles would be on NFS lands, would cause substantial disturbance to NFS lands and potentially extensive schedule delays (at least an additional 6 months for procurement), which would not meet the recommendations of the California Energy Commission's 2005 IEPR, which states that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously".

The intent of this alternative was to address the Forest Service objectives of minimizing the negative effects to open space and natural settings on NFS lands, conflicts with Forest Management activities (e.g., wildland fire suppression) and reducing the risk of avian collision/electrocution.

Feasibility

Installation Concerns for Underground Transmission System Options

SCFF underground transmission systems and HPFF systems are considered mature and well developed at lower voltages. However, application of the SCFF cable type within the United States has largely been limited to the 115/138 kV range, with only a few miles at 220 kV installed commercially. While this type of cable has been used extensively outside of the United States, it currently makes up less than five percent of the transmission cable in this country. This cable has been manufactured for system voltages from 69 kV up to 500 kV. The only installation of this cable type at 500 kV within the United States is a short section of cable at Grand Coulee Hydroelectric Plant in Washington, where approximately four miles of cable was used for each of the six generators for a total of 24 miles. As a three-phase line this would be approximately 7,000 feet of circuit length. The cable runs through the galleries in the dam and then a tunnel to reach the switchyard. Long submarine cable circuits are one application where this type of cable has definite advantages over the other types of cables. This is due to the fact that there are overseas submarine cable factories that have the capability of manufacturing this type of cable in lengths exceeding five miles in length – thus avoiding the necessity of having field- or factory-installed joints. These systems typically use dc technology due to the lengths involved. An example is the 130-km (80-mile) 350-kV dc submarine link between Denmark and Norway.

HPFF underground transmission system cable systems with system voltages ranging from 69 kV up to 345 kV have been in commercial operation for over 35 years. HPFF cable systems with rated system voltages up to and including 765 kV are commercially available and have passed long-term qualification tests.

XLPE underground transmission system cable has been available for system voltages up to 138 kV since the early 1970s; however, there was a lack of widespread acceptance in this country because of reliability problems with the first generation cable and accessories for some of the initial installations. As the newest technology, XLPE systems have begun to have installations with long enough service life to increase utility confidence in their reliability. Recent years have seen substantial improvement in XLPE systems and acceptance and adoption for higher transmission voltages. Currently, the number of 220-kV solid dielectric cable installations in the United States is also increasing with approximately 50 circuit miles in service.

Utility acceptance in the United States has grown relatively rapidly (last 5 years) for use at 220 kV and 345 kV. For example, a California utility proposed a project using over 12 miles of 220 XLPE underground transmission in September 2002 and a New England utility is presently constructing a 345 kV line which includes 2.1 miles of XLPE underground transmission cable with a second phase of the project proposed with a 5.5-mile XLPE alternative segment. Internationally, a number of XLPE systems up to 420 kV have been installed including a 13.75-mile and 6.25-mile direct buried loop in Copenhagen, Denmark, which was completed in 1997. The first long-distance 500-kV XLPE lines were installed in Tokyo, Japan, in 2000. This XLPE system is two circuits (with a third planned) and was installed in a cable tunnel and in ducts beneath bridges for 25 miles. As only one 500-kV XLPE system has been installed in the world, and was specially installed in a cable tunnel (and ducts), XLPE technology has scant operating history that can serve as a basis for demonstrating reliability at this voltage. However, XLPE cable has been successfully installed and operated for long lengths at lower voltages and has been shown to be technically feasible for a 500-kV installation since the fundamental technology is the same. Use of XLPE cable would require superior quality control during manufacturing, as a key reliability factor for the cables is the purity of the XLPE insulating material. In addition, during installation of the XLPE cable, special skills and proprietary equipment associated with the cable supplier may be required for cable splicing (joining of two segments in a splicing vault).

CGTL underground transmission system technology has primarily been used in applications where high power transfer is required over short distances, such as short dips in overhead lines or relatively short substation connections (get-aways) to overhead lines. Relatively short lengths (i.e., less than 1,000 feet) of the 100 percent SF6 compressed-gas underground transmission lines have been installed in the United States, Japan, and European countries for several decades.

One 275-kV CGTL system, installed in a tunnel with other utilities in Nagoya, Japan, is two miles long. The system voltages for these installations have been from 138 kV up to 765 kV. The first commercial application of the second generation CGTL technology was the construction of a “dip” in an existing 400-kV overhead transmission line in Geneva, Switzerland, in 2000. Because it is not proven for more than two miles, CGTL technology would have significant technically feasibility issues for the distance required for the Antelope-Pardee transmission line. Another particularly challenging issue for assembly of CGTL would be creating a dust-controlled environment to avoid particle pollution of the insulating gas. The lack of installation and operation information for buried CGTL transmission over any significant distance is as much a practicality issue as a feasibility issue that would eliminate the use of CGTL as a feasible alternative.

Installation Concerns for the Forest Underground Options

Seismic Considerations. Underground transmission lines are more at risk for damage from earthquakes and landslides than overhead lines. Furthermore, the occurrence of one of these events after construction could substantially increase the required operation and maintenance activities associated with the underground lines.

The underground portion of the transmission line would be located within the vicinity of the active San Andreas Fault zone (near mile 4.7). The mean value of the maximum displacement for an Mw 7.8 earthquake on the central portion of the San Andreas (repeat of 1857 rupture length) is approximately 10 meters and the mean value of the average displacement is approximately 5 meters. Therefore, a seismic event could expose the cable to potential fault rupture, local ground cracking, and groundshaking, which could damage the underground cable and result in it not being able to transmit power. As such, serious reliability concerns would exist, which would challenge the feasibility of underground construction near an active fault zone.

Slope Considerations. Placing cables on a slope for any significant distance is of concern as there is a risk of movement of the cable down slope due to either gravity or contraction and expansion effects. While there are no hard and fast specific guidelines on slope limitations, and free-laying cables have been placed on slopes that range from five to eight percent for relatively short distances (less than 500 feet), cable grappling or retention systems would need to be considered if the cable slope is in excess of five percent for distances greater than 500 feet. Significant cable slopes with cable retention systems are rarely used due to the potential for the attachments to introduce physical, electrical, and thermal stress points that can result in cable failures.

Cost. As a result of the considerable construction activities associated with undergrounding transmission lines, the associated costs are substantially greater than the cost of installing overhead transmission lines (approximately 10 times more expensive). The cost of undergrounding the transmission line within the ANF for approximately 12.9 miles (12.6 miles of NFS lands) could be cost prohibitive.

Feasibility Conclusion

Of the four underground cable technologies described above, the three that appear to be technically feasible are HPFF, SCFF, and XLPE. However, while SCFF and HPFF are feasible technologies, due to their potential for dielectric fluid release into the environment (see Environmental Disadvantages) only XLPE technology would be considered for underground construction. The CGTL system, as discussed above, has remaining questions as to its technical feasibility for the distances required for the Antelope-Pardee Forest Underground Alternative and would also have the potential to release SF6 gas into the environment (see Environmental Disadvantages).

None of the technologies have been implemented at 500 kV in the United States close to the length of the Antelope-Pardee Forest Underground Alternative (12.9 miles), and there has only been limited implementation in other countries. Therefore, the reliability of underground 500-kV technologies for use in the Antelope-Pardee Forest Underground Alternative has not been fully demonstrated.

Additionally, there are serious reliability concerns associated with slope construction and placement of underground cables near active fault zones, which puts into question the feasibility of the Antelope-Pardee Forest Underground Alternative. Finally, from an economic feasibility review, the cost of underground construction for approximately 12.9 miles along the proposed route through the ANF could be cost prohibitive (approximately 10 times more expensive than overhead transmission line construction).

Environmental Advantages

Under the proposed Project, overhead transmission lines would be placed on new structures that are taller and wider than those currently in the corridor. The line would traverse portions of Lancaster and Santa Clarita and 12.9 miles of the ANF (12.6 miles of NFS lands) between Antelope and Pardee Substations, creating potentially significant visual impacts, especially in the ridge top areas along the route. The Antelope-Pardee Forest Underground Alternative would reduce visual impacts to distant viewers by eliminating the existing overhead transmission lines along the Saugus-Del Sur corridor in ANF. It would also eliminate any additional visual impacts from taller towers; however, permanent scarring along the alignment in the Forest would result from the installation of all-weather access roads, splicing vaults, and potential above-ground cooling equipment (see Environmental Disadvantages).

The presence of an underground line would be less likely to interfere with Forest Management activities, such as forest fire and hazardous fuels management operations. In general, fire suppression air operations usually occur on the ridge tops and the proposed tower height would be a concern for fight fighting aircraft. Backfiring operations and fire prevention efforts, such as prescribed burning and to maintain fuelbreaks, occur on the tops of ridges and would not be impacted by this alternative. Furthermore, fire fighter safety with respect to working under power lines would be improved, and the integrity of the line would be protected during a wildfire as a result of being located underground. Placement of the transmission line underground would also reduce concerns regarding the use of fire retardant on overhead transmission lines. There would also be a decreased need to shut down the transmission line during a wildfire. Underground transmission lines would also eliminate the potential for avian collision and/or electrocution on the ridge.

Environmental Disadvantages

Construction of the Antelope-Pardee Forest Underground Alternative would require substantially more construction activity and ground disturbance due to the continuous trenching required. In order to accommodate the infrastructure described above for underground cable installation, an 80-foot wide construction zone would be required above the trenches.

Overhead transmission line construction would result in construction disturbance primarily at individual structure sites, located approximately every 1,100 feet (assumes 60 towers over 12.9 miles) along the alignment. Underground construction and trenching would involve much greater ground disturbance and construction-related impacts (traffic, air quality and dust, and noise). There is also a greater potential to encounter contaminated soils and buried cultural resources, and to impact biological resources due to the greater ground disturbance. The individual construction and trenching requirements for the four technologies are discussed above under "General Considerations for Underground Transmission Lines".

Before the trench for underground transmission lines may be installed, vegetation must be cleared and terrain must be leveled by grading and filling, in order to accommodate the required 80-foot-wide construction zone, along the entire length of the corridor (i.e., similar to pipeline construction). Such construction is much more difficult and results in much more land disturbance than overhead lines. The land that needs to be kept free of vegetation for overhead lines is usually limited to the area around each tower (plus vegetation management below each tower), where towers are generally spaced 1,400 to 1,500 feet apart (range of 800 to 2,000 feet) in mountainous terrain. Vegetation between towers must also be "pruned" or maintained to prevent interference with cables.

Whenever possible, existing roads would be utilized to minimize new access road construction. In forest areas, vegetation must be cleared prior to beginning underground construction. Access roads must be created or improved to handle large construction vehicles and trucks hauling reels of cable. On steep slopes, access roads would need to be cut in switchback patterns so that large construction vehicles are able to traverse them.

The installation of an underground transmission line would likely require more time and/or resources than construction of an equivalent length of overhead line because of the work required for excavating trenches, constructing the duct banks, fluid reservoirs, and/or stop joints. Construction could be substantially extended due to restrictions on the times of the year available for construction, required to limit the impacts on the environment or due to winter weather.

While in operation, the land above the underground cables must remain free from secondary surface development, including overhead transmission lines, in order to accommodate operation and maintenance activities. Only restricted vegetation would be permitted above the underground route throughout the life of the proposed Project. Also, duct banks, fluid reservoirs, stop joints and/or splicing vaults are required for certain underground technologies, increasing the need for cleared land and continued all-weather access for operation and maintenance. Scarring along the alignment would result from the installation of all-weather access roads, splicing vaults, and potential above-ground cooling equipment resulting in substantial visual impacts.

It should also be noted that the maintenance of underground transmission lines is more difficult than overhead lines because when a problem occurs underground it can be very difficult to identify the exact location of the problem. When the problem is located, the segment (length between two splicing vaults) of cable on which the problem occurred must be removed and replaced. This process involves additional excavation and construction. In addition to the environmental implications, this process would cause circuit restoration to take longer than with overhead transmission lines. Furthermore, underground lines have been found to have a shorter overall lifespan than overhead lines due to the degradation of the insulation surrounding the cables. Replacement activities, assuming an empty parallel duct is not provided, would include removal and replacement of the cable system, which would have substantial environmental consequences.

The disadvantages of each of the four underground technologies are discussed individually below.

HPFF Underground Transmission System. The primary disadvantages of this underground transmission system are:

- Larger volume of dielectric fluid in the cable pipe increases potential for a larger release to the environment compared to other cable types (especially near water bodies).
- Pressurizing or pumping plant is required to maintain dielectric fluid pressure under all load conditions. These plants would require secondary sources of power at the distribution voltage level.

- Cable system requires significantly more maintenance than solid dielectric cables due to the routine maintenance associated with the fluid pressurization plants and the pipe cathodic protection equipment.
- Cable system requires at least one day to restore service if there is a total loss of dielectric fluid pressure (SCE PEA, p. 3-49).
- Current carrying capacity of the cable system is lower than other cable systems with the same conductor size due to the close proximity of the conductors and magnetic losses in the steel pipe.
- Relatively high charging current and dielectric losses. For long lines, facilities may be required to compensate for the capacitive charging current.
- Availability of skilled cable splicers for this technology is becoming a problem.
- Multiple cables and duct banks would be necessary for the required power transfer capability.

SCFF Underground Transmission System. The primary disadvantages for this cable type are:

- Historically higher maintenance than HPFF or solid dielectric cable systems.
- More complex to design and operate compared to solid dielectric cable systems.
- Concerns about dielectric fluid leaks.
- Relatively high charging current and dielectric losses.
- Higher magnetic fields than HPFF cable systems.
- Availability of skilled cable splicers for this technology is becoming a problem.
- Multiple cables and duct banks would be necessary for the required power transfer capability.

XLPE Underground Transmission System. The primary disadvantages of extruded dielectric cables are:

- Does not have the proven long-term reliability record similar to HPFF or SCFF cable systems for system voltages of 345 kV and above.
- Requires extremely good manufacturing process quality control.
- Special skills and proprietary equipment associated with the cable supplier may be required for cable splicing.
- Multiple cables and duct banks would be necessary for the required power transfer capability.

CGTL Underground Transmission System. The primary disadvantages of compressed-gas insulated transmission systems are:

- Relatively high cost.
- Environmental concerns about releases of SF6 gas to the environment.
- A relatively high amount of field assembly work is required.
- Less flexibility in avoiding other underground obstacles.
- Larger right-of-way required compared to other underground cable systems.
- System reliability is sensitive to contaminants introduced during field assembly.

Alternative Conclusion

ELIMINATED. The Antelope-Pardee Forest Underground Alternative would meet most project objectives; however, construction activities would cause substantial disturbance to NFS lands and the construction schedule would be delayed extensively (at least 6 months for procurement), which would not meet the recommendations of the California Energy Commission's 2005 IEPR, which states that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously". Three of the four technologies would be technically feasible (CGTL would not be technically feasible at the voltages required and/or for the distances required for the Antelope-Pardee Forest Underground Alternative); however, only XLPE would be considered due to the potential for HPFF and SCFF technologies to release dielectric fluid into the environment. As stated in SCE's PEA, the USDA Forest Service requested that SCE evaluate undergrounding the proposed transmission line across NFS lands in the ANF. The CAISO directed the construction of the Antelope-Pardee transmission line to 500-kV design and construction standards to help accommodate potential new wind generation north of Antelope Substation and to avoid constructing and tearing down multiple 220-kV transmission lines. As such, the underground technology options must meet this requirement.

- **HPFF Underground Transmission System.** HPFF transmission cable technology is a viable technical candidate with a proven performance record for use to construct underground transmission lines with system voltages of 220 kV, 345 kV, and 500 kV. However, given the reliability concerns associated with the steep slopes and placement of underground cables near an active fault zone, and the associated greater potential impacts to the environment associated with HPFF, such as dielectric fluid leaks, this technology is eliminated from further consideration for the Antelope-Pardee Forest Underground Alternative.
- **SCFF Underground Transmission System.** SCFF transmission cable technology is a possible candidate with a proven performance record for constructing underground transmission line with system voltages of 220 kV, 345 kV, and 500 kV. However, the current trend around the world is to use cable system types other than SCFF for 220-kV and 345-kV cable systems for applications other than submarine cables. This is primarily due to the complexity and higher maintenance of this cable system type. Given the complexity to design, install, and operate in the rugged terrain through ANF, reliability concerns associated with steep slopes and placement of underground cables near an active fault zone, and the associated greater potential impacts to the environment associated with SCFF, such as dielectric fluid leaks, this technology is eliminated from further consideration for the Antelope-Pardee Forest Underground Alternative.
- **XLPE Underground Transmission System.** Solid dielectric transmission cable technology is a proven, viable technology for constructing underground transmission lines up to 345 kV. Solid dielectric cables have been commercially available for several years up to 420 kV and have performed well in European installations. While 500-kV solid dielectric cables and accessories are beginning to be commercially available, there is scant operating history that can serve as a basis for demonstrating reliability at this voltage. However, XLPE cable has been successfully installed and operated for long lengths at lower voltages and has been shown to be technically feasible for a 500-kV installation since the fundamental technology is the same. However, given the reliability concerns associated with the steep slopes and placement of underground cables near an active fault zone, this technology is eliminated from further consideration for the Antelope-Pardee Forest Underground Alternative.
- **CGTL Underground Transmission System.** Compressed-gas insulated cable technology is a viable technology for constructing 220-kV, 345-kV, and 500-kV underground transmission lines; however, not for the length required for the Antelope-Pardee Forest Underground Alternative. This type of underground transmission system can easily match the power transfer capabilities of overhead lines; however, its use has primarily been limited to short installations (less than 1,000 feet) due to its relatively high cost. With consideration for the potential release of SF_6 gas to the atmosphere, the

associated environmental impacts, the reliability concerns associated with the steep slopes and placement of underground cables near an active fault zone, the dust-controlled environment requirements, and the high cost of this option, this technology is eliminated from further consideration.

Therefore, given the potential for increased significant environmental impact associated with the construction; the substantial disturbance to NFS lands; the extended construction schedule; the reliability concerns associated with the steep slopes and the placement of underground cables near an active fault zone; and the high cost of these technologies, undergrounding of the transmission line through NFS lands within the ANF between Antelope Substation and Pardee Substation has been eliminated from further analysis.

3.2.2 Antelope-Pardee Partial Underground Alternative

Alternative Description

This alternative would provide for placing the 500-kV transmission line underground in specific high-impact segments of the proposed route. In ANF, to reduce visual impacts, conflicts with Forest Management activities (e.g., wildland fire suppression), and the potential for avian collision and/or electrocution underground construction was considered. Underground construction would be proposed along the Del-Sur Ridge Road beginning just south of Mile 11.0 and ending just south of Mile 15.0 (total underground construction of approximately 4.0 miles) (See Figure 2A). A transition station, approximately 80 feet high and with a footprint of approximately 2 to 3 acres, would be required at each end of the underground segment to transfer the 500-kV transmission lines from overhead to underground and vice versa. Within ANF, a 16-foot-wide all-weather access road would be constructed, following a similar alignment to the existing access road, for equipment access and material deliveries. Similar to the proposed Project, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

At the public scoping meeting on July 14, 2005, the City of Santa Clarita requested consideration of underground construction within their city. As such, underground construction in the City of Santa Clarita has been considered between Mile 22.7 and Mile 25.6 (Pardee Substation), as shown in Figure 2B. Upon leaving ANF, the transmission line would continue to follow the proposed Project route; however, at Mile 20.3, where the proposed Project enters the existing Pardee-Vincent corridor, new 500-kV single-circuit towers would be placed in the vacant position of this existing ROW, rather than replacing the existing 500-kV single-circuit towers with double-circuit towers to keep the vacant position open. At Mile 22.7 the transmission line would exit the existing Pardee-Vincent ROW and tie into a new transition station, which would be located west of the corridor on the east side of San Francisquito Canyon Road, near Copper Hill Drive. From the transition station, the underground transmission line would travel south on San Francisquito Canyon Road for approximately 0.3 miles, then head west and southwest on Copper Hill Drive for approximately 2.3 miles before turning west on Newhall Ranch Road for approximately 0.3 miles and connecting to the Pardee Substation (total underground construction of approximately 2.9 miles). A transition station would be required at the Pardee Substations to support the underground cable termination and to connect the underground cable to the overhead bus within the substation. This transition station would take the place of the substation "deadend" structure required for overhead line terminations.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

Similar to the proposed Project, the Antelope-Pardee Partial Underground Alternative would meet the project objectives for initial operation at 220 kV to accommodate the local and regional potential for power generation, and final operation at 500 kV to accommodate the future distribution of renewable energy and prevent overloading of existing transmission facilities. This alternative would provide infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to customers of the SCE transmission grid, through the installation of a 500-kV line. Furthermore, the Forest Service's objectives to minimize adverse environmental effects to visual resources, birds, urbanization, open space and natural settings on NFS land, along with minimizing conflicts with Forest Management activities (e.g. wildland fire suppression) are addressed by this alternative. Therefore, this alternative would meet the objectives, purpose, and need of the proposed Project. However, depending on the final length of undergrounding involved, the time required for the construction of the underground segments has the potential to delay the Project schedule, which would not meet the recommendations of the California Energy Commission's 2005 IEPR, which states that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously". The final length of underground segments would also influence the overall disturbance to NFS lands within the ANF.

Feasibility

Feasibility concerns associated with each of the four underground transmission line technologies are discussed under the Antelope-Pardee Forest Underground Alternative in Section 3.2.1, above. Three of the four technologies would be feasible for all lengths of the Antelope-Pardee Partial Underground Alternative (SCFF, HPFF, and XLPE). While SCFF and HPFF are feasible technologies, due to their potential for dielectric fluid release into the environment (see Environmental Disadvantages), only XLPE technology would be considered for underground construction. As described above, the reliability of underground 500-kV technologies has not been fully demonstrated, and there are serious reliability concerns associated with slope construction, which makes the feasibility of this alternative questionable.

Environmental Advantages

The advantages of each of the four underground technologies are discussed individually under the Antelope-Pardee Forest Underground Alternative in Section 3.2.1, above.

Under the proposed Project, overhead transmission lines would be placed on taller and wider tower structures traversing through Lancaster and Santa Clarita and 13.6 miles of the ANF (12.6 miles on NFS lands) between Antelope and Pardee Substations, creating potentially significant visual impacts, especially in the ridge-top areas along the route and in the communities of Santa Clarita and Palmdale. The Antelope-Pardee Partial Underground Alternative could reduce visual impacts to distant viewers by eliminating the existing overhead transmission lines along a segment of the Saugus-Del Sur corridor in a highly sensitive area; however, scarring along the alignment would result from the installation of all-weather access roads, splicing vaults, and transition stations (see Environmental Disadvantages). Underground construction in Santa Clarita would reduce visual impacts to the residents in the area.

The Antelope-Pardee Partial Underground Alternative would also reduce interference with Forest Management activities (e.g., wildland fire suppression) in those areas where applied. In general, fire suppression air operations usually occur on the ridge tops and the proposed tower height would be a concern for fight fighting aircraft. Backfiring operations and fire prevention efforts, such as prescribed burning and to maintain fuelbreaks, occur on the tops of ridges and would not be impacted by this alternative. Ensuring the 12-15 foot wide clearance along the buried line would also assist in maintenance of the fuelbreak on the ridge. Furthermore, fire fighter safety with respect to working under power lines would be improved, and the integrity of the line would be protected during a wildfire as a result of being located underground. Placement of the transmission line underground would also reduce concerns regarding the use of fire retardant on overhead transmission lines. There would also be a decreased need to shut down the transmission line during a wildfire. In addition, underground transmission lines would eliminate the potential for avian collision and/or electrocution on the ridge.

Environmental Disadvantages

The disadvantages of each of the four underground technologies are discussed individually under the Antelope-Pardee Forest Underground Alternative in Section 3.2.1, above. Based on the potential for dielectric fluid to be released into the environment, which is associated with both SCFF and HPFF, only XLPE technology would be considered for underground construction.

