

2.1 INTRODUCTION

This section describes the process Southern California Edison (SCE) used to develop the alternatives for the Tehachapi Renewable Transmission Project (TRTP) and to select the proposed Project for recommendation to the California Public Utilities Commission (CPUC). The chapter also provides a description of each Project alternative (including the No Project Alternative) and discusses the ability of each of these alternatives to meet the Project objectives, purpose, and need. Also included is the rationale for either eliminating an alternative or carrying it forward. For purposes of describing the alternatives to the proposed Project, this section considers system, technology, and routing alternatives. The California Environmental Quality Act (CEQA) does not require in-depth analysis of all Project alternatives, but specifies that a reasonable range of alternatives be considered and evaluated.

This section begins with a description of the approach to the initial routing and alternatives selection, discusses requirements of CEQA and the National Environmental Policy Act (NEPA), and then provides descriptions of alternatives eliminated and retained for evaluation in this Proponent's Environmental Assessment (PEA).

While the California Independent System Operator (CAISO) is responsible for providing open and non-discriminatory access to the CAISO Controlled Grid in California, the CPUC retains exclusive jurisdiction over the siting of CAISO-approved transmission projects and is the lead agency with respect to such projects under CEQA. Therefore, in the Application of which this PEA is a part, SCE seeks from the CPUC a Certificate of Public Convenience and Necessity (CPCN) in accordance with CPUC General Order 131-D. The CPCN would identify the selected route for the CAISO-approved Project, based on environmental review of SCE's proposed route and alternatives thereto, as required by CEQA, and would authorize construction of the Project along the CPUC-selected route, consistent with Public Utilities Code section 1001. This PEA includes a detailed environmental analysis of SCE's proposed route, together with other information required by CPUC rules, in order to assist the CPUC in preparing its Initial Study of the Project pursuant to CEQA.

The principal Project alternatives SCE considered were:

- No Project Alternative – Transmission facilities would not be constructed
- Alternative transmission line segments connecting:
 - Antelope Substation and proposed Whirlwind Substation
 - Antelope Substation and Vincent Substation
 - Planned Cottonwind Substation (being permitted by Kern County) and proposed Whirlwind Substation

- Mesa Substation and Vincent Substation
- Mira Loma Substation and Vincent Substation
- Proposed Whirlwind Substation and recently approved Windhub Substation
- Alternative transmission line routes in the Angeles National Forest (ANF), including both forest and non-forest alternatives
- Alternative transmission line routes in the Chino Hills area
- Alternative technologies including:
 - Undergrounding
 - Tower Structures
 - Composite Core Conductor

2.1.1 Summary of SCE's Findings

SCE evaluated each alternative for its ability to meet the Project objectives. Each of these alternatives differs according to environmental impacts, engineering feasibility, and cost. SCE concluded that alternatives presented in Section 2.4.1, Alternatives Evaluated in the PEA, would be feasible and could be implemented in an efficient and expedited manner. As discussed in Section 2.4.2, Alternatives Considered and Eliminated, the analysis determined that implementation of several of the alternatives considered would not satisfy SCE's basic Project objectives. The No Project Alternative (see Section 2.4.3) would not meet the Project objectives but is retained in the PEA to provide a baseline for analysis of the proposed Project.

2.2 APPROACH TO ALTERNATIVES SELECTION

2.2.1 Project Objectives

SCE evaluated a number of alternative methods for achieving the basic project objectives defined in Section 1.0 (Purpose, Need, and Objectives) before recommending the proposed Project for approval by the CPUC. SCE has identified the following objectives for meeting the proposed Project's purpose and need (see Section 1.3) (each objective is followed by an abbreviated title that is used throughout this section):

1. Reliably interconnect new wind generation resources in the TWRA and enable SCE and other California utilities to comply with California's Renewable Portfolio Standard in an expedited manner (Reliably Interconnect TWRA and Comply with Renewable Portfolio Standard [RPS] in an Expedited Manner).

2. Comply with all applicable reliability planning criteria required by NERC, WECC and the CAISO (Comply with Reliability Planning Criteria).
3. Construct facilities in an orderly, rational and cost-effective manner to maintain reliable electric service, by minimizing service interruptions, during construction (Construct in an Orderly, Rational, and Cost-effective Manner).
4. Address the reliability needs of the CAISO controlled grid due to projected load growth in the Antelope Valley (Increase Reliability in Antelope Valley).
5. Address the South of Lugo transmission constraints, an ongoing source of concern for the Los Angeles Basin (Increase Reliability in the LA Basin).
6. Maximize the use of existing transmission line right-of-ways in order to minimize effects on previously undisturbed land and resources (Maximize Use of Existing R-O-W and Corridors).¹
7. Minimize environmental impacts, through selection of routes, tower types and locations (Minimize Environmental Impacts).
8. Where existing right-of-way is not available, utilize the shortest feasible route that minimizes environmental impacts (Select the Shortest Feasible Route).
9. Meet project needs in a cost-effective and timely manner (Meet Project Needs in a Cost-effective and Timely Manner).

The proposed Project is discussed in detail in Section 3.0 Project Description. The proposed Project maximizes use of existing R-O-W as set out in the objectives for the Project. Generally, routing alternatives were eliminated when they would require the establishment of new transmission corridors which, compared to the retained alternatives, would: 1) increase the environmental impacts, including impacts in currently undisturbed and urban areas; 2) cause disruption or relocation of existing or planned developments; 3) increase the project cost; and 4) potentially create a longer project schedule.

2.2.2 Initial Routing and Siting Study

This Project represents the culmination of a comprehensive, long-term planning process undertaken by several key stakeholders over a period of several years. Participants included

¹ See Garamendi Principles (Senate Bill 2431, Stats. 1988, Ch. 1457) regarding State transmission siting policies, including; 1) encourage the use of existing rights-of-way by upgrading existing transmission facilities where technically and economically justifiable; 2) when construction of new transmission lines is required, encourage expansion of existing right-of-way, when technically and economically feasible; 3) provide for the creation of new rights-of-way when justified by environmental, technical, or economic reasons as determined by the appropriate licensing agency; 4) where there is a need to construct additional transmission capacity seek agreement among all interested utilities on the efficient use of that capacity.

SCE, CAISO, the CPUC, the California Energy Commission (CEC), generating companies, and others. Under the CAISO's federally approved tariff (CAISO Tariff), the CAISO is responsible for providing open and non-discriminatory access to the CAISO Controlled Grid. In order to satisfy this obligation, the CAISO, in cooperation with SCE, applied the Large Generator Interconnection Procedures (LGIP)² to identify the required transmission upgrades necessary to interconnect and deliver the TWRA generation. As part of the CAISO South Regional Transmission Plan for 2006 (CSRTP, 2006), the CAISO applied its LGIP to determine the least-cost transmission solution for integrating generation resources in the TWRA. The CAISO Governing Board approved the Project plan on January 24, 2007³. Specifically, the CAISO determined that the TRTP:

- Provides the least-cost solution that reliably interconnects TWRA generation resources
- Addresses the reliability needs of the CAISO Controlled Grid resulting from projected load growth in the Antelope Valley area and addresses the South of Lugo (SOL) transmission constraints, which are an ongoing source of reliability concern for the Los Angeles (LA) Basin
- Facilitates the ability of California utilities to comply with the state-mandated RPS by providing access to planned renewable resources in the TWRA

After determining general areas where transmission facilities were needed to transmit electric capacity from the wind resources in the TWRA to the urban areas in the Los Angeles Basin, SCE developed numerous potential alignments for new 500 kV transmission lines and three different sites for the proposed new Whirlwind Substation. SCE typically considers several important factors when siting electric facilities. These factors include the following:

- Ability to modify or otherwise make use of existing transmission facilities rather than construct entirely new facilities in undisturbed areas
- Ability to follow established utility corridors
- Ability to utilize existing R-O-W where practicable
- Minimization of environmental impacts
- Accessibility to construct and maintain supporting structures

² The Federal Energy Regulatory Commission (FERC) issued Order No. 2003-C which approved Appendix B, Standard Large Generator Interconnection Procedures (LGIP). The LGIP can be found at <http://www.ferc.gov/industries/electric/indus-act/gi/stnd-gen/2003-C-LGIP.doc>

³ Findings and recommendations on the TRTP are presented in Part II of the 2006 CSRTP dated December 29, 2006. The TRTP recommendations were approved by the CAISO Board of Governors on January 24, 2007. <http://www.caiso.com/1b70/1b70eeda42890.pdf?ht=tehachapi%20transmission%20project%20tehachapi%20transmission%20project%20tehachapi%20transmission%20project%20tehachapi%20transmission%20project>

- Length of new transmission lines and number of new towers or poles
- Number of crossings of highways, creeks, and other electric lines
- Minimization of exposure to geologic hazards
- Ability to avoid disruption or relocation of existing development
- Compatibility with local planning agencies' vision and/or planning strategy for development in the Project area to the extent practicable
- Easement acquisition costs
- Installation and maintenance costs
- Overall project cost
- NERC and WECC Reliability and planning standards

Potential locations for new facilities were identified through fieldwork and review of aerial photographs and publicly available data. SCE identified general corridors for transmission line facilities based on the CAISO-approved TRTP, which satisfies the need to build 500 kV transmission lines from the TWRA to the LA Basin load area while incorporating system reliability measures.

By comparing environmental considerations, engineering feasibility, and order of magnitude costs of each segment and technology, SCE determined the preferred route and transmission method (i.e., type of conductor, overhead or underground) for the proposed transmission line. For example, a transmission line connecting the new Windhub Substation can be routed different ways. Possible routing options along the various segments were compared against each other. The proposed and feasible alternative transmission line routes and new substation site were determined by rejecting some route segments and substation site options in favor of others for environmental, engineering feasibility, or cost reasons.

SCE engineers and construction managers experienced in design and construction of electric transmission lines conducted the engineering feasibility and relative cost evaluations. Following SCE's determinations, the technical staff responsible for the impact analysis chapters of the PEA analyzed each segment and substation site determined by SCE to be potentially feasible against a variety of environmental criteria (primarily based on CEQA significance criteria as listed in the technical chapters of this PEA).

2.2.3 Requirements of the California Environmental Quality Act

An important aspect of the environmental review process is the identification and assessment of a reasonable range of alternatives. CEQA Guidelines were used in the development and

screening of alternatives. The CEQA Guidelines (Section 15126.6[d]) require the selection of a reasonable range of feasible alternatives to the proposed project, including a No Project Alternative. CEQA requires that sufficient information is provided about each alternative to allow meaningful evaluation, analysis, and comparison with the proposed Project. A reasonable range of feasible alternatives is established through consideration of the following requirements:

- An alternative must have the potential to “avoid or substantially lessen any of the significant effects of the project” (Guidelines Section 15126.6[a]). If an alternative was identified that clearly does not have the potential to provide an overall environmental advantage as compared to the proposed Project, it was eliminated from further consideration. 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.
- An alternative can be retained even if it is considered to be more costly than other alternatives or if it were to impede the attainment of Project objectives to some degree (Guidelines Section 15126.6[b]). The CEQA Guidelines state that alternatives whose effects cannot be reasonably ascertained and whose likelihood of implementation is remote or speculative do not have to be retained.
- A range of reasonable alternatives to the proposed project must be considered and discussed. The range of potential alternatives shall include those that would feasibly accomplish most of the basic objectives of the project and could avoid or lessen one of more of the significant effects (Guidelines Section 15126.6[c]). The selection rationale for alternatives retained as well as eliminated should be included. Among the factors that may be used to eliminate alternatives from further consideration include failure to meet most of the basic project objectives, infeasibility, or inability to avoid significant environmental impacts.
- Guideline Section 15126.6(f)(1) states that 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 the proponent’s control over alternative sites in determining the range of alternatives. For the proposed Project’s screening analysis, the overall feasibility of potential alternatives was assessed taking into consideration the specific economic, legal (regulatory), and technical feasibility of each alternative.

The CPUC uses the PEA and any subsequent data requests during their preparation of an Environmental Impact Report (EIR) pursuant to CEQA. CPUC would use the EIR as the

CEQA document for the CPUC's consideration and approval of the TRTP. The EIR would also be reviewed by other agencies acting as responsible agencies under CEQA. The EIR may also be used by federal agencies as part of the information considered by the agency in making approval decisions that may be required for the Project.

2.2.4 Requirements of the National Environmental Policy Act

This PEA is not intended to comply with NEPA requirements, however, they were reviewed in the development and screening of alternatives. NEPA regulations (40 CFR 1502.14 [c]) identify the need to consider reasonable alternatives, including those that are not within the jurisdiction of the lead agency. In addition, NEPA (40 CFR Section 1502.23) states that the merits and drawbacks of the alternatives do not need to be displayed in a monetary cost/benefit analysis and that economic concerns should not outweigh important qualitative considerations. NEPA requires consideration of all aspects that may be relevant and important to decision-makers, including factors that are not related to environmental quality. NEPA requires equal treatment of each alternative, including the proposed action (Project), so that reviewers may evaluate their comparative merits (40 CFR Section 1502.14).

2.3 APPROACH TO ALTERNATIVES DEVELOPMENT

2.3.1 Project Area Description

2.3.1.1 Background

Under Sections 210 and 212 of the Federal Power Act (16 U.S.C § 824 [i] and [k]) and Sections 24 and 25 of the CAISO Tariff, SCE is obligated to interconnect and integrate power generation facilities into its electric system. SCE is also required to comply with the state-mandated RPS to increase the sale of electricity produced by renewable energy sources.

SCE's TRTP includes a series of new and upgraded high-voltage electric transmission lines (T/L) and substations to be permitted and constructed, by independent power producers, to deliver electricity from new wind farms in eastern Kern County to the LA Basin. This section includes a general description of the Project area from Kern County to the LA Basin, and focuses specifically on topography and level of development and land use.

There are many variables and criteria involved in selecting an appropriate route for new electric transmission lines. Considerations for selecting the route include the terrain, or topography, across which the transmission lines would travel and the level of development in the area. The terrain can result in higher project costs and reduced transmission reliability. The level of development in the area is a key consideration for minimizing effects on communities.

2.3.1.2 Geographic Locations

The Project area can be described in three parts: 1) The Antelope Valley in the north, 2) public lands in the center of the Project area, and 3) the LA Basin in the south. A regional map is provided in Figure 2-1.

2.3.1.2.1 Antelope Valley. The Antelope Valley is located in northern Los Angeles County and the southeastern portion of Kern County in California. The Project area includes the northwesterly trending San Andreas Rift Zone, located just south of Antelope Valley. The principal cities in the Antelope Valley are Lancaster and Palmdale. Triangular in shape, the Antelope Valley comprises the western tip of the Mojave Desert, opening up to the Victor Valley and the Great Basin to the east. Lying north of the San Gabriel Mountains and southeast of the Tehachapi Mountains, this desert ecosystem spans approximately 2,200 square miles.

The Antelope Valley contains smaller hills and long broad valleys that often contain dry lakes. Many of the lower mountains, which dot the vast terrain, rise from 1,000 to 4,000 feet above the valley floor. The Antelope Valley is bordered in the northwest by the Tehachapi Mountains which are separated from the Sierra Nevada in the north by the Tehachapi Pass (3,800 feet in elevation). The Antelope Valley is bordered on the south by the San Gabriel Mountains, which are bisected by Soledad Canyon (3,300 feet in elevation).

The Antelope Valley experienced rapid population growth in the past decade. Once a rural farming community, then a military aerospace hub, the Antelope Valley was transformed in the 1980s by extensive urban development and continues to develop rapidly as one of California's largest growing regions.

2.3.1.2.2 Public Lands. The middle portion of the Project area includes a significant portion of the ANF and San Bernardino National Forests (SBNF). The ANF encompasses 694,187 acres including almost the entire San Gabriel Mountain range. The topography of the forests ranges from mountain peaks over 10,000 feet to low-lying canyon bottoms at approximately 1,200 feet above sea level. Over 36,000 acres within the ANF are designated as the San Gabriel Wilderness Area and have been set aside to preserve their wilderness character. The area encompasses some rugged terrain, ranging in elevation from 1,600 to 8,200 feet. The lower elevations are covered with dense chaparral that changes to pine- and fir-covered slopes at the higher elevations. Existing SCE and Los Angeles Department of Water and Power (LADWP) transmission lines traversing the ANF and SBNF are located within corridors that are specifically identified in the United States Department of Agriculture (USDA) Forest Service Land Management Plan (FSLMP) as designated utility corridors.

2.3.1.2.3 The Los Angeles Basin. In this PEA, the portion of the Project area south of the San Gabriel Mountains and the western Inland Empire are collectively referred to as the LA Basin, which is a relatively flat coastal plain with rolling foothills. The LA Basin contains the major metropolitan area of Los Angeles and many smaller cities. Dense urbanization within this area limits available land for transmission corridors to those that are already established. Expansion of these R-O-Ws or creation of new corridors could result in adverse effects to existing or planned developments, including possible dislocation.