Construction of an underground transmission line would require substantially more construction activity and ground disturbance due to the continuous trenching requirements. Overhead transmission line construction would result in construction disturbance primarily at individual structure sites, located approximately every 1,100 feet along the alignment. Underground construction and trenching would involve much greater construction-related impacts (air quality, traffic, noise, erosion, and removal of vegetation) and at a much higher cost (approximately 10 times that of overhead construction). For example, before the trench for underground transmission lines may be installed, vegetation must be cleared and terrain must be leveled by grading and filling in order to accommodate the required 80-foot-wide construction zone, along the entire length of the corridor (i.e., similar to pipeline construction). Such construction is much more difficult and results in much more land disturbance than overhead lines, especially in hilly, rugged terrain where overhead lines can typically span between ridge tops. It should be noted, however, that underground construction along the Del Sur Ridge would generally occur within the existing roadway, which would limit impacts to vegetation.

Permanent impacts to the profile of Del Sur Ridge would result from grading and filling for the 80-foot wide construction area. Furthermore, construction of the four transition stations would require a footprint of approximately 2 to 3 acres each, which would result in temporary and permanent land disturbance (biological resources), and visual resources impacts. There is also a greater potential to encounter contaminated soils and buried cultural resources, and to impact biological resources due to increased excavation and ground disturbance. The individual construction and trenching requirements for XLPE are discussed in Section 3.2.1, above.

Whenever possible, existing roads would be utilized to minimize new access road construction. However, in forest areas, vegetation must be cleared before the underground construction begins. Access roads must be created or improved to handle large construction vehicles and trucks hauling reels of cable. On steep slopes, access roads would need to be cut in switchback patterns so that large construction vehicles could traverse them.

The installation of an underground transmission line would likely require more time and/or resources than construction of an equivalent length of overhead line because of the work required for excavating trenches, constructing the duct banks, and other types of underground infrastructure. Construction could be substantially extended due to restrictions on the times of the year available for construction, required to limit the impacts on the environment or due to winter weather.

While in operation, the land above the underground cables must remain free from secondary surface development, including overhead transmission lines, in order to accommodate operation and maintenance activities. The area must also remain clear of lengthy-rooted vegetation, which could disturb the buried cables. Only restricted vegetation would be permitted above the underground route throughout the life of the proposed Project. Also, duct banks and/or splicing vaults are required, increasing the need for cleared land and continued all-weather access for operation and maintenance. As such, underground construction would result in permanent impacts to biological resources; visual resources would also be permanently impacted due to scarring along the alignment from all-weather access roads, splicing vaults, and transition stations.

It should also be noted that the maintenance of underground transmission lines is more difficult than overhead lines because when a problem occurs underground it can be very difficult to identify the exact location of the problem. When the problem is located, the segment (length between two splicing vaults) of cable on which the problem occurred must be removed and replaced. This process involves additional excavation and construction. In addition to the environmental implications, this process would cause circuit restoration to take longer than with overhead transmission lines. Furthermore, underground lines have been found to have a shorter overall lifespan than overhead lines due to the degradation of the insulation surrounding the cables. Replacement activities, assuming an empty parallel duct is not provided, would include removal and replacement of the cable system, which would have substantial environmental consequences.

Alternative Conclusion

RETAINED FOR ANALYSIS. The USDA Forest Service requested that partial undergrounding be considered for the proposed 500-kV transmission line across NFS lands in the ANF. In addition, at the public scoping meeting on July 14, 2005, the City of Santa Clarita also requested consideration of underground construction within their city. The Antelope-Pardee Partial Underground Alternative would meet all project objectives and three of the four technologies would be technically feasible; however, based on the potential for SCFF and HPFF technologies to release dielectric fluid into the environment, only XLPE technology would be considered for underground construction.

While the Antelope-Pardee Partial Underground Alternative would have the potential to increase environmental impacts, specifically to biological resources, buried cultural resources, air quality, and geology and soils (erosion), these additional impacts would primarily be short-term construction impacts. The Antelope-Pardee Partial Underground Alternative would have the potential to reduce or eliminate visual impacts, avian electrocution and collision, and conflicts with Forest Management activities (e.g. wildland fire suppression) of the proposed Project in certain areas. The shorter length of the underground segments with the Antelope-Pardee Partial Underground Alternative (as opposed to the Antelope-Pardee Forest Underground Alternative) may not make these technologies cost prohibitive to construct. Because the Antelope-Pardee Partial Underground Alternative meets Project objectives, is feasible, and has the potential to reduce potentially significant visual impacts of the proposed Project, it has been retained for consideration in the EIR/EIS. However, it would only be recommended where needed to reduce significant impacts and, therefore, may be utilized in the EIR/EIS as mitigation rather than as an alternative.

3.2.3 Antelope-Pardee 220-kV Single-circuit Partial Underground Alternative

Alternative Description

The proposed Project would involve the construction of a new transmission line built to 500-kV standards, but initially energized at 220 kV. SCE conducted all of its study work associated with the proposed Project assuming the new transmission lines would initially operated at 220 kV, without identifying any system problems. Therefore, this alternative would consist of the construction of a new 220-kV transmission line between the Antelope and Pardee Substations rather than a 500-kV line, with sections built underground in specific high-impact segments of ANF and the City of Santa Clarita to reduce visual impacts. The new 220-kV line would generally follow the same alignment as the proposed Project. As with the proposed Project, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would provide infrastructure to meet the project objectives for initial operation at 220 kV to accommodate the local and regional potential for power generation. However, this alternative would not be built to the 500-kV transmission requirements approved by the CAISO to accommodate the additional potential renewable energy generation that will occur north of the Antelope Substation and prevent future overloading of transmission facilities. Alternatively, the Forest Service's objectives to minimize adverse environmental effects to visual resources, birds, urbanization, open space and natural settings on NFS land, along with minimizing conflicts with Forest Management activities (e.g. wildland fire suppression) are addressed by this alternative. Therefore, this alternative would only partially fulfill the project objectives, purpose, and need.

Feasibility

The 220-kV single-circuit towers would be built in the same corridor as the proposed Project using similar construction techniques. Construction of overhead 220-kV transmission lines is fully feasible. Feasibility concerns associated with each of the four underground transmission line technologies are discussed under the Antelope-Pardee Forest Underground Alternative in Section 3.2.1, above. For this alternative, three of the four technologies (SCFF, HPFF, and XLPE) would be feasible for all lengths of underground construction. For distances less than approximately 1,000 feet, CGTL technology would be feasible as well. While SCFF, HPFF, and CGTL are feasible technologies, due to their potential for release of dielectric fluid (SCFF and HPFF) or SF6 gas (CGTL) into the environment (see Environmental Disadvantages), only XLPE technology would be considered for underground construction.

Environmental Advantages

The 220-kV single-circuit overhead towers would be shorter (approximately 10 to 15 feet) and narrower than the proposed 500-kV towers, which would slightly reduce visual impacts. Additionally, as a result of using lower voltage towers, the ROW would not need to be widened to the extent necessary for 500-kV towers thereby reducing potential land use impacts. Smaller pads would also be constructed for the 220-kV single-circuit towers compared to the 500-kV tower pads, resulting in slightly reduced construction air quality impacts and biological impacts.

Similar to the Antelope-Pardee Partial Underground Alternative discussed in Section 3.2.2, underground transmission lines could reduce visual impacts to distant viewers by eliminating the existing overhead transmission lines along certain segments of the Saugus-Del Sur corridor in highly sensitive areas; however, scarring along the alignment would result from the installation of all-weather access roads, splicing vaults, and potential above-ground cooling equipment (see Environmental Disadvantages).

Undergrounding would also reduce interference with Forest Management activities (e.g., wildland fire suppression) in those areas where applied. In general, fire suppression air operations usually occur on the ridge tops and the proposed tower height would be a concern for fight fighting aircraft. Backfiring operations and fire prevention efforts, such as prescribed burning and to maintain fuelbreaks, occur on the tops of ridges and would not be impacted by this alternative. Ensuring the 12-15 foot wide clearance along the buried line would also assist in maintenance of the fuelbreak on the ridge. Furthermore, fire fighter safety with respect to working under power lines would be improved, and the integrity of the line would be protected during a wildfire as a result of being located underground. Placement of the transmission line underground would also reduce concerns regarding the use of fire retardant on overhead transmission lines. There would also be a decreased need to shut down the transmission line during a wildfire. Furthermore, underground transmission lines would eliminate the potential for avian collision and/or electrocution on the ridge.

Environmental Disadvantages

For the overhead portion of this alternative, the environmental disadvantages would be similar to the proposed Project. For the underground portion of this alterative, the disadvantages of each of the four underground technologies are discussed individually under the Antelope-Pardee Forest Underground Alternative in Section 3.2.1, above. Based on the potential for dielectric fluid to be released into the environment, which is associated with both SCFF and HPFF, or SF6 gas, which is associated with CGTL, only XLPE technology would be considered for underground construction.

As discussed in Section 3.2.1 and 3.2.2, construction of underground transmission lines compared to overhead transmission lines would require substantially more construction activity and ground disturbance resulting in greater construction-related impacts (air quality, traffic, noise, erosion, and removal of vegetation) at a much higher cost (approximately 10 times that of overhead construction). There is also a greater potential to encounter contaminated soils and buried cultural resources, and to impact biological resources due to the greater ground disturbance. Furthermore, access roads must be created or improved to handle large construction vehicles and trucks hauling reels of cable. While in operation, the land above the underground cables must remain free from secondary surface development, including overhead transmission lines, in order to accommodate operation and maintenance activities. The area must also remain clear of lengthy-rooted vegetation, which could disturb the buried cables. Only restricted vegetation would be permitted above the underground route throughout the life of the proposed Project. Also, duct banks and/or splicing vaults are required, increasing the need for cleared land and continued all-weather access for operation and maintenance. As such, underground the transmission line would result in permanent impacts to biological resources; visual resources would also be permanently impacted due to scarring along the alignment from all-weather access roads, splicing vaults, transition stations, and potential above-ground cooling equipment. It should also be noted that the maintenance of underground transmission lines is more difficult than overhead lines because when a problem occurs underground it can be very difficult to identify the exact location of the problem. When the problem is located, the segment (length between two splicing vaults) of cable on which the problem occurred must be removed and replaced. This process involves additional excavation and construction. In addition to the environmental implications, this process would cause circuit restoration to take longer than with overhead transmission lines.

Furthermore, installation of a 220-kV line rather than a 500-kV line would not accommodate the potential additional (future) generation that could occur north of the Antelope Substation. As such, new infrastructure may be required for future generation projects, which may mean re-building the lines to 500 kV as load increases. If needed in the future, additional upgrades to the system resulting from initial installation of limited transmission capability would result in additional environmental impacts.

Alternative Conclusion

ELIMINATED. While this alternative would be feasible and would meet most of the Project objectives, it would not meet the 500-kV transmission requirements approved by the CAISO to accommodate the potential additional (future) generation that may occur north of the Antelope Substation. Future upgrades to the system, directly resulting from installation of a system that meets only the immediate needs identified by SCE but does not adequately provide for future transmission needs, would eliminate any positive reduction in impacts to air quality, biological, and visual impacts that this alternative offers compared to the proposed Project. Therefore, this alternative has been eliminated from further consideration.

3.2.4 Antelope-Pardee 220-kV Double-circuit Partial Underground Alternative

Alternative Description

The proposed Project would involve the construction of a new transmission line built to 500-kV standards, but initially energized at 220 kV. For this alternative, a new double-circuit 220-kV line would be built between the Antelope and Pardee Substations following the same alignment as the proposed Project, with sections built underground in specific high-impact segments of ANF to reduce visual impacts, potential for avian collision/electrocution, and conflicts with Forest Management activities (e.g. wildland fire suppression). The new double-circuit 220-kV line would meet the initial need for 220 kV and provide for some additional capacity in the future. As with the proposed Project, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would provide infrastructure to prevent overloading of existing facilities and meet the project objectives for initial operation at 220 kV to accommodate the local and regional potential for power generation. While this alternative would not provide the 500-kV transmission line approved by the CAISO to accommodate the potential additional generation needs north of the Antelope Substation, it would provide for some additional capacity in the future. Furthermore, the Forest Service's objectives to minimize adverse environmental effects to visual resources, birds, urbanization, open space and natural settings on NFS land, along with minimizing conflicts with Forest Management activities (e.g. wildland fire suppression) are addressed by this alternative. Therefore, this alternative would fulfill most of the Project objectives.

Feasibility

The 220-kV double-circuit towers would be built in the same ROW as the proposed Project using similar construction techniques. For the overhead portion, use of existing double-circuit tower designs would not prevent icing above 3,000 feet, according to SCE. Furthermore, high wind conditions, coupled with icing, may limit the tower loading (conductor weight) to a single circuit tower-line design. Along the Saugus-Del Sur corridor, elevations above 3,000 feet are common. As such, icing and reduced loading of the overhead double-circuit towers would occur affecting the reliability of the system. Modifications to the double-circuit tower design, which are available in the industry, would be required to reduce any reliability issues to a less-than-significant level.

Feasibility concerns associated with each of the four underground transmission line technologies are discussed under the Antelope-Pardee Forest Underground Alternative is Section 3.2.1, above. Three of the four technologies (SCFF, HPFF, and XLPE) would be feasible for all lengths of underground construction for this alternative. For distances less than approximately 1,000 feet, CGTL technology would be feasible as well. While SCFF, HPFF, and CGTL are feasible technologies, due to their potential for release of dielectric fluid (SCFF and HPFF) or SF6 gas (CGTL) into the environment (see Environmental Disadvantages), only XLPE technology would be considered for underground construction.

Environmental Advantages

Use of 220-kV double-circuit towers, which would be approximately 140 feet tall, as shown in Figure 4, compared to the 113 to 178 feet for single-circuit 500-kV towers, would reduce visual impacts; although, twice as many conductors would be strung on the towers. Smaller pads would also be constructed for the 220-kV double-circuit towers compared to the 500-kV tower pads, resulting in reduced construction air quality impacts and potential biological impacts.

Similar to the Antelope-Pardee Partial Underground Alternative discussed in Section 3.2.2, underground transmission lines could reduce visual impacts to distant viewers by eliminating the existing overhead transmission lines along certain segments of the Saugus-Del Sur corridor in highly sensitive areas; however, scarring along the alignment would result from the installation of all-weather access roads, splicing vaults, and potential above-ground cooling equipment (see Environmental Disadvantages).

Undergrounding would also reduce interference with Forest Management activities (e.g., wildland fire suppression) in those areas where applied. In general, fire suppression air operations usually occur on the ridge tops and the proposed tower height would be a concern for fight fighting aircraft. Backfiring operations and fire prevention efforts, such as prescribed burning and to maintain fuelbreaks, occur on the tops of ridges and would not be impacted by this alternative. Ensuring the 12-15 foot wide clearance along the buried line would also assist in maintenance of the fuelbreak on the ridge. Furthermore, fire fighter safety with respect to working under power lines would be improved, and the integrity of the line would be protected during a wildfire as a result of being located underground. Placement of the transmission line underground would also reduce concerns regarding the use of fire retardant on overhead transmission lines. There would also be a decreased need to shut down the transmission line during a wildfire. Furthermore, underground transmission lines would eliminate the potential for avian collision and/or electrocution on the ridge.

Environmental Disadvantages

For the overhead portion of this alternative, the environmental disadvantages would be similar to the proposed Project. For the underground portion of this alterative, the disadvantages of each of the four underground technologies are discussed individually under the Antelope-Pardee Forest Underground Alternative in Section 3.2.1, above. Based on the potential for dielectric fluid to be released into the environment, which is associated with both SCFF and HPFF, or SF6 gas, which is associated with CGTL, only XLPE technology would be considered for underground construction.

As discussed in Section 3.2.1 and 3.2.2, construction of underground transmission lines compared to overhead transmission lines would require substantially more construction activity and ground disturbance resulting in greater construction-related impacts (air quality, traffic, noise, erosion, and removal of vegetation) at a much higher cost (approximately 10 times that of overhead construction). There is also a greater potential to encounter contaminated soils and buried cultural resources, and to impact biological resources due to the greater ground disturbance. Furthermore, access roads must be created or improved to handle large construction vehicles and trucks hauling reels of cable. While in operation, the land above the underground cables must remain free from secondary surface development, including overhead transmission lines, in order to accommodate operation and maintenance activities. The area must also remain clear of lengthy-rooted vegetation, which could disturb the buried cables. Only restricted vegetation would be permitted above the underground route throughout the life of the proposed Project. Also, duct banks and/or splicing vaults are required, increasing the need for cleared land and continued all-weather access for operation and maintenance. As such, underground the transmission line would result in permanent impacts to biological resources; visual resources would also be permanently impacted due to scarring along the alignment from all-weather access roads, splicing vaults, transition stations, and potential above-ground cooling equipment. It should also be noted that the maintenance of underground transmission lines is more difficult than overhead lines because when a problem occurs underground it can be very difficult to identify the exact location of the problem. When the problem is located, the segment (length between two splicing vaults) of cable on which the problem occurred must be removed and replaced. This process involves additional excavation and construction. In addition to the environmental implications, this process would cause circuit restoration to take longer than with overhead transmission lines.

Furthermore, installation of a 220-kV double-circuit lines rather than a 500-kV line would not adequately accommodate the potential additional (future) generation that will occur north of the Antelope Substation. As such, new infrastructure would be required for future generation projects, which may mean returning in the future and re-building the lines to 500-kV as load increases. Additional upgrades to the system resulting from initial installation of limited transmission capability would increase environmental impacts well beyond the proposed Project.

Alternative Conclusion

ELIMINATED. While this alternative would be feasible and would meet most of the Project objectives, it would not meet the 500-kV transmission requirements approved by the CAISO to accommodate the potential additional (future) generation that may occur north of the Antelope Substation. Future upgrades to the system, directly resulting from installation of a system that meets the immediate needs identified by SCE but does not adequately provide for future transmission needs, would eliminate any positive reduction in impacts to air quality, biological, and visual impacts that this alternative offers compared to the proposed Project. Therefore, this alternative has been eliminated from further consideration.

3.2.5 Antelope-Pardee – Relocation of Towers Off Del Sur Ridge (Mid-slope) Alternative

Alternative Description

This alternative would follow generally the same route as the proposed Project, but would relocate most of the towers off the top of the Del Sur Ridge to specifically reduce visual impacts, as well as conflicts with Forest Management activities (e.g., wildland fire suppression), and the potential for avian collision and/or electrocution. Two options were considered for this alternative, one which would place the towers to the east of the ridge towards Bouquet Canyon (Option A), and one which would place the towers to the west of the ridge towards San Francisquito Canyon (Option B).

- **Option A** would traverse the eastern face of Del Sur Ridge, mid-slope between the ridge top and the canyon bottom, skirting east around Bouquet Reservoir (See Figure 3A). Option A varies from the proposed Project roughly between Mile 5.7 and Mile 17.5, where the towers would be situated below and on the eastern face of Del Sur Ridge, rather than on top of the ridge. As such, the new towers would fall outside of the boundaries of the existing 1,000-foot-wide Saugus-Del Sur utility corridor (approximately 11.8 miles would be re-routed outside of the existing 1,000-foot utility corridor). The transmission line would traverse the NFS lands for about 13.2 miles, an additional 0.6 miles compared to the proposed Project, of which 12.2 miles would deviate from the existing 66-kV line (considered new ROW). The total length for Option A would be 26.7 miles.

  The height of individual towers would generally range between 113 to 178 feet, depending on the slope severity. The height of towers would increase with slope severity in order to maintain minimum clearance between the conductor and the ground. The distance of the new transmission line alignment from the proposed route on the slope would also depend on slope severity, as gradual slopes would require the tower alignment to shift farther downhill than steep slopes in order to prevent visibility on the ridge. For example, with a 10 percent slope the alignment would need to move down the slope approximately 1,200 feet below the ridge top; for steeper slopes, the down hill shift would be smaller. Figure 3B provides a depiction of how the tower views from Bouquet Canyon would be limited and/or avoided by lowering the towers from the ridgeline.

- **Option B** would traverse the western face of Del Sur Ridge, mid-slope between the ridge top and the canyon bottom (See Figure 3C). Option B varies from the proposed Project roughly between Mile 5.7 and Mile 18.1, where the towers would be situated below and on the western face of Del Sur Ridge, rather than on top of the ridge. The transmission line would traverse the NFS lands for about 13.3 miles, an additional 0.7 miles compared to the proposed Project, of which 12.8 miles would be in new ROW. The total length for Option B would be 26.0 miles. Similar to Option A, the height of individual towers would generally range between 113 to 178 feet, depending on the slope severity. Figure 3D provides a depiction of how the tower views from San Francisquito Canyon would be limited and/or avoided by lowering the towers from the ridgeline.

Similar to the proposed Project, this alternative (Options A and B) would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would achieve the project objective for initial operation at 220 kV to accommodate the local and regional potential for power generation, and final operation at 500 kV to accommodate the future distribution of renewable energy and prevent overloading of existing transmission facilities. Implementation of this alternative would not significantly delay the Project schedule, which would meet the recommendations of the California Energy Commission's 2005 IEPR, which states that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously". Furthermore, the Forest Service's objectives to minimize adverse environmental effects to visual resources and birds on NFS lands, along with minimizing conflicts with Forest Management activities (e.g. wildland fire suppression) are addressed by this alternative.

Feasibility

This alternative would be technically feasible. Construction and operation of this alternative would require amending the 2005 ANF Land Management Plan, including re-locating approximately 12.1 miles of the 1,000-foot-wide Saugus-Del Sur utility corridor to follow the alternative route on NFS lands. To fully remove the towers from the ridge, the new alignment would fall outside of the boundaries of the 1,000-foot corridor width (500 feet of either side of centerline) of the existing Antelope-Pardee transmission corridor.

Environmental Advantages

This alternative would reduce visual impacts of the proposed Project's towers along Del Sur Ridge. Moving the towers off the ridge towards Bouquet Canyon (Option A) or San Francisquito Canyon (Option B) so that the transmission line would not be profiled against the skyline from most vantage points would provide for a substantial reduction in visual impacts. Especially within Bouquet Canyon, Option A would substantially reduce visual impacts from most locations because there are few direct views of the alignment from the base of the canyon and Bouquet Canyon Road.

Removal of the towers from the ridge line may reduce potential impacts associated with avian collisions and/or electrocution. Additionally, below-ridge placement of the towers would reduce potential conflicts with Forest Management activities (e.g., wildland fire suppression).

Environmental Disadvantages

Placement of towers off Del Sur Ridge would require the establishment of a re-routed utility corridor through the ANF, in addition to new ROW already proposed south of proposed Project Mile 18.6. Implementation could potentially create resource/issue-specific impacts during construction (such as biological resources). For example, Option B would place the transmission line in San Francisquito Canyon, which has known populations of red-legged frog (federally threatened species and a State species of special concern) and unarmored three-spine stickleback (federally endangered species) in the creek and its tributaries. Furthermore, San Francisquito Canyon Creek is currently eligible to be included in the National Wild and Scenic River System as a Recreational River (USDA, 2005). For an eligible river under the recreational classification, such as San Francisquito Creek, the construction of new transmission lines is permitted when there is "no reasonable alternative," and the transmission line must be situated in an existing right-of-way (USDA, 2006).

Depending on the side slope, this alternative may require taller towers than if they were placed on the ridge top due to the reduced clearance that occurs beneath the uphill side of the tower legs (uphill phase). The tower height increase would be roughly equal to the ground elevation difference between the center of the structure and the downhill side of the tower legs (outside phase). For example, the typical tower identified for the proposed Project is 115 feet tall with 32.5-foot phase spacing; its replacement tower for this alternative would need to be 3 feet taller on a 10 percent slope, and 10 feet taller on a 30 percent slope. The increase in height would add slightly to the visual bulk of this segment of the transmission line, although towers would be camouflaged by the background of the hillside.

Lattice towers are typically assembled in major sections on the ground and then lifted and set in place using a crane. On the face of the ridge these construction efforts may be substantially more difficult, depending on the severity of the slope. Helicopter construction may therefore be warranted in some locations. These efforts would likely increase temporary disturbances during construction, as well as the time needed for construction, which would result in increased noise and air quality impacts.