2.3.2 Transmission Line and Substation Alternatives

Alternatives to the Project were developed and evaluated based on the Project objectives, purpose, and need. As discussed in Section 1.0 of this PEA, the purpose of the proposed TRTP is to provide the electrical facilities necessary to integrate levels of new wind generation in excess of 700 megawatt (MW) and up to approximately 4,500 MW in the TWRA. SCE's TRTP includes a series of new and upgraded high-voltage electric transmission lines and substations to deliver electricity from new wind farms, planned by independent power producers, in eastern Kern County to the Los Angeles Basin.

Selection of alternatives for either further evaluation or elimination was based on their ability to meet the purpose and need in a manner that was consistent with the objectives listed in Section 1.3, including engineering feasibility, cost effectiveness, and minimization of environmental impacts. Alternatives retained for evaluation are discussed in Section 2.4.1 and alternatives eliminated are discussed in Section 2.4.2. The range of alternatives initially considered included: 1) system alternatives; 2) technology alternatives; and 3) routing/siting alternatives and are described as follows:

- System alternatives include non-transmission alternatives, such as in-basin generation of electricity or implementation of demand-side management and energy efficiency programs. Other system alternatives, such as routing transmission lines from the TWRA to Pacific Gas and Electric's (PG&E) Midway Substation (located near Bakersfield), are regional in scope. System alternatives were eliminated from further consideration because they do not meet the Project purpose and need (see Section 2.4.2.1).
- Technology alternatives include composite core conductor, tower construction and materials, overhead construction versus undergrounding transmission lines, and single-circuit or double-circuit transmission lines. Technologies were evaluated based on their feasibility, cost, reliability, and environmental impacts.
- Types of routing and siting alternatives include alternative locations, use of existing corridors and R-O-Ws, and establishment of new corridors and R-O-Ws. Feasibility of the alternatives were determined by topography, cost and time associated with establishing transmission lines and associated equipment and facilities, and the ability of

a corridor configuration to provide for reliability requirements. Environmental advantages and disadvantages evaluated included ground disturbance, visual impacts, and potential impacts to existing or planned developments.

2.3.3 Initial Routing and Siting

For integrating up to 4,500 MW of generation resources, technical evaluations were conducted in various forums, including the Tehachapi Collaborative Study Group established in response to CPUC Decision 04-06-010 and the CAISO Southern Regional Transmission Plan (CSRTP, 2006). These technical evaluations determined that the existing system is incapable of integrating the generation resources without significant system upgrades. As a result, numerous Project arrangements were examined to identify the optimal Project arrangement that would meet stated Project objectives, purpose, and need. Factors considered included use of existing R-O-W, minimizing environmental impacts, topographic limitations, development, easement acquisition costs, and operation and maintenance costs. All options examined in these various forums included most transmission elements of the TRTP with slightly different electrical arrangements.

2.3.4 Alternatives Screening Criteria

Alternatives were evaluated with respect to their ability to meet the purpose and need of the proposed Project, engineering feasibility, cost effectiveness, and potential environmental impacts. Specifically, the alternatives were evaluated against the Project objectives listed in Section 2.2.1 Project Objectives.

2.4 SCREENING RESULTS

This section presents the results of the alternatives screening process. The screening analysis did not focus on economic factors other than the consideration of whether the alternatives were economically feasible. Therefore, alternatives capable of eliminating or reducing significant environmental effects were considered even though they could impede the attainment of the Project objectives or prove to be more costly. Findings are summarized in Table 2-1, Routing Alternatives Considered and Retained; Table 2-2, System Alternatives Considered and Eliminated; Table 2-3, Technology Alternatives Considered and Eliminated; and Table 2-4, Routing Alternatives Considered and Eliminated.

2.4.1 Alternatives Evaluated in the PEA

The information in this section briefly describes the alternatives retained for evaluation in this PEA and provides reasons for retaining the alternatives. Expanded descriptions are provided in Section 3.0, Project Description. The proposed transmission routes are shown on

**TABLE 2-1
ROUTING ALTERNATIVES CONSIDERED AND RETAINED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects of Alternatives Retained |
|---|--|--|---|
| <p>RA-Retained 1. Segment 4 Whirlwind 500/220 kV Transmission Elements</p> <ul style="list-style-type: none"> Expand R-O-W in existing corridor between Antelope Substation and planned Cottonwind Substation New single-circuit 500 kV transmission line, approximately 16 miles, between Antelope Substation and proposed Whirlwind Substation Two new single-circuit 220 kV transmission lines, approximately 4 miles, between the proposed Whirlwind Substation and the planned Cottonwind Substation | <ul style="list-style-type: none"> Would meet project objectives. New T/L supports wind generation development | <p>Advantages</p> <ul style="list-style-type: none"> Feasible Adjacent to existing R-O-W <p>Disadvantages</p> <ul style="list-style-type: none"> New R-O-W acquisition required | <p>Advantages</p> <ul style="list-style-type: none"> New R-O-W adjacent to existing corridor minimizing road construction requirements Straight line route represents shortest distance between two substations <p>Disadvantages</p> <ul style="list-style-type: none"> Would require new R-O-W acquisition and result in impacts to previously undisturbed land May result in potential increased visual impacts (new set of structures) |
| <p>RA-Retained 2. Segment 5 Antelope to Vincent No. 2 500 kV T/L</p> <ul style="list-style-type: none"> Remove the existing Antelope – Vincent 220 kV T/L and approximately 18 miles of the existing Antelope – Mesa 220 kV T/L Construct new single-circuit Antelope – Vincent No.2 500 kV T/L. | <ul style="list-style-type: none"> Would meet project objectives. Utilizes existing R-O-W | <p>Advantages</p> <ul style="list-style-type: none"> Feasible Uses existing R-O-W <p>Disadvantages</p> <ul style="list-style-type: none"> None | <p>Advantages</p> <ul style="list-style-type: none"> Would use existing R-O-W minimizing road construction Would not affect existing and planned development. <p>Disadvantages</p> <ul style="list-style-type: none"> May result in potential increased visual impacts (New 500 kV towers would be taller than existing towers being replaced) |

**TABLE 2-1 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND RETAINED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects of Alternatives Retained |
|--|---|--|--|
| <p>RA-Retained 3. Segment 6 Transmission Upgrades Between Vincent Substation and the Southern ANF Boundary with the City of Duarte</p> <ul style="list-style-type: none"> • Remove approximately 27 miles of single-circuit 220 kV transmission line between Vincent Substation and the southern boundary of the Angeles National Forest (ANF) • Construct approximately 27 miles of single-circuit 500 kV transmission line in vacated R-O-W • Remove approximately 5 miles of single-circuit 220 kV transmission line between Vincent Substation and the northern boundary of the ANF • Construct approximately 5 miles of single-circuit 500 kV transmission line in vacated R-O-W | <ul style="list-style-type: none"> • Would meet project objectives. • Utilizes existing R-O-W | <p>Advantages</p> <ul style="list-style-type: none"> • Feasible • Uses existing R-O-W <p>Disadvantages</p> <ul style="list-style-type: none"> • Limited access for future maintenance on towers installed by helicopter | <p>Advantages</p> <ul style="list-style-type: none"> • Would use existing R-O-W minimizing road construction • Would not affect existing and planned development <p>Disadvantages</p> <ul style="list-style-type: none"> • May result in increased visual impacts (New 500 kV towers would be taller than existing towers being replaced) |

**TABLE 2-1 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND RETAINED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects of Alternatives Retained |
|--|---|--|---|
| <p>RA-Retained 4. Segment 7 New Mira Loma to Vincent 500 kV T/L Section Between Boundary of ANF with City of Duarte and the Mesa Substation</p> <ul style="list-style-type: none"> • Remove approximately 16 miles of existing single-circuit 220 kV transmission line from the southern boundary of the ANF to the existing Mesa Substation • Relocate several 66 kV Subtransmission lines north of the Rio Hondo Substation and from the Rio Hondo Substation to the Mesa Substation • Construct new double-circuit 500 kV transmission line from the southern boundary of the ANF to the existing Mesa Substation | <ul style="list-style-type: none"> • Would meet project objectives. • Utilizes existing R-O-W | <p>Advantages</p> <ul style="list-style-type: none"> • Feasible • Provides for possible future upgrade <p>Disadvantages</p> <ul style="list-style-type: none"> • None | <p>Advantages</p> <ul style="list-style-type: none"> • Would use existing R-O-W minimizing road construction • Would not affect existing and planned development <p>Disadvantages</p> <ul style="list-style-type: none"> • May result in increased visual impacts (New double-circuit 500 kV towers would be taller than existing single-circuit 220 kV towers being replaced) |

**TABLE 2-1 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND RETAINED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects of Alternatives Retained |
|---|---|--|--|
| <p>RA-Retained 5. Segment 8 New Mira Loma to Vincent 500 kV T/L Section Between the Mesa Substation and the Mira Loma Substation</p> <ul style="list-style-type: none"> • Remove existing single-circuit 220 kV transmission line between the Mesa Substation and Chino Substation • Relocate several 66 kV Subtransmission lines near the Chino Substation • Remove existing single-circuit 220 kV transmission line, small portion build with double-circuit construction, between the Chino Substation and Mira Loma Substation and rebuild with new double-circuit 220 kV transmission line • Remove existing double-circuit 220 kV transmission line, different than one constructed above, between Chino and Mira Loma substations • Construct new double-circuit 500 kV transmission line between Mesa and Mira Loma substations, approximately 33 miles | <ul style="list-style-type: none"> • Would meet project objectives. • Utilizes existing R-O-W | <p>Advantages</p> <ul style="list-style-type: none"> • Feasible <p>Disadvantages</p> <ul style="list-style-type: none"> • None | <p>Advantages</p> <ul style="list-style-type: none"> • Would use existing R-O-W minimizing road construction • Would not affect existing and planned development <p>Disadvantages</p> <ul style="list-style-type: none"> • May result in increased visual impacts (New 500 kV and 2220 kV towers would be taller than existing towers being replaced) |

**TABLE 2-1 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND RETAINED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects of Alternatives Retained | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|---|--|--|--|-------------|-------------|---------------|----------|-----------|---------------|----------|-----------|---------------|----------|-----------|--------------|--|----------|-------------|--|-----------|-----------|--------------------|--|----------|--------------------|--|-------------|--------------------|--|
| <p>RA-Retained 6. Segment 9 Substation Facilities</p> <ul style="list-style-type: none"> • New 500/220 kV substation (Whirlwind) located approximately 4 to 5 miles south of the planned Cottonwind Substation near the intersection of 170th Street and Holiday Avenue in Kern County near the TWRA • Alternative Site A • Alternative Site B • Alternative Site C (Proposed Project) • Upgrades at various Substations: Antelope, Gould, Mesa, Mira Loma, and Vincent | <ul style="list-style-type: none"> • Would meet project objectives. • Must be in line with the Cottonwind and Antelope substations • Shortest Distance • No significant T/L extension required | <p>Advantages</p> <ul style="list-style-type: none"> • Alternative B and C - Easier connection because does not require crossing of existing 220 kV T/L corridor • All three Whirlwind Substations are feasible • Various Substations – all work done at Gould, Mesa, and Mira Loma within existing fenced line • Various Substations – eliminates need for new substations elsewhere <p>Disadvantages</p> <p><u>Alternative A</u></p> <ul style="list-style-type: none"> • Soil stability issues from aquifer recharge facility proposed for the site • Would require crossing of existing 220 kV T/L corridor <p><u>Alternative B and C and Various Substations</u></p> <ul style="list-style-type: none"> • None | <p>Advantages</p> <ul style="list-style-type: none"> • Site adjacent to existing T/L corridor minimizing road construction <p>Disadvantages</p> <ul style="list-style-type: none"> • Would require new R-O-W acquisition and result in impacts to previously undisturbed land <table border="1" data-bbox="1455 816 1921 1214"> <thead> <tr> <th></th> <th>Disturbance</th> <th>Acquisition</th> </tr> </thead> <tbody> <tr> <td>Alternative A</td> <td>66 acres</td> <td>113 acres</td> </tr> <tr> <td>Alternative B</td> <td>66 acres</td> <td>102 acres</td> </tr> <tr> <td>Alternative C</td> <td>66 acres</td> <td>106 acres</td> </tr> <tr> <td>Antelope Sub</td> <td></td> <td>12 acres</td> </tr> <tr> <td>Vincent Sub</td> <td></td> <td>0.2 acres</td> </tr> <tr> <td>Gould Sub</td> <td>Within Fenced Area</td> <td></td> </tr> <tr> <td>Mesa Sub</td> <td>Within Fenced Area</td> <td></td> </tr> <tr> <td>Vincent Sub</td> <td>Within Fenced Area</td> <td></td> </tr> </tbody> </table> | | | | Disturbance | Acquisition | Alternative A | 66 acres | 113 acres | Alternative B | 66 acres | 102 acres | Alternative C | 66 acres | 106 acres | Antelope Sub | | 12 acres | Vincent Sub | | 0.2 acres | Gould Sub | Within Fenced Area | | Mesa Sub | Within Fenced Area | | Vincent Sub | Within Fenced Area | |
| | Disturbance | Acquisition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alternative A | 66 acres | 113 acres | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alternative B | 66 acres | 102 acres | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alternative C | 66 acres | 106 acres | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Antelope Sub | | 12 acres | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vincent Sub | | 0.2 acres | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gould Sub | Within Fenced Area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mesa Sub | Within Fenced Area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vincent Sub | Within Fenced Area | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**TABLE 2-1 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND RETAINED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects of Alternatives Retained |
|--|--|--|---|
| <p>RA-Retained 7. Segment 10 Whirlwind to Windhub 500 kV T/L</p> <p>A new 500 kV transmission line traveling approximately over new R-O-W between the Windhub¹ Substation and the proposed new Whirlwind Substation.</p> <ul style="list-style-type: none"> Proposed Project Alternative 10A - Alternative route for a portion of Segment 10 mostly paralleling the existing Los Angeles Aqueduct and access roads. Alternative 10B - Alternative alignment of Alternative Segment 10A. | <ul style="list-style-type: none"> Would meet project objectives. New T/L supports wind generation development | <p>Advantages</p> <ul style="list-style-type: none"> All three routes are feasible Proposed Project is 17 miles <p>Disadvantages</p> <ul style="list-style-type: none"> All three routes create new R-O-W Alternative 10A is 18 miles Alternative 10B is 19 miles | <p>Advantages</p> <ul style="list-style-type: none"> Straight line route represents shortest distance between two substations (Shortest route alternative between Windhub and Whirlwind Substations) <p>Disadvantages</p> <ul style="list-style-type: none"> Would require new R-O-W acquisition and result in impacts to previously undisturbed land May result in increased visual impacts to corridor location. |

**TABLE 2-1 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND RETAINED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects of Alternatives Retained |
|--|--|---|---|
| <p>RA-Retained 8. Segment 11 New Mesa to Vincent (via Gould) 500/220 kV T/L</p> <ul style="list-style-type: none"> • A rebuild of approximately 19 miles of existing 220 kV transmission line to 500 kV standards between the existing Vincent and Gould Substations • Install new 220 kV circuit on vacant tower position of the existing double-circuit structures supporting the Eagle Rock – Mesa 220 kV T/L between the existing Gould Substation and the existing Mesa Substation • Connect 500 kV transmission section with 220 kV transmission section | <ul style="list-style-type: none"> • Would meet project objectives. • New T/L supports wind generation development | <p>Advantages</p> <ul style="list-style-type: none"> • Feasible <p>Disadvantages</p> <ul style="list-style-type: none"> • Limited access for future maintenance on towers installed by helicopter | <p>Advantages</p> <ul style="list-style-type: none"> • Mesa – Gould 220 T/L would use vacant position on existing structures – No new construction required. • Would use existing R-O-W (Gould – Vincent 500 kV T/L would use existing R-O-W for most construction) • New transmission R-O-W would not affect existing and planned development <p>Disadvantages</p> <ul style="list-style-type: none"> • Would require new R-O-W acquisition and result in impacts to previously undisturbed land (Gould – Vincent 500 kV T/L would require additional R-O-W width north of Gould Substation in ANF) • May result in increased visual impacts (New 500 kV towers would be taller than existing towers) |

¹ The Windhub Substation was included in SCE's proposed Antelope Transmission Project Segments 2&3 application (A.04-12-008) submitted to the California Public Utilities Commission for approval in December 2004. The application was amended in September 2005.