For those towers where an uneven leg design (generally used for placement on a hillside) could not be accommodated due to geotechnical reasons, construction and maintenance of larger tower pad areas in comparison to the proposed Project would be required. For example, on a 20 percent slope a side wall of approximately 4 feet or more would need to be created on the uphill side of the tower pad. In order to minimize erosion or sluffing of the side wall, it is anticipated that the tower pad cut would be graded into the hill side, resulting in larger areas of disturbance. Construction along a slope may also trigger the need to create a "level" pad for the erection crane, which would also increase the area of disturbance of this alternative in comparison to the proposed Project.

This alternative would also require the construction and maintenance of multiple spur roads, either entirely new or extending from the existing ridgeline access road. These spur roads would need to be cut down slope to each tower location, except those towers where helicopter construction is employed. On steep slopes, a spur road could not be routed directly to the tower but would need to wind its way downhill (switchback) in order to have a road grade that large construction vehicles could navigate. Construction of the spur roads would create additional noise and air quality (dust) impacts in the area. They would additionally become a permanent feature along the face of the slope, which would result in new visual impacts from some viewing locations, depending on the specific placement of each spur road. Erosion-related impacts could additionally occur, depending on the slope on which the spur roads are placed. Again, helicopter construction could be employed to mitigate impacts associated with construction and maintenance of spur roads for some tower locations.

For those towers where helicopter construction may be employed, spur roads would not be in place to allow access for maintenance activities. Therefore, maintenance on hillsides and access to some tower locations would be only by helicopter or walk-in trails adding to maintenance access difficulties.

Furthermore, lowering the towers along this segment of the transmission line would place them closer to some rural residences adjacent to Bouquet Canyon Road (Option A) or San Francisquito Canyon Road (Option B), thereby placing construction and operational/maintenance activities closer to these receptors. These activities could exacerbate air and noise impacts to local residents, and may generate concerns regarding public health and safety (EMF concerns), as well as near-distance visual impacts of the towers.

Alternative Conclusion

RETAINED FOR ANALYSIS - OPTION A. The visual impacts of this alternative would generally be less than those of the proposed Project, as the transmission line would not be profiled against the skyline from most vantage points. Additionally, this alternative would reduce potential conflicts with Forest Management activities (e.g., wildland fire suppression), and would reduce the risk of avian collision and/or electrocution. Unlike Option B (mid-slope towards San Francisquito Canyon), Option A (mid-slope toward Bouquet Canyon) of this alternative would not create substantial additional environmental impacts. Therefore, Option A of this alternative will be retained for full analysis in the EIR/EIS.

ELIMINATED - OPTION B. Option B (mid-slope towards San Francisquito Canyon) of this alternative would meet the project objectives, purpose, and need, would be feasible, and would reduce the visual impacts associated with the proposed Project. However, the the new corridor and access roads required for Option B would be located in an area with known populations of red-legged frog (federally threatened species and a State species of special concern) and unarmored three-spine stickleback (federally endangered species), as well as riparian vegetation, which would greatly increase the potential for biological impacts. Furthermore, the transmission towers and access roads would need to be placed at least 98 feet from any seasonally flowing/intermittent stream per the 2005 ANF Land Management Plan, such as San Francisquito Canyon Creek. This may not be possible to do and continue to achieve the visual impact reduction intended for this alternative. In addition, since San Francisquito Canyon Creek is currently eligible to be included in the National Wild and Scenic River System as a Recreational River (USDA, 2005), the Forest must treat it as such. As such, construction of new transmission lines would only be permitted when there is “no reasonable alternative,” and the transmission line would need to be situated in an existing ROW (USDA, 2006). Option B would not meet these criteria. Overall, this alternative would have greater biological impacts, would not substantially lessen any impacts of the proposed Project without creating greater impacts of its own, and would potentially conflict with the 2005 ANF Land Management Plan and the National Wild and Scenic River System requirements. Therefore, Option B of this alternative was eliminated from further analysis in this EIR/EIS.

3.2.6 Antelope-Pardee – Single-circuit 500-kV Towers Between Haskell Canyon and Pardee Substation

Alternative Description

This alternative was suggested by SCE in its PEA as Alternative 2. This alternative is a minor variation of the proposed Project and would include constructing single-circuit 500-kV towers between Haskell Canyon and the Pardee Substation (Mile 20.3 to 25.6), rather than constructing double-circuit 500-kV towers and removing the existing single-circuit 500-kV towers. The single-circuit towers would be built in the vacant position of the Pardee-Vincent 500-kV ROW (near the center of the ROW) from Haskell Canyon to Pardee, as shown in Figure 5. As with the proposed Project, this alternative would include the removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would meet the project objectives, purpose, and need by providing infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to southern California through the installation of a 500-kV line. However, there would continue to be Forest Service concerns/issues related to visual resources, birds, urbanization, open space and natural settings on NFS lands, along with concerns regarding conflicts with Forest Management activities (e.g. wildland fire suppression).

Feasibility

The single-circuit towers would be built in the vacant position of the Pardee-Vincent 500-kV ROW (near the center of the ROW) from Haskell Canyon to Pardee. No feasibility issues related to construction or operation within this corridor or reliability issues have been identified.

Environmental Advantages

Similar to the proposed Project, this alternative would use a portion of the vacant ROW from Pardee to Haskell Canyon to construct single-circuit 500-kV towers. The single-circuit 500-kV towers would reduce the visual prominence of the additional towers in the corridor as they would be similar in height to the existing single-circuit 500-kV towers that currently exist in the corridor. Alternatively, the proposed Project would increase the visual prominence of the new towers within this 5.3 mile segment by constructing double-circuit 500-kV towers, which are approximately 175 to 220 feet tall verses 113 to 178 feet for single-circuit 500-kV towers.

For this alternative, construction activities associated with the dismantling of the existing single-circuit 500-kV towers located between Mile 20.3 and 25.6 would no longer occur. As a result, air quality, noise, and traffic impacts associated with these activities would be reduced.

Environmental Disadvantages

Having an additional set of towers within the corridor could potentially increase visual impacts, as having an additional set of towers within the corridor could be considered a greater visual impact than a single set of double-circuit 500-kV towers (proposed Project). Furthermore, along the edges of the ROW, the magnetic fields may be higher than with the proposed Project due to the proximity of new 500-kV transmission lines to the ROW edges.

Additionally, this alternative would eliminate the possibility of a future second Pardee-Vincent 500-kV line by using up a portion of the vacant ROW from Pardee to Haskell Canyon. Given the increase in development between Pardee Substation and Haskell Canyon, it may be very difficult and expensive to acquire a new 500-kV ROW in the area for future construction of a second Pardee-Vincent 500-kV line. Acquiring a new ROW in the area (for possible future expansion) would require the displacement of existing residences and businesses.

Alternative Conclusion

RETAINED FOR ANALYSIS. This alternative is feasible and would meet the project objectives, purpose, and need. Visual impacts for this alternative may be reduced compared to the proposed Project by providing similarly sized towers to the existing towers in the ROW; although, the overall number of towers within the corridor would increase potentially causing increasing visual impacts compared to the proposed Project. This alternative also has the potential to reduce significant environmental impacts to air quality, noise, and traffic as a result of reduced construction activities associated with the dismantling of the existing single-circuit 500-kV towers. Therefore, this alternative was retained for full analysis in the EIR/EIS.

3.2.7 Antelope-Pardee – Tubular Steel Poles in the Antelope Valley and City of Santa Clarita Alternative

Alternative Description

During the public scoping meeting on June 29, 2005, it was requested that SCE consider placing tubular steel poles along the Antelope Valley portion of the proposed route. For this alternative, tubular steel poles would be utilized from the Antelope Substation (Mile 0) to the boundary of the ANF (Mile 5.7). Similar to the proposed Project, SCE would utilize three 70-foot tall, double-circuit 220-kV tubular steel poles between Mile 0 and Mile 0.1. New tubular steel poles would be placed within the Saugus-Del Sur corridor between Mile 0.1 and Mile 5.7, in place of the four-legged single-circuit 500-kV towers proposed as part of the Project.

In a meeting with the Santa Clarita Planning Department on August 4, 2005, it was requested that tubular steel poles be placed in the City of Santa Clarita. Therefore, this alternative additionally includes placement of tubular steel poles in the proposed Project's ROW between the boundary of ANF (Mile 19.3) and the Pardee Substation (Mile 25.6).

The use of tubular steel poles within ANF was not considered as part of this alternative, and will be assessed and employed as visual mitigation, as necessary.

As with the proposed Project, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would provide infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to southern California through the installation of a 500-kV line. However, there would continue to be Forest Service concerns/issues related to visual resources, birds, urbanization, open space and natural settings on NFS lands, along with concerns regarding conflicts with Forest Management activities (e.g. wildland fire suppression).

Feasibility

This alternative would be feasible. Because the tubular steel poles would need to be spaced more closely than lattice steel towers, this alternative would be more expensive than the proposed Project, but the additional cost would not be excessive.

Environmental Advantages

Placement of the tubular steel poles, as opposed to the four-legged, single-circuit, 500-kV towers, is visually preferred by the local residents of Antelope Valley and the City of Santa Clarita. A single-circuit 500-kV tubular steel pole would be approximately 140 feet in height (Figure 6), while a double-circuit 500-kV tubular steel pole would be an estimated 170-feet tall (Figure 7). The proposed Project's PEA estimates that the single-circuit lattice 500-kV towers would range in height between 113 and 178 feet, and that the new double-circuit 500-kV towers would be between 175- and 220-feet tall. The tubular steel poles would thus be shorter in height, potentially diminishing the line's visual impacts, particularly from mid-range viewing locations. Additionally, the tubular steel poles would avoid the complex lattice structure of the proposed Project's tower design. Nearby residents have expressed a preference for the appearance of tubular steel poles compared to lattice steel towers.

Construction of the tubular steel poles would require, site-by-site, less area than the four-legged lattice towers. Generally, construction of a lattice tower requires the disturbance of approximately 15,000 square feet (a bench area of 40 by 50 feet, plus an area around the footings resulting from foundation construction of 40 square feet, plus a tower laydown area of approximately 175 by 60 feet, and a 50 by 50 crane pad area). For each tubular steel pole, the total area disturbed is roughly 4,000 square feet (including foundation excavation of a 7- to 8-foot diameter area, plus an area around the pole base resulting from foundation construction of 40 square feet, and a pole laydown area of 175 by 8 feet and a 50-foot by 50-foot crane pad), or one-quarter of the area needed for a four-legged lattice tower. With less ground disturbance from constructing the tubular steel poles (and taking into consideration twice as many poles would be needed) tubular steel poles would result in fewer temporary impacts to biological resources.

Tubular steel poles may also reduce the transmission line's electric magnetic field (EMF) strength within the areas where they would be installed. Use of tubular steel poles has been shown to reduce EMF by moving the phases closer to each pole and into a somewhat more triangular configuration than a traditional lattice tower, both of which contribute to field cancellation.

Environmental Disadvantages

Although this alternative would reduce the visual bulk of the line, the tubular steel poles would be more discernable at far distances. Additionally, each tubular steel pole would span an estimated 600 to 700 feet, which is approximately half the distance that a four-legged lattice tower can span. Consequently, for both segments where this alternative applies, nearly twice as many poles would need to be installed. Due to the additional towers needed, this alternative would not be expected to substantially reduce the collective visual impact of the proposed Project. Similarly, construction-related impacts associated with this alternative would not be expected to be substantially reduced in comparison to the proposed Project.

Alternative Conclusion

RETAINED FOR ANALYSIS. This alternative is feasible and would meet all project objectives, purpose, and need. Additionally, both the residents of the Antelope Valley and the City of Santa Clarita prefer this alternative to the proposed Project. Therefore, this alternative will be retained for full analysis in the EIR/EIS.

3.2.8 Antelope-Pardee – Re-routing of New ROW in Santa Clarita Alternative

Alternative Description

During the public scoping meeting on July 14, 2005, it was requested that SCE find a new parallel corridor to avoid the Veluzat Motion Picture Ranch and planned development in the Santa Clarita area. Specifically, the owners of the TV/film ranch expressed concerns regarding the proposed Project's effects on the ranch's operations, including the line's possible interference with or preclusion of both aerial and ground filming, as well as the possible disruption or interference of filming due to maintenance activities of the line, such as traffic and noise. EMF and potential transmission line electronic interference were also issues of concern for the TV/film ranch. By avoiding these types of impacts to the TV/film ranch, this alternative would not jeopardize its economic viability due to compromised operations.

As shown in Figure 8, this alternative would follow the proposed Project route until approximately Mile 17.5, north of Haskell Canyon Road. At this point, the transmission line would divert from the proposed Project route and continue in a southerly direction as the proposed Project route shifts to the west-southwest. Traveling in a new ROW on NFS lands within the ANF, the transmission line would continue southwest for approximately 0.5 miles, then south for another 0.8 miles before leaving NFS lands and the ANF. Once leaving the Forest, the transmission line would continue south another 0.7 miles before turning east for roughly 0.3 miles along the base of a hill. Just north of the City of Santa Clarita, the transmission line would make an abrupt turn to the south-southwest (about 90 degrees) and continue for about 0.2 miles before entering the existing Pardee-Vincent 500-kV ROW, where it would head due west for approximately 0.6 miles and rejoin the proposed Project route at approximately Mile 20.3. This alternative would require 2.5 miles of new ROW (in addition to the 1.1 miles of new ROW at the Antelope Substation), of which 1.3 miles are on NFS lands in ANF. The transmission line would terminate at the Pardee Substation. The total length of this alternative would be 25.9 miles.

Similar to the proposed Project, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would meet the project objectives, purpose and need. This alternative would provide infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to southern California through the installation of a 500-kV line. However, there would continue to be Forest Service concerns/issues related to visual resources, birds, urbanization, open space and natural settings on NFS lands, along with concerns regarding conflicts with Forest Management activities (e.g. wildland fire suppression).

Feasibility

This alternative would be technically feasible; however, it would require the establishment of a new or modified utility corridor on NFS lands through ANF and east of Haskell Canyon south of the ANF.

Environmental Advantages

This alternative would reduce physical impacts to the existing, operational Veluzat Motion Picture Ranch, as well as planned development in the Santa Clarita area. Short-term construction-related impacts, such as noise and dust generation and increased traffic in the area, would be displaced farther east of the ranch and planned development projects. Additionally, visual and land use impacts to the ranch and planned development projects would be minimized, as would impacts associated with noise, EMF and potential transmission line electronic interference. Placement of the line outside the viewing area of the TV/film ranch would also reduce possible interference with or preclusion of both aerial and ground filming.

Environmental Disadvantages

The 3.1-mile re-route to avoid the Veluzat Motion Picture Ranch and planned development projects in the Santa Clarita area would increase the overall alignment by approximately 0.3 miles (proposed Project is 2.8 miles between Mile 17.5 and 20.3) and would require establishing a new or modified 2.5-mile ROW/utility corridor east of Haskell Canyon. Implementation could potentially create resource/issue-specific impacts during construction (such as biological resources); require new, permanent access roads that would be visible from certain viewing locations; and introduce a new transmission line corridor to the area, thereby creating new visual and EMF-related impacts.

Alternative Conclusion

RETAINED FOR ANALYSIS. This alternative would reduce impacts to the Veluzat Motion Picture Ranch, as well as proposed development projects along Haskell Canyon. Therefore, this alternative will be retained for full analysis in the EIR/EIS.

3.3 Alternate Corridors

Each of the following alternatives is located within a new or existing transmission line corridor between Antelope Substation and either the Pardee and Vincent Substations. Unless specified in alternatives descriptions, alternatives involve the 500-kV line as described for the proposed Project. The discussions below explain the reasons for elimination or retention for full analysis in the EIR/EIS for each potential alternative.

3.3.1 Parallel LADWP ROW

Alternative Description

The Parallel LADWP ROW Alternative would provide a new 22.8-mile 500-kV line between the Antelope Substation and Haskell Canyon (2.3 miles longer than the corresponding portion of the proposed route). This alternative was presented by SCE in the PEA as Alternative 1 and is depicted in Figure 9. The route would depart the Antelope Substation on tubular steel poles heading west across the existing Antelope-Magunden 220-kV ROW and the Midway-Vincent No.3 500-kV ROW. At Mile 3.9, it would cross the existing LADWP transmission line and turn southwest, paralleling the existing LADWP ROW. The route would use a new 160-foot to 180-foot-wide ROW for the next 22.8 miles (after Mile 3.9) as it heads towards the Pardee Substation.

The line would switch to the east side of the LADWP ROW at Mile 5.7, just north of Andrade Corner. At Mile 6.8, the line would enter and remain mostly on NFS lands managed by ANF for the next 14.4 miles. This portion of the utility corridor through the Forest would be 160 feet wide. At Mile 8.4 and for the next two miles, the line would cross U.S. Department of the Interior (USDI), Bureau of Land Management (BLM), and private property near the community of Green Valley before re-entering NFS lands managed by ANF. At Mile 11.8, the line would cross the Midway-Vincent No.1 and No.2 500-kV transmission lines. The line would stay on the east side of the LADWP ROW until Mile 14.0, where it would switch to the west side of the ROW at Bee Canyon. At Mile 18.9, the line would cross a transmission line from LADWP San Francisquito Power House No. 2.

The line would exit the ANF at Mile 21.2 and would continue on private property for approximately 1.5 miles. This section of new ROW would be 180 feet wide. The line would cross the Antelope-Pole Switch 74 66-kV line at Mile 22.4. At Mile 22.8, the Parallel LADWP ROW Alternative would rejoin and would be identical to the proposed route for the last 5.1 miles to the Pardee Substation.

Similar to the proposed Project, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

The Parallel LADWP ROW Alternative would meet the project objectives, purpose, and need by providing infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to southern California through the installation of a 500-kV line. However, there would continue to be Forest Service concerns/issues related to visual resources, biological resources, urbanization, open space, and natural settings on NFS lands.

Feasibility

No feasibility concerns have been identified. This alternative would be feasible to construct and operate.

Environmental Advantages

In the Parallel LADWP ROW alternative, the route would be adjacent to an existing transmission line corridor and would be located largely along the sides and bottom of a canyon (as opposed to on ridge tops with the proposed Project) and, therefore, could result in reduced visual resources impacts.

In addition, the line location of the alternative (not on the ridge) may be less likely to interfere with Forest Management activities (e.g., wildland fire suppression). In general, fire suppression air operations usually occur on the ridge tops. Backfiring operations and fire prevention efforts, such as prescribed burning to maintain fuelbreaks, occur on the tops of ridges and would not be impacted by this alternative. Furthermore, fire fighter safety with respect to working under power lines would be improved, as would concerns regarding the use of fire retardant on overhead transmission lines. In addition, placement of the towers off the ridge tops would reduce the potential for avian collision and/or electrocution on the ridge.

Environmental Disadvantages

Although the line would be adjacent to an existing transmission line, a new 160- to 180-foot ROW/utility corridor and new spur roads would be required along much of the route since the new line would be outside the existing ROW/utility corridor. This would increase short-term construction impacts (air quality, noise) and the area of permanent disturbance, thereby creating greater potential impacts to biological and cultural resources than with the proposed Project. Placement of the transmission line towards the bottom of San Francisquito Canyon, which has known populations of red-legged frog (federally listed threatened species and a State species of special concern) and unarmored three-spine stickleback (federally listed endangered species) in the creek and its tributaries, further increases the potential for greater biological impacts. San Francisquito Canyon Creek is also currently eligible to be included in the National Wild and Scenic River System as a Recreational River (USDA, 2005). For an eligible river under the recreational classification, such as San Francisquito Creek, the construction of new transmission lines is permitted when there is "no reasonable alternative," and the transmission line must be situated in an existing right-of-way (USDA, 2006).

There would be increased negative impacts to recreation in ANF due to the higher recreational value of the land compared to the proposed Project and the greater public access in the alternative route area. A Forest Service Special Use Authorization would need to be issued to the project and would include stipulations that would make impacts to the Forest less severe.

A greater number of residences would be affected with this alternative in the vicinity of Leona Valley (Mile 5.5 to 6.3), Green Valley (Mile 8.3 to 11.0), and Haskell Canyon (Mile 21.8 to 22.8) than with the proposed Project, which is located in sparsely populated areas largely removed from public access. Therefore, construction, operational, and maintenance activities could exacerbate air and noise impacts to local residents, and may generate concerns regarding public health and safety (EMF concerns), as well as near-distance visual impacts of the towers.

Alternative Conclusion

ELIMINATED. Although this alternative would meet the project objectives, purpose, and need, and would be feasible, the greater amount of new corridor and access roads required would increase the potential for biological, cultural, and recreational resource impacts. Although this alternative route would be adjacent to an existing LADWP transmission line, it would pass in very close proximity to residences in Leona Valley, Green Valley, and Haskell Canyon thereby increasing potential land use and short-term construction impacts to sensitive receptors. Overall, this alternative would not substantially lessen any impacts of the proposed Project without creating greater impacts of its own. Therefore, the Parallel LADWP Alternative was eliminated from further analysis in this EIR/EIS.

3.3.2 Antelope-Vincent 500-kV Line in Existing Antelope-Vincent Corridor

Alternative Description

This alternative would provide for the transmission of wind power from the Tehachapi area while avoiding ANF by constructing a new 500-kV line from the Antelope Substation southeast to the Vincent Substation in the existing Antelope-Vincent corridor. Figure 9 shows the existing Antelope-Vincent corridor. Improvements and/or expansion of Antelope and Vincent Substations would be required to connect the Antelope-Vincent transmission line to these substations.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would meet the project objectives for initial operation at 220 kV to accommodate the local and regional potential for power generation, and final operation at 500 kV to accommodate the future distribution of renewable energy and prevent overloading of existing transmission facilities. This alternative would provide infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to customers in southern California through the installation of a 500-kV line. Furthermore, because this alternative is outside the ANF and off of NFS lands, it would not be subject to the 2005 ANF Land Management Plan and would meet the Forest Service's objectives (purpose) for this project. However, this alternative would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line initially energized to 220 kV to be installed between the Antelope and Pardee Substations. As such, this alternative would only partially fulfill the project objectives, purpose, and need.

Feasibility

The existing corridor between Antelope and Vincent Substations initially contains one 500-kV line (Midway-Vincent No. 3) and three 220-kV lines (Antelope-Vincent, Antelope-Mesa, and a non-SCE line), and as it proceeds south is joined by two 500-kV lines (Midway-Vincent No. 1 and No. 2). As discussed with SCE, the existing Antelope-Vincent corridor from beginning (Antelope Substation) to end (Vincent Substation) is physically not wide enough to support the installation of an additional transmission line without removal of an existing line or substantial widening of the corridor.

Furthermore, use of a common right-of-way (ROW), such as the Vincent-Antelope corridor, triggers certain planning criteria developed by the CAISO, WECC, and the North American Electric Reliability Council (NERC), which requires the loss of the existing line(s) and the new line to be analyzed. To the extent the simultaneous loss of both lines creates a problem, SCE must have in place acceptable mitigation measures (often referred to as a Remedial Action Scheme [RAS] or a Special Protection Scheme [SPS]) that are readily available and operate automatically. Should both the existing and new Vincent-Antelope lines be lost, other lines connected to the Antelope Substation would tend to pick up the power that was previously flowing on the lines that were lost. In particular, the Antelope-Mesa 220-kV line, which travels within the Antelope-Vincent corridor, exceeds its rating and steps must be taken to reduce the power flow on the line. Reliability criteria require that for the loss of a single line (N-1) the system be designed such that there is no overloading. In the case where both Antelope-Vincent lines are lost, it is necessary to reduce power flowing into Antelope from generation at Pastoria and Big

Creek as well as any wind generation connected to Antelope. For the situation where two lines are lost (N-2), the CAISO criteria limit the amount of generation drop or reduction to not more than 1,400 MW. With the connection of new wind generation at Antelope, the total generation that would be subject to dropping would be 1,144 MW plus the additional electricity generated by new wind projects in the Antelope Valley (750 Pastoria, 394 Big Creek, plus additional wind projects). (Note that the actual amount of generation reduction is determined by the amount of overload that needs to be reduced; however, in theory the entire amount of generation included in the SPS may be dropped if necessary. SCE has stated that it is unsure of the amount of overload that needs to be reduced for the N-2 outage of two Antelope-Vincent lines.) While this is below the 1,400 MW CAISO ceiling, SCE claims that integration of the additional wind generation into the existing SPS would be extremely complex in that it is based upon a number of different criteria (monitors various line loadings and generator levels) and is designed to limit reducing generation to situations only where certain line flows and other parameters are exceeded. The CAISO has stated in a letter to SCE "…due to high complexity of the existing and planned Special Protection System (SPS) in the Big Creek Corridor, any further expansion of the SPS should be very limited and will have to be approved by the California ISO…" As such, SCE is reluctant to undertake extensive modifications to this SPS to implement the second Antelope-Vincent line prior to an Antelope-Pardee line (or alternative) given knowledge and expectation regarding additional wind generation.

Environmental Advantages

This alternative would eliminate the impacts to ANF by placing a new 500-kV line in an existing corridor that does not traverse NFS lands. Placement of the line in an existing corridor would also reduce potential impacts to biological resources, as the area would already be degraded from previous construction and maintenance activities associated with the existing transmission lines. Furthermore, because transmission lines already exist within the corridor, the addition of another transmission line would not substantially reduce the visual quality of the area. Other objectives associated with the proposed Project, such as conflicts with Forest Management activities (e.g., wildland fire suppression) within ANF and minimal impacts to resources (e.g., the increased potential for avian collision and/or electrocution with placement of the towers along the Del Sur Ridge) would also be eliminated for this alternative, as the new transmission line would not be placed within the ANF.

Environmental Disadvantages

The potential environmental disadvantages associated with this alternative would be construction impacts (air quality and noise) and the introduction of an additional source of EMF for those new developments, such as the Ritter Ranch and City Ranch (formerly Anaverde Master Planned Community) specific plan areas, which did not exist when the existing transmission lines were built within the Antelope-Vincent corridor.

Alternative Conclusion

ELIMINATED. While this alternative would meet some of the project objectives, purpose, and need by adding capacity to allow for transmission of wind power from the Tehachapi area, it would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. This alternative has also been eliminated as it violates reliability criteria due to the number of major lines located in an existing corridor; requires complex SPS to drop generators to the north, such as Pastoria, Big Creek, and future wind projects. Furthermore, the existing Antelope-Vincent corridor from

Antelope Substation to Vincent Substation is not physically wide enough to support the installation of an additional transmission line along the entire route without substantial widening of the corridor. Therefore, this alternative has been eliminated from detailed analysis in the EIR/EIS.

3.3.3 Antelope-Vincent 500-kV Line in New Corridor Alternative

Alternative Description

Several options were considered for siting a new 500-kV corridor between the Antelope and Vincent Substations. A goal in selecting an alignment for a new corridor was to minimize disruptions to existing land uses by routing the corridor across open land to the extent feasible. Four major development projects (Ritter Ranch, City Ranch, Joshua Ranch, and Palmdale 1000), which are currently planned and/or are under construction, severely limit the ability to establish a new overhead line between the Antelope and Vincent Substations. For example, Option A, described below, would require that a portion of the line be constructed underground within public streets in order to avoid the development projects currently under construction (Ritter Ranch, City Ranch, and Joshua Ranch) and would traverse the Palmdale 1000 planned development area.

The technology that would be used for the underground portions of this alternative is called Solid Dielectric, or XLPE. To date, only one 500-kV XLPE system has been installed in the world, so this technology is not generally considered to be proven as reliable at this voltage. However, XLPE has been installed successfully at lower voltages and is considered technically feasible for a 500-kV installation because the technology is the same. Use of XLPE would require superior quality control during manufacturing, as reliability of the conductors depends on the insulation. In addition, during installation of the XLPE cables, special skills and proprietary equipment associated with the cable supplier may be required for cable splicing (joining of two segments in a splicing vault).

A 2- to 3-acre transition station would be required at each end of each underground segment in order to support the underground cable terminations and to connect the underground cable to the overhead facilities. At the Antelope Substation (Option A), this transition station would take the place of the substation deadend structure required for overhead line terminations. See the discussion of undergrounding presented in Section 3.2.1 of this report for additional details on underground construction and operation.

Option B provides for an all-overhead transmission line between the Antelope and Vincent substations. The two options are discussed below and depicted in Figure 10.

- For **Option A**, an underground 500-kV line would proceed east from Antelope Substation in Avenue J, which is a two-lane paved road, for approximately 2.6 miles; and then turn south along 70th Street West, which is a two-lane paved road, for approximately 4.1 miles to Avenue N. The transmission line would continue east in Avenue N, which varies between a two-lane paved roadway (70th Street West to 60th Street West, and 45th Street West to 20th Street West) and a four- to five-lane paved road (60th Street West to 45th Street West), for approximately five miles; turn south on to 20th Street West, which is a two-lane paved road between Avenue N and Quick Street and unfinished/unimproved between Quick Street and Elizabeth Lake Road, for approximately three miles; turn east on Elizabeth Lake Road, which is a five-lane paved road, for approximately one mile; and then turn south on Tierra Subida Avenue, which is a two-lane paved road, for approximately 0.8 miles (total underground construction of approximately 16.5 miles). The line would then connect to a transition station situated on a currently undeveloped property located on the west side of Tierra Subida Avenue, south of Avenue Q-10. After transitioning above ground, the transmission line would continue southwest 1.5 miles and then south through the Palmdale 1000 development for another approximately 1.5 miles. At this point, the transmission line would turn southeast and run parallel to the existing Antelope-Vincent ROW (approximately 0.25 mile between ROWs) for approximately 3.5 miles, before turning southwest for approximately 1.25 miles to connect to the Vincent Substation. The total length of this alternative is approximately 24.25 miles.

- **Option B** would follow the proposed Project route from the Antelope Substation to just north of Bouquet Reservoir, a distance of approximately 8.0 miles. The new overhead 500-kV line would then turn east in the existing Midway-Vincent No. 1 and No. 2 corridor and continue within this corridor until the eastern-most boundary of ANF. A new corridor would be established, which would proceed south for approximately 1.7 miles within and along the boundary of ANF, bordering the Ritter Ranch Specific Plan area. At this point, the new corridor would exit ANF and continue southeast for approximately two miles, and then east for approximately 3.9 miles, potentially traversing a small portion of land currently owned by the Bureau of Land Management (BLM). The new 500-kV transmission line would then join the Midway-Vincent No. 2 corridor for the remaining approximately 5.7 miles to Vincent Substation. This option would traverse approximately 8.9 miles of the ANF, of which approximately 1.7 miles would be within a new utility corridor. A total of 5.9 miles of new ROW would be established outside the Forest. The total length of this alternative is approximately 25.8 miles.

For each of the above options, improvements and/or expansion of Antelope and Vincent Substations would be required to connect the Antelope-Vincent transmission line to these substations. Additionally, this alternative would include removal of approximately 119 existing 66-kV towers from the Saugus-Del Sur corridor, as is proposed for the Project.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

CPUC Decision 04-06-010, Ordering Paragraph No. 8, required SCE to "file an application seeking a certificate authorizing construction of the first phase of Tehachapi transmission upgrades consistent with its 2002 [2003] conceptual study and the [Tehachapi Collaborative] study group's recommendation…" The "first phase" of these transmission upgrades mentioned in CPUC Decision 04-06-010, Ordering Paragraph 8, requires a 500-kV transmission line initially energized to 220 kV between the Antelope and Pardee Substations. While this alternative (Options A and B) would meet some of the project objectives, purpose, and need by preventing overloading of the Antelope-Mesa line through the addition of capacity allowing for the transmission of wind power from the Tehachapi area, it would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8. Furthermore, Option A, which requires substantial underground construction, would result in potentially extensive schedule delays (at least an additional 6 months for procurement), which would not meet the recommendations of the California Energy Commission's 2005 IEPR, which states that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously". However, because Option A is outside the ANF and off of NFS lands, it would not be subject to the 2005 ANF Land Management Plan and would meet the Forest Service's objectives (purpose) for this project. As such, this alternative would only partially meet the project objectives, purpose, and need.

Feasibility

This alternative provides a fundamentally different transmission path from the proposed Project in that it would install a new 500-kV transmission line between the Antelope Substation and the Vincent Substation, rather than between the Antelope Substation and the Pardee Substation. Modification and expansion of Vincent Substation would be required to accommodate the new 500-kV transmission line. Currently, there is one 220-kV position not in use at the substation. This position would not accommodate a new 500-kV line without modifications. All necessary 500-kV tie-in equipment would need to be added to Vincent Substation. These upgrades may require expanding the facility; however, due to topography limitations and development around the substation, expansion of the facility would likely require the addition of substantial fill material to the west of the substation. Furthermore, power flow studies have not been completed to assess system-wide operations with an additional connection between the Antelope and Vincent Substations. As such, there is uncertainty as to how the system would operate for this alternative.

Although not commonly implemented to date, underground placement of a 500-kV line for short distances is technically feasible as detailed in Section 3.2.1; however, serious reliability concerns associated with undergrounding near active fault zones puts into question the feasibility of Option A. Option B provides for a completely overhead transmission line. No equivalent feasibility issues have been identified for overhead construction. Implementation of any of these options would require the establishment of new utility corridors.

Environmental Advantages

Option A. The estimated length of Option A is approximately 24.25 miles, of which approximately 16.5 miles would be placed underground. Land uses along Avenue J are primarily open space and rural residential. Land uses along 70th Street West are predominantly open space and rural residential north of Avenue L, and residential south of Avenue L. A substantial amount of new residential development is currently under construction east of 70th Street West. The underground segment of this option would also traverse urban areas, including residential and commercial land uses along Avenue N, 20th Street West, Elizabeth Lake Road, and Tierra Subida Avenue. Placing the transmission lines underground in these streets would fully avoid the visual impacts that would occur from an overhead line. In addition to the above, the below-ground segment of this option would be within or immediately adjacent to existing roads; placement of the line within these previously disturbed areas would not, therefore, be expected to result in any significant impacts to cultural, biological or water resources. In addition to the above, Option A would avoid all resource/issue-specific impacts within ANF.

Option B. While Option B would be approximately 25.8 miles in length, which is slightly greater than the proposed Project (25.6 miles), it would traverse only approximately 8.9 miles of ANF verses the proposed Project which would traverse 13.6 miles. However, approximately 1.7 miles of new ROW would need to be established within the Forest, as well as 5.9 miles outside the Forest, thereby impacting lands that otherwise would be unaffected by the Project (see Environmental Disadvantages). Extensive use of existing transmission corridors and limited construction within ANF would substantially reduce resource/issue-specific impacts within ANF.

Environmental Disadvantages

Option A. This option is similar in length to the proposed Project (25.6 miles); however, the underground segment would require substantially greater construction-related activity than above-ground placement of towers. Undergrounding would require trenching, placement of the lines, and trench filling/road reconstruction within or adjacent to Avenue J, 70th Street West, Avenue N, 20th Street West, Elizabeth Lake Road, and Tierra Subida Avenue. These activities would result in temporary lane closures and traffic delays, as well as temporary increased air and noise-related impacts to adjacent land uses.

Option A would create a new overhead transmission line corridor south of the Elizabeth Lake Road. While a number of existing transmission lines are located south and west of the Antelope Substation, installation of additional overhead transmission lines would further degrade the visual quality of the area. Multiple areas of residential development are either planned or currently in construction in these areas. Placement of new overhead transmission corridors would create temporary construction-related impacts such as noise and traffic, as well as permanent visual impacts due to tower placement above ground. Furthermore, Option A would introduce a new EMF source to the area, thereby creating localized public health and safety concerns.

Option B. Unlike Option A, Option B would not require undergrounding of the transmission line, and would generally remain in existing transmission corridors. However, approximately 7.6 miles of new ROW/utility corridor would need to be established for Option B, of which approximately 1.7 miles would be located on NFS lands within the ANF, thereby impacting lands that otherwise would be unaffected by the proposed Project. The proposed Project would only require the addition of 2.8 miles of new ROW. With the establishment of a new ROW, potential impacts to biological and cultural resources could occur. Additionally, Option B may cross a small portion of BLM lands, which would require approval from another federal agency. Similar to Option A, Option B would create temporary construction-related impacts such as noise and traffic, as well as substantial permanent visual impacts due to tower placement above ground in prominent ridge top locations. Furthermore, Option B would introduce a new EMF source to the area, thereby creating localized public health and safety concerns.

Alternative Conclusion

ELIMINATED. While this alternative (Options A and B) would meet some of the project objectives, purpose, and need by adding capacity to allow for the transmission of wind power from the Tehachapi area, it would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. Furthermore, the feasibility of this alternative is in question due to serious reliability concerns associated with underground construction near active fault zones (Option A). In addition, Option B would require additional new ROW/utility corridor (compared to the proposed Project) and result in substantial visual impacts to NFS lands within the ANF as a result of placing towers in prominent ridge top locations. Therefore, this alternative (Options A and B) has been eliminated from detailed analysis in the EIR/EIS.

3.3.4 Antelope-Vincent 220-kV Double-circuit in New Corridor Alternative

Alternative Description

The same two options considered for a 500-kV corridor between the Antelope and Vincent Substations were considered for a 220-kV double-circuit corridor. These two options are discussed in Section 3.3.3, above, and presented in Figure 10.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative appears to provide the transmission connection needed to for initial operation at 220 kV to accommodate the initial local and regional potential for power generation, and prevent overloading of existing transmission facilities. However, this alternative would not provide as much transmission capacity as a 500-kV line to accommodate future renewable power generation north of Antelope Substation. Furthermore, this alternative would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line initially energized to 220 kV to be installed between the Antelope and Pardee Substations. Furthermore, Option A, which requires substantial underground construction, would result in potentially extensive schedule delays (at least an additional 6 months for procurement), which would not meet the recommendations of the California Energy Commission's 2005 IEPR, which states that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously". However, because Option A is outside the ANF and off of NFS lands, it would not be subject to the 2005 ANF Land Management Plan and would meet the Forest Service's objectives (purpose) for this project. As such, this alternative would only partially fulfill the project objectives, purpose, and need.

Feasibility

Underground placement of a 220-kV double-circuit transmission line is technically feasible and has been successfully implemented in other areas of California, such as the Tri-Valley Capacity Increase Project and Northeast San Jose Transmission Reinforcement Project. However, as described in Section 3.2.1, serious reliability concerns associated with undergrounding near active fault zones puts into question the feasibility of Option A. Alternatively, Option B provides for a completely overhead transmission line. No feasibility issues associated with overhead construction have been identified for Option B. Implementation of either of these options would require the establishment of new utility corridors.

Environmental Advantages

The environmental advantages of Options A and B are the same as those discussed for the Antelope-Vincent 500-kV Line in New Corridor Alternative in Section 3.3.3, above.

Environmental Disadvantages

The environmental disadvantages of Options A and B are the same as those discussed for the Antelope-Vincent 500-kV Line in New Corridor Alternative in Section 3.3.3, above.

Alternative Conclusion

ELIMINATED. While this alternative (Options A and B) would meet some of the project objectives, purpose, and need by adding capacity to allow for the transmission of wind power from the Tehachapi area, it would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. Furthermore, it would not accommodate the potential additional (future) generation that is expected to occur north of the Antelope Substation. Future upgrades to the system, directly resulting from installation of a system that meets the immediate needs identified by SCE but does not adequately provide for future transmission needs, would eliminate any positive reduction in environmental impacts that this alternative may offer compared to the proposed Project. In addition, serious reliability concerns associated with undergrounding near active fault zones puts into question the feasibility of Option A. Option B would require additional new ROW (compared to the proposed Project) and result in substantial visual impacts to ANF as a result of placing towers in prominent ridge top locations. Therefore, this alternative (Options A and B) has been eliminated from further consideration.

3.3.5 Antelope-Pardee 500-kV Line in New Corridor Alternative

Alternative Description

To eliminate concerns associated with the placement of the transmission line within ANF, a non-forest alternative was explored. A goal in selecting an alignment for a new corridor between the Antelope and Pardee Substations was to substantially avoid the Forest, and also to minimize disruptions to existing land uses by routing the corridor across open land to the extent feasible. Four major development projects (Ritter Ranch, City Ranch, Joshua Ranch, and Palmdale 1000), which are currently planned and/or are under construction, severely limit the ability to establish a new overhead line between the Antelope and Pardee Substations. Because of this goal, approximately 0.5 miles of line was routed onto NFS lands in the ANF to avoid impacting residential homes in Leona Valley. Two additional NFS land properties located outside the Forest boundary would also be crossed (1.0 miles) in Soledad Canyon (Mile 17.1 to Mile 17.5 and Mile 17.9 to Mile 18.5). As shown in Figure 11, an overhead 500-kV transmission line would head south from the Antelope Substation for about 3.4 miles, over the California Aqueduct and the Portal Ridge mountain range. The transmission line would then veer southwest for 1.6 miles, and then south again for 0.6 miles. At this point, this alternative would enter the ANF (on NFS lands) and head south for approximately 0.5 miles, exiting the ANF (and NFS lands). The route would continue southeast for approximately 2.2 miles, and then head in a southerly direction for the next 8.5 miles, traversing the western-most portion of the Ritter Ranch Specific Plan area, the Agua Dulce area, and crossing the Sierra Highway. At approximately Mile 16.8, the transmission line would head southeast for 1.4 miles and then south for another 0.8 miles. This portion of the alignment would cross the Antelope Valley Freeway as well as two properties owned and managed by the Forest (1.0 mile on NFS lands). At this point (Mile 19.0), south of the Antelope Valley Freeway, the transmission line would enter the existing Pardee-Vincent corridor and head west for about 13.1 miles, replacing the existing northernmost single-circuit 500-kV towers within the corridor with new double-circuit 500-kV towers. The transmission line would join the proposed Project route at Mile 32.1 (proposed Project Mile 20.3). The new double-circuit 500-kV towers would continue to replace the existing Pardee-Vincent single-circuit 500-kV towers between Mile 32.1 and Mile 34.1 (Same as proposed Project Mile 20.3 to Mile 22.3). Between Mile 34.1 and Mile 37.4 the new double-circuit 500-kV towers would be placed in the vacant position within the existing Pardee-Vincent corridor and the existing single-circuit 500-kV towers would be removed (Same as proposed Project Mile 22.3 to Mile 25.6). The total length of this alternative is approximately 37.4 miles, of which 19.0 miles would be within a new ROW, where 1.5 miles would traverse NFS lands.

Improvements and/or expansion of Antelope and Pardee Substations and would be required to connect the transmission line to these substations. These improvements would be similar to the proposed Project. This alternative would also include the removal of 119 existing 66-kV towers from the Saugus-Del Sur corridor, as is proposed for the proposed Project.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would provide infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to southern California through the installation of a 500-kV line. Furthermore, the Forest Service's objectives to minimize adverse environmental effects to visual resources, birds, urbanization, open space and natural settings on NFS land, along with minimizing conflicts with Forest Management activities (e.g. wildland fire suppression) are addressed by this alternative, as only 1.5 miles of NFS lands would be affected by this alternative. However, due to the need to establish approximately 19.0 miles of new ROW/utility corridor, potentially extensive schedule delays could result. This would not meet the recommendations of the California Energy Commission's 2005 IEPR, which states that the Antelope-Pardee Transmission Project ("Phase 1") should move forward "expeditiously." As such, this alternative would mostly fulfill the project objectives, purpose, and need.

Feasibility

This alternative provides for a completely overhead transmission line. No feasibility issues have been identified. Implementation of this alternative would require the establishment of a new utility corridor.

Environmental Advantages

While this alternative would be approximately 37.4 miles in length, which is greater than the proposed Project (25.6 miles), it would traverse only 1.5 miles of NFS lands verses the proposed Project which would traverse 12.6 miles. However, approximately 19.0 miles of new ROW would need to be established (1.5 miles on NFS lands, of which 0.5 miles would be within the ANF), thereby impacting lands that otherwise would be unaffected by the proposed Project (see Environmental Disadvantages). Extensive use of the existing Pardee-Vincent transmission corridor would substantially reduce resource/issue-specific impacts.

Environmental Disadvantages

Approximately 19.0 miles of new ROW (1.5 miles on NFS lands, of which 0.5 miles would be within the ANF) would need to be established (verses 2.8 miles of new ROW for the proposed Project – none of which is on NFS lands), thereby impacting lands that otherwise would be unaffected by the proposed Project. With the establishment of a new ROW, much of which would cross lands that are currently undeveloped, potential impacts to biological resources would occur. This alternative would create temporary construction-related impacts such as air quality, noise and traffic, as well as permanent visual impacts due to tower placement above ground. Furthermore, it would introduce a new EMF source to the area, thereby creating localized public health and safety concerns.

Alternative Conclusion

RETAINED FOR ANALYSIS. This alternative would fully maintain the proposed Project's objectives, purpose, and need while avoiding all impacts to the ANF. Although this alternative would substantially increase construction-related impacts as a result of the longer route (compared to the proposed Project), these impacts would be temporary in nature. Therefore, this alternative will be retained for full analysis in the EIR/EIS.

3.4 Other Transmission Alternatives

This section addresses alternative corridors to the proposed Project for delivering power from north of Antelope Substation to the southern California market. The discussions below explain the reasons for elimination or retention for full analysis for each potential alternative.

3.4.1 Antelope-Mesa Replacement Alternative

Alternative Description

This alternative originally involved upgrading conductor and transmission towers to 500-kV on the existing Antelope-Mesa 220-kV line over approximately 37 miles between the Antelope and Mesa Substations, including portions of the Santa Clara/Mojave Rivers and Los Angeles River Ranger Districts of the ANF. The original concept was abandoned when additional future wind generation projects in the Project area requested interconnection through the CAISO Interconnection process. Therefore, this alternative would involve complete removal of the existing Antelope-Mesa and Antelope-Vincent 220-kV transmission lines and construction of new 500-kV line from Antelope to Mesa via Vincent. The replacement would involve the entire 60 mile length of the existing corridor.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would provide initial operation at 220 kV to accommodate the local and regional potential for power generation, and final operation at 500 kV to accommodate the future distribution of renewable energy and prevent overloading of existing transmission facilities. This alternative would also provide infrastructure to prevent overloading of existing facilities and, as approved by the CAISO, provide the capacity for transferring future renewable energy generated north of the Antelope Substation to customers of the SCE transmission grid, through the installation of 500-kV lines. Furthermore, because this alternative is outside the ANF and off of NFS lands, it would not be subject to the 2005 ANF Land Management Plan and would meet the Forest Service's objectives (purpose) for this project. However, this alternative would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. As such, this alternative would only partially fulfill the project objectives, purpose, and need.

Feasibility

Replacement of the existing Antelope-Mesa line may require approval (granting) of a wider ROW to accommodate the 500-kV capacity of the replacement line; however, the terrain traversed by the corridor would remain the same.

In order to construct the Antelope-Vincent-Mesa 500-kV transmission line, the existing Antelope-Vincent 220-kV transmission line and the Antelope-Mesa 220-kV transmission line would be removed from service to allow for construction activities, as there is insufficient room within the existing ROW to maintain either of the existing lines in service during the construction of the new 500-kV line. During the prolonged outage period required for construction, the entire Antelope Valley (Palmdale/Lancaster area) would be served by the remaining two 220-kV lines connecting the Antelope Substation to the Magunden Substation located 60 miles to the north. Due to the radial connection configuration system, voltages cannot be maintained on the two remaining northbound 220-kV lines. As a result, involuntary load interruptions (estimated by SCE at over 50 percent) would be necessary to protect system-wide reliability. WECC Transmission Planning and Operating Criteria, which does not allow unplanned load interruption to occur following the loss of a single transmission line, would be violated. Violation of the reliability requirements established by WECC would deem this alternative infeasible.

Environmental Advantages

The majority of activities associated with replacing the Antelope-Mesa transmission line would occur within an existing and previously disturbed utility corridor, similar to the proposed Project. The Antelope-Mesa transmission line would also traverse NFS lands. As such, no environmental advantages over the proposed Project have been identified.

Environmental Disadvantages

Removal of the existing Antelope-Mesa transmission line would require the use of cranes and other heavy equipment for tower and line dismantling and removal. Consequently, removal of the existing line and construction of a new line would substantially increase the duration of tear-down and construction-related noise, air quality, and traffic-related impacts in comparison to the proposed Project. Furthermore, the existing Antelope-Mesa transmission line is 60 miles in length, which is 34.4 miles longer than the proposed Project (25.6 miles). The increased mileage of this alternative would also substantially increase the duration of temporary noise, air quality and traffic impacts. These additional construction activities would negatively impact the construction schedule, causing SCE to miss their scheduled on-line date of December 2007.