**TABLE 2-2
SYSTEM ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|--|--|---|
| <p>System Alternative-1. Transmission Lines to Midway Substation</p> <p>The Midway Substation is owned and operated by Pacific Gas and Electric Company (PG&E) and located near Bakersfield. System alternatives include transmission lines from the TWRA to the Midway Substation and upgrades to the Midway Substation.</p> | <ul style="list-style-type: none"> • Would not maximize use of existing R-O-W (Objective 6). Transmission lines to the Midway Substation would require a new R-O-W. • Would not select the shortest feasible route that minimizes environmental impacts where new R-O-W is required (Objective 8). This alternative would result in a T/L that would be approximately 94 miles longer than the T/L for proposed Segment 4. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Transmission line would be approximately 94 miles longer than the proposed transmission line. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Would require new R-O-W and would result in greater land disturbance than the proposed Project. |
| <p>System Alternative-2. Non-Transmission System</p> <p>Non-transmission system alternatives include the development of in-basin generation instead of interconnecting generation from the TWRA and implementation of demand-side management and energy efficiency programs.</p> | <ul style="list-style-type: none"> • The Non-Transmission System Alternative does not interconnect and integrate generation resources in the TWRA (Objective 1). | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Would not eliminate the need to provide the electrical facilities necessary to integrate levels of new generation between 700 MW and approximately 4,500 MW in the TWRA. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Would not minimize environmental effects because the proposed Project would still be required to interconnect TWRA. |

**TABLE 2-3
TECHNOLOGY ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|---|--|---|
| <p>Technology Alternative- 1. Composite Core Conductor (Alternative to Standard Core Conductor)</p> <p>This alternative involves replacing the conductor on the existing 220 kV single-circuit towers between the Vincent Substation and the Mesa Substation, and between the Mesa Substation and the Chino Substation, adding towers where necessary, along the proposed routes of Segments 6, 7, 8, and 11 of the SCE TRTP.</p> | <ul style="list-style-type: none"> • Would not construct the Project to reliably interconnect TWRA in an expedited manner (Objective 1). The long-term reliability of this new technology is unknown. • Would not meet the Project needs in a cost-effective and timely manner (Objective 9). This alternative is 10 to 15 times more expensive than the standard core conductor. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Limited increase is insufficient to support the identified 4,500 MW from the TWRA. • Existing towers cannot support the composite core conductor large enough to provide the required capacity increase. • Existing tower design does not allow for increase in voltage operation from 220 kV to 500 kV. • New, unproven technology (pilot testing phase) with unknown lifecycle performance • Costs are approximately 10 to 15 times higher than standard technology • Mechanically fragile (e.g., subject to vandalism) | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Does not minimize environmental impacts (replacement of existing towers along the proposed Segments 6, 7, 8, and 11 of the TRTP does not reduce any of the environmental impacts as compared to the retained project alternatives). |

**TABLE 2-3 (CONTINUED)
TECHNOLOGY ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|---|--|---|
| <p>Technology Alternative-2. Tubular Steel Poles in the ANF (Alternative to Lattice Structures)</p> <p>TSPs would be used as an alternative to the use of LSTs.</p> | <ul style="list-style-type: none"> • Would not minimize environmental effects through selection of routes, tower types, and locations (Objective 7). | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Wide access roads required for truck transport; road turning radius needs to be larger due to length of pole sections • Requires crane for construction • Cannot be constructed using helicopter | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Would not minimize environmental effects. (New access roads would need to be established, resulting in greater ground disturbance. Access roads required for construction would include trucks with a minimum of 50-foot inside-turn radius, and heavy cranes). • The single footing of a TSP is larger in volume than the four footings combined of the LSTs. |

**TABLE 2-3 (CONTINUED)
TECHNOLOGY ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|---|--|---|
| <p>Technology Alternative-3. Painted Transmission Structures (Alternative to Galvanized Structures)</p> <p>Transmission structures would be painted after construction rather than utilizing the proposed, galvanized structures.</p> | <ul style="list-style-type: none"> • Would not minimize environmental impacts through selection of routes, tower types, and locations (Objective 7). | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Would require painting in the field and ongoing maintenance of painted structures. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Would not minimize environmental impacts. Requires field painting which would result in volatile organic compound emissions and could result in paint spills. • The shorter life span of paint would require more frequent maintenance, resulting in environmental impacts from mobilizing the equipment. |
| <p>Technology Alternative-4. Undergrounding Transmission Lines (Alternative to Overhead Transmission Lines)</p> <p>This alternative would construct new facilities using underground technology rather than overhead line construction, following generally the same routes as the proposed Project. Currently existing aboveground facilities would be removed.</p> | <ul style="list-style-type: none"> • Would not minimize environmental impacts through selection of routes, tower types, and locations (Objective 7). • Would not construct the Project in a cost-effective and timely manner (Objective 9). Underground construction of the T/L would result in longer construction time and greater project cost due (due to construction time and specialized manufacturing and construction requirements) than the proposed Project. | <p>Advantages</p> <ul style="list-style-type: none"> • For the most part, existing R-O-W can be utilized. <p>Disadvantages</p> <ul style="list-style-type: none"> • XLPE technology has scant operating history. • In many cases it is not possible for underground transmission lines to match the capability of overhead transmission lines without the installation of more underground cables than overhead conductors. | <p>Advantage</p> <ul style="list-style-type: none"> • Reduced visual impact from overhead structures <p>Disadvantages</p> <ul style="list-style-type: none"> • Ground disturbance from construction of transition stations with an approximate footprint of 2 to 3 acres. • Undergrounding would result in impacts to air quality from emissions from construction equipment and from dust generation during construction and use of unpaved access roads. |

**TABLE 2-3 (CONTINUED)
TECHNOLOGY ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|-------------------------|--------------------|--|---|
| | | <ul style="list-style-type: none"> • Underground 500 kV technologies in geographic areas with active fault zones has a greater potential, as compared to overhead construction, to result in prolonged service interruption because any sections requiring repair would be more difficult to identify and would take longer to repair. • Does not construct Project in a cost-effective manner due to construction time and specialized manufacturing and construction requirements. | <ul style="list-style-type: none"> • Undergrounding could result in the release of hazardous materials into the environment, either as inadvertent spills during construction or during failure of the cables and subsequent release of SF-6 gas or dielectric fluid. • Construction would result in large amounts of solid waste (i.e., soil and rock) which would have to be disposed of properly. • Trenching could affect surface features, such as habitat, soils, and surface water; it could disturb cultural resources and hazardous waste (e.g., mining waste) buried at shallow depths. • Tunneling could create noise and vibration, potentially affecting nearby structures and protected species; it could affect both surface and groundwater resources, and deeply buried geologic and paleontologic features. |

**TABLE 2-3 (CONTINUED)
TECHNOLOGY ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|--|---|--|
| <p>Technology Alternative-5. Single Circuit (Alternative to Double-circuit Segments 7 and 8)</p> <p>This alternative would construct a 500 kV transmission line between the Mira Loma and Vincent substations (Segments 6, 7, and 8), totaling 76 miles as a single-circuit T/L, mostly on existing R-O-W.</p> | <ul style="list-style-type: none"> • Would not result in the construction of facilities in an orderly, rational, and cost-effective manner (Objective 3) as it would require tear-down of the single-circuit T/L built under this alternative to accommodate future transmission requirements with a replacement double-circuit line. • Would not minimize environmental impacts (Objective 7). • Would not meet Project needs in a cost-effective and timely manner (Objective 9) because of future costs for replacing this single-circuit T/L. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • This alternative would not facilitate the possibility of adding a second 500 kV transmission line if and when one is determined to be required, e.g., when generation at TWRA exceeds 4,500 MW. • Use of single circuits does not allow conductor “phasing” for EMF reduction. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Requires removal of existing facilities and equipment with associated environmental impacts (future upgrades to double-circuit 500 kV result in additional construction impacts as they would require removal of the single-circuit line). |

**TABLE 2-4
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|---|---|---|
| <p>RA-Eliminated-1. T/L Segment Antelope to Whirlwind (Alternative to Segment 4)</p> <p>This alternative would create a new R-O-W for the 500 kV line between the existing Antelope Substation and the proposed Whirlwind Substation at a distance of at least 2,000 feet on either side of the existing Midway – Vincent No. 3 500 kV transmission line. The width of the new, separate R-O-W would be 200 feet or greater.</p> | <ul style="list-style-type: none"> • Would improve system reliability by eliminating the risk of simultaneous outage of transmission lines contained within a common transmission corridor. • Would not maximize the use of existing R-O-W (Objective 6) and would therefore result in greater environmental effects and project costs than the retained alternative. • The new corridor could move the line closer to the Antelope Valley Poppy Reserve (west side routing), or, in the alternative direction (east side routing), interfere with existing or planned development, resulting in additional environmental effects and thus not meet Objective 7. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • New separate R-O-W, 200-foot-wide in comparison to 150-foot R-O-W expansion needed for proposed project (Segment 4). • Western alignment of new R-O-W would move line closer to the Antelope Valley California Poppy Reserve, a California State Park. • Eastern alignment would potentially interfere with existing or planned development in the Antelope Valley. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Greater impacts to previously undisturbed land due to required R-O-W acquisition (would be wider than expansion along the existing R-O-W – 200 feet as compared to 150 feet.) • New access roads would need to be established, resulting in greater ground disturbance • May result in increased visual impacts by western alignment closer to the Antelope Valley California Poppy Reserve, a California State Park. |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|--|--|--|
| <p>RA-Eliminated-2. T/L Segment 5 Antelope – Vincent North – New R-O-W</p> <p>This alternative would create a new R-O-W for the 500 kV line between Antelope and Vincent at a distance of at least 2,000 feet on either side of, but not adjacent to, the existing R-O-W. The width of the new, separate R-O-W would be at least 200 feet.</p> | <ul style="list-style-type: none"> • Would improve system reliability by eliminating the risk of simultaneous outage of transmission lines contained within a common transmission corridor. • Would not maximize the use of existing R-O-W (Objective 6) and would therefore result in greater environmental effects and project costs than the retained alternative. • The new corridor could interfere with existing or planned development in the Antelope Valley, resulting in additional environmental effects and thus not meeting Objective 7. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • New access roads would need to be established due to placement of the new 500 kV T/L in a new, separate R-O-W. • Increased costs due to separate R-O-W. | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • Greater impacts to previously undisturbed land due to required R-O-W acquisition • New access roads would need to be established, resulting in greater ground disturbance |
| <p>RA-Eliminated-3. Alternative Routing through Angeles National Forest – Option 6/11A – Upgrade Transmission through ANF in Segment 6 Only (No Upgrades through ANF in Segment 11)</p> <p>In Segment 6, this option would replace one 220 kV T/L with one 500 kV T/L, and construct a new 500 kV T/L through the ANF between Vincent and the City of Duarte. No work would</p> | <ul style="list-style-type: none"> • Upgrades to Segment 6 only would compromise overall reliability of transmission to the LA Basin. • This option may not address the South of Lugo transmission constraints (Objective 5) due to locating all upgrades in one corridor. • This option would not maximize the use of existing R-O-Ws (Objective 6). Implementation of this option would require widening an existing corridor along Segment 6 and creating a new corridor. • Environmental impacts would not be minimized through selection of routes, tower | <p>Advantages</p> <ul style="list-style-type: none"> • Eliminates work in the Segment 11 designated utility corridor across the ANF <p>Disadvantages</p> <ul style="list-style-type: none"> • Would require expanding the existing R-O-W within the designated utility corridor. • Would require establishment of new 200-foot R-O-W between the cities of Duarte and Pasadena (in an east-west direction) to an area south of the Gould Substation to complete the Mesa-Vincent No. 2 500/220 kV T/L. • To completely route the new 200-foot corridor through urban areas, large number | <p>Advantages</p> <ul style="list-style-type: none"> • Eliminates work in the Segment 11 designated utility corridor across the ANF. <p>Disadvantages</p> <ul style="list-style-type: none"> • Greater impacts to previously undisturbed land due to required R-O-W acquisition (Requires approximately 8 miles of new R-O-W, east-west). • New access roads would need to be established, resulting in greater ground disturbance (to support additional construction to the area south of Gould Substation, east-west). |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|--|---|---|
| <p>be conducted within Segment 11 and the two existing T/Ls located in Segment 11 would continue to be operated as under current conditions.</p> | <p>types and locations (Objective 7). The new corridor would have to be routed through the ANF and potentially also through urban area.</p> <ul style="list-style-type: none"> Routing the T/L through existing development might require a longer route than would be possible if the route were to be built in open space. This would be counter to project objectives of using the shortest feasible routes to minimize environmental impacts (Objective 8). Would not meet project needs in a cost-effective and timely manner (Objective 9). This option would result in greater costs and might require a longer implementation period than the retained alternatives. | <p>of residences and other structures, such as schools, in densely populated areas would be affected.</p> <ul style="list-style-type: none"> Requires establishment of a new corridor and access roads between the cities of Duarte and Pasadena, to and area south of the Gould Substation, resulting in construction in previously undisturbed territory in the ANF and potentially in developed urban areas. This could also result a longer line to avoid ANF and residential and structural features. | <ul style="list-style-type: none"> May result in increased visual impacts (in foothills due to west-east orientation of new line). New transmission R-O-W could affect existing and planned development Does not eliminate corridor through ANF |
| <p>RA-Eliminated-3. Alternative Routing through Angeles National Forest – Option 6/11B – Upgrade Transmission through ANF in Segment 11 Only (No Upgrades through ANF in Segment 6)</p> <p>In Segment 11, this option would replace one 220 kV T/L with one 500 kV T/L, and construct a new</p> | <ul style="list-style-type: none"> Would not maximize the use of existing R-O-Ws to minimize effects on previously undisturbed land and resources (Objective 6). Implementation of this option would require widening an existing corridor along Segment 11 and creating a new corridor. The new corridor would have to be routed through the ANF and potentially also through urban area. This would not meet the requirements of Objective 7 to minimize | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> Would require widening of the existing R-O-W through ANF in Segment 11 Would require obtaining new R-O-W for a new utility corridor between the Gould Substation and the City of Duarte The rerouted Mira Loma – Vincent 500 kV | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> Greater impacts to previously undisturbed land due to required R-O-W acquisition. With the establishment of new access and spur roads associated with the new R-O-W in ANF along Segment 11, greater environmental impact is anticipated to occur as compared to the retained Segments 6 and 11. New access roads would need to be |

TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|--|---|--|
| <p>500 kV T/L through the ANF between the Vincent and the Gould substations. Transmission upgrades (as described in Section 2.4.1) for Segment 7 and Segment 8 would still be required. Removal of the existing Antelope – Mesa 220 kV T/L through Segment 6 would be required. The remaining two existing T/Ls in the ANF located through Segment 6 would continue to be operated as under current conditions.</p> | <p>environmental impacts, through selection of routes, tower types and location.</p> <ul style="list-style-type: none"> Routing the T/L through existing development might require a longer route than would be possible if the route were to be built in open space. Building a longer route would not meet Objective 8, to select the shortest feasible route that minimizes environmental impacts. This option would not meet project needs in a cost-effective and timely manner (Objective 9). Longer routing and associated environmental impacts would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9. | <p>T/L is longer than constructing it in the proposed Segment 6 (approximately 40 miles as compared to 27 miles).</p> <ul style="list-style-type: none"> Would not comply with reliability requirements due to co-locating within same corridor. All 500 kV T/L upgrades would be located within the same corridor causing less system reliability than with implementation of the retained options for Segments 6 and 11. Could effect existing or planned development | <p>established, resulting in greater ground disturbance (to support additional construction from Gould Substation to Duarte, west-east).</p> <ul style="list-style-type: none"> May result in increased visual impacts (foothills due to west-east orientation of new line) Does not eliminate corridor through ANF Requires removal of existing facilities and equipment with associated environmental impacts |
| <p>RA-Eliminated-3. Alternative Routing through Angeles National Forest – Option 6/11C – Co-locate all of SCE T/Ls in Either Segment 6 or Segment 11 Across the ANF</p> <p>This option would locate a total of five T/Ls through the ANF in either Segment 6 or in Segment 11, both designated utility corridors. This option requires the establishment of a</p> | <ul style="list-style-type: none"> Implementation of this option would degrade system reliability because it would locate all upgrades in one corridor, thus not meeting Objective 5. Would not maximize use of existing R-O-Ws (Objective 6). Implementation of this option would require widening the existing corridor selected for transmission and creating a new corridor, thus not meeting Objective 6. Would not minimize environmental impacts | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> It would be necessary to expand the existing R-O-W within the designated utility corridor. In addition, this option requires the establishment of a new R-O-W sufficiently wide to accommodate up to three T/Ls | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> With the establishment of new access and spur roads associated with the new R-O-W in ANF along the segment selected for transmission, greater environmental impact is anticipated to occur under this option than the retained alternatives for Segments 6 and 11. Greater impacts to previously undisturbed land due to required R-O-W acquisition |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|---|---|---|
| <p>new R-O-W sufficiently wide to accommodate up to three T/Ls between the Gould Substation in La Cañada Flintridge and the City of Duarte south of the ANF.</p> | <p>through selection of routes, tower types and location (Objective 7). The new corridor would have to be routed through urban areas.</p> <ul style="list-style-type: none"> Routing the T/L through existing development might require a longer route than would be possible if the route were to be built in open space. Building a longer route would not meet Objective 8 to select the shortest feasible route that minimizes environmental impact. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 to meet the project needs in a cost-effective and timely manner. | <p>between the Gould Substation in La Cañada Flintridge and the City of Duarte south of the ANF.</p> <ul style="list-style-type: none"> To completely route the new 200-foot corridor through urban areas, large number of residences and other structures, such as schools, in densely populated areas would be affected. | <ul style="list-style-type: none"> New access roads would need to be established, resulting in greater ground disturbance Does not eliminate corridor through ANF Requires removal of existing facilities and equipment with associated environmental impacts The east-west orientation of the new line would also result in greater visual impacts in the foothills. |
| <p>RA-Eliminated-3. Alternative Routing through Angeles National Forest – Option 6/11D – Use LADWP Transmission Corridor through ANF</p> <p>This option would locate two additional 500 kV transmission lines within one of the two designated utility corridors that currently contain LADWP transmission facilities through</p> | <ul style="list-style-type: none"> When compared to the retained alternatives for Segment 6 and Segment 11, this option could inhibit full integration of 4,500 MW of wind generation into SCE's transmission system, thus potentially compromising meeting Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner. Implementation of this option may not adequately improve the South of Lugo transmission constraint, thus compromising meeting Objective 5 – Increase Reliability in | <p>Advantages</p> <ul style="list-style-type: none"> Eliminates construction of Segment 6 and 11 T/Ls through ANF <p>Disadvantages</p> <ul style="list-style-type: none"> Requires expanded R-O-W within the designated utility corridor used by LADWP selected to accommodate two new SCE T/Ls. New 300-foot R-O-W would be required. Would still require completion of the proposed transmission upgrades between | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> New R-O-W within one of the two existing LADWP corridors would require the establishment of new access and spur roads in ANF and result in greater environmental impacts than the retained alternatives for Segments 6 and 11. May require new R-O-W within ANF along the foothills between the exiting point of the LADWP corridor and the Gould Substation and |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|--|--|--|
| <p>ANF.</p> <p>To complete the new Mira Loma-Vincent 500 kV transmission line, the transmission upgrades for proposed Segments 7 and 8 (see Section 2.4.1) would still be required.</p> <p>Removal of the existing Antelope – Mesa 220 kV T/L in Segment 6 would be required as this line segment would be disconnected. The remaining two existing T/Ls in the ANF located in Segment 6 and the two existing 220 kV T/Ls in the ANF located in Segment 11 would continue to be operated as under current conditions.</p> | <p>the LA Basin.</p> <ul style="list-style-type: none"> Implementation of this option would require widening the existing LADWP corridor selected for transmission and creating a new corridor, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through ANF and potentially through urban areas, not meeting Objective 7 – Minimize Environmental Impacts, Routing the T/L through existing development might require a longer route than would be possible if the route were to be built in open space. Building a longer route would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or potentially compromise meeting, Objective 1 and Objectives 5 through 9, this option was | <p>the City of Duarte and the Mesa Substation (proposed Segment 7) and between the Mesa Substation and the Mira Loma Substation (proposed Segment 8).</p> <ul style="list-style-type: none"> Would require removal of existing Antelope – Mesa 220 kV T/L in Segment 6. Would require continued use of two existing T/Ls in the ANF located in Segment 6 and the two existing 220 kV T/Ls in the ANF located in Segment 11. Potential impacts to a large number of residences and other structures, such as schools, in densely populated areas if routing of the new 300-foot corridor through urban areas is necessary. | <p>City of Duarte areas.</p> <ul style="list-style-type: none"> Longer route for Mira Loma – Vincent 500 kV T/L between Vincent and the City of Duarte and Mesa – Vincent No. 2 500/220 kV T/L between Vincent and the Gould Substation than the retained Segments 6 and 11. Requires removal of existing facilities and equipment with associated environmental |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|--|---|---|
| | eliminated. | | |
| <p>RA-Eliminated-3. Alternative Routing through Angeles National Forest – Option 6/11E – Create a New Corridor across ANF</p> <p>This option would locate two 500 kV transmission lines within a new corridor across the ANF.</p> <p>To complete the new Mira Loma-Vincent 500 kV transmission line, the transmission upgrades for proposed Segments 7 and 8 (see Section 2.4.1) would still be required.</p> <p>Removal of the existing Antelope – Mesa 220 kV T/L in Segment 6 would be required as this line segment would be disconnected. The remaining two existing T/Ls in the ANF</p> | <ul style="list-style-type: none"> When compared to the retained alternatives for Segment 6 and Segment 11, this option could inhibit full integration of 4,500 MW of wind generation into SCE's transmission system, thus potentially compromising meeting Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner. Implementation of this option may not adequately improve the South of Lugo transmission constraint, thus compromising meeting Objective 5 – Increase Reliability in the LA Basin. Implementation of this option would require a new corridor, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through ANF and potentially through urban areas, not meeting Objective 7 – Minimize | <p>Advantages</p> <ul style="list-style-type: none"> Eliminates construction of Segment 6 and 11 T/Ls through ANF <p>Disadvantages</p> <ul style="list-style-type: none"> Requires a new 300-foot R-O-W within a new corridor through the ANF. Requires a new 300-foot R-O-W across the ANF from the existing point towards the City of Duarte and the Gould Substation. Would still require completion of the proposed transmission upgrades between the City of Duarte and the Mesa Substation (proposed Segment 7) and between the Mesa Substation and the Mira Loma Substation (proposed Segment 8). Would require removal of existing Antelope – Mesa 220 kV T/L in Segment 6. Would require continued use of two existing | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> New R-O-W within a new corridor through the ANF would require the establishment of new access and spur roads in ANF and result in greater environmental impacts than the retained alternatives for Segments 6 and 11. May require new R-O-W within ANF along the foothills between the exiting point of the new corridor and the City of Duarte and Gould Substation areas. Longer route for Mira Loma – Vincent 500 kV T/L between Vincent and the City of Duarte and Mesa – Vincent No. 2 500/220 kV T/L between Vincent and the Gould Substation than the retained Segments 6 and 11. Requires removal of existing facilities and equipment with associated environmental |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|--|--|--|
| <p>located in Segment 6 and the two existing 220 kV T/Ls in the ANF located in Segment 11 would continue to be operated as under current conditions.</p> | <p>Environmental Impacts,</p> <ul style="list-style-type: none"> Routing the T/L through a new corridor will require a longer route than compared to the retained alternative. Building a longer route would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or potentially compromise meeting, Objective 1 and Objectives 5 through 9, this option was eliminated. | <p>T/Ls in the ANF located in Segment 6 and the two existing 220 kV T/Ls in the ANF located in Segment 11.</p> <ul style="list-style-type: none"> Potential impacts to a large number of residences and other structures, such as schools, in densely populated areas if routing of the new 300-foot corridor through urban areas is necessary. | |
| <p>RA-Eliminated-4. Route a New Corridor Along Highway 14 (Alternative to Segment 6 and Segment 11)</p> <p>This alternative would locate two 500 kV transmission lines within a new corridor outside of the ANF and along California State Highway 14. To complete the new Mira Loma-Vincent 500 kV transmission line, the transmission upgrades for</p> | <ul style="list-style-type: none"> When compared to the retained alternatives for Segment 6 and Segment 11, this option could inhibit full integration of 4,500 MW of wind generation into SCE's transmission system, thus potentially compromising meeting Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner. Implementation of this option may not adequately improve the South of Lugo transmission constraint, thus compromising | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> 300-foot corridor outside of the ANF would be routed through urban areas and large numbers of residences and other structures, such as schools, in densely populated areas would be affected. Establishment of new access and spur roads associated with new R-O-W. | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> Establishment of new access and spur roads associated with new R-O-W along Highway 14 and in the ANF, and between Rinaldi Substation area and City of Duarte south of ANF, as well as longer routing would result in greater environmental impact under this alternative than the retained alternatives for Segments 6 and 11. |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|---|---|---|
| <p>proposed Segments 7 and 8 (see Section 2.4.1) would still required. Removal of the existing Antelope – Mesa 220 kV T/L in Segment 6 would be required as this line would be disconnected. The remaining two existing T/Ls in the ANF located through Segment 6 and the two existing 220 kV T/Ls in the ANF located through Segment 11 would continue to be operated as under current conditions.</p> | <p>meeting Objective 5 – Increase Reliability in the LA Basin`.</p> <ul style="list-style-type: none"> • Would require creating two new corridors, one along Highway 14 and the other from the Rinaldi Substation area to the City of Duarte, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. • The new corridor would have to be routed through urban areas, not meeting <p>Objective 7 – Minimize Environmental Impacts.</p> <ul style="list-style-type: none"> • Routing the T/L through existing development might require a longer route than would be possible if the route were to be built in open space. Building a longer route would not meet Objective 8 – Select the Shortest Feasible Route. • This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. | <ul style="list-style-type: none"> • Removal of existing lines in Segment 6 | <ul style="list-style-type: none"> • Greater visual impacts in the foothills of the San Gabriel Mountains due to west-east orientation of new lines. |
| <p>RA-Eliminated-5. Route T/L through Cajon Pass (Alternative to Proposed</p> | <ul style="list-style-type: none"> • Would not result in sufficient system capability to interconnect and deliver up to 4,500 MW of generation resources from the TWRA; the | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> |

TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|---|--|---|
| <p>Segments 6, 7, and 8) This alternative would route the proposed Mira Loma-Vincent 500 kV T/L from SCE's existing Vincent Substation east, towards the existing Lugo Substation where the route would turn south and travel through the Cajon Pass to the Mira Loma Substation. T/Ls and structures in the unutilized portions of the existing Antelope – Mesa 220 kV T/L through the ANF would require removal. All other currently existing T/L structures in ANF would remain.</p> | <p>alternative thus does not meet Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner.</p> <ul style="list-style-type: none"> • Would not meet the applicable planning and reliability criteria, thus not meeting Objective 2 • Would result in an increase to the maximum amount of transfer capability to the LA Basin from the north and would thus not meet Objective 5 – Increase Reliability in the LA Basin. • Would require establishment of a new R-O-W through undisturbed land in SBNF, not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. | <ul style="list-style-type: none"> • Would require implementation of a complex SPS which is not practical or feasible. Constructing a new transmission in the Cajon Pass would not result in increasing the overall system capability without the construction of additional new transmission facilities. | <ul style="list-style-type: none"> • Would establish a new R-O-W between the Vincent Substation and the Lugo Substation area and within SBNF. Creating a new R-O-W through SBNF would result in greater environmental impact than the retained alternative, which would use an existing established utility R-O-W in the ANF. |
| <p>RA-Eliminated-6. Alternative Routing Through Chino Hills-Option 1 – 220 kV and 500 kV T/Ls through Chino Hills State Park (Alternative to Section within Segment 8A) This option would create new a 500 kV T/L corridor through Chino Hills State Park (Park), parallel to an existing 220 kV</p> | <ul style="list-style-type: none"> • Would require construction of a T/L through a Park, thus not meeting Objective 7 – Minimize Environmental Impacts. • Would result in a longer route than under retained Segment 8A (see Section 2.4.1); building a longer route would not meet Objective 8 – Select the Shortest Feasible Route. • Would result in greater costs and might require a longer implementation period than | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • The widened corridor from near the intersection of Pine Ave and State Highway 71 to the Chino Substation would be routed for approximately 4.5 miles through the developed areas of Chino, the remainder of the route widening would occur through the Chino Hills State Park. To route the new widened corridor | <p>Advantages</p> <ul style="list-style-type: none"> • None <p>Disadvantages</p> <ul style="list-style-type: none"> • With the establishment of new access and spur roads associated with the widened R-O-W in the Chino Hills State Park, greater environmental impact in undeveloped areas is anticipated to occur under this option than the retained alternatives for Segment 8A. |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|---|---|---|--|
| <p>T/L traversing the Park. Portions of the existing R-O-W for the Mira Loma-Olinda and Mira Loma-Walnut 220 kV T/Ls and portions of the existing Chino-Serrano and Chino-Viejo 220 kV T/Ls would be widened by up to 200 feet to accommodate the new 500 kV T/L. In urban areas, the new 500 kV T/L R-O-W would be required from a point near Pine Ave and State Highway 71 to the Chino Substation. An existing idle 220 kV T/L would be removed.</p> | <p>the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner.</p> | <p>through urban areas, residences and other structures, such as schools, in densely populated areas would be affected.</p> <ul style="list-style-type: none"> Avoidance of the Chino Hills State Park features and residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. | <ul style="list-style-type: none"> The 500 kV T/L section between the Mesa and Chino substations would be longer than constructing it under the retained Segment 8A (approximately 29 miles as compared to 26 miles). Routing additional T/L through the Chino Hills State Park would result in greater visual impacts from viewpoints in the Park. Avoiding features in the Chino Hills State Park and other may result in increased environmental impacts |
| <p>RA-Eliminated-6. Alternative Routing Through Chino Hills-Option 2 – 500 kV T/L through Chino State Park; 220 kV T/L through Chino Hills (Alternative to Section within Segment 8A)</p> <p>This option would replace the existing idle 220 kV T/L in Chino Hills with a new double-circuit 220 kV T/L, remove existing</p> | <ul style="list-style-type: none"> Implementation of this option would require construction for replacement of a T/L through Chino Hills and construction for a replacement of a T/L through Chino Hills State Park, thus not meeting Objective 7 – Minimize Environmental Impacts. It would also result in a longer route than under retained Segment 8A (see Section 2.4.1); building a longer route would not meet Objective 8 – Select the Shortest Feasible Route. | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> The widened corridor from the intersection of Pine Ave and State Highway 71 to the Chino Substation would be routed for approximately 4.5 miles through the developed areas of Chino; the remainder of the route widening would occur through the Chino Hills State Park. To route the new widened corridor through urban areas, residences and other structures, | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> With the establishment of new access and spur roads associated with the widened R-O-W in the Chino Hills State Park, greater environmental impact in undeveloped areas is anticipated to occur under this option than the retained alternatives for Segment 8A. A new switching station near the intersection of Pine Ave and State Highway 71 will result in |

TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|---|--|--|
| <p>double-circuit 220 kV T/L through the Chino Hills State Park towards the intersection of Pine Ave and State Highway 71 in Chino and replace with new 500 kV double-circuit, new 220 kV switching station near Pine Ave and State Highway 71, and new 500 kV double circuit T/L from the intersection of Pine Ave and State Highway 71 towards Chino Substation. The existing R-O-W for the double circuit Mira Loma-Olinda and Mira Loma-Walnut 220 kV T/Ls would be widened by up to 100 feet to accommodate the new 500 kV T/L. The new 500 kV T/L corridor would be required from the intersection of Pine Ave and State Highway 71 to the Chino Substation.</p> | <ul style="list-style-type: none"> This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. | <p>such as schools, in densely populated areas would be affected.</p> <ul style="list-style-type: none"> Avoidance of Chino Hills State Park features and residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. | <p>additional land disturbance not required under the retained alternatives for Segment 8A.</p> <ul style="list-style-type: none"> The 500 kV T/L section between the Mesa and Chino substations would be longer than constructing it under the retained Segment 8A (approximately 29 miles as compared to 26 miles). Routing additional T/L through the Chino Hills State Park would result in greater visual impacts from viewpoints in the Park. Avoiding features in the Chino Hills State Park and other may result in increased environmental impacts |
| <p>RA-Eliminated-7. T/L Whirlwind to Cottonwind to Windhub (Alternative to Segment 10) This alternative would route the</p> | <ul style="list-style-type: none"> Could potentially interfere with reliably interconnecting to TWRA and compliance with the RPS in an expedited manner (Objective 1). The new corridor could interfere with wind generation projects planned in the area to meet the RPS. | <p>Advantages</p> <ul style="list-style-type: none"> Adjacent to existing R-O-W for a short distance <p>Disadvantages</p> <ul style="list-style-type: none"> New R-O-W and access roads would need | <p>Advantages</p> <ul style="list-style-type: none"> None <p>Disadvantages</p> <ul style="list-style-type: none"> Greater impacts to previously undisturbed land due to required R-O-W acquisition |

**TABLE 2-4 (CONTINUED)
ROUTING ALTERNATIVES CONSIDERED AND ELIMINATED**

| Alternative Description | Project Objectives | Feasibility | Environmental Effects Compared to the Proposed Project |
|--|--|--|--|
| <p>T/L from Whirlwind Substation northwest, following existing R-O-W, toward the proposed Cottonwind Substation. From the Cottonwind Substation, the route would continue to the northwest following existing R-O-W until it reaches the foothills of the Tehachapi Range. At the foothills, the route would turn east towards the Windhub Substation.</p> | <ul style="list-style-type: none"> • Would not maximize the use of existing R-O-Ws in order to minimize effects on previously undisturbed land and resources (Objective 6). New R-O-W would be necessary from the Tehachapi Range to the Windhub Substation and new access roads would be required. | <p>to be established for the west-east portion of this alternative, crossing the foothill of the Tehachapi Range.</p> <ul style="list-style-type: none"> • Line would be routed near or through currently planned wind generation projects and potentially adversely affect amount of potential wind generation in the area | <ul style="list-style-type: none"> • New access roads would need to be established, resulting in greater ground disturbance (greater access road establishment required in comparison to proposed project). |

Figure 2-3. Alternative locations for the Whirlwind Substation (see Segment 9) and the Windhub Substation to Whirlwind Substation T/L are shown on Figure 2-4.

2.4.1.1 System Alternative

The proposed system alternative is driven by the purpose and need of the Project (Section 1.0) and has been formulated through the following directives and decisions:

- Comply with the state-mandated RPS, per California Senate Bill 107 (see Section 1.1.2)
- Interconnect and integrate power generation facilities, such as those planned for the TWRA, into SCE's electric system, per CAISO Tariff (see Section 1.1.3)
- Implement the project plan approved by the CAISO Governing Board on January 24, 2007 (see Section 2.2.2)

The project plan described the system alternative to be implemented. Because the proposed system alternative has been selected and approved by the CAISO Governing Board, other system alternatives were eliminated (see Section 2.4.2.1).

2.4.1.2 Technology Alternatives

2.4.1.2.1 Standard Core Conductor.

Description. For the TRTP, SCE would use standard core conductor equipment to support new transmission line construction. For the 500 kV T/Ls, SCE would use two bundled 2156 kcmil Aluminum Conductor Steel Reinforced (ACSR) conductor or "2B-2156 ACSR" equipment with nonspecular finish. The 220 kV T/Ls would be strung with 2B-1590 kcmil ACSR with nonspecular finish.

Project Objectives, Feasibility, and Environmental Considerations. Standard core conductor is durable and reliable in long-term use and therefore would meet project objectives. Standard core conductor is a proven, reliable technology that is also the most cost-effective choice for construction of the TRTP. Therefore, standard core conductor was retained for use on the TRTP.

2.4.1.2.2 Lattice Steel Towers.

Description. Lattice steel towers (LSTs) are a common type of transmission structure used in high voltage transmission line applications. LSTs are a freestanding steel framework that has been used to support transmission lines by many of the nation's largest utilities. For the TRTP, SCE would use LSTs to support new transmission construction on all proposed new

T/L segments. Both 220 kV and 500 kV tower types would be used; the project would also use both single-circuit and double-circuit towers.

Project Objectives, Feasibility, and Environmental Considerations. The use of LSTs offers several advantages as compared to other structure types. Primarily, LSTs have low maintenance costs and their strength-to-weight ratios allow for longer spans thus resulting in fewer structures. High quality hot-dipped galvanizing of structural members and fasteners assures long term integrity, reliability and low-maintenance. Because LSTs have a well-earned reputation for dependability and provide for longer spans resulting in fewer structures, LSTs were retained as the primary structure type used for TRTP construction.

2.4.1.2.3 Tubular Steel Poles.

Description. Tubular steel poles (TSPs) are relatively new structures used by utilities for supporting 220 kV and 500 kV transmission lines. TSPs are steel poles manufactured in long sections which taper in cross-sections from the base of the pole to top of the pole.

Project Objectives, Feasibility, and Environmental Considerations. The use of TSPs can offer an advantage over LSTs in certain types of applications, such as locations where R-O-W width is constrained or space for structure installation is limited, for example in developed urban areas. TSPs require large footings and are manufactured in long sections requiring use of long-bed trucks for transportation and heavy cranes that can lift and stack the TSP sections for assembly. Because TSP sections are long and heavy, construction of TSPs by helicopter is not practical.

TSPs would only be viable for use in specific locations within the transmission segments of the TRTP where construction equipment can be mobilized to the area. Therefore, TSPs were considered for site-specific locations.

2.4.1.2.4 Galvanized Structures.

Description. Transmission structures are galvanized for corrosion protection purposes. This process allows for shading, which helps reduce their aesthetic impact. Primary methods for shading or coloring towers include galvanizing, which is a factory-applied non-paint treatment applied prior to construction, or painting, which would be applied to steel structure elements after structure construction is completed.

Project Objectives, Feasibility, and Environmental Considerations. LSTs require a continuous electric path through each steel element to ground for personnel safety and to mitigate the effects of short circuits or lightning strikes. Thus, any coloring technique used for LSTs must preserve this continuous electrical path. Because galvanizing is a non-paint treatment, there is no coating between structure pieces that would impede surface-on-surface

contact, and the electric path between all steel elements is preserved. Galvanizing is a one-time application without the on-going maintenance-related environmental impacts associated with reapplication of new coloring. Presently, available galvanizing treatments offer a choice of appearance in shades of grey, ranging from light to very dark as shown in Figure 2-2, which can reduce aesthetic impacts.

Galvanizing is a durable method of shading transmission structures, which protects from corrosion and reduces aesthetic impact while preserving proper grounding of structures to protect personnel and equipment. SCE has retained galvanizing as the preferred alternative for LSTs.

2.4.1.2.5 Overhead Construction.

Description. The transmission segments of the TRTP would use overhead construction at voltages of 500 kV, 220 kV, and 66 kV. Under this method of construction, transmission conductor would be strung overhead on supporting steel structures. Heights of structures for the TRTP would vary widely both within and between segments depending on the electrical clearances required.

Project Objectives, Feasibility, and Environmental Considerations. Overhead construction could 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 the 500 kV transmission lines.

Overhead transmission line construction is a proven and reliable technology for high voltage transmission line applications. It is more cost-effective than underground construction and is better suited to the construction requirements of the TRTP project area, which includes two significant segments through the ANF. Therefore, overhead construction was retained for primary design of the TRTP transmission line segments.

2.4.1.3 Routing/Siting Alternatives

2.4.1.3.1 RA Retained 1 – Segment 4: Whirlwind 500/220 kV Transmission Elements.

Description. This alternative would expand the R-O-W in the existing transmission corridor between the Antelope Substation and a planned Cottonwind Substation (being permitted by Kern County as part of a wind generation project) for a new single-circuit 500 kV transmission line section between the existing Antelope Substation and the proposed Whirlwind Substation (approximately 16 miles) and two 220 kV transmission lines between the proposed Whirlwind Substation and the planned Cottonwind Substation (approximately 4 miles). To avoid multiple crossovers of existing transmission lines, the expansion for the

R-O-W for the single-circuit 500 kV transmission line section would be on the west side of the existing corridor (subsegment 1) and the expansion of the R-O-W for the two 220 kV transmission lines will be on the east side of the corridor (subsegment 2). Additional detail regarding the routing of this alternative is provided in Section 3.0 under Segment 4.

Project Objectives, Feasibility, and Environmental Considerations. While this alternative would require new R-O-W acquisition, the new R-O-W would be located parallel to existing R-O-W and would result in the shortest distance between the substations. Therefore, this design specification would achieve the most efficient use of land for energy. Additionally, providing needed transmission routing in an area adjacent to existing R-O-W would help to meet California's RPS in an expedited and cost-effective manner. Furthermore, the single-circuit 500 kV transmission line section would enhance the capability of SCE's transmission system to serve the Antelope Valley.

Segment 4 would meet the Project objectives, purpose, and need. This alternative would maximize the use and capability of the proposed new R-O-Ws on both subsegments of the corridor and meet the capacity needs of the Antelope Valley. Furthermore, by optimizing the use of each new R-O-W, impact to the environment would be reduced. Segment 4 was retained for further analysis.

2.4.1.3.2 RA Retained 2 – Segment 5: Antelope – Vincent No. 2 500 kV T/L.

Description. This alternative would utilize the existing R-O-W between the existing Antelope Substation and existing Vincent Substation for a new single-circuit 500 kV transmission line of approximately 18 miles. The R-O-W would be made available with the removal of the existing Antelope – Vincent 220 kV T/L and portion of the existing Antelope – Mesa 220 kV T/L, from Antelope Substation to a location near the Vincent Substation. To avoid and minimize crossovers of the existing Midway – Vincent No. 3 500 kV and future Antelope – Vincent No. 1 500 kV T/Ls (Segment 2 of the Antelope Transmission Project)⁴, several transmission reconfigurations will be implemented. Additional detail regarding the routing of this alternative is provided in Section 3.0 under Segment 5.

Project Objectives, Feasibility, and Environmental Considerations. Segment 5 would meet the Project objectives, purpose, and need outlined in Section 1.0. Segment 5 is needed to help meet California's RPS in an expedited and cost-effective manner. Furthermore, the single-circuit 500 kV transmission line would enhance the capability of SCE's transmission system to serve the Antelope Valley. Construction in existing R-O-Ws avoids environmental impacts

⁴ The proposed Antelope – Vincent No. 1 500 kV T/L has been licensed and was addressed in the PEA submitted to support the Antelope Transmission Project, Segments 2 & 3 (A.04-12-008).

on previously undisturbed land and resources and avoids displacement of existing and planned development. Construction of the single-circuit 500 kV transmission line next to the identical existing and future 500 kV transmission lines would reduce the visual impacts as compared to locating the transmission line in a new transmission corridor. Locating Segment 5 within existing R-O-W and adjacent to existing and planned transmission lines complies with all applicable reliability planning criteria required by NERC, WECC, and the CAISO due to redundancy provided by all other transmission lines connecting to the Antelope Substation.

Because Segment 5 would meet the objectives, purpose, and need of the Project and is consistent with the CAISO approved plan of service, the alternative was retained for analysis.

2.4.1.3.3 RA Retained 3 – Segment 6: Transmission Upgrades Between Vincent Substation and the Southern ANF Boundary with the City of Duarte.

Description. This alternative would utilize the existing R-O-W between the existing Vincent Substation and the southern boundary of the ANF with the City of Duarte. The R-O-W for the construction of 27 miles of single-circuit 500 kV transmission line, initially energized at 220 kV, would be made available with the removal of a portion of the existing Antelope – Mesa 220 kV T/L, from Vincent Substation to the southern boundary of the ANF and City of Duarte. The R-O-W for the construction of approximately 5 miles of single-circuit 500 kV transmission line would be made available with the removal of a portion of the existing Vincent – Rio Hondo No. 2 220 kV T/L, from Vincent Substation to the northern ANF boundary, south of State Highway 14. To minimize 500 kV transmission line crossovers, a transmission reconfiguration will be implemented near the northern boundary of the ANF.

No new R-O-W is required for this alternative. The completed Project would result in two roughly parallel circuits constructed to 500 kV standards on existing R-O-W from Vincent Substation to the southern boundary of the ANF. The easterly circuit would be the new Rio Hondo – Vincent No. 2 500 kV T/L, initially energized at 220 kV, and the westerly circuit would be utilized as part of the proposed Mira Loma – Vincent 500 kV T/L. Additional detail regarding the routing of this alternative is provided in Section 3.0 under Segment 6.

Project Objectives, Feasibility, and Environmental Considerations. Segment 6 would meet all Project objectives, purpose, and need outlined in Section 1.0. Design specifications would achieve the most efficient use of land for energy by working within existing R-O-W. Use of existing R-O-W facilitates meeting the RPS in an expedited and cost-effective manner. Construction within the existing R-O-W minimizes environmental impacts on previously undisturbed land and impacts to existing and planned development. Additionally, Segment 6 work would not require a new utility corridor in the ANF. This segment would assist in

removing the South of Lugo transmission bottleneck because it provides for a portion of a new 500 kV transmission line from the north to the Mira Loma Substation.

Because Segment 6 would meet the objectives, purpose, and need of the Project and is consistent with the CAISO approved plan of service, the alternative was retained for analysis.

2.4.1.3.4 RA Retained 4 – Segment 7: New Mira Loma – Vincent 500 kV T/L Section between the Boundary of the ANF with City of Duarte and the Mesa Substation.

Description. This alternative would utilize the existing R-O-W between the boundary of the ANF with the city of Duarte and the Mesa Substation, located in the Monterrey Park/Montebello area. The R-O-W for the construction of approximately 15 miles of double-circuit 500 kV transmission line would be made available with the removal of the remaining portion of the existing Antelope – Mesa 220 kV T/L, from the southern boundary of the ANF with the City of Duarte to the Mesa Substation. To make room in the existing R-O-W, several 66 kV lines near the Rio Hondo Substation, located in the City of Irwindale, and between the Rio Hondo and Mesa substations will be relocated mostly within existing R-O-W. The new double-circuit 500 kV structures would be located adjacent to existing double-circuit 220 kV structures.

The completed Project would result in two parallel 500 kV circuits, on double-circuit structures, on existing R-O-W from the southern boundary of the ANF to the Mesa Substation. Additional detail regarding the routing of this alternative is provided in Section 3.0 under Segment 7.

Project Objectives, Feasibility, and Environmental Considerations. Segment 7 would largely replace the remaining portion of an insufficient 220 kV single-circuit transmission system with an upgraded double-circuit 500 kV transmission line between the southern boundary of the ANF to SCE's existing Mesa Substation. These design specifications would achieve the most efficient use of land for energy transmission by optimizing the system components to be installed on existing R-O-W. Additionally, replacement of the existing single-circuit 220 kV transmission line with an upgraded double-circuit 500 kV transmission line would help to meet California's RPS in an expedited and cost-effective manner by anticipating and avoiding future potential upgrade needs. This segment would assist in removing the South of Lugo transmission bottleneck because it provides for a portion of a new 500 kV transmission line from the north to the Mira Loma Substation.

Because Segment 7 would meet the Project objectives, purpose, and need, and is consistent with the CAISO approved plan of service, the alternative was retained for analysis.

2.4.1.3.5 RA Retained 5 – Segment 8: New Mira Loma – Vincent 500 kV T/L Section between the Mesa Substation and the Mira Loma Substation.

Description. Except for a collective 3 miles, this alternative would utilize existing R-O-W between the existing Mesa Substation and existing Mira Loma Substation, a distance of approximately 32 miles. Existing R-O-W for the construction of approximately 25 miles of double-circuit 500 kV transmission line would be made available with the removal of an existing single-circuit 220 kV transmission line that runs from the San Gabriel Junction (two miles east of the Mesa Substation) to SCE's existing Chino Substation area. Existing R-O-W for the construction of the remaining 7 miles of double-circuit 500 kV transmission line, between the existing Chino Substation and the existing Mira Loma Substation, would be made available by replacing an existing 220 kV single-circuit transmission line, partially constructed with double-circuit 220 kV towers, with a new double-circuit 220 kV transmission line of greater capability allowing for the removal of a double-circuit 220 kV transmission line between Chino and the Mira Loma Substation. The 220 kV transmission upgrade is located in a different corridor than the 220 kV double-circuit transmission removal. To make room in the existing R-O-W, several 66 kV lines in the Chino area will also be relocated mostly within existing R-O-W or installed underground.

The completed project would result in two parallel circuits on double-circuit structures, constructed to 500 kV standards, primarily on existing R-O-W from the San Gabriel Junction to Chino Substation. On this section, the northerly circuit would be the proposed new Mira Loma – Vincent 500 kV transmission line and the southerly circuit would be the future proposed Mesa – Mira Loma 500 kV transmission line.

From Chino Substation to Mira Loma Substation, there would be two corridors of approximately 7 miles with two parallel circuits on double-circuit structures in each corridor. The northern corridor would be constructed to 220 kV standards on existing R-O-W while the southern corridor would be constructed to 500 kV standards primarily on existing R-O-W. On the 220 kV double-circuit tower the circuits would be the Chino-Mira Loma No. 1 and No. 2 220 kV T/Ls. On the 500 kV double-circuit tower, the northern circuit would be the proposed Mira Loma – Vincent 500 kV transmission line and the southerly circuit would be operated at 220 kV to provide for the Chino – Mira Loma No. 3 220 kV transmission line. Additional detail regarding the routing of this alternative is provided in Section 3.0 under Segment 8.

Project Objectives, Feasibility, and Environmental Considerations. Segment 8 would complete the circuit required to alleviate the transmission constraints experienced in the area South of Lugo and in the LA Basin area thereby addressing the reliability needs of the CAISO Controlled Grid. The design specifications of double-circuit and use of existing R-O-W would achieve the most efficient use of land for energy transmission by optimizing the

system components to be installed on existing R-O-W. Additionally, Segment 8 would help to meet California's RPS in an expedited and cost-effective manner by anticipating and avoiding future potential upgrade needs. New R-O-W requirements established contiguous to the existing R-O-W would minimize construction-related environmental impacts to previously undisturbed land resources by reducing establishment of access roads.

Because Segment 8 would meet the Project objectives, purpose, and need, and is consistent with the CAISO approved plan of service, the alternative was retained for analysis.

2.4.1.3.6 RA Retained 6 – Segment 9: Substation Facilities. Segment 9 would include the construction of a new substation, the Whirlwind Substation, as well as upgrades to several existing substations with new equipment.

Whirlwind Substation Description. The Whirlwind Substation would be a new 500/220 kV substation located approximately 4.5 miles south of the planned Cottonwind Substation near the intersection of 170th Street and Holiday Avenue in Kern County near the TWRA. Three alternative sites, A, B, and C, have been identified for the new Whirlwind Substation. All three alternatives are located in the same general area. Most activities supporting construction of the Whirlwind Substation would be common to all three alternative sites, although there would be some variation in the amount of total disturbance required based on configuration of the facility footprint and access road. Permanent land disturbance would be between 66 and 67 acres. The facility and access roads would be accommodated within a larger land area to be acquired by SCE. The proposed new Whirlwind Substation would include a 500 kV switchyard and a 220 kV switchyard to connect to the transmission lines included as part of Segment 4 (see above) and Segment 10 (see below).