By SCE standards, the existing 220-kV Antelope-Mesa transmission line requires a 100-foot ROW, whereas a 500-kV line would require a ROW width of 180- to 200-feet. As such, a wider ROW may be needed to accommodate the 500-kV capacity of the replacement line, which would cause permanent impacts to land uses located adjacent to the existing transmission corridor. .

Due to the replacement line’s increased capacity (from 220-kV to 500-kV), taller, wider and bulkier towers would be needed. However, the net effect the increased bulk of this alternative would not be expected to create a substantially greater visual impact than the existing transmission line, which is already an established feature of the landscape.

Alternative Conclusion

ELIMINATED. This alternative may substantially reduce or fully avoid some resource/issue-specific impacts during line removal and construction in comparison to the proposed Project because an existing and previously disturbed ROW would be used. Increased temporary impacts due to tear-down and construction may be mitigated to a level that is not significant. However, violation of the reliability requirements established by WECC would deem this alternative infeasible. Furthermore, this alternative would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. Therefore, this alternative has been eliminated from further consideration.

3.4.2 Big Creek-Fresno Phase Shifted Tie Alternative

Alternative Description

As presented in Appendix B of the "Report of the Tehachapi Collaborative Study Group", this alternative would establish a new interconnection point between the PG&E and SCE systems. The proposal calls for connecting PG&E's Gregg-Helms Pump Storage Plant transmission system with SCE's Big Creek-Rector 220-kV lines at a new switching station. The switching station would include phase shifting devices in order to "push" power from the SCE system into the PG&E system. Studies indicate that operation of a phase-shift transformer is extremely complex and difficult to manage. Since power flow through the phase-shift transformer is dependent on the angle differences between the SCE and PG&E systems, installing a 200 MW phase-shift system tie will necessitate designing the SCE system to enable up to 850 MW of power transfers. Detailed studies covering each hour of the year were performed, where historical data was used to replicate network performance with and without the phase-shifted system tie. Based on the results of these studies the following upgrades would be necessary:

- Currently planned 20-mile San Joaquin Valley Rector Look 220-kV Project
- New 60-mile Antelope-Magunden 220-kV Transmission Line Project
- New 135-mile Magunden-Vestal-Rector-Fresno Tie-Big Creek Transmission Line Project
- Big Creek3, Magunden, Rector and Vestal Substation expansions
- Installation of several reactive support facilities (i.e., capacitor banks and SVCs) throughout the San Joaquin Valley in order to maintain adequate voltages
- Installation of Complex Protection Schemes potentially requiring upgrades to existing telecommunication facilities.

Not only would this alternative require network upgrades, but it would also require contractual arrangements between PG&E and SCE on issues such as inadvertent flow; agreement between PG&E, SCE, and CAISO governing the dispatch and operation of the existing generators; and resolution of any physical limitations of Gregg-Helms Pump Storage Plant and other operating issues.

Consideration of CEQA/NEPA Criteria

Project Objectives, Purpose, and Need

This alternative would provide the transmission capacity needed to provide initial operation at 220 kV to accommodate the local and regional potential for power generation, and prevent overloading of existing transmission facilities. However, while providing for the initial transfer of renewable energy generation, the ability to transfer significant amounts of additional wind generation would require additional system improvements and larger phase shifting devices. However, because this alternative is outside the ANF and off of NFS lands, it would not be subject to the 2005 ANF Land Management Plan and would meet the Forest Service's objectives (purpose) for this project. In addition, this alternative would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. As such, this alternative would only partially fulfill the project objectives, purpose, and need.

Feasibility

The alternative is technically feasible, although additional system study work would be required to identify the type and characteristics of the phase shifting device. In addition, SCE studies indicate that in order to transfer 200 MW from the SCE area into the PG&E area through a tie in the Fresno area several new transmission lines would be required. For example, SCE's Magunden-Vestal No.1 & 2 lines and Vestal-Rector No.1 & 2 lines overload and must be rebuilt. To rebuild the transmission lines, additional ROW would be needed, as there is not enough room in the existing ROW to accommodate building a double-circuit line while keeping the other lines in service. Additionally, a few schools have been sited adjacent to the existing ROW limiting the ability to expand the ROW width. SCE study work also indicates the potential need for approximately 100 MW of reactive support in the area resulting from the transfer. Furthermore, physical limitations at the Gregg-Helms Pump Storage Plant would need to be resolved.

Environmental Advantages

This alternative would avoid NFS lands, thereby reducing impacts to potentially sensitive biological resources and impacts to recreational resources.

Environmental Disadvantages

This alternative would require network upgrades to support the import, including three transmission line projects totaling 215 miles of new transmission lines, substation expansions, and installation of several reactive support facilities. As a result, impacts associated with construction would be greater than the proposed Project (215 miles of construction verses 25.6 miles) and potentially cause greater impacts on biological resources than the proposed Project.

Alternative Conclusion

ELIMINATED. Although this alternative would meet most of the Project objectives, it may not be feasible due to ROW width limitations, and the greater amount of new line and substation construction would increase construction impacts and the potential for biological resources impacts. Furthermore, this alternative would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. Therefore, this alternative has been eliminated from further consideration.

4. Summary of Alternative Screening Results

Proposed alternatives identified by the Applicant (SCE), the NEPA Lead Agency (USDA Forest Service), the EIR/EIS team, and the public are listed below according to the determination made for EIR/EIS analysis (i.e., whether or not each is analyzed in the EIR/EIS or eliminated from further analysis). Section 3 describes each of the listed alternatives in detail, and presents the rationale for elimination of each alternative that is not analyzed. This section presents a summary of the conclusions of Section 3, identifying alternatives that were eliminated and those that are carried forward for full EIR/EIS analysis.

Criterion 1: Project Objectives, Purpose, and Need

Several of the alternatives described in Section 3 are modifications to SCE's proposed transmission line route between the Antelope and Pardee Substations. All of these alternatives would meet the basic project objectives, purpose and need and may be considered as mitigation measures to the proposed Project.

Those alternatives which provide for electricity transfer capabilities in amounts less than 500 kV (220 kV or 220-kV double-circuit) would not meet CAISO's approval for installation of a 500-kV transmission line, which would avoid the need to construct and/or tear down and replace multiple 220-kV facilities with 500-kV facilities to accommodate future potential additional wind generation that is expected to occur north of the Antelope Substation based on previous studies of the area.

Alternatives that provide for transmission of electricity between the Antelope and Vincent Substations would meet some of the project objectives, purpose, and need by preventing overloading of the Antelope-Mesa line through the addition of capacity allowing for the transmission of wind power from the Tehachapi area; however, they would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations. Other alternatives proposed between the Antelope and Vincent Substations would not meet reliability planning criteria requirements.

Criterion 2: Feasibility

The alternatives vary in their ability to meet economic, environmental, legal, social, and technical feasibility criteria described in Section 2 above. Technical feasibility issues for alternatives related primarily to physical constraints, such as engineering/design limitations for construction on steep slopes. Other alternatives had legal feasibility problems associated with consistency with regulatory standards associated with operational reliability.

Criterion 3: Environmental Effects

The preliminary potentially significant environmental impacts of the proposed Project are summarized in Table Ap.1-1, above. Each alternative is evaluated as to its overall ability to reduce or avoid significant effects of the proposed Project. In some cases, an alternative may reduce or eliminate a proposed Project effect, but it may create a new significant effect in a different discipline or geographic area. In these cases, the aggregate environmental effects of the proposed Project segment and the alternative segment have been compared to determine whether the alternative meets the overall CEQA/NEPA requirements.

4.1 Alternatives to be Analyzed in the EIR/EIS

The alternatives listed in Table Ap.1-2 below have been chosen for detailed analysis in the EIR/EIS through the alternative screening process. These alternatives are described in Section 3 of this Appendix.

Table Ap.1-2. Alternatives to be Fully Analyzed in the EIR/EIS

Alternative		Project Objectives, Purpose and Need	Feasibility	Environmental Advantages/Disadvantages Compared to the Proposed Project
Antelope-Pardee Partial Underground Alternative		• Meets all project objectives, purpose, and need • May delay construction schedule due to underground construction	• XLPE is technically feasible • The reliability of underground 500-kV technologies has not been fully demonstrated • Serious reliability concerns associated with slope construction	Advantages • Reduces visual impacts to distant viewers and recreational users by eliminating existing overhead transmission lines • Reduces conflicts with Forest Management activities (e.g., wildland fire suppression) • Reduces potential for avian collision/electrocution • Improves fire fighter safety with respect to working under power lines • Protects the integrity of the transmission line during a wildfire Disadvantages • Greater impacts to air quality, biological resources (removal of vegetation), traffic, noise, and geology/soils (erosion) would result from the substantially increased construction activity and ground disturbance required for continuous trenching to install 4.0 miles of underground 500-kV transmission line. • Increased potential to encounter contaminated soils and buried cultural resources due to the increase in excavation and ground disturbance • Greater permanent impacts to biological and visual resources as a result of scarring along the alignment from installation of all-weather access roads, splicing vaults, and transition stations • Permanent impacts to the profile of Del Sur Ridge as a result of grading and filling • Restricted vegetation on lands above underground cables resulting in permanent impacts to biological resources and no secondary development allowed • Greater potential for long-term impacts to air quality, biological resources, traffic, noise, and geology/soils (erosion) that could result from maintenance problems or system failures (during operation), which could require re-excavation to replace underground cables. • Shorter overall lifespan than overhead transmission lines.
Antelope-Pardee – Relocation of Towers off Del Sur Ridge (Mid-slope) Alternative	Option A (Bouquet Canyon)	• Meets all project objectives, purpose, and need • May require additional time to construct, but is not expected to substantially delay the construction schedule	• Feasible • To fully remove the towers from the ridge, the new alignment would fall outside the existing Antelope-Pardee transmission corridor	Advantages • Reduces visual impacts as the transmission line would not be profiled against the skyline from most vantage points • Reduces conflicts with Forest Management activities (e.g., wildland fire suppression) • Reduces potential for avian collision/electrocution

Table Ap.1-2. Alternatives to be Fully Analyzed in the EIR/EIS

Alternative		Project Objectives, Purpose and Need	Feasibility	Environmental Advantages/Disadvantages Compared to the Proposed Project
Antelope-Pardee – Relocation of Towers off Del Sur Ridge (Mid-slope) Alternative	Option A (Bouquet Canyon)			Disadvantages • Would require the establishment of a new/revised utility corridor through the ANF, which could potentially create resource/issue-specific impacts during construction (biological resources) • Taller towers may be required, which adds to the visual prominence of the transmission line (foreground views only) • More difficult construction depending on severity of slope • Increased construction disturbance associated with larger tower pads and extended spur roads, resulting in increased impacts to biological resources, noise, traffic, air quality, and visual resources • Construction by helicopter (as mitigation) may increase construction duration and result in increased noise and air quality impacts, but would reduce biological, traffic, and visual impacts • Erosion-related impacts could also occur depending on the slope on which spur roads are placed • For towers installed by helicopter, maintenance activities would be more difficult as access would only be by helicopter or walk-in trails • Increased air quality, noise, and visual impacts on some rural residences as a result of placing the towers closer to the canyon road Increased potential for EMF concerns as a result of the towers being placed closer to residences
Antelope-Pardee – Single-circuit 500-kV Towers Between Haskell Canyon and Pardee Substation		• Meets all project objectives, purpose, and need	• Feasible	Advantages • Reduces construction air quality, noise, and traffic impacts, as the construction activities associated with the dismantling of the existing single-circuit 500-kV towers would not occur • The single-circuit 500-kV towers would be similar in height to the existing towers in the corridor Disadvantages • Potentially increases visual impacts, as having an additional set of towers within the corridor could be considered a greater visual impact than a single set of double-circuit 500-kV towers (proposed Project) • EMF may be higher than the proposed Project along the ROW edges • Eliminates the possibility of adding another 500-kV line by using up a portion of the vacant ROW from Pardee to Haskell Canyon • Adverse visual, biological, Forest management activities, urbanization, open space, natural settings impacts on NFS land remain the same as the proposed Project

Table Ap.1-2. Alternatives to be Fully Analyzed in the EIR/EIS

Alternative	Project Objectives, Purpose and Need	Feasibility	Environmental Advantages/Disadvantages Compared to the Proposed Project
Antelope-Pardee – Tubular Steel Poles in Antelope Valley and City of Santa Clarita Alternative	• Meets all project objectives, purpose, and need	• Feasible	Advantages • Reduces mid-range visual impacts, as the tubular steel poles would generally be shorter than the equivalent lattice towers, and would avoid the complex lattice structure of the lattice tower design • Reduces temporary biological impacts, as the tubular steel poles require less laydown area during construction • May reduce EMF strength compared to lattice tower designs Disadvantages • Increases visual impacts from far distances, as the tubular steel poles would be more discernable than the lattice towers and twice as many poles would need to be installed to cover the same distance • Adverse visual, biological, Forest Management activities, urbanization, open space, natural settings impacts on NFS land remain the same as the proposed Project
Antelope-Pardee – Re-routing of New ROW in Santa Clarita Alternative	• Meets all project objectives, purpose, and need	• Feasible • A new utility corridor would need to be established, of which 1.3 miles would be located on NFS lands in ANF	Advantages • Reduces physical impacts to the existing, operational Veluzat Motion Picture Ranch, as well as planned development projects in the Santa Clarita area • Displaces air quality (dust), noise, and traffic impacts away from the existing TV/film ranch and planned development projects in the Santa Clarita area • Reduces land use impacts, as well as visual, noise, EMF and potential transmission line electronic interference • Reduces the transmission line's possible interference with or preclusion of both aerial and ground filming at the TV/Film ranch Disadvantages • Increases construction impacts as a result of increasing the overall alignment by approximately 0.3 miles • Could potentially create resource/issue-specific impacts during construction (biological resources) • Requires new, permanent access roads that would be visible from certain viewing locations • Creates new visual and EMF-related impacts due to the introduction of a new transmission corridor to the area • Adverse visual, biological, Forest Management activities, urbanization, open space, natural settings impacts on NFS land remain the same as the proposed Project

Table Ap.1-2. Alternatives to be Fully Analyzed in the EIR/EIS

Alternative	Project Objectives, Purpose and Need	Feasibility	Environmental Advantages/Disadvantages Compared to the Proposed Project
Antelope-Pardee 500-kV Line in New Corridor Alternative	• Meets most project objectives, purpose, and need • Delays construction schedule due to longer route (37.4 vs. 25.6 miles) and need to establish 19.0 miles of new ROW	• Feasible	Advantages • Reduces resource/issue-specific impacts within ANF (0.5 miles vs. 13.6 miles) and NFS lands (1.5 miles vs. 12.6 miles) as a result of the shorter distance traversed • Reduces potential resource/issue-specific impacts by placing the line within the existing Pardee-Vincent corridor (previously disturbed area) Disadvantages • Greater potential impacts to air quality and biological resources as a result of the longer route (37.4 miles vs. 25.6 miles) and associated construction activities • Increases the need for new ROW (approximately 19.0 miles verses 2.8 miles for the proposed Project) resulting in greater potential for resource-specific impacts (biological resources) • Creates permanent visual impacts to adjacent land uses due to tower placement above ground in a new utility corridor south of Antelope Substation • Introduces a new EMF source to the area

4.2 Alternatives Eliminated from EIR/EIS Consideration

The alternatives eliminated from detailed EIR/EIS consideration are listed in Table Ap.1-3. The rationale for elimination of each alternative is presented in detail in Section 3 of this Appendix.

Table Ap.1-3. Alternatives Eliminated from EIR/EIS Consideration

Alternative	Project Objectives, Purpose, and Need	Feasible	Avoid/Reduce Environmental Effects Compared to the Proposed Project
Antelope-Pardee Forest Underground Alternative	• Meets most project objectives, purpose, and need • Would cause substantial disturbance to NFS lands and require substantial modifications to the 2005 ANF Land Management Plan • Would greatly delay the construction schedule	• XLPE is technically feasible. • The reliability of underground 500-kV technologies has not been fully demonstrated. • Serious reliability concerns associated with slope construction and underground construction near an active fault zone. • May be cost prohibitive to underground the entire alignment.	Advantages • Reduces some visual impacts in ANF to distant viewers by eliminating existing overhead transmission lines • Reduces interference with forest fire management operations • Reduces potential for avian collision/electrocution • Reduces visual impacts to recreational users in ANF • Fire fighter safety with respect to working under power lines would be improved • Integrity of the line would be protected during a wildfire Disadvantages • Substantially more construction activity and ground disturbance due to the continuous trenching required for underground construction resulting in greater impacts to air quality, biological resources (removal of vegetation), traffic, noise, and geology/soils (erosion) • Increased potential to encounter contaminated soils and buried cultural resources due to increase excavation and ground disturbance • Greater permanent impacts to biological and visual resources as a result of scarring along the alignment due to all-weather access roads, splicing vaults, and transition stations • Permanent impacts to the profile of Del Sur Ridge as a result of grading and filling • Restricted vegetation on lands above underground cables resulting in permanent impacts to biological resources and no secondary development allowed • Maintenance problems or system failures (during operation) may result in re-excavation to replace underground cable(s). • Shorter overall lifespan than overhead transmission lines

Table Ap.1-3. Alternatives Eliminated from EIR/EIS Consideration			
Alternative	Project Objectives, Purpose, and Need	Feasible	Avoid/Reduce Environmental Effects Compared to the Proposed Project
Antelope-Pardee 220-kV Single-circuit Partial Underground Alternative	• Only partially fulfills project objectives, purpose and need as it would not be built to accommodate potential additional (future) generation	• Overhead portion feasible • XLPE is technically feasible • Serious reliability concerns associated with slope construction	Advantages <u>Overhead Portion</u> • Reduces visual impacts, as the 220-kV single-circuit towers would be shorter and narrower • Reduces potential land use impacts as the ROW would not be widened to the extent necessary for 500-kV towers • Reduces construction air quality and biological impacts, as smaller tower pads would be constructed and the ROW would require less widening <u>Underground Portion</u> See Antelope-Pardee Partial Underground Alternative for Advantages and Disadvantage Disadvantages • New infrastructure may be required for future generation projects, which may mean returning and re-building the lines to 500-kV as load increases <u>Overhead Portion</u> • Conflicts with Forest Management activities (e.g., wildland fire suppression) (similar to the proposed Project) • Increases potential for avian collision/electrocution (similar to the proposed Project)
Antelope-Pardee 220-kV Double-circuit Partial Underground Alternative	• Fulfills most of the project objectives, purpose, and need, but would not meet the 500-kV transmission requirements approved by CAISO to accom-modate potential additional (future) generation	• Overhead portion feasible • Existing overhead double-circuit tower designs would not prevent icing at elevations above 3,000 feet, which could affect the reliability of the system • High wind conditions coupled with icing may limit tower loading to a single circuit tower-line design • XLPE is technically feasible • Serious reliability concerns associated with slope construction	Advantages <u>Overhead Portion</u> • Slightly reduces visual impacts, as the 220-kV double-circuit towers would be shorter; however, twice as many conductors would be strung on the towers • Slightly reduces construction air quality and biological impacts, as smaller tower pads would be constructed <u>Underground Portion</u> • See Antelope-Pardee Partial Underground Alternative for Advantage and Disadvantages Disadvantages • New infrastructure may be required to accommodate future generation projects, which may mean returning in the future and re-building the lines to 500-kV as load increases <u>Overhead Portion</u> • Conflicts with Forest Management activities (e.g., wildland fire suppression) (similar to the proposed Project) • Increases potential for avian collision/electrocution (similar to the proposed Project)

Table Ap.1-3. Alternatives Eliminated from EIR/EIS Consideration

Alternative		Project Objectives, Purpose, and Need	Feasible	Avoid/Reduce Environmental Effects Compared to the Proposed Project
Antelope-Pardee – Relocation of Towers Off Del Sur Ridge (Mid-slope) Alternative	Option B (San Francisquito Canyon)	• Meets all project objectives, purpose, and need • May require additional time to construct, but is not expected to substantially delay the construction schedule	• Feasible • To fully remove the towers from the ridge, the new alignment would fall outside the existing Antelope-Pardee transmission corridor	Advantages See Option A in Table Ap. 1-2 Disadvantages See Option A in Table Ap. 1-2 • Greater potential biological impacts due to being located in an area with known populations of red-legged frog (federally threatened species and a State species of special concern) and unarmored three-spine stickleback (federally endangered species), as well as riparian vegetation • May conflict with the Forest Service Land Management (2005), which requires the transmission towers and access roads to be placed at least 98 feet from any seasonally flowing/intermittent stream (i.e., San Francisquito Canyon Creek) • Greater recreational impacts due to San Francisquito Canyon Creek being eligible to be included in the National Wild and Scenic River System as a Recreational River, which limits construction of new transmission lines to when there is "no reasonable alternative," and the transmission line would need to be situated in an existing ROW
Antelope-Vincent 500-kV Line in New Corridor Alternative	Option A	• Only partially fulfills project objectives, purpose, and need as it would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations • Delays construction schedule due to approximately 16.5 miles of underground construction	• XLPE is technically feasible • The reliability of underground 500-kV technologies has not been fully demonstrated • Serious reliability concerns associated with undergrounding near an active fault zone • Requires establishment of a new utility corridor • Additional power flow studies are needed	Advantages • Reduces visual impacts, as a result of underground construction • Reduces potential impacts to biological, cultural, and water resources by placing the line within or immediately adjacent to existing roads (previously disturbed areas) • Avoids all resource/issue-specific impacts within the ANF Disadvantages • Substantially more construction activity and ground disturbance due to the continuous trenching required for underground construction resulting in greater impacts to air quality and biological resources, as well as greater noise and traffic/transportation impacts during construction • Creates permanent visual impacts to adjacent land uses due to tower placement above ground in new utility corridor south of Lake Palmdale • Introduces a new EMF source to the area

Table Ap.1-3. Alternatives Eliminated from EIR/EIS Consideration

Alternative		Project Objectives, Purpose, and Need	Feasible	Avoid/Reduce Environmental Effects Compared to the Proposed Project
Antelope-Vincent 500-kV Line in New Corridor Alternative	Option B (All over-head)	• Only partially fulfills project objectives, purpose, and need as it would not meet the requirements set forth by the CPUC in Decision 04-06-010, Ordering Paragraph No. 8, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations	• Feasible • Requires establishment of new utility corridor • Additional power flow studies are needed	Advantages • Substantially reduced resource/issue-specific impacts within ANF due to extensive use of existing transmission corridors and limited construction within the Forest (8.9 miles vs. 13.6 miles) • No underground construction required Disadvantages • Increases the need for new ROW (approximately 7.6 miles verses 2.8 miles for the proposed Project), of which 1.7 miles of new ROW would be in ANF • Potentially increases impacts to biological resources as a result of establishing a greater amount of new ROW • Substantial visual impacts to ANF because of the prominent ridge top locations of the towers • Introduces a new EMF source to the area
Parallel LADWP ROW		• Meets all project objectives, purpose, and need	• Feasible	Advantages • Reduces visual impacts by placing towers largely along the sides and bottom of a canyon adjacent to an existing transmission corridor • Reduces interference with Forest Management activities (e.g., wildland fire suppression) by not placing towers along ridge tops • Reduces potential for avian collision/electrocution Disadvantages • Increases short-term construction impacts (air quality and noise) and permanent land use impacts as a result of new 160- to 180-foot ROW and spur roads • Placement of the transmission line towards the bottom of San Francisquito Canyon increases the potential for greater biological impacts, as San Francisquito Canyon has known populations of red-legged frog (federally threatened species and a State species of special concern) and unarmored three-spine stickleback (federally endangered species) in the creek and its tributaries • Increases recreational impacts in ANF due to greater public access to this route and the higher recreational value of land along this corridor (e.g., San Francisquito Canyon Creek is eligible to be included in the National Wild and Scenic River System as a Recreational River) • Increases potential land use and short-term construction impacts (air quality, noise, visual, EMF) on sensitive receptors, as a result of being placed in very close proximity to residences of Leona Valley, Green Valley, and Haskell Canyon

Table Ap.1-3. Alternatives Eliminated from EIR/EIS Consideration

Alternative		Project Objectives, Purpose, and Need	Feasible	Avoid/Reduce Environmental Effects Compared to the Proposed Project
Antelope-Vincent 500-kV Line in Existing Antelope-Vincent Corridor		• Meets all project objectives, purpose, and need	• Corridor is not wide enough to support installation of an additional transmission line without removal of an existing line • Would violate WECC reliability criteria due to the number of major lines located in a single corridor • Requires complex Special Protection Systems (SPS) to drop generators to the north, such as Pastoria, Big Creek, and future wind projects	Advantages • Eliminates impacts to ANF, including conflicts with Forest Management activities (e.g., wildland fire suppression) • Reduces potential biological impacts, as the transmission line would be placed in an existing transmission corridor • Reduces potential for avian collision/electrocution with placement of the towers outside ANF and off ridge tops • Would not further degrade the visual quality of the area Disadvantages • Increases short-term construction impacts (air quality and noise) for sensitive receptors in new residential developments, such as Ritter Ranch and City Ranch, which did not exist when this corridor was originally built • Introduces an additional source of EMF for new residential developments
Antelope-Vincent 220-kV Double-circuit in New Corridor Alternative	Option A	• Only partially fulfills project objectives, purpose, and need • Would not be built to accommodate potential additional (future) generation • Would not meet the requirements set forth by the CPUC in Decision 04-06-010, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations • Delays construction schedule due to approximately 16.5 miles of underground construction	• XLPE is technically feasible • Serious reliability concerns associated with undergrounding near an active fault zone • Requires establishment of new utility corridor	Advantages • See Antelope-Vincent 500-kV Line in a New Corridor Alternative Option A Disadvantages • See Antelope-Vincent 500-kV Line in a New Corridor Alternative Option A • Installation of a system that meets the immediate needs identified by SCE but does not adequately provide for future transmission needs, would eliminate any positive reduction in environmental impacts compared to the proposed Project

Table Ap.1-3. Alternatives Eliminated from EIR/EIS Consideration

Alternative		Project Objectives, Purpose, and Need	Feasible	Avoid/Reduce Environmental Effects Compared to the Proposed Project
Antelope-Vincent 220-kV Double-circuit in New Corridor Alternative	Option B (all overhead)	• Only partially fulfills project objectives, purpose, and need • Would not be built to accommodate potential additional (future) generation • Would not meet the requirements set forth by the CPUC in Decision 04-06-010, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations	• Feasible • Requires establishment of new utility corridor	Advantages • See Antelope-Vincent 500-kV Line in a New Corridor Alternative Option B Disadvantages • See Antelope-Vincent 500-kV Line in a New Corridor Alternative Option B • Installation of a system that meets the immediate needs identified by SCE but does not adequately provide for future transmission needs, would eliminate any positive reduction in environmental impacts compared to the proposed Project
Antelope-Mesa Replacement Alternative		• Only partially fulfills project objectives, purpose, and need • Would not meet the requirements set forth by the CPUC in Decision 04-06-010, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations	• Feasible, but may require approval of a wider ROW • Corridor is not wide enough to support installation of the additional transmission line without removal of an existing line • Would violate WECC reliability criteria during construction due to unplanned load interruption following the loss of a single transmission line	Advantages • None identified Disadvantages • Increases short-term construction impacts, such as noise, air quality, and traffic as a result of removing the existing line and construction of the new line along 60 miles of the existing corridor (34.4 miles longer than proposed Project) • Increases the construction schedule • Wider ROW may be needed to accommodate the 500-kV replacement line increasing impacts to land uses located adjacent to the existing transmission corridor • Increased visual impacts within this corridor due to the taller, wider, and bulkier towers that would replace the existing towers

Table Ap.1-3. Alternatives Eliminated from EIR/EIS Consideration

Alternative	Project Objectives, Purpose, and Need	Feasible	Avoid/Reduce Environmental Effects Compared to the Proposed Project
Big Creek-Fresno Phase Shifted Tie Alternative	• Only partially fulfills project objectives, purpose, and need as the ability to transfer significant amounts of additional generation beyond 220 MW would require additional system improvements and larger phase shifting devices • Would not meet the requirements set forth by the CPUC in Decision 04-06-010, which requires a 500-kV transmission line to be installed between the Antelope and Pardee Substations	• May not be feasible due to ROW width limitations for rebuilding the Magunden-Vestal No. 1 & 2 lines and Vestal-Rector No. 1 & 2 lines • Phase shifting device to be determined • Potential need for 100 MW of reactive support • Physical limitations at the Gregg-Helms Pump Storage Plant need to be resolved	Advantages • Avoids NFS lands, reducing impacts to potentially sensitive biological resources and impacts to recreational resources Disadvantages • Greater environmental impacts (air quality, biological, traffic, and noise) associated with construction of new transmission lines and a new switching station

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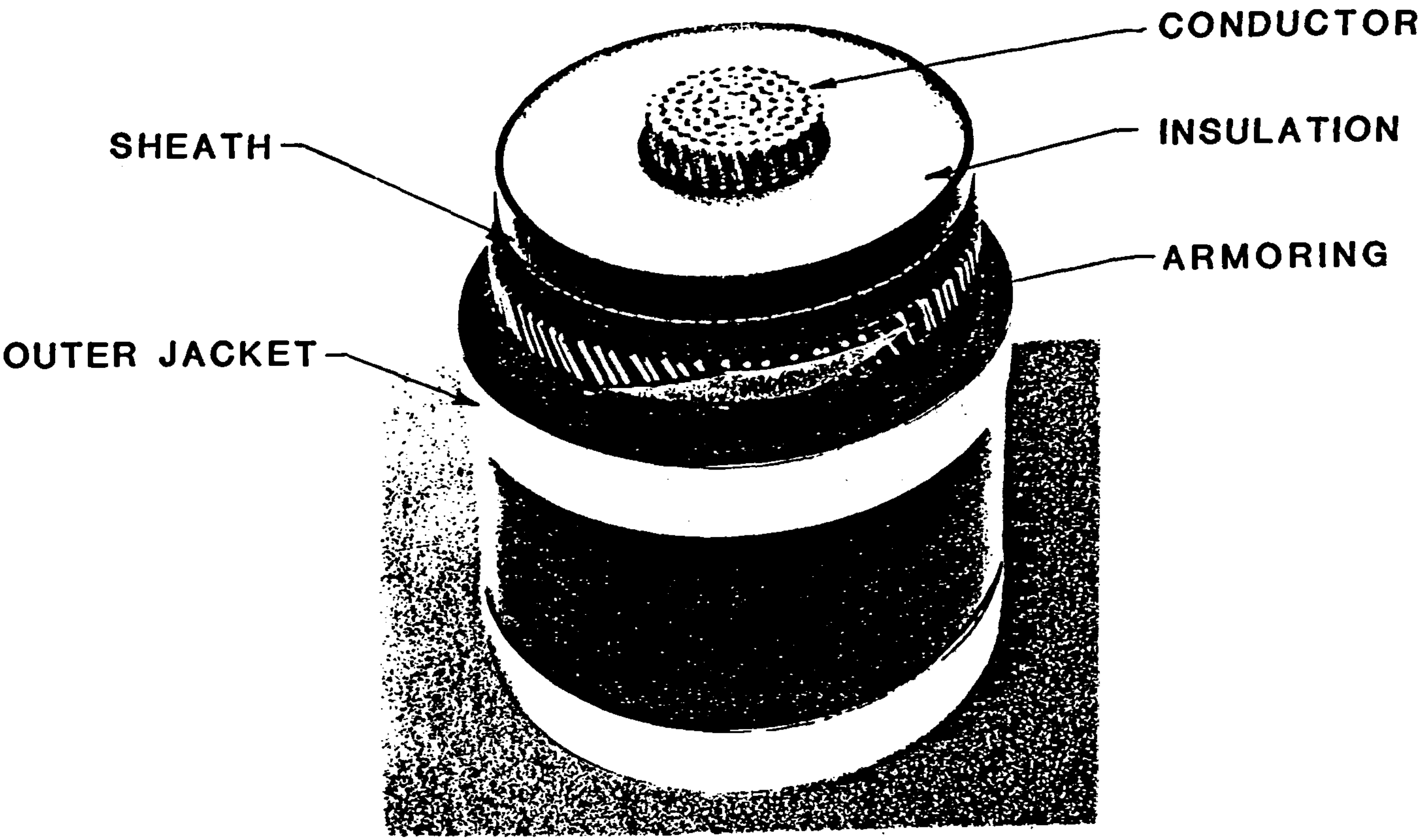

Source: "Technology and Environmental Assessment Guide on Underground HV Power Transmission (Year 2000 Update)" report prepared by RW Beck for the CPUC as part of the Tri-Valley Capacity Increase Project Draft EIR, Appendix 2 (Application No. 99-11-025).

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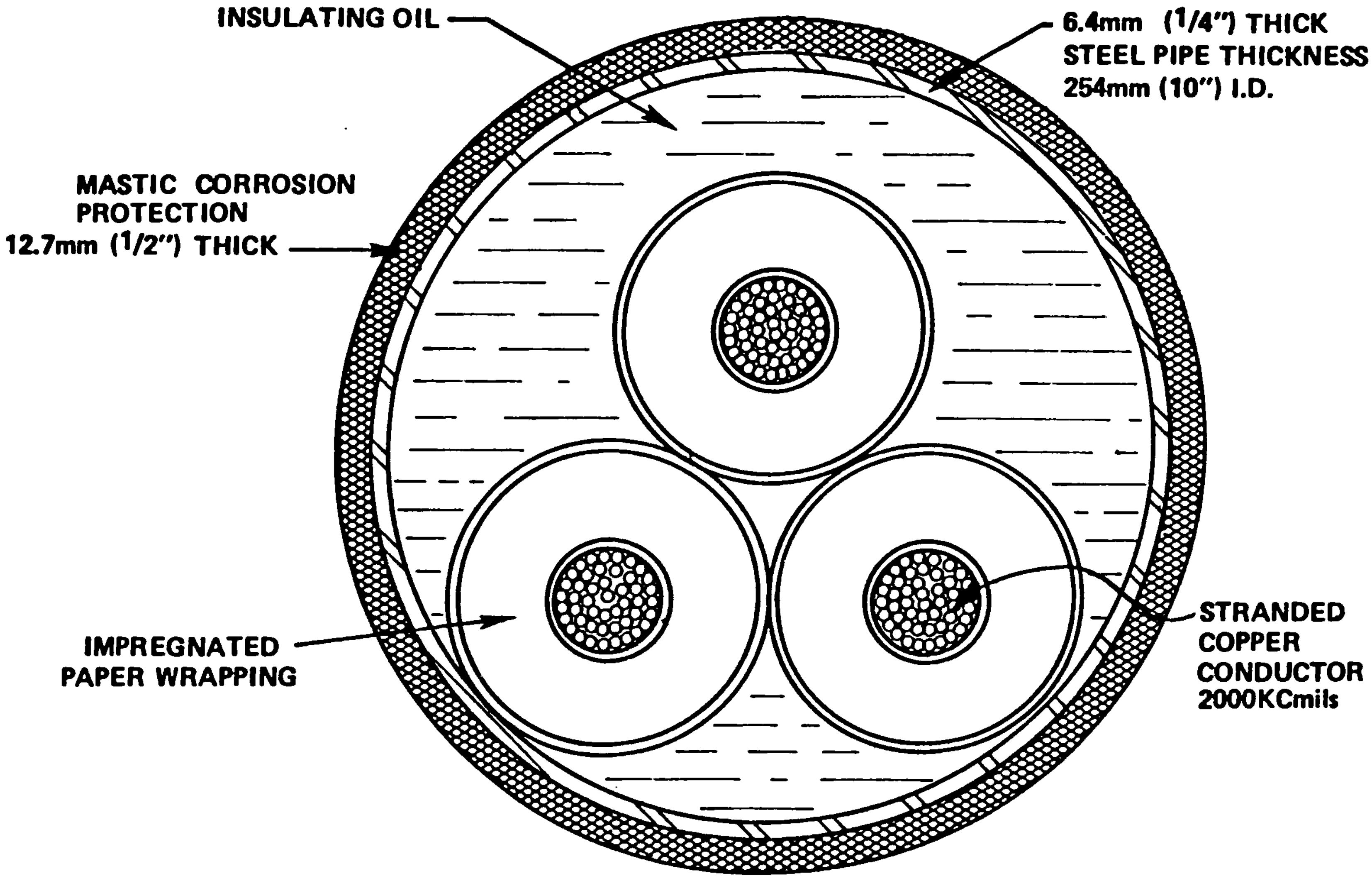
General Cable Cross-Section

Antelope-Pardee Transmission Project

Figure 1A



Source: "Technology and Environmental Assessment Guide on Underground HV Power Transmission (Year 2000 Update)" report prepared by RW Beck for the CPUC as part of the Tri-Valley Capacity Increase Project Draft EIR, Appendix 2 (Application No. 99-11-025).

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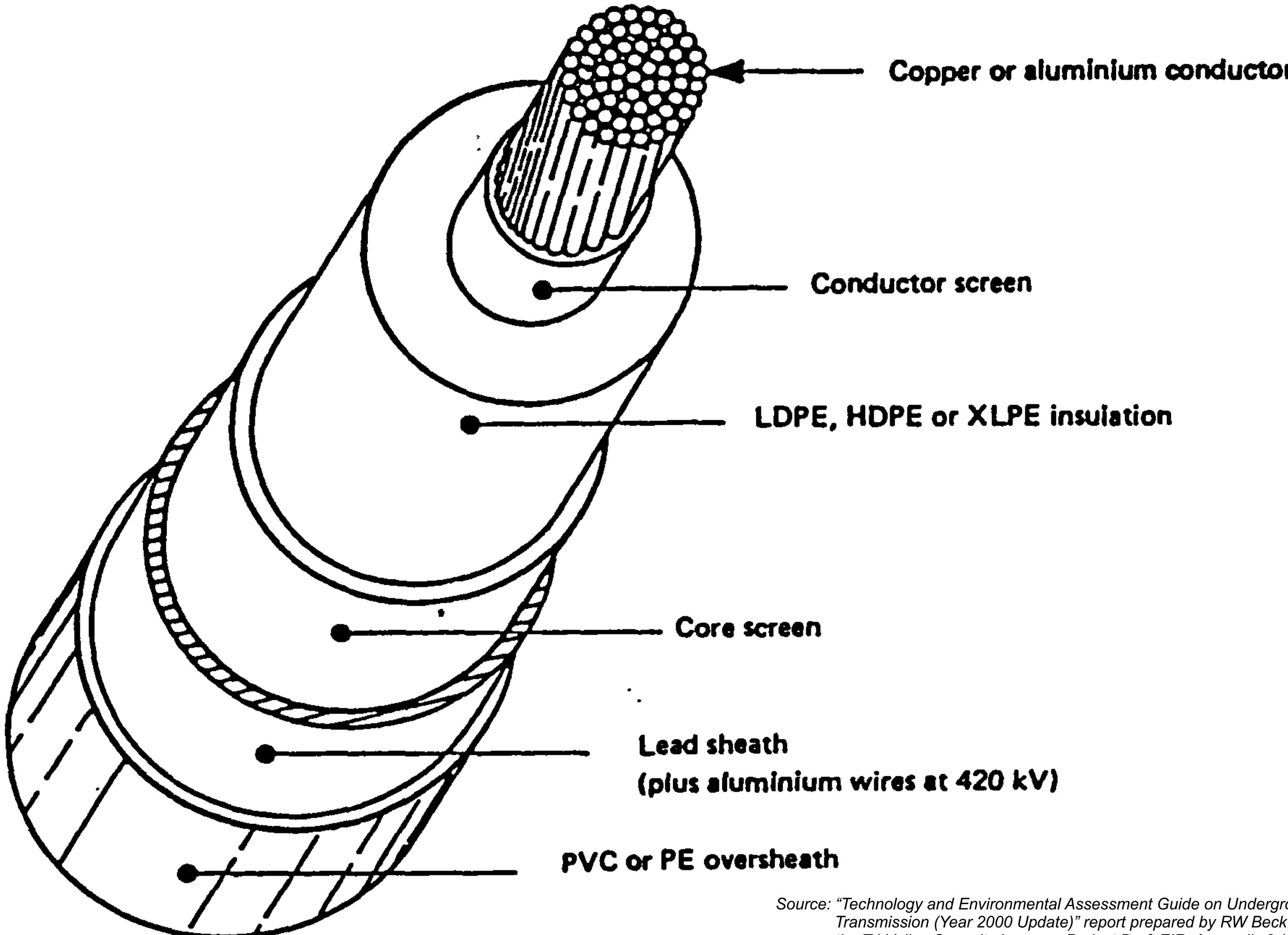
Typical High Pressure Oil-Filled Pipe Type (HPOFPT) Cable Cross Section

Antelope-Pardee Transmission Project

Figure 1B



Source: "Technology and Environmental Assessment Guide on Underground HV Power Transmission (Year 2000 Update)" report prepared by RW Beck for the CPUC as part of the Tri-Valley Capacity Increase Project Draft EIR, Appendix 2 (Application No. 99-11-025).

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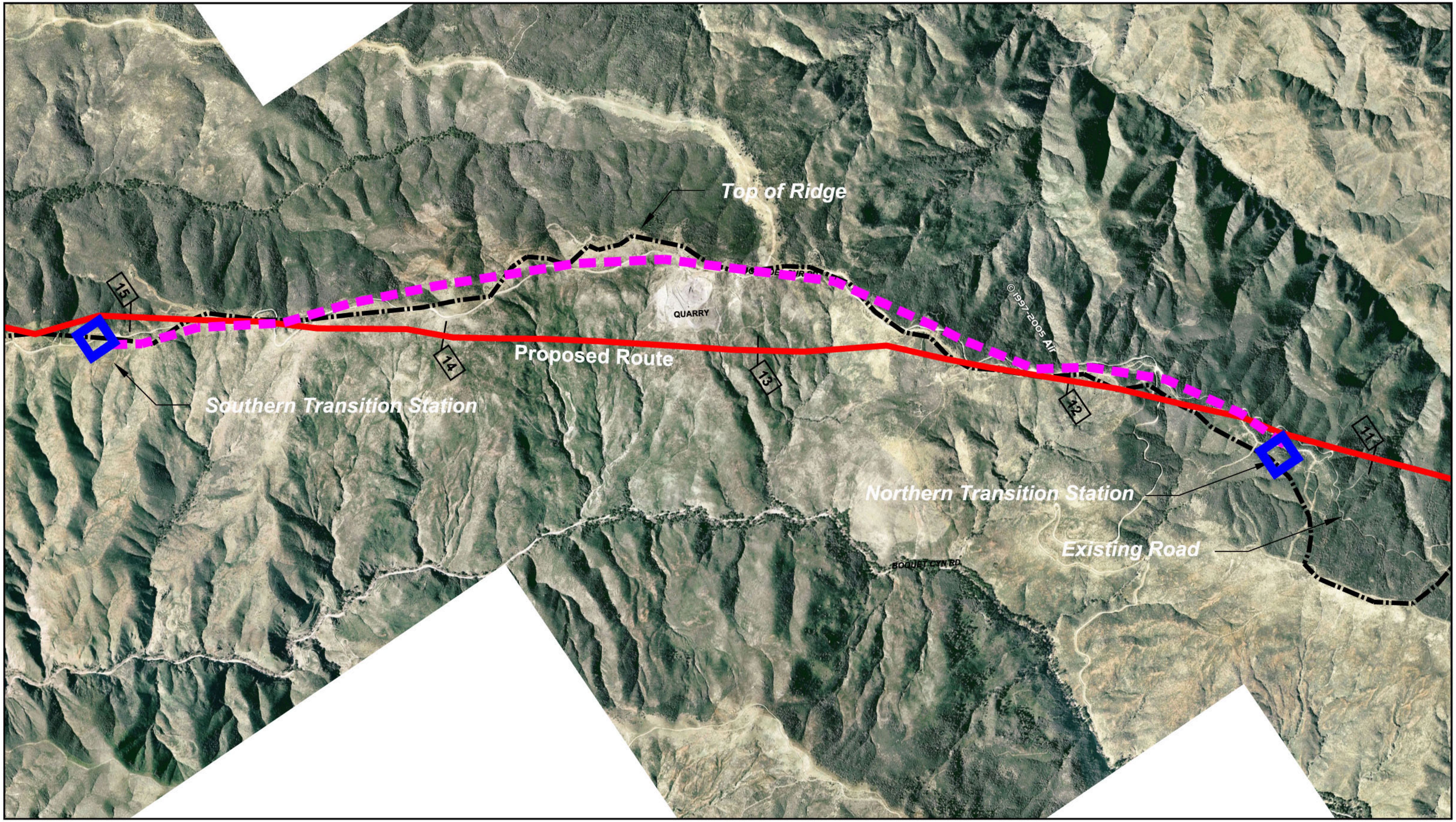
Typical Solid Dielectric Cable Cross-Section

Antelope-Pardee Transmission Project

Figure 1C



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Scale: 1" = 1,500'
Date: January 10, 2006
File: 1236_Altmap4.dwg

NORTH

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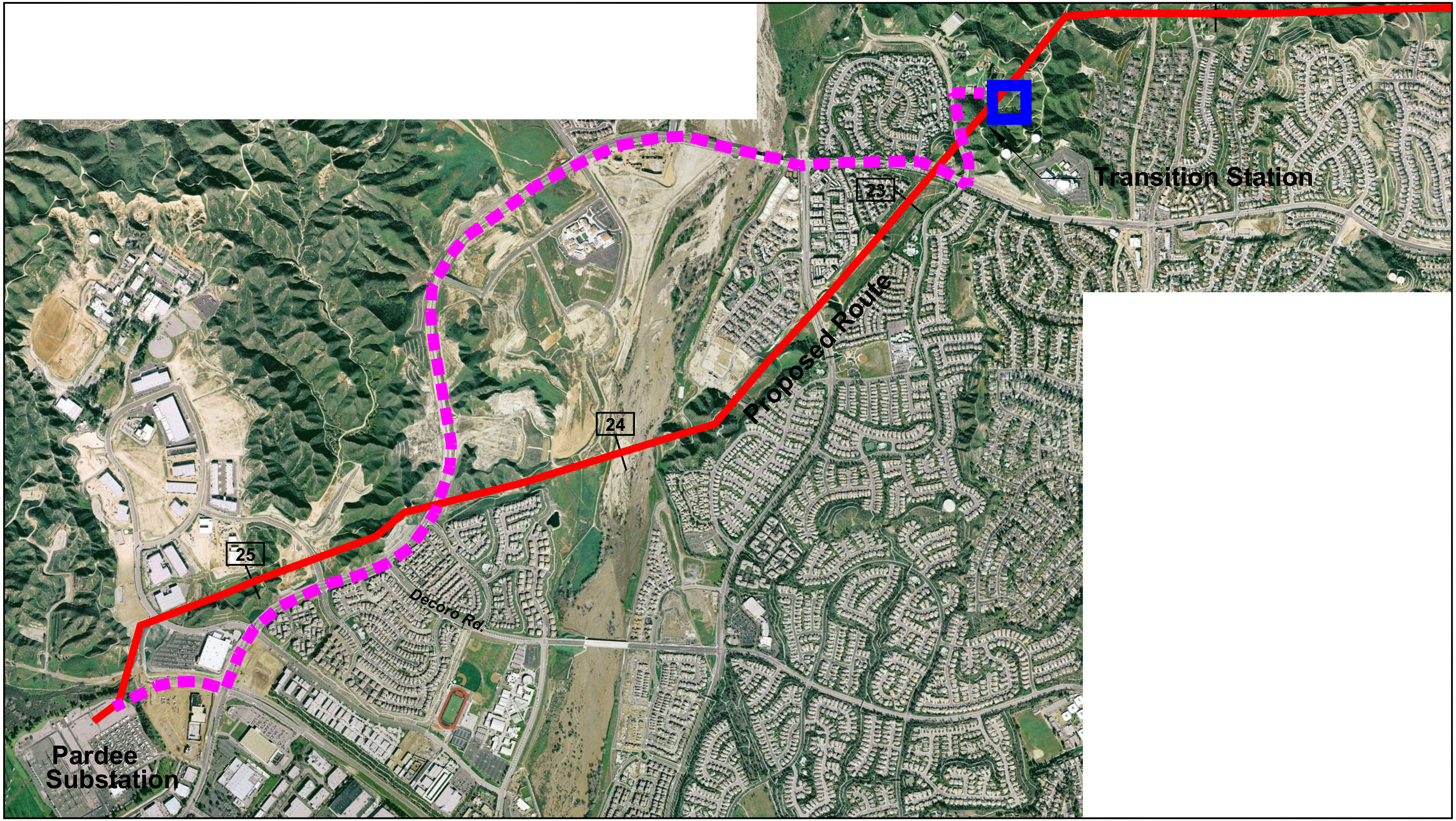
Graphical Scale Feet