Whirlwind Substation Alternative A. Alternative Site A would be located on approximately 113 acres of previously disturbed land. It is assumed that grading results in stripping an average of 2 inches over the entire substation site resulting in an estimated quantity of 15,000 cubic yards of soil mixed with small stones and organic matter. The material would be disposed of in an appropriate manner.

Whirlwind Substation Alternative B. Alternative Site B would be located on approximately 102 acres of previously undisturbed land. It is assumed that grading of the entire substation site would result in an estimated quantity of 24,000 cubic yards of soil mixed with small stones and organic matter. The material would be disposed of in an appropriate manner.

Whirlwind Substation Alternative C (Proposed). Alternative Site C would be located on approximately 106 acres, partly on previously disturbed and plowed land and partly on native terrain. The average natural slope ranges between 1 and 3 percent across the proposed site. It

is assumed that grading of the entire substation site would result in an estimated quantity of 15,000 cubic yards of soil mixed with small stones and organic matter. The material would be disposed of in an appropriate manner.

Whirlwind Substation Project Objectives, Feasibility, and Environmental Considerations.

It is important that the new substation alternatives are in line with the Cottonwind and Antelope substations and be located near proposed wind generation projects in the area to reduce routing distances and support electric transmission efficiency. The Alternative A connection would require crossing of existing 220 kV transmission lines, which decreases overall reliability. Additionally, soil stability issues could be a concern as an aquifer recharge facility is proposed for the site. Alternatives B and C are comparable with the exception of disturbed and undisturbed land.

Land disturbance and land acquisition of the three alternatives are relatively comparable. All three alternatives are feasible, would provide the shortest distance for routing between Cottonwind and Antelope substations, and require no significant transmission line extensions. The alternatives comply with CAISO requirements in the selection of the shortest feasible route that minimizes environmental impacts and project costs.

Whirlwind Substation Alternatives A, B, and C would serve the purpose of the TRTP by providing the electrical facilities necessary to integrate levels of new wind generation through construction of a new 500/220 kV substation. All three alternatives are feasible and would comply with CAISO requirements and therefore were retained for analysis.

Antelope Substation Description. The Antelope Substation portion of Segment 9 requires the expansion beyond what was previously permitted, as part of the Antelope Transmission Project,⁵ for the additional 500 kV equipment to support system voltages. The new equipment would be installed in an area of approximately 12 acres. SCE would acquire approximately 18 acres of additional land at the substation site to accommodate the additional new construction at the Antelope Substation. No upgrade to the substation's existing power system would be required. Additional lighting would be provided for the new 500 kV SVC and shunt capacitor banks.

Antelope Substation Project Objectives, Feasibility, and Environmental Considerations.

Upgrades to the Antelope Substation component of Segment 9 would support reliable energy transmission from the TWRA and would help SCE to comply with California's RPS by providing necessary substation facilities and equipment. The project would require

⁵ The proposed expansion to 500 kV of the Antelope Substation has been licensed and was addressed in the PEA submitted to support the Antelope Transmission Project, Segment 1 (A.04-12-007) (D.07-03-012). However, the increased land requirements for the installation of a 200 MVAR Static VAR Compensator (SVC) and two 500 kV, 150 MVAR each, shunt capacitor banks were not included.

disturbance of approximately 12 acres outside of the existing fenced substation boundaries; this activity would require acquisition of an additional 18 acres at the substation site. While new land would be required to accommodate the upgrades, this expansion is necessary for the overall operation, capacity, and reliability of the proposed SCE transmission system. Without the Antelope Substation upgrades, transmission constraints and reliability issues would continue in the Antelope Valley and into the LA Basin.

By providing substation facilities and related equipment necessary to reliably interconnect and deliver energy from renewable resources located in the TWRA to SCE and other California utilities, the Antelope Substation component of Segment 9 would meet the Project objectives, purpose, and need. This is an essential component of the proposed TRTP to alleviate transmission constraints in the Antelope Valley and LA Basin. The Antelope Substation component of Segment 9 was retained for further analysis.

Vincent Substation Description. Segment 9 includes upgrade of the existing 500/220 kV Vincent Substation with new equipment to accommodate new transmission connections associated with Segments 5, 6, and 11 (see below) and to support system voltages. This new equipment would necessitate two separate extensions of existing switchyards. At the southwestern corner of the facility, the south 220 kV bus extensions would require an addition to the existing limits of the graded pad. A retaining wall would be constructed and back-filled to match the existing site grade. The 500 kV switchyard would be extended to the west by approximately 880 feet where extensive new grading would be required (this activity is discussed in detail in Section 3.3.2.3). The 500 kV substation expansion would be on existing SCE fee-owned property. The 220 kV switchyard expansion would require approximately 0.2 acres of new property acquisition.

Vincent Substation Project Objectives, Feasibility, and Environmental Considerations. Upgrade of the existing Vincent Substation would accommodate new transmission line construction and system compensation elements consistent with Project objectives, purpose, and need. This component of Segment 9 would comply with the planning criteria and reliability needs in a cost-effective and timely manner while use of existing facilities would minimize environmental impacts.

By providing substation facilities and related equipment necessary to reliably interconnect and deliver energy from renewable resources located in the TWRA to SCE and other California utilities, the Vincent Substation component of Segment 9 would meet the Project objectives, purpose, and need. This is an essential component of the proposed TRTP to help alleviate transmission constraints South of Lugo as well as in the Antelope Valley. The Vincent Substation component of Segment 9 was retained for further analysis.

Mesa Substation Description. The Mesa Substation portion of Segment 9 includes upgrade of the existing 220 kV switchyard at the Mesa Substation with additional equipment to accommodate the connection of the new Mesa – Vincent No. 2 220 kV T/L (see discussion of Segment 11). All upgrades at the Mesa Substation would take place within the existing fence line.

Mesa Substation Project Objectives, Feasibility, and Environmental Considerations. The Mesa Substation component of Segment 9 would install new and upgrade existing equipment at the Mesa Substation to allow for interconnection of a new 220 kV transmission line. Upgrading the existing system avoids the need for new or redundant development and unnecessary impact to the environment.

The Mesa Substation component of Segment 9 would meet the Project objectives, purpose, and need by providing connection for existing and future transmission requirements. The Mesa Substation would avoid unnecessary impact to the environment by installing equipment within the existing fence line. The Mesa Substation upgrade was retained for further analysis.

Gould Substation Description. The Gould Substation portion of Segment 9 would include upgrade of the existing 220 kV switchyard to accommodate the connection of the new transmission line formed by utilizing a portion of the existing Pardee – Eagle Rock 220 kV T/L (see discussion of Segment 11) as well as equipment existing bus positions for both 220/66 kV transformer banks to comply with SCE’s Line and Bus Criteria. All upgrades at the Gould Substation would take place within the existing fence line.

Gould Substation Project Objectives, Feasibility, and Environmental Considerations. The Gould Substation component of Segment 9 would upgrade the existing facilities and equipment at the Gould Substation and provide for the connection of necessary transmission. Upgrading the existing system avoids the need for new or redundant development and unnecessary impact to the environment. The use of existing facilities and equipment also result in meeting the Project needs in a cost-effective and timely manner.

The Gould Substation component of Segment 9 would upgrade existing equipment and facilities to meet the Project objectives, purpose, and need in a cost- and time-effective manner without unnecessary impact to the environment. The Gould Substation upgrade was retained for further analysis.

Mira Loma Substation Description. The Mira Loma Substation portion of Segment 9 would include the equipping of a 500 kV position to terminate new Mira Loma – Vincent 500 kV T/L as described under Segment 8. All work would take place within the existing Mira Loma fence line.

Mira Loma Substation Project Objectives, Feasibility, and Environmental Considerations.

The Mira Loma Substation component of Segment 9 would upgrade the existing facilities and equipment at the Mira Loma Substation and ultimately assist in alleviating existing transmission constraints and provide more reliable transmission to LA Basin. Upgrading the existing system avoids the need for new or redundant development that would result in additional costs and time. Additionally, this would avoid unnecessary impact to the environment.

The Mira Loma Substation component of Segment 9 would meet the Project objectives, purpose, and need without unnecessary impact to the environment by installing equipment within the existing fenced line. The Mira Loma Substation upgrade was retained for further analysis.

2.4.1.3.7 RA Retained 7 – Segment 10: New Whirlwind – Windhub 500 kV Transmission Line.

Description. This alternative would require new R-O-W for a new 17-mile single-circuit 500 kV transmission line between the Windhub and Whirlwind substations. Segment 10 would provide a transmission system connection to the planned Windhub Substation⁶ in a new 330-foot-wide R-O-W that is separated by at least 2,000 feet from the 500 kV transmission line associated with Segment 3 of the Antelope Transmission Project⁷. The route would represent the most direct route feasible for transmitting energy between the Windhub and Whirlwind substations.

Several alignment alternatives were considered for siting a new 500 kV transmission line between the recently permitted Windhub substation and the proposed new Whirlwind substation. The goal in identifying appropriate alignment alternatives was to find the least environmentally intrusive alignment.

The proposed new single-circuit 500 kV transmission line would exit the south side of the Windhub Substation generally heading southwest for approximately 4 miles, where the route would turn west for less than half a mile, and then turn south for approximately 3 miles. At this point, the route would turn southwest and parallel the south side of Petroleum Road for approximately 9 miles to the intersection of Rosamond Boulevard and North 170th Street. The route would then turn south for less than a mile where the transmission line would enter the east side of the proposed new Whirlwind Substation.

⁶ The proposed Windhub 500/220/66 kV Substation has been licensed and was addressed in the PEA submitted to support the Antelope Transmission Project, Segments 2 and 3 (A.04-12-008) (D.07-03-045).

⁷ The proposed Antelope-Windhub 500 kV T/L has been licensed and was addressed in the PEA submitted to support the Antelope Transmission Project, Segments 2 and 3 (A.04-12-008) (D.07-03-045).

Two alignment alternatives, Segment 10A and 10B, were considered for the western portion of Segment 10.

- **Alternative Segment 10A.** This alternative route would mostly parallel the existing Los Angeles Aqueduct and access roads. The final Segment 10A corridor, including the appropriate portions of Segment 10, would be approximately 18 miles long.
- **Alternative Segment 10B.** This alternative route would follow the Alternative Segment 10A for approximately 2.5 miles then head west for approximately 4 miles. At this point, the route turns south along the undesignated 160th Street West for approximately 2 miles. From this point, the route realigns with Segment 10A. The final Segment 10B corridor, including appropriate portions of Segments 10 and 10A, would be approximately 19 miles long.

Project Objectives, Feasibility, and Environmental Considerations. Segment 10, 10A, and 10B generally meet the Project objectives, purpose, and need and further provide the critical interconnection of wind generation resources in the TWRA to the SCE transmission line system to comply with California's RPS. Furthermore, the routing for each of these alternative corridors, and the spacing from the already permitted Segment 3 near the eastern extension of Segment 10, were selected and designed to meet NERC and WECC spacing and positioning requirements to optimize reliability and integrity of the proposed system. Locating the transmission line adjacent to the already permitted Segment 3 would limit the amount of generation resource that could be interconnected in the Windhub Substation area to no more than 1,400 MW. This limitation is due to the fact that CAISO Planning Criteria caps the amount of generation that can be tripped under simultaneous outages of common corridor transmission lines. Because only two 500 kV transmission lines would be interconnect to the Windhub Substation, loss of both transmission lines would result in effectively tripping all generation connected in this area.

Because acquisition of a new R-O-W would be required, the time and cost effectiveness of each of the three routing alternatives would be comparable. However, because Segment 10 is more direct, the efficiency of this line would be expected to be slightly improved. Each of these alternatives would provide the necessary capability to reliably support projected load growth in the Antelope Valley and transmit energy further south into the LA Basin. Design components, such as tower types and numbers, and the alignment corridor routes for each of these alternatives were selected with an objective to minimize impacts to the environment. Furthermore, the proposed and alternate R-O-Ws that would be acquired are through private land and do not include any physical hindrances, such as topography or residential housing, to this type of development.

Segment 10 would be an essential leg of the proposed transmission line as it provides an additional point of connection to the Windhub Substation for delivery of wind resources from the TWRA. Because a new R-O-W would be required in this corridor, three routing options were identified for Segment 10. While Alternative Segments 10A and 10B are less direct than Segment 10 and, therefore, potentially less efficient, they are considered feasible and otherwise meet the Project objectives, purpose, and need. Each of the three alignment options was retained for analysis to determine which alignment would provide a reliable conduit with the least amount of environmental impact.

2.4.1.3.8 RA Retained 8 – Segment 11: New Mesa – Vincent (via Gould) 500/220 kV Transmission Line.

Description. This alternative would mostly utilize the existing R-O-W between the existing Vincent Substation and the existing Gould Substation to construct a new 500 kV transmission line. The R-O-W for the construction of 19 miles of single-circuit 500 kV transmission line, initially energized at 220 kV, would be made available with the removal of a portion of the existing Pardee – Eagle Rock 220 kV T/L, from near Vincent Substation to the Gould Substation area. R-O-W widening is required for approximately 3 miles from Gould Substation north towards the Vincent Substation. Under this alternative, completion of the new transmission line between the Vincent and Mesa substations is provided by installing 18-miles of conductor on the vacant side of the double-circuit 220 kV LSTs, supporting the existing Eagle Rock – Mesa 220 kV T/L, and connecting it to the new 500 kV transmission line section forming the new Vincent – Mesa 500/220 kV T/L. To continue to provide adequate service, the remaining portions of the existing Pardee – Eagle Rock 220 kV T/L will be terminated into the Vincent and Gould substations.

Project Objectives, Feasibility, and Environmental Considerations. The central goal of Segment 11 is to optimize the use of the existing transmission corridor by upgrading the facilities that limit system capability. This proposal would upgrade an existing SCE corridor by replacing an existing 220 kV line with a 500 kV line between the Gould and Vincent substations and adding a new 220 kV transmission line section alongside an existing 220 kV line between the Gould and Mesa substations. This would maximize the capability and use of existing transmission corridors, minimize environmental impacts, and avoid significant waste associated with multiple tear-down and rebuild construction activities. The use of the 500 kV design specifications on the northern extension of Segment 11, as well as the installation of the second 220 kV transmission line section along the southern portion, would achieve the most efficient use of land for energy and also help to meet California's RPS in an expedited and cost-effective manner. Furthermore, these upgrades would alleviate transmission constraints leading into the LA Basin.

Segment 11 would meet the Project objectives, purpose, and need. This alternative would maximize the use of the existing SCE corridor by upgrading the facilities that limit system capabilities while limiting impacts to the environment and optimizing existing facilities and resources. Furthermore, Segment 11, as implemented through this alternative, would alleviate the overburdening of current facilities and enhance reliability in the SCE transmission system to the LA Basin. Segment 11 was retained for further analysis.

2.4.2 Alternatives Considered and Eliminated

2.4.2.1 System Alternatives

System alternatives were developed in conjunction with a collaborative study group with representation from state electric system regulators, utility planners, and developers.

2.4.2.1.1 System Alternative 1 – Transmission Lines to Midway Substation.

Description. The Midway Substation is owned and operated by PG&E and located near Bakersfield. System alternatives include transmission lines from the TWRA to the Midway Substation and upgrades to the Midway Substation.

Project Objectives, Feasibility, and Environmental Considerations. The participants in the CS RTP ruled out transmission lines to Midway Substation from further consideration. These eliminated system alternatives would result in a transmission line that would be approximately 94 miles longer than the transmission line proposed to be constructed between SCE's existing Antelope Substation and the proposed Whirlwind Substation (Segment 4). Transmission lines to the Midway Substation would require a new R-O-W and would therefore result in greater land disturbance than the proposed Project.

This alternative does not meet the Project objectives of maximizing use of existing R-O-W (Objective 6 – Maximize Use of Existing R-O-W and Corridors) and selecting the shortest feasible route that minimizes environmental impacts where new R-O-W is required (Objective 8 – Select the Shortest Feasible Route).

2.4.2.1.2 System Alternative 2 – Non-transmission System.

Description. Non-transmission system alternatives include the development of in-basin generation instead of interconnecting generation from the TWRA and implementation of demand-side management and energy efficiency programs.

Project Objectives, Feasibility, and Environmental Considerations. 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 CAISO Tariff, SCE is obligated to interconnect and integrate power generation facilities into

its electric system. Numerous applications have been submitted by generation developers requesting interconnection with the TWRA (see Section 1.1.4). Because SCE is obligated to interconnect generation as requested, non-transmission system alternatives would not eliminate the need to provide the electrical facilities necessary to integrate levels of new generation in excess of 700 MW and up to approximately 4,500 MW in the TWRA.

The Non-Transmission System Alternative does not interconnect and integrate generation resources in the TWRA (Objective 1 – Construct in an Orderly, Rational, and Cost-effective Manner); therefore, this alternative was eliminated from further consideration.

2.4.2.2 Technology Alternatives

2.4.2.2.1 Technology Alternative 1 – Composite Core Conductor Alternative (Alternative to Standard Core Conductor).

Description. This alternative involves replacing the conductor on the existing 220 kV single-circuit towers between the Vincent Substation and the Mesa Substation, and between the Mesa Substation and the Chino Substation, adding towers where necessary, along the proposed routes of Segments 6, 7, 8, and 11 of the SCE TRTP (see Section 3.0). The replacement conductor would use a lightweight composite core wrapped with high-performance, trapezoid-shaped aluminum alloy wires. This is a new technology for overhead electrical power transmission conductors for which limited field test data exists. This new technology can provide an increase in capacity (up to 50 percent) over conventional conductors with similar mechanical properties. Where appropriate, these conductors could be installed on the existing towers without the need for new construction. However, existing towers south of the Vincent Substation within the ANF and between the Mesa and Chino substations would not be able to support the weight of the composite core conductor that would be needed to provide for the required capacity increase. This determination was made by evaluating the use of composite core conductors utilizing design wind criteria and applying the resulting design requirements for mechanical loads and composite conductor weights to the existing structures. SCE's evaluation determined that the existing structures would fail under the new weight and certain wind conditions. It was also determined that the resulting conductor sag would not meet the minimum CPUC General Order-95 line clearance requirements (vertical clearance from ground). In addition, the existing towers would not allow SCE to operate the existing transmission lines between the Mira Loma Substation and the Vincent Substation at 500 kV because the tower design does not provide adequate spacing for operation at 500 kV (horizontal clearance between phases). Therefore, the existing tower structures would have to be replaced to provide sufficient mechanical strength and adequate clearances for ultimate operation at 500 kV.

Project Objectives, Feasibility, and Environmental Considerations. Because the composite core conductor is a new technology, it has several drawbacks when it is compared to the standard core conductor. While the United States Department of Energy Technical Review Committee on Composite Core Conductors has deemed several composite core conductors as a “commercial product,” the technology is not supported by sufficient field experience and, therefore, SCE finds that its reliability in long-term use is unknown. The technology is 10 to 15 times more expensive than the standard core conductor and more fragile than conventional conductors. And finally, the amount of increased system transmission capability on a 220 kV voltage level is limited by other existing 220 kV transmission elements between the Vincent and Pardee substations and the LA Basin. Therefore, the use of composite core conductor does not represent an added benefit to the system.

With implementation of this alternative, the existing towers along the proposed Segments 6, 7, 8, and 11 of the TRTP would have to be replaced to provide sufficient mechanical strength and adequate clearances for ultimate operation of 500 kV. The use of composite core conductor does not reduce any of the environmental impacts as compared to the retained Project alternatives. In addition, implementation of this alternative would increase the cost of the TRTP but it would not contribute to greater system reliability.

Technology Alternative 1 would result in greater Project costs but would not provide reliable interconnection and therefore would not meet Objective 1 – Construct in an Orderly, Rational, and Cost-effective Manner. Because the alternative would meet neither Objective 1 nor Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner, it was eliminated from further consideration.

2.4.2.2.2 Technology Alternative 2 – Tubular Steel Poles in the ANF (Alternative to Lattice Steel Towers).

Description. TSPs are an alternative type of transmission structure that could be used to support conductor on the transmission segments of the TRTP. TSPs would be used as an alternative to the use of LSTs. Both types of structures are currently in use by SCE.

Project Objectives, Feasibility, and Environmental Considerations. TSPs can offer an advantage over LSTs in certain types of applications, such as locations where R-O-W width is constrained, or space for structure installation is limited, for example in developed urban areas. TSPs are placed on a single footing, while LSTs require four footings. Because the single footing of a TSP is larger in volume than the four footings combined of the LSTs, there would be more land disturbance associated with installation of a TSP. During construction, LSTs are assembled from numerous elements that may be transported on smaller, lighter trucks. TSPs, however, require heavy equipment to transport and construct the individual long and heavy TSP sections. Trucks with a minimum of 50-foot inside-turn

radius would be necessary to transport the pole sections. In addition, heavy cranes would be required to construct because TSPs cannot be constructed using a helicopter because of their weight. Therefore, they cannot be installed in environmentally sensitive or rough terrain locations where helicopter construction typically would be used to avoid access and spur road construction.

Implementation of Technology Alternative 2 is not feasible in the ANF areas where access roads with a suitably wide turning radius and space for crane construction cannot be provided. In addition, the greater footprint and access road requirements, compared to LSTs which are used for the proposed Project, would not minimize environmental effects (Objective 7 – Minimize Environmental Impacts). Therefore, this alternative was eliminated from further consideration in these areas.

2.4.2.2.3 Technology Alternative 3 – Painted Transmission Structures (Alternative to Galvanized Structures).

Description. Under this alternative, transmission structures would be painted after construction rather than utilizing the proposed, galvanized structures, which do not require painting after construction. Presently, available galvanized treatments offer a choice of appearance in shades of grey, ranging from light to very dark as shown on Figure 2-2. Both galvanized and paint coatings can be used on transmission towers to protect the steel surfaces.

Project Objectives, Feasibility, and Environmental Considerations. For personnel safety, LSTs require a continuous electrical path through each steel element to the ground. This electrical path is achieved when the individual galvanized steel elements are securely bolted together. Painting or powder coating of steel lattice structure elements prior to assembly impedes the continuous electric path because it creates an insulator between the elements. Therefore, paint applications for lattice steel structures would need to be applied in the field *after* assembly of the individual pieces into a tower. Powder coating would not be possible after construction because it must be applied in a specialized closed environment.

From a practical perspective, SCE can paint structures in the field and has done so for very specific purposes. However, painting in the field could have more long-term environmental effects associated with ongoing maintenance than galvanizing, including emission and inadvertent paint spills. The paint would have to be applied in the open air where volatile organic compound emissions would occur and paint spills could occur. In addition, paint has a life cycle much shorter than the structure. This would require repainting over the life of the Project resulting in additional environmental impacts associated with mobilizing the equipment required to each of the tower sites and scraping off loose paint before a new paint coat can be applied. To reduce the long-term environmental effects resulting from the use of

painted structures, both on USFS and non-USFS lands, SCE uses galvanizing or similar factory-applied conductive non-paint treatments.

Because painted structures would require periodic applications of new paint coatings resulting in higher maintenance costs related to the TRTP and the environmental impacts would be increased as compared to the galvanized alternative, Technology Alternative 3 was eliminated from further consideration.

2.4.2.2.4 Technology Alternative 4 – Undergrounding Transmission Lines (Alternative to Overhead Transmission Lines).

Description. Transmission lines are overhead conductors or underground cables capable of transmitting 220 kV or 500 kV. Lines energized at lower voltages are subtransmission or distribution lines. The following four underground technologies are commercially available for 500 kV: high-pressure fluid-filled (HPFF) cables; self-contained fluid-filled (SCFF); solid dielectric (XLPE) transmission cables; and compressed gas insulated transmission lines (CGTL).

While HPFF and SCFF are feasible technologies, they have a potential to release dielectric fluid into the environment. World-wide, the CGTL system has been installed for only up to 2 miles in length. Its reliability over greater distances is not known. The assembly of CGTL requires a dust-controlled environment to avoid particle pollution of the insulated gas. CGTL may be feasible for short distances, however the cost is extremely high (ranging from \$25 to \$50 million per mile, per circuit, depending on installation requirements). CGTL also requires greater ongoing maintenance to ensure reliable operation.

The first long-distance 500 kV XLPE cables 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).

A transition station, approximately 80 feet high and with a footprint of approximately 2 to 3 acres, would be required at each end of an underground segment to transfer the 500 kV

transmission lines from overhead to underground and vice versa. If HPFF cable were installed, additional space would be required at the transition station for the fluid pressurization equipment.

This alternative would construct new facilities using underground technology rather than overhead line construction, following generally the same routes as the proposed Project. Currently, existing aboveground facilities would be removed. The CAISO approved the proposed Project with 500 kV design and construction standards to provide for adequate system capability, in a manner that meets reliability planning standards, and to avoid constructing and tearing down multiple 220 kV transmission lines. Underground construction must also provide for the same system capability as overhead construction and must therefore be capable of operating at 500 kV. Because bare overhead conductors generally have significantly higher capability, as compared to the same conductor that is covered with electrical insulation and buried in the ground, larger conductors will be required to maintain the same transmission capacity. Underground transmission cable manufacturing constraints limit the maximum cable size. In many cases, it is not possible for underground transmission lines to match the capability of overhead transmission lines without the installation of more underground cables than overhead conductors. For example, a 500 kV overhead transmission line requires six conductors, whereas undergrounding would require a minimum of nine, and possibly up to twelve, cables.

In relatively flat terrain, such as residential areas in the LA Basin, installing 500 kV underground facilities would require trenching of the cable and associated underground infrastructure (e.g., cooling equipment, splice vaults, and underground ducts). The R-O-W above the underground facilities would need to be maintained undeveloped and clear of vegetation.

In mountainous terrain, such as the ANF, the underground alternative would require a combination of trenching and tunneling due to the mechanical restrictions associated with 500 kV underground cables. Underground 500 kV cables do not provide sufficient flexibility to follow terrain in mountainous areas. In addition, the gravitational pull on the cables in terrain with significant uphill and downhill grades would require the installation of anchoring facilities in order to minimize the cable slippage. As with any high-voltage facility, the design would include the installation of the cables and associated underground infrastructure with proper access for maintenance. A sufficiently large tunnel through the ANF would be required and the land above the trenched underground facilities would need to be maintained clear of vegetation. These requirements would increase the overall Project environmental impacts and costs.

Installation of CGTL would require an open trench or underground tunnel approximately 15 feet in diameter with room for a maintenance vehicle to travel the length of the installation and a transition station at each end.

Due to the time required for repair of underground facilities additional cables or CGTL tubes would have to be installed as spares. This would further increase the impact by requiring additional ducts or tunnels.

Project Objectives, Feasibility, and Environmental Considerations. Underground construction of the T/L would result in greater land disturbance, a longer construction period, and greater project cost (due to a longer construction period, and specialized manufacturing and construction requirements) than the proposed Project. In addition, underground 500 kV technologies in geographic areas with active fault zones have a greater potential, as compared to overhead construction, to result in prolonged service interruption because any sections requiring repair would be more difficult to identify and would take longer to repair. While overhead conductors can be repaired within days, underground cables might take months to repair.

Underground installation of cables could be achieved with trenching and tunneling construction methods. Both construction methods would result in impacts to air quality from emissions from construction equipment and from dust generation during construction and the use of unpaved access roads. Both could result in the release of hazardous materials into the environment, either as inadvertent spills during construction or during failure of the cables and subsequent release of SF-6 gas or dielectric fluid. Both would result in large amounts of solid waste (i.e., soil and rock) which would have to be disposed of properly. Trenching would potentially affect surface features, such as habitat, soils, and surface water. Furthermore, it could disturb cultural resources and hazardous waste (e.g., mining waste) buried at shallow depths. Tunneling could create noise and vibration, potentially affecting nearby structures and protected species. Tunneling could affect both surface and groundwater resources, as well as deeply buried geologic and paleontologic features.

Undergrounding portions of the TRTP would neither minimize environmental impacts (Objective 7 – Minimize Environmental Impacts) nor construct the Project in a cost-effective and timely manner (Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner). In addition, undergrounding 500 kV transmission lines over distances exceeding 2 miles has not been thoroughly field-tested and the technology's reliability is thus unknown. Therefore, Technology Alternative 4 was eliminated from further consideration.

2.4.2.2.5 Technology Alternative 5 – Single Circuit (Alternative to Double-circuit Segments 7 and 8).

Description. This alternative would construct a 500 kV transmission line between the Mira Loma and Vincent substations (Segments 6, 7, and 8) for a total of 76 miles as a single-circuit transmission line mostly on existing R-O-W.

Project Objectives, Feasibility, and Environmental Considerations. This alternative would not facilitate the possibility of adding a second 500 kV transmission line if and when one is determined to be required, for example, when generation at TWRA exceeds 4,500 MW (see Section 1.1.4). As a result, the need for future upgrades would necessitate complete tear-down of the single-circuit 500 kV transmission line between the City of Duarte and the Mira Loma Substation (Segment 7 and 8) and rebuilding it with a double-circuit 500 kV transmission line (i.e., the proposed Project), as well as minor system rearrangement. No upgrades to Segment 6 are anticipated beyond installation of a single-circuit 500 kV transmission line. Use of single circuits in Segments 7 and 8 does not provide SCE with the option to utilize conductor “phasing” for electric and magnetic field (EMF) reduction in urban areas.

This alternative would not result in the construction of facilities in an orderly, rational, and cost-effective manner (Objective 3 – Construct in an Orderly, Rational, and Cost-effective Manner) as it would require tear-down of the single-circuit transmission line built under this alternative to accommodate future transmission requirements with a replacement double-circuit transmission line. Such future upgrades would result in construction impacts that would be avoided with implementation of the proposed Project. Constructing a single-circuit transmission line now and replacing it in the future would not minimize environmental impacts (Objective 7 – Minimize Environmental Impacts) and costs (Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner). Because the alternative does not meet Objectives 3, 7, and 9, it was eliminated from further analysis.

2.4.2.3 Routing/Siting Alternatives**2.4.2.3.1 RA Eliminated 1 – Antelope Substation to Whirlwind Substation (Alternative to Segment 4).**

Description. This alternative would create a new R-O-W for the 500 kV transmission line between the existing Antelope Substation and the proposed Whirlwind Substation at a distance of at least 2,000 feet on either side of the existing Midway – Vincent No. 3 500 kV T/L. The width of the new, separate R-O-W would be 200 feet or greater.

Project Objectives, Feasibility, and Environmental Considerations. This alternative would improve system reliability by eliminating the risk of simultaneous outage of transmission

lines contained within a common transmission corridor. However, placement of the new 500 kV transmission line in a new, separate R-O-W would require the establishment of new access roads. The width of the new, separate R-O-W would be at least 200 feet, which would be greater than the 150-foot-wide R-O-W expansion needed for construction of new transmission facilities adjacent to existing transmission (see description of Segment 4 of the proposed Project, Section 2.4.1). In addition, a western alignment of the new R-O-W would move the transmission line closer to the Antelope Valley California Poppy Reserve, a California State Park and potentially increase visual impacts over those associated with the retained alternative. An eastern alignment would potentially interfere with existing development in the Antelope Valley.

This alternative would not maximize the use of existing R-O-W (Objective 6 – Maximize Use of Existing R-O-W and Corridors) and would therefore result in greater environmental effects and project costs than the retained alternative. In addition, the new corridor could move the transmission line closer to the Antelope Valley Poppy Preserve (west side routing), or, in the alternative direction (east side routing), interfere with existing or planned development, resulting in additional environmental effects and thus not meeting Objective 7 – Minimize Environmental Impacts. Therefore, this alternative was eliminated.

2.4.2.3.2 RA Eliminated 2 – Antelope Substation to Vincent Substation New R-O-W.

Description. This alternative would create a new R-O-W for the 500 kV transmission line between the Antelope and Vincent substations on either side of, but not adjacent to, the existing R-O-W. The width of the new, separate R-O-W would be at least 200 feet.

Project Objectives, Feasibility, and Environmental Considerations. This alternative would improve system reliability by eliminating the risk of simultaneous outage of transmission lines contained within a common transmission corridor. However, placement of the new 500 kV transmission line in a new, separate R-O-W would require the establishment of new access roads. The width of the new, separate R-O-W would be at least 200 feet. No new R-O-W and access roads are anticipated to be required for the retained Segment 5 alternative (see Section 2.4.1). Because this alternative would require new R-O-W and associated access roads, this alternative would also have a higher cost than the retained alternative. New R-O-W acquisition could also potentially interfere with existing or planned development.

This alternative would not maximize the use of existing R-O-W (Objective 6 – Maximize Use of Existing R-O-W and Corridors) and would therefore result in greater environmental effects and project costs than the retained alternative. In addition, the new corridor could interfere with existing or planned development in the Antelope Valley, resulting in additional environmental effects and thus not meeting Objective 7 – Minimize Environmental Impacts. Therefore, this alternative was eliminated.

2.4.2.3.3 RA Eliminated 3 – Alternative Routing through Angeles National Forest.

SCE considered several options for routing new transmission lines through ANF. Table 2-5 summarizes the existing and proposed conditions as well as the options for routing the transmission lines through ANF. The options would entail removal of existing transmission lines, replacement of existing transmission lines with new transmission lines, and addition of new transmission lines. The proposed conditions are discussed in Section 2.4.1 under the descriptions for Segment 6 and Segment 11. The options and the rationale for eliminating them are further discussed below.