Antelope-Pardee Partial Underground Alternative in the ANF

Antelope-Pardee Transmission Project

Figure 2A



Prepared by Aspen Environmental Group

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NORTH

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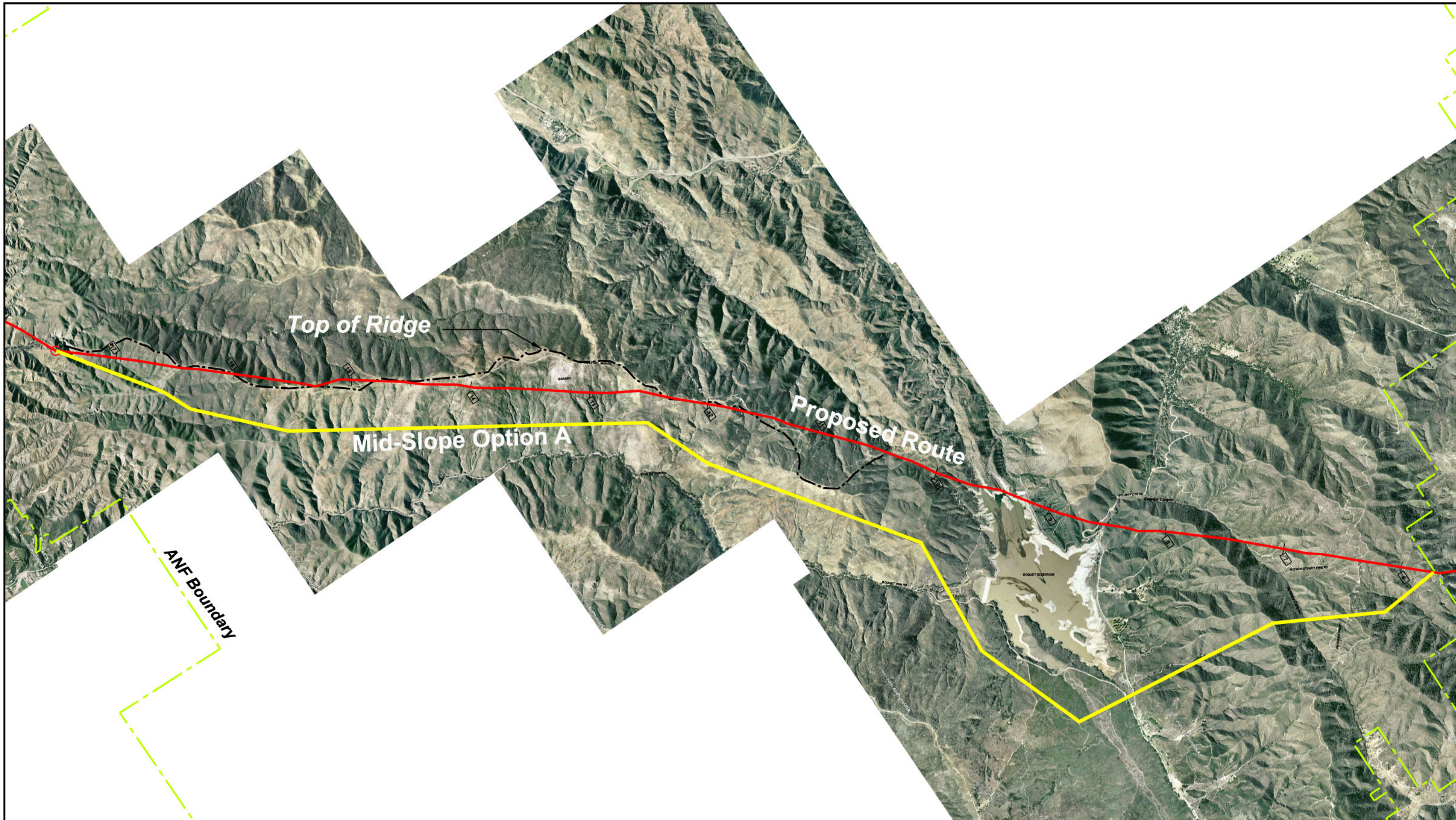
Graphical Scale Feet

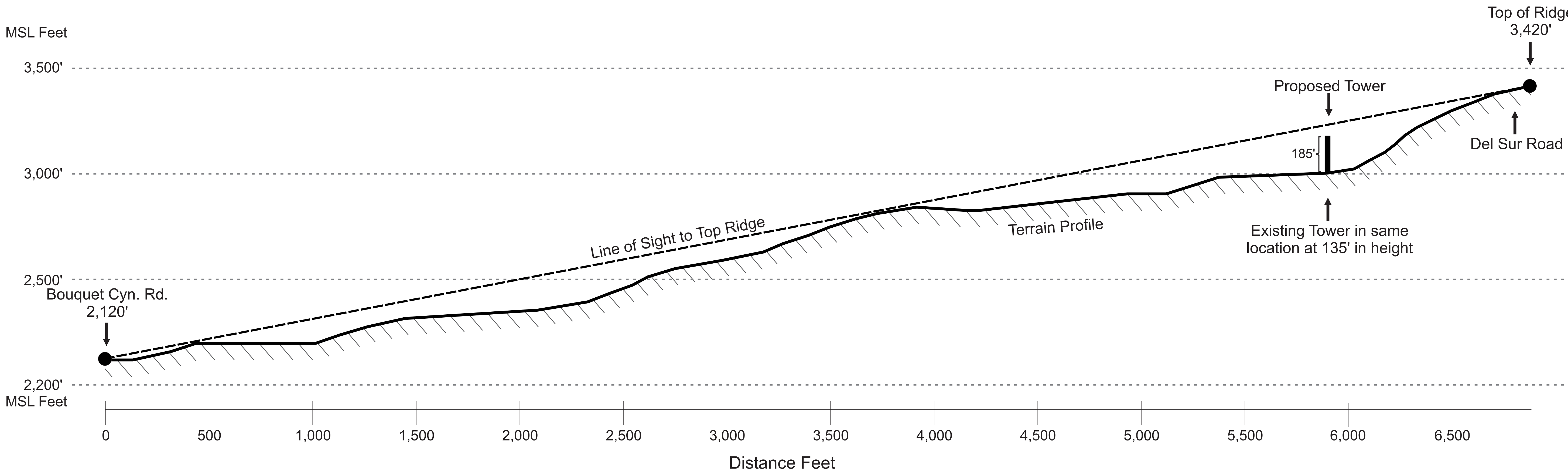
Antelope-Pardee Partial Underground Alternative in Santa Clarita

Antelope-Pardee Transmission Project

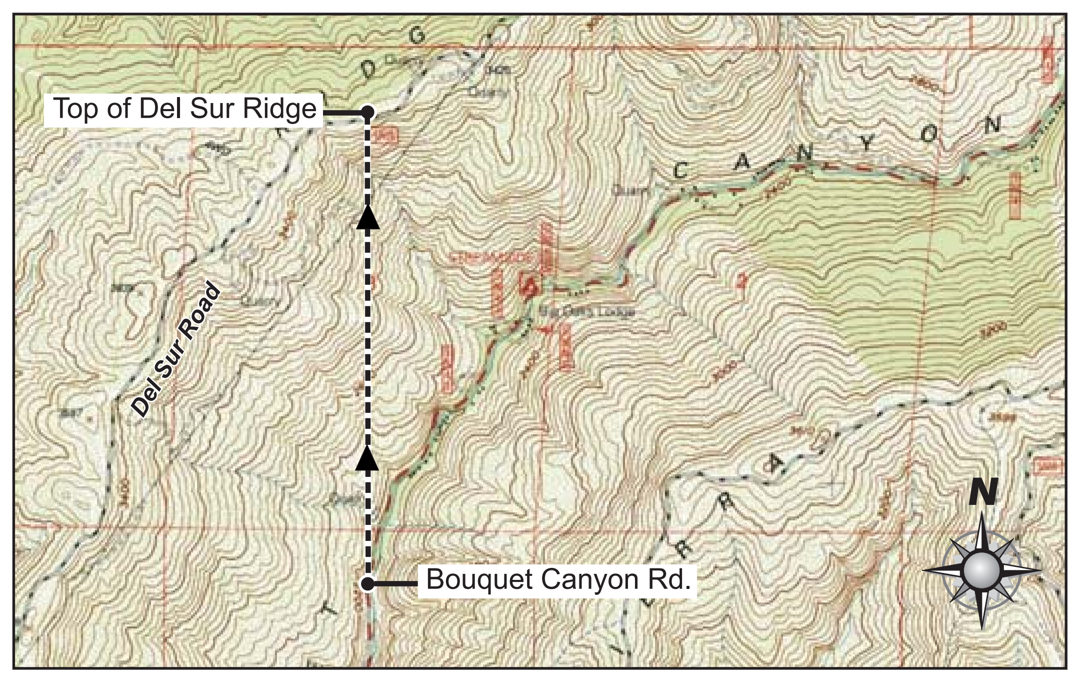
Figure 2B



Prepared by Aspen Environmental Group	Scale: 1" = 4,000' Date: January 10, 2006 File: 1236_Altmap4.dwg	NORTH	0 2,000 4,000 8,000 Graphical Scale Feet	**Mid-Slope Alternative** **Option A - Eastside of Del Sur Ridge**	**Antelope-Pardee Transmission Project** Figure 3A



Profile View: Looking North on Bouquet Canyon Road (0.8 miles south of Big Oaks Lodge) up to Del Sur Ridge



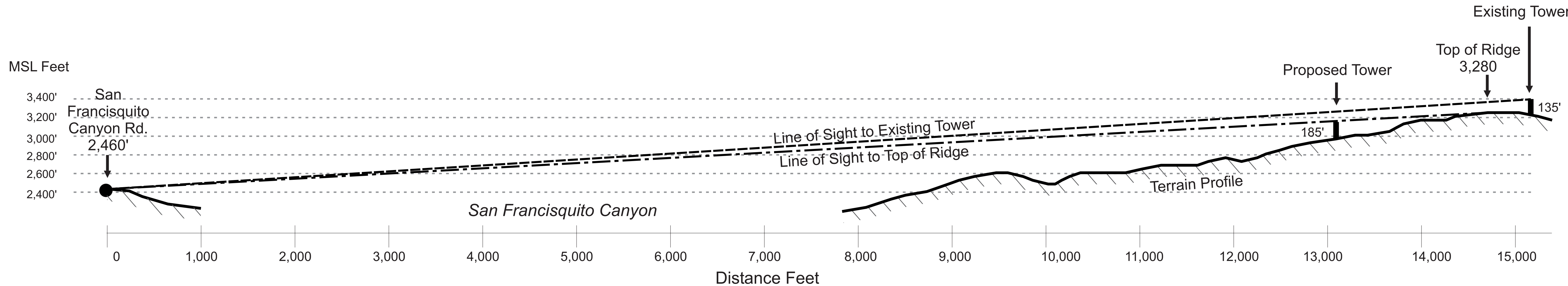
PREPARED BY Aspen Environmental Group

Example of View from Bouquet Canyon Road with Relocation of Towers East off Del Sur Ridge

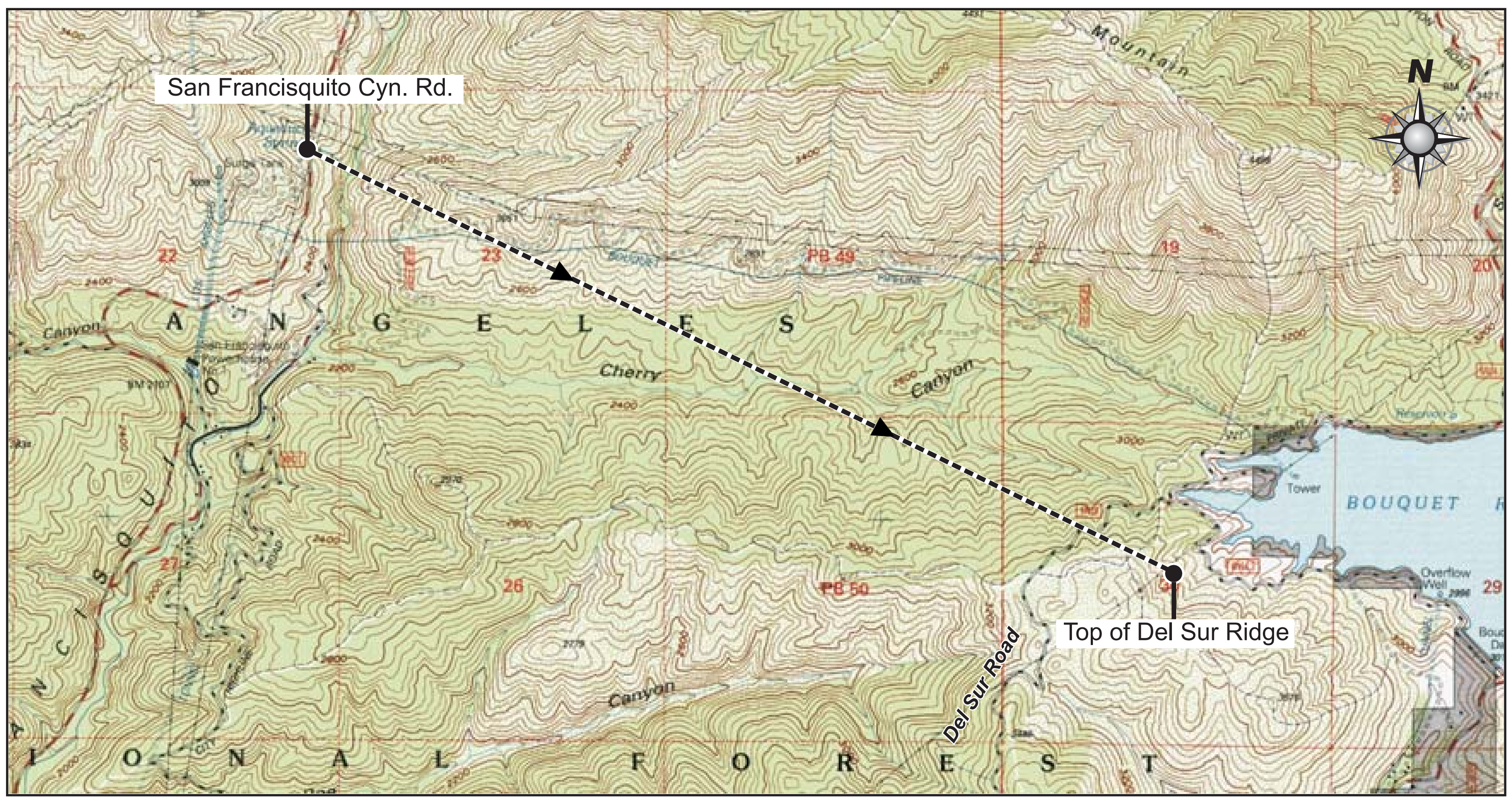
Antelope-Pardee Transmission Project

Figure 3B

Prepared by Aspen Environmental Group	Scale: 1" = 4,000' Date: January 10, 2006 File: 1236_Altmap4.dwg	NORTH	0 2,000 4,000 8,000 Graphical Scale Feet	**Mid-Slope Alternative** **Option B - Westside of Del Sur Ridge**	**Antelope-Pardee Transmission Project** Figure 3C



Profile View: Looking East-Southeast from San Francisquito Canyon Road to up to Del Sur Ridge



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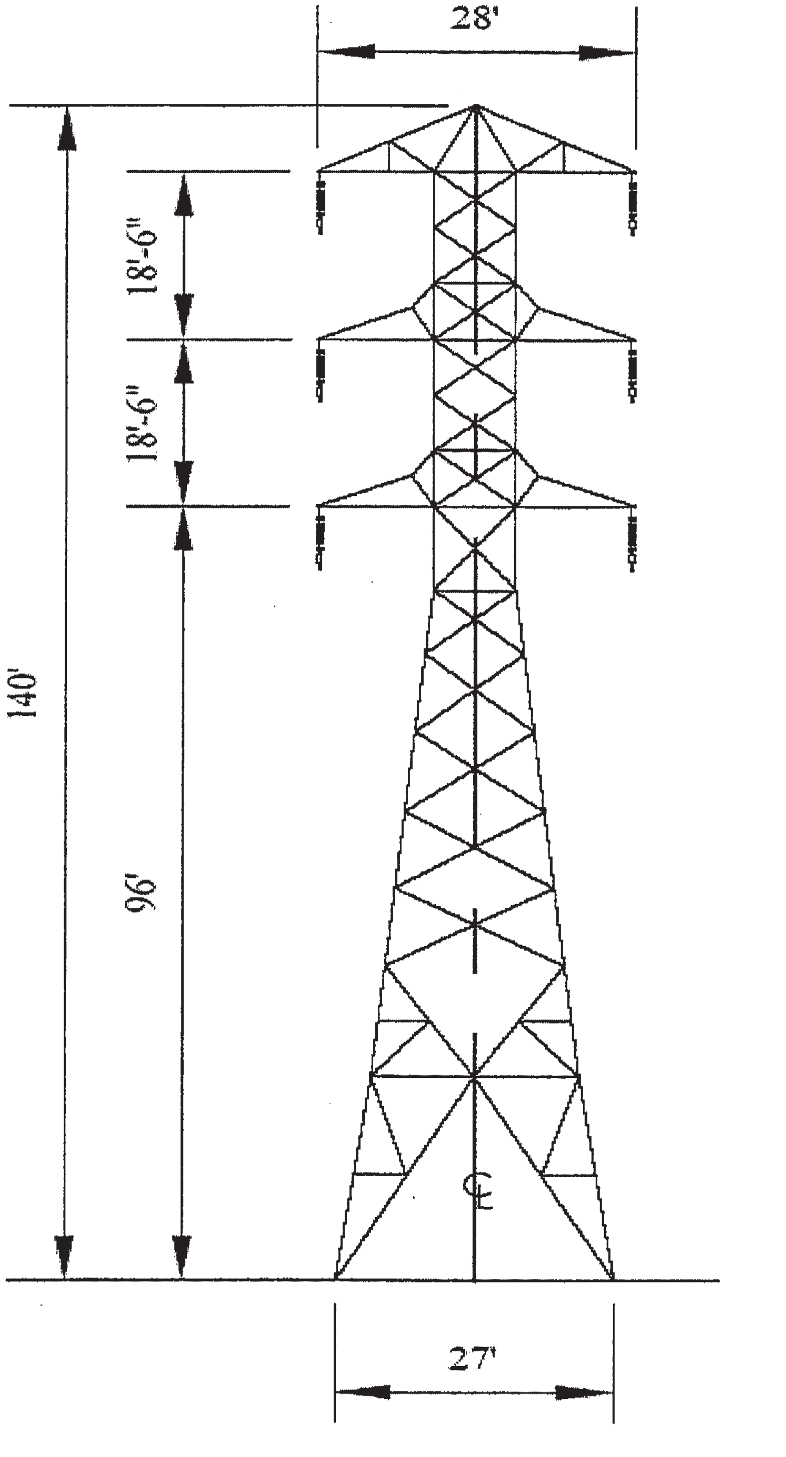
Example of View from San Francisquito Canyon Road with Relocation of Towers West off Del Sur Ridge

Antelope-Pardee Transmission Project

Figure 3D



Note: Overall height is approximate and may vary with site conditions.

Source: SCE, 2004.

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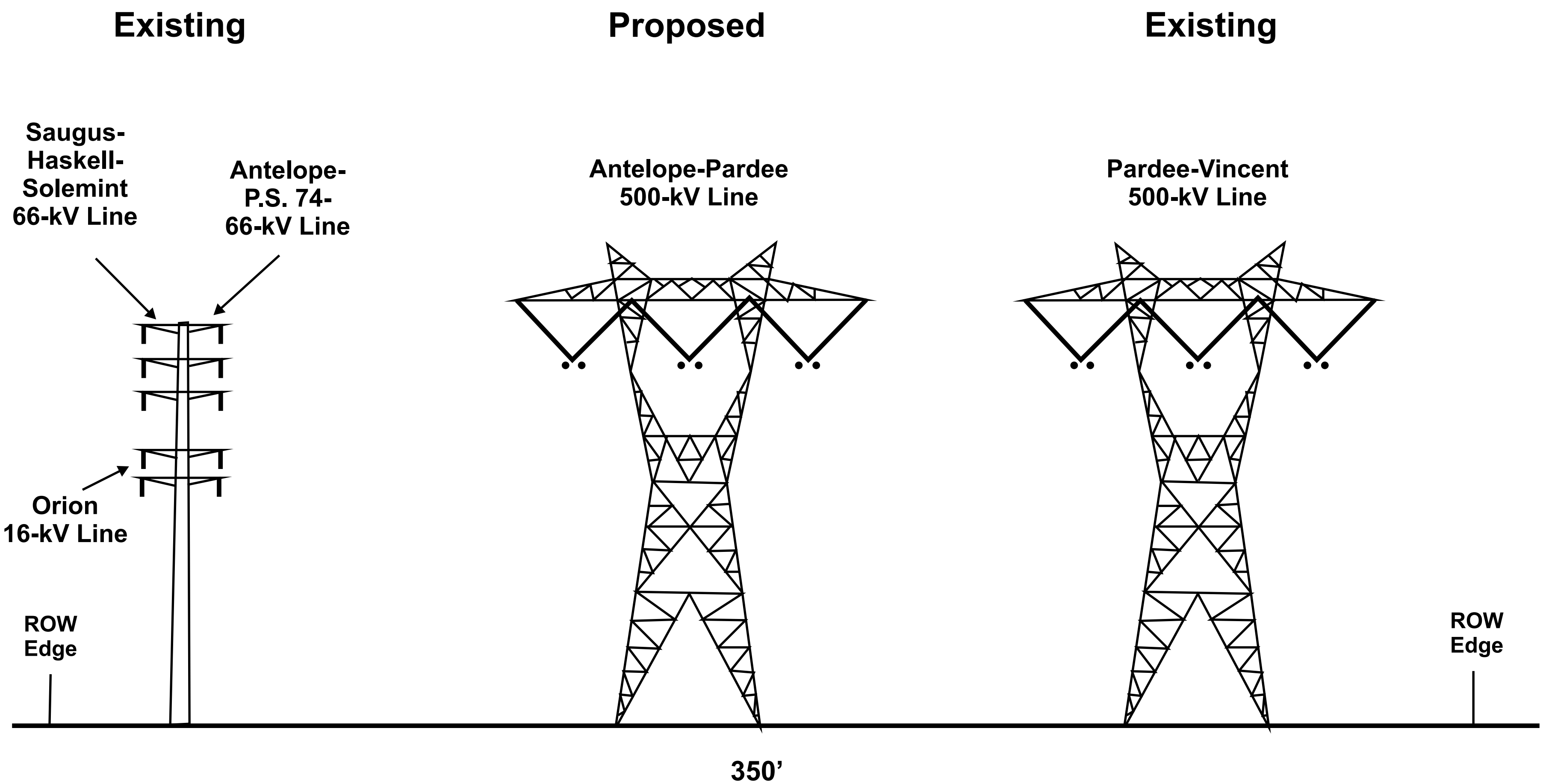
Typical 220-kV Double-circuit Lattice Tower

Antelope-Pardee Transmission Project

Figure 4



Source: SCE, 2004.