**TABLE 2-5
TRANSMISSION LINE ROUTING OPTIONS
THROUGH ANGELES NATIONAL FOREST**

| Option | Segment 6 | | Segment 11 | |
|--|--|------------|------------|------------|
| | 220 kV T/L | 500 kV T/L | 220 kV T/L | 500 kV T/L |
| Existing Conditions | 2 | 1 | 2 | 0 |
| Proposed Segment 6 and Segment 11 ¹ | 1 | 2 | 1 | 1 |
| Option 6/11A – All Upgrades in Segment 6 | 1 | 3 | 2 | 0 |
| Option 6/11B – All Upgrades in Segment 11 | 1 | 1 | 1 | 2 |
| Option 6/11C – Co-locate all SCE T/Ls in Either Segment 6 or Segment 11 Across the ANF | Create one corridor along either Segment 6 or along Segment 11 with two 220 kV and three 500 kV T/Ls | | | |
| Option 6/11D – Use LADWP Transmission Corridor through ANF | 1 | 1 | 2 | 0 |
| | Two new 500 kV T/Ls in LADWP corridor | | | |
| Option 6/11E – Create a New SCE Corridor Across the ANF | 1 | 1 | 1 | 0 |
| | Create a third SCE corridor across ANF with two 500 kV T/Ls | | | |

¹ Described in Section 2.4.1.

Option 6/11 A – Upgrade Transmission through ANF in Segment 6 Only (No Upgrades through ANF in Segment 11).

Description. In Segment 6, this option would replace one 220 kV transmission line with one 500 kV transmission line, and construct a new 500 kV transmission line through the ANF between Vincent and the City of Duarte. To support this option, it would be necessary to expand the existing R-O-W within the designated utility corridor. In addition, this option requires the establishment of a new 200-foot R-O-W between the cities of Duarte and Pasadena (in an east-west direction) to an area south of the Gould Substation to complete the new Mesa-Vincent No. 2 500/220 kV T/L. The circuit would be completed by stringing an existing vacant tower position to the Mesa Substation. No work would be conducted within

Segment 11 and the two existing transmission lines located in Segment 11 would continue to be operated as under current conditions.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this option would result in maintaining two transmission lines in Segment 11 and four transmission lines in Segment 6, in two separate existing, designated utility corridors. While upgrades to Segment 6 would remove the South of Lugo transmission constraint, locating three 500 kV transmission lines in a common corridor between Vincent Substation and the City of Duarte would compromise overall reliability of transmission to the Rio Hondo and Mesa Substation area of the LA Basin. In addition, the new east-west corridor from the southern boundary of the ANF to an area south of the Gould Substation would be routed either entirely through the ANF or partially through the ANF and partially through urban areas. These urban areas potentially include areas in the cities of Altadena, Arcadia, Duarte, Monrovia, Pasadena, and Sierra Madre. To completely route the new 200-foot corridor through urban areas, large number of residences and other structures, such as schools, in densely populated areas would be affected.

Because all 500 kV transmission line upgrades would be located within the same corridor, system reliability would be degraded compared to the reliability achieved with implementation of the retained options for Segments 6 and 11 (see Section 2.4.1). This option would require a new R-O-W within the existing corridor and establishment of new access and spur roads in the ANF along Segment 6, resulting in greater environmental impact than the retained options for Segments 6 and 11. The Mesa – Vincent No. 2 500/220 kV T/L under this option is longer than constructing it under the retained Segment 11 (approximately 35 miles as compared to 22 miles). In addition, this option would require the establishment of a new corridor and access roads for a new corridor between the cities of Duarte and Pasadena, to an area south of the Gould Substation, resulting in construction in previously undisturbed territory in the ANF and, potentially, in developed urban areas. To avoid certain features in the ANF and residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. The east-west orientation of the new line would result in visual impacts in the foothills.

Implementation of this option would compromise overall reliability of transmission to the LA Basin because it would locate all upgrades in one corridor, thus not meeting Objective 5 – Increase Reliability in the LA Basin. Implementation of this option would require widening an existing corridor along Segment 6 and creating a new corridor, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through the ANF and, potentially, also through urban area, not meeting Objective 7 – Minimize Environmental Impacts. Routing the proposed Vincent – Mesa 500/220 kV T/L through Segment 6 will result in a longer route as compared to routing it

through Segment 11 and would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or would potentially compromise meeting, Objectives 5 through 9, it was eliminated.

Option 6/11 B – Upgrade Transmission through ANF in Segment 11 Only (No Upgrades through ANF in Segment 6).

Description. In Segment 11, this option would replace one 220 kV transmission line with one 500 kV transmission line, and construct a new 500 kV transmission line through the ANF between the Vincent and the Gould substations. The existing R-O-W for Segment 11 would be widened. In addition, this option requires the establishment of a new 200-foot R-O-W between the City of La Cañada Flintridge and the City of Duarte. To enable completion of the new Mira Loma – Vincent 500 kV T/L, transmission upgrades (as described for the proposed Project in Section 2.4.1) between the City of Duarte and the Mesa Substation (Segment 7), and between the Mesa Substation and the Mira Loma Substation (Segment 8) would still be required. In addition, removal of the existing Antelope – Mesa 220 kV T/L through Segment 6 would be required, as this transmission line segment would be disconnected. The remaining two existing transmission lines in the ANF located through Segment 6 would continue to be operated as under current conditions.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this option would result in two transmission lines in Segment 6 (one 500 kV and one 220 kV) and three transmission lines in Segment 11 (two 500 kV and one 220 kV), in two separate existing designated utility corridors. The new corridor from the southern boundary of the ANF near the Gould Substation to the southern boundary of the ANF near the City of Duarte would be routed either entirely through the ANF or partially through the ANF and partially through urban areas. The potentially affected urban areas include areas in the cities of Altadena, Arcadia, Duarte, La Cañada Flintridge, Monrovia, Pasadena, and Sierra Madre. To completely route the new 200-foot corridor through urban areas, large number of residences and other structures, such as schools, in densely populated areas would be affected.

With the establishment of new access and spur roads associated with the new R-O-W in the ANF along Segment 11, greater environmental impact is anticipated to occur under this option than under the retained alternatives for Segments 6 and 11. Under this option, the Mira Loma – Vincent 500 kV T/L section between Vincent and the City of Duarte would be longer than constructing it under the retained Segment 6 (approximately 40 miles as compared to 27 miles). In addition, this option would require the establishment of a new corridor and access roads between the Gould Substation and the City of Duarte south of the ANF, resulting in construction in previously undisturbed territory in the ANF and,

potentially, in developed urban areas. To avoid certain features in the ANF and residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. The east-west orientation of the new line would also result in greater visual impacts in the foothills.

Implementation of this option would require widening an existing corridor along Segment 11 and creating a new corridor, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through the ANF and, potentially, also through urban area, not meeting Objective 7 – Minimize Environmental Impacts. Routing the transmission line through existing development might require a longer route than would be possible if the route were to be built in open space. Building a longer route would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or would potentially compromise meeting, Objectives 6 through 9, it was eliminated.

Option 6/11 C – Co-locate all SCE T/Ls in Either Segment 6 or Segment 11 Across the ANF.

Description. This option would locate a total of five transmission lines through the ANF in either Segment 6 or in Segment 11, both designated utility corridors. All upgrades would be conducted to either one of the corridors, and existing transmission facilities would be moved from the corridor to be unused to the corridor to be used. Moving the existing transmission facilities that were not identified for upgrade through the CSRTP process is not required to meet the stated Project objectives but was included for completeness of alternative review. To support this option, it would be necessary to expand the existing R-O-W within the designated utility corridor that was selected to transmit electricity. In addition, this option requires the establishment of a new R-O-W sufficiently wide to accommodate up to three transmission lines between the Gould Substation in La Cañada Flintridge and the City of Duarte south of the ANF.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this option would result in five transmission lines in either Segment 6 or Segment 11. In addition, up to three 500 kV transmission lines would be added in a new corridor between the Gould Substation and the City of Duarte. The new corridor from the southern boundary of the ANF near the Gould Substation to the southern boundary of the ANF near the City of Duarte would be routed either entirely through the ANF or partially through the ANF and partially through urban areas. The potentially affected urban areas include areas in the cities of Altadena, Arcadia, Duarte, La Cañada Flintridge, Monrovia, Pasadena, Santa Clarita, and

Sierra Madre. To completely route the new corridor, up to 420 feet wide, through urban areas, large number of residences and other structures, such as schools, in densely populated areas would be affected.

Because all transmission lines would be located within the same corridor, system reliability would be degraded compared to the existing system and the reliability achieved with implementation of the retained options for Segments 6 and 11 (see Section 2.4.1). With the establishment of new access and spur roads associated with the new R-O-W in the ANF along the segment selected for transmission, greater environmental impact is anticipated to occur under this option than the retained alternatives for Segments 6 and 11. Under this option, up to three transmission lines (two 500 kV and one 220 kV) would be longer between Vincent Substation and the City of Duarte than constructing the retained Segment 6 and 11 (approximately 35 to 40 miles for each line as compared to approximately 22 to 27 miles). In addition, this option would require the establishment of a new corridor and access roads between the Gould Substation and the City of Duarte south of the ANF, resulting in construction in previously undisturbed territory in the ANF and, potentially, in developed urban areas. To avoid certain features in the ANF and residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. The east-west orientation of the new line would also result in greater visual impacts in the foothills.

Implementation of this option would degrade electrical transmission reliability because it would locate five transmission lines in one corridor and would not meet Objective 5 – Increase Reliability in the LA Basin. Implementation of this option would require widening the existing corridor selected for transmission and creating a new corridor, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through ANF and potentially, also through urban areas, not meeting Objective 7 – Minimize Environmental Impacts. Up to three of the upgraded and/or relocated transmission lines require a longer route than would be possible if the route than the proposed project and would not meet Objective 8 – Select the Shortest Feasible Route. Relocation of existing transmission lines that were not identified through the CS RTP to require upgrade is an added expense that is not required to support the project objectives resulting in greater costs and potentially requiring a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or would potentially compromise meeting, Objectives 5 through 9, it was eliminated.

Option 6/11 D – Use LADWP Transmission Corridor through ANF.

Description. This option would locate two additional 500 kV transmission lines within one of the two designated utility corridors that currently contain LADWP transmission

facilities through ANF. The designated utility corridor with LADWP transmission lines located in the ANF portion north of Highway 14 (northern corridor) contains two 500 kV transmission lines, while the designated utility corridor with LADWP transmission lines that is located in the ANF portion south of Highway 14 (southern corridor) contains one 500 kV transmission line. To support this option, it would be necessary to expand the existing R-O-W within the designated utility corridor used by LADWP that is selected to accommodate two new SCE 500 kV transmission lines. If the northern corridor were selected, the new 500 kV transmission lines would originate from Antelope, rather than Vincent, and the R-O-W widening would traverse the City of Santa Clarita, unincorporated areas, and continue towards SCE's Sylmar Substation located near the interchange of Interstate 5 and Highway 210 where new 300-foot R-O-W in a west-east direction would be required towards the Gould Substation and City of Duarte. If the southern corridor were selected, the new 500 kV transmission lines would originate from Vincent and exit the ANF in Tujunga Valley near the Hansen Flood Control Basin where new 300-foot R-O-W in a west-east direction would be required towards the Gould Substation and City of Duarte.

To complete the new Mira Loma – Vincent 500 kV T/L, the proposed transmission upgrades between the City of Duarte and the Mesa Substation (proposed Segment 7, see Section 2.4.1), and between the Mesa Substation and the Mira Loma Substation (proposed Segment 8, see Section 2.4.1) would still be required. To complete the new Mesa – Vincent 220/500 kV T/L, the stringing of conductor on an existing vacant tower position to the Mesa Substation portion of Segment 11 would still be required.

Under this option, removal of the existing Antelope – Mesa 220 kV T/L in Segment 6 would be required, as this line segment would be disconnected. The remaining two existing transmission lines in the ANF located in Segment 6 and the two existing 220 kV transmission lines in the ANF located in Segment 11 would continue to be operated as under current conditions.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this option would result in two transmission lines in Segment 6 (one 500 kV and one 220 kV) and two transmission lines in Segment 11 (both 220 kV), in two separate, existing designated utility corridors. In addition, two new 500 kV transmission lines would be added in one of two existing designated utility corridors through the ANF with existing LADWP transmission. Lastly, the new corridor routed from either near the Sylmar Substation or near the Hansen Flood Control Basin located in the Tujunga Valley to the southern boundary of the ANF near the City of Duarte would be routed either entirely through the ANF or partially through the ANF and partially through urban areas. These urban areas potentially include areas in the cities of Altadena, Arcadia, Duarte, Glendale, La Cañada Flintridge, Monrovia, Pasadena, Shadow Hills, Sierra Madre, and Sunland-Tujunga. To completely route the new

300-foot corridor through urban areas, large number of residences and other structures, such as schools, in densely populated areas would be affected.

Because this option would require a new R-O-W within one of two the existing LADWP corridors, the establishment of new access and spur roads in the ANF would result in greater environmental impact than the retained alternatives for Segments 6 and 11 (see Section 2.4.1) for which only approximately 3 miles of R-O-W widening are required. The Mira Loma – Vincent 500 kV T/L section, between Vincent and the City of Duarte, and Mesa – Vincent No. 2 500/220 kV T/L section, between Vincent and the Gould Substation, under this option is longer than constructing them under the retained Segment 6 and Segment 11 (approximately 50 miles, as compared to 27 miles for the Mira Loma – Vincent 500 kV T/L, and approximately 47 miles, as compared to 22 miles for the Mesa – Vincent No. 2 500/220 kV T/L). Because this option would result in transmission line sections that are approximately twice as long as the retained alternative, transmission capability would be reduced. In addition, this option would require the establishment of a new corridor and access roads between the Sylmar Substation or the Hansen Flood Control Basin, located in the Tujunga Valley, and the City of Duarte south of the ANF, resulting in construction in previously undisturbed territory in the ANF and potentially in developed urban areas. Selecting the northern LADWP corridor will result in construction in developed urban areas of the City of Santa Clarita. To avoid residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. The west-east orientation of the new transmission lines between the Sylmar Substation and the Hansen Flood Control Basin, located in the Tujunga Valley, and the City of Duarte south of the ANF would also result in greater visual impacts in the foothills of the ANF.

When compared to the retained alternatives for Segment 6 and Segment 11, this option could inhibit full integration of 4,500 MW of wind generation into SCE's transmission system, thus potentially compromising meeting Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner. Implementation of this option may not adequately improve the South of Lugo transmission constraints, thus compromising meeting Objective 5 – Increase Reliability in the LA Basin. Implementation of this option would require widening the existing LADWP corridor selected for transmission and creating a new corridor, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through the ANF and potentially through urban areas, not meeting Objective 7 – Minimize Environmental Impacts. Routing the transmission lines through either of the LADWP corridors will require a longer route and would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this

option would not meet, or would potentially compromise meeting, Objective 1 and Objectives 5 through 9, it was eliminated.

Option 6/11E – Create a New SCE Corridor across the ANF.

Description. This option would create a new 300-foot corridor through the ANF to support two new 500 kV transmission lines. Several possibilities were examined including routing the corridor between the San Gabriel Wilderness Area and the Sheep Mountain Wilderness Area generally following State Highway 39. The corridor would exit in the southern boundary of the ANF and the City of Azusa or City of Glendora, east of the Segment 6 corridor that exits at the City of Duarte. In addition, a new 330-foot R-O-W in an east-west direction would be required towards the City of Duarte and a 200-foot R-O-W in an east-west direction would be required between the City of Duarte and a point south of the Gould Substation.

To complete the new Mira Loma – Vincent 500 kV T/L, the proposed transmission upgrades between the City of Duarte and the Mesa Substation (proposed Segment 7, see Section 2.4.1), and between the Mesa Substation and the Mira Loma Substation (proposed Segment 8, see Section 2.4.1) would still be required. To complete the new Mesa – Vincent 220/500 kV T/L, the stringing of conductor on an existing vacant tower position from a point south of the Gould Substation to the Mesa Substation (portion of Segment 11) would still be required.

Under this option, removal of the existing Antelope – Mesa 220 kV T/L in Segment 6 would be required, as this line segment would be disconnected. The remaining two existing transmission lines in the ANF located in Segment 6 and the two existing 220 kV transmission lines in the ANF located in Segment 11 would continue to be operated as under current conditions.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this option would result in two transmission lines in Segment 6 (one 500 kV and one 220 kV) and two transmission lines in Segment 11 (both 220 kV), in two separate, existing designated utility corridors. In addition, two new 500 kV transmission lines would be added in a new corridor through the ANF. Lastly, the new corridor routed from the southern boundary of the ANF and City of Azusa to the southern boundary of the ANF near the City of Duarte and from this point to a point south of the Gould Substation would be routed either entirely through the ANF or partially through the ANF and partially through urban areas. These urban areas potentially include areas in the cities of Arcadia, Duarte, Glendale, Glendora, Monrovia, Pasadena, and Sierra Madre. To completely route the new 300-foot corridor through urban