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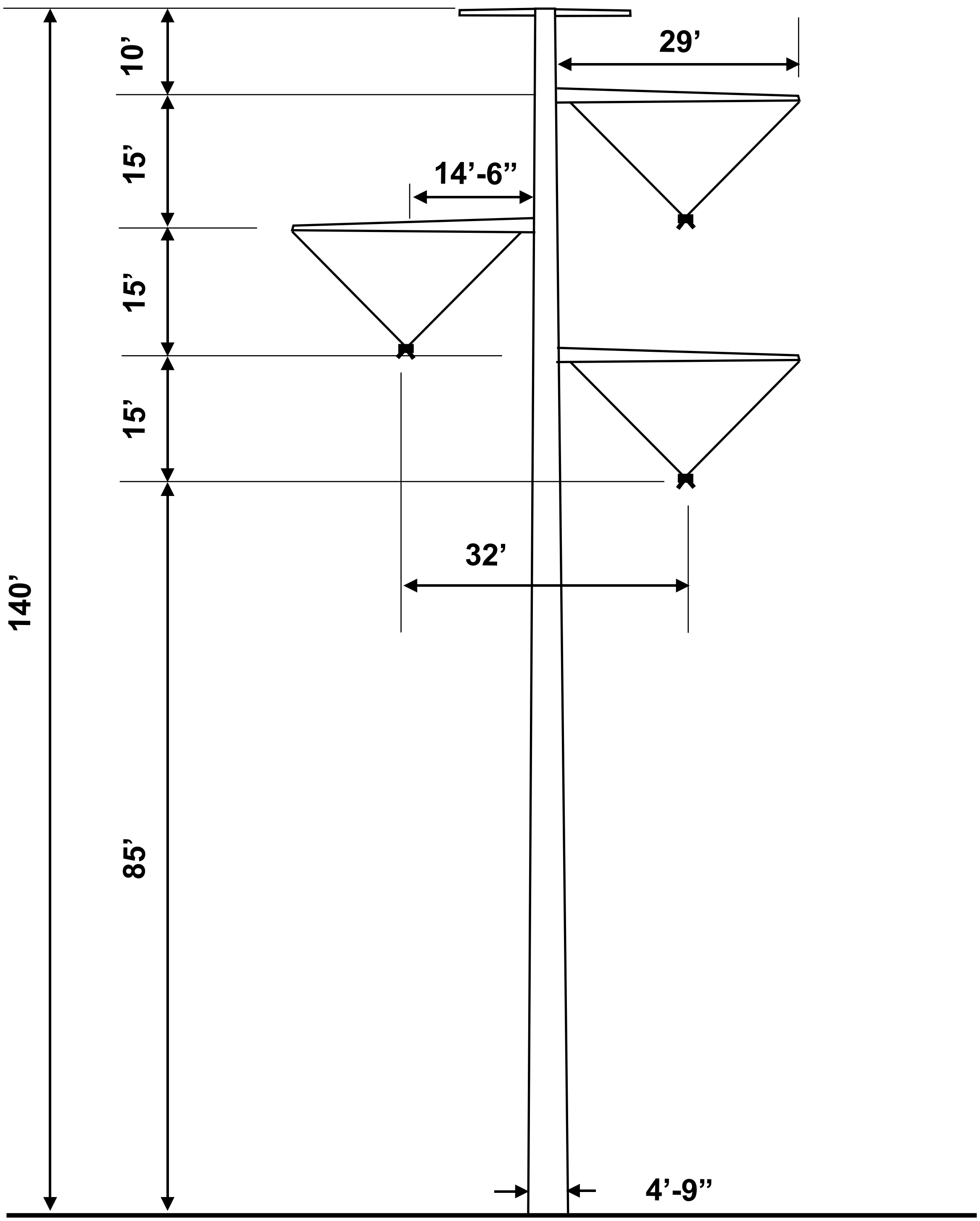
Cross-Section View of the Right-of-Way between Mile 20.3 and Mile 25.6

Antelope-Pardee Transmission Project

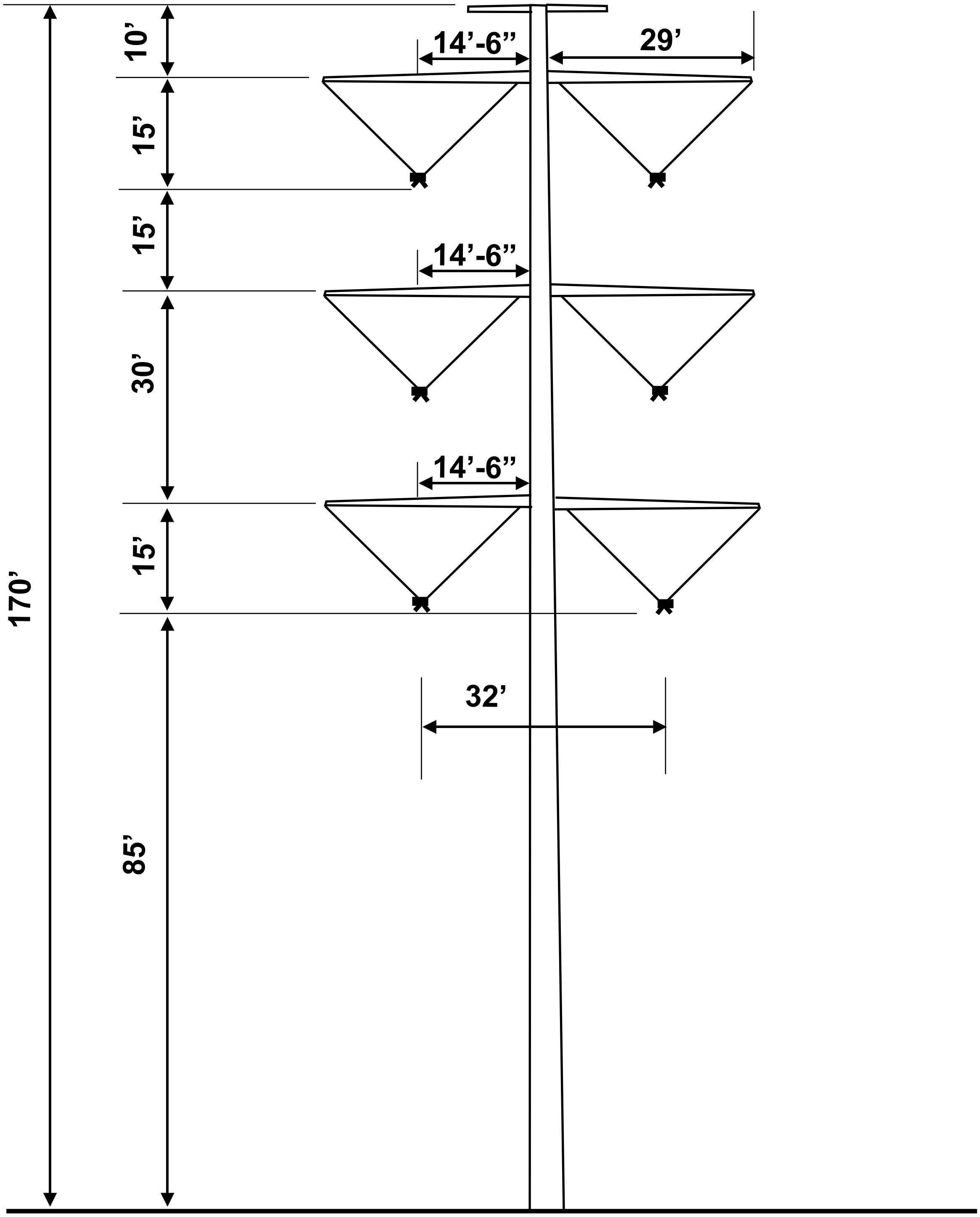
Figure 5



Note: Overall height is approximate and may vary with site conditions.

Source: SCE, 2004.

PREPARED BY Aspen Environmental Group	Typical 500-kV Single-circuit Tubular Steel Pole	Antelope-Pardee Transmission Project Figure 6



Note: Overall height is approximate and may vary with site conditions.

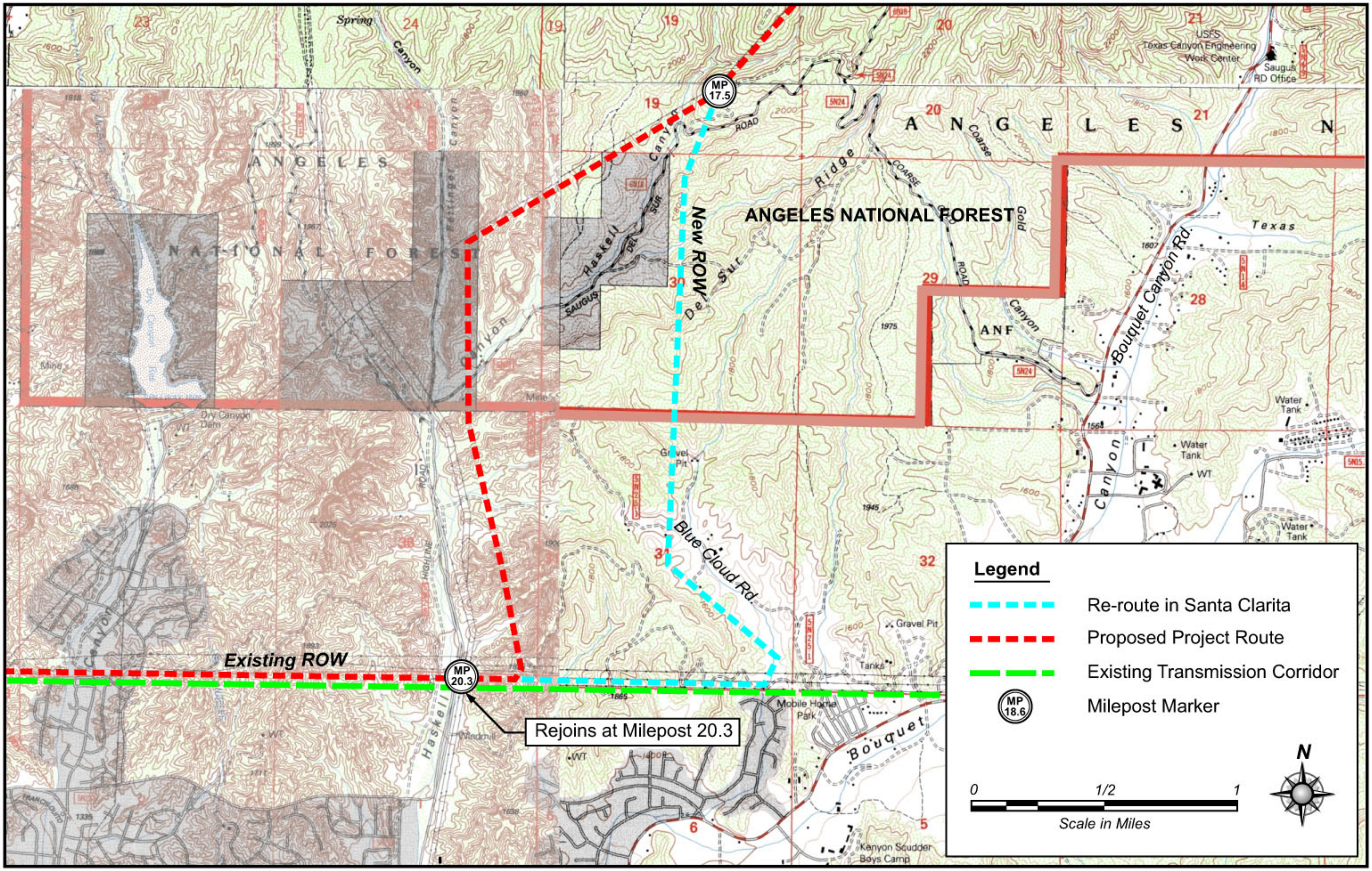
Source: SCE, 2004.

PREPARED BY Aspen Environmental Group

Typical 500-kV Double-circuit Tubular Steel Pole

Antelope-Pardee Transmission Project

Figure 7



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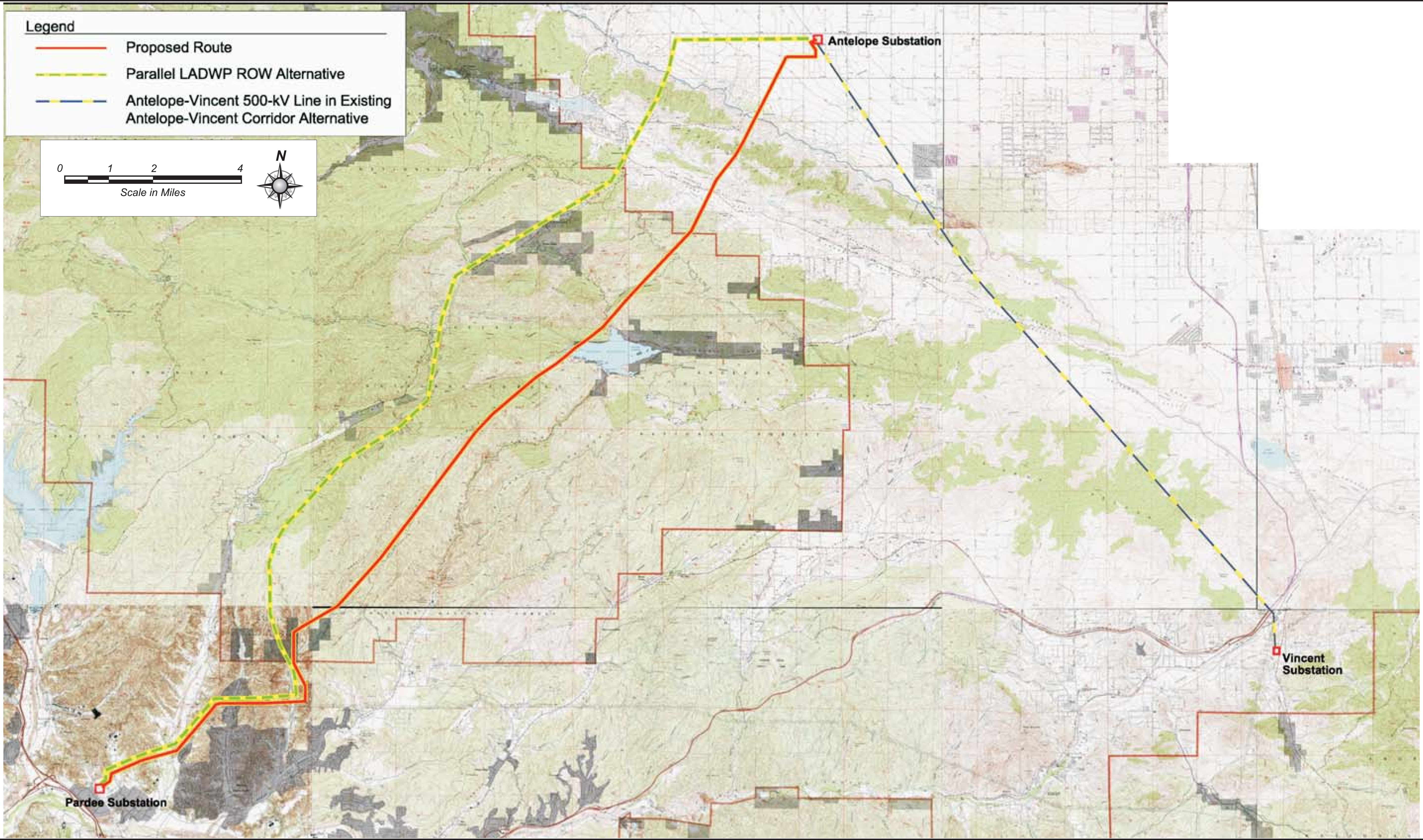
Re-routing of New ROW in Santa Clarita Alternative

Antelope-Pardee Transmission Project

Figure 8



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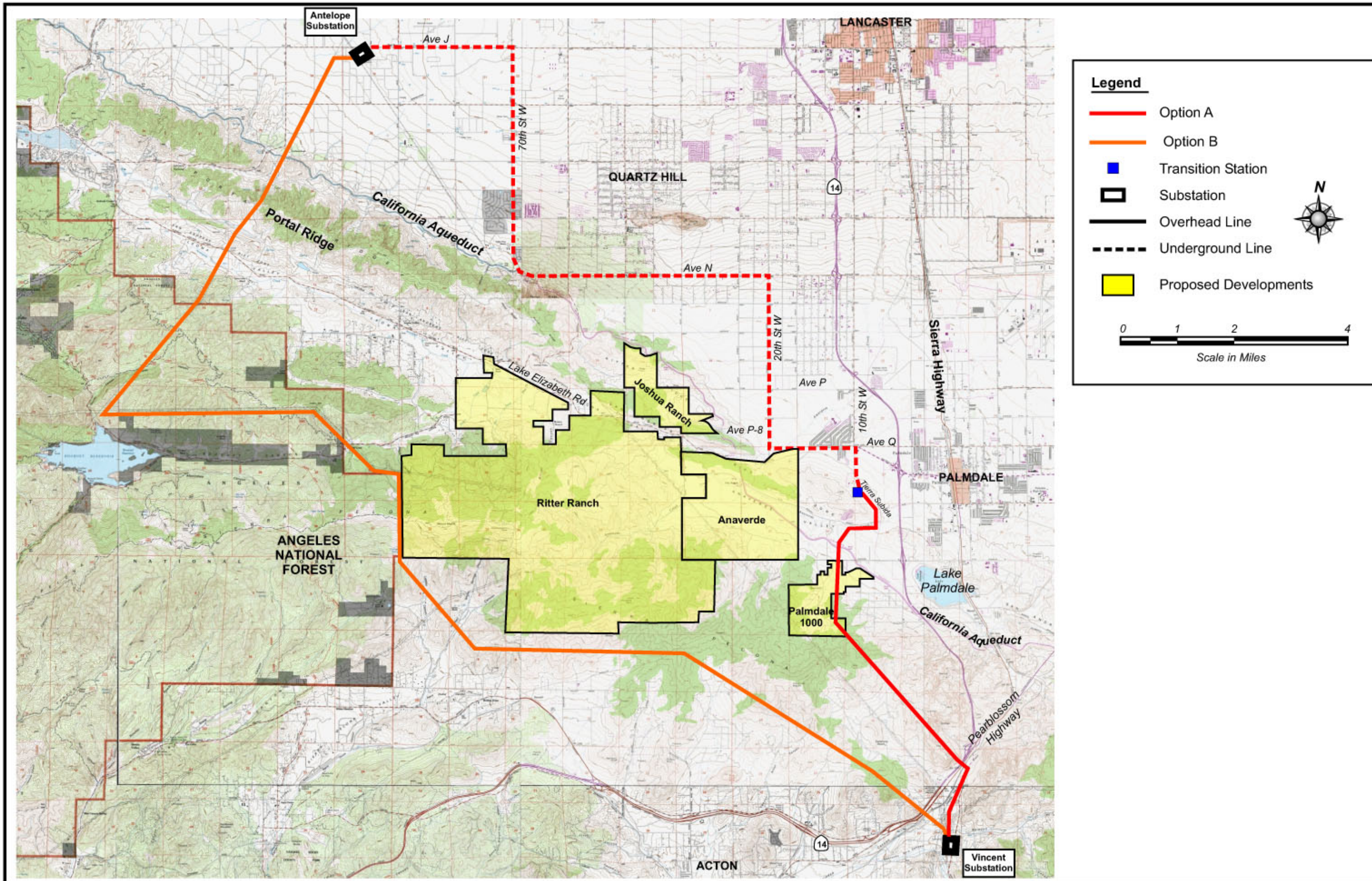
Antelope-Pardee 500-kV Transmission Project EIR
California Public Utilities Commission

Parallel LADWP ROW Alternative and Antelope-Vincent 500-kV Line in Existing Antelope-Vincent Corridor

Antelope-Pardee Transmission Project
Figure 9



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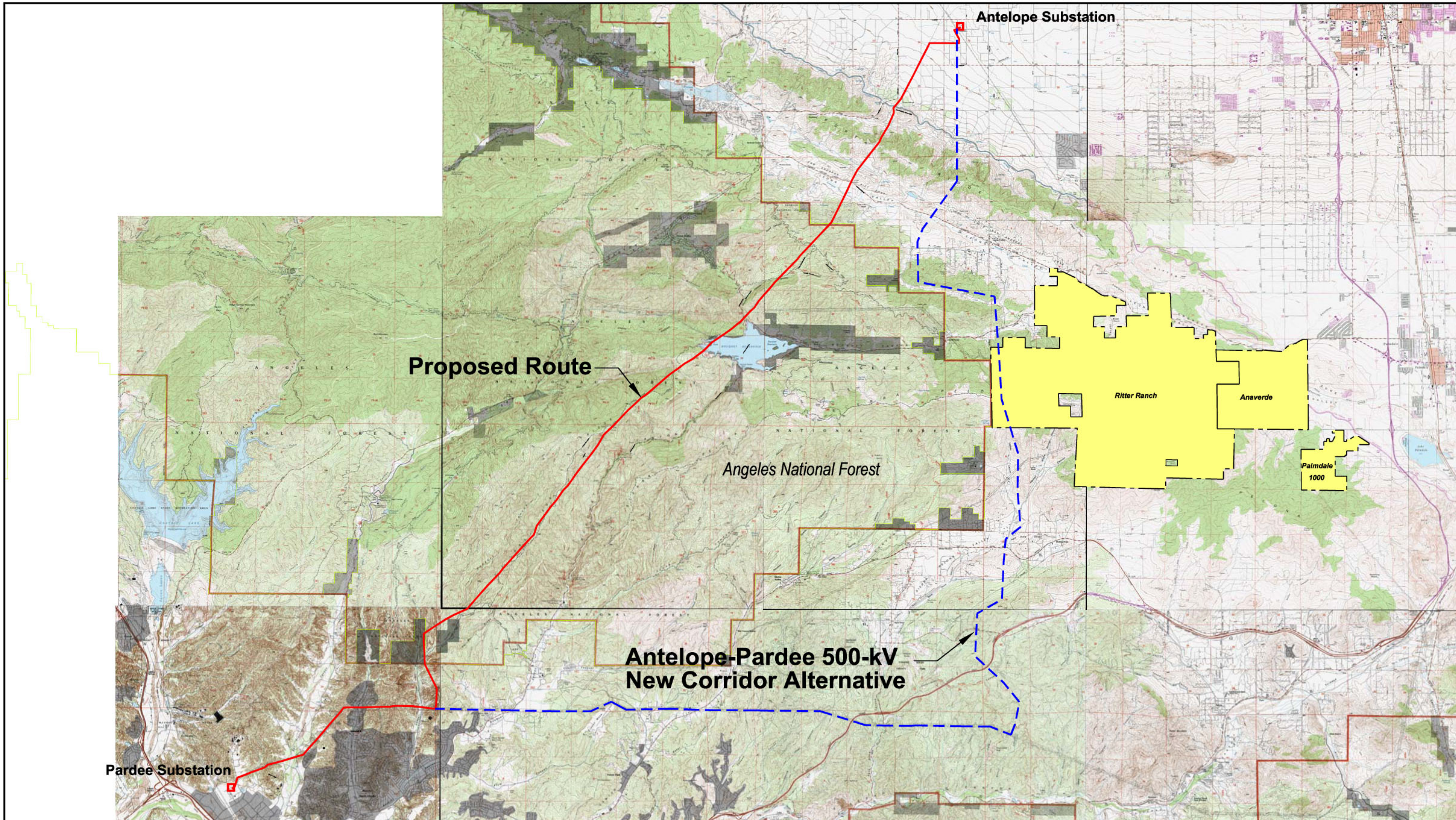
Antelope-Vincent 500-kV Line in New Corridor Alternative

Antelope-Pardee Transmission Project

Figure 10



Prepared by Aspen Environmental Group

Scale: 1" = 2 Miles
Date: January 10, 2006
File: 1236_Altmap4.dwg

NORTH

0 1 2 4
Graphical Scale Miles

Antelope-Pardee 500-kV Line in New Corridor Alternative

Antelope-Pardee Transmission Project
Figure 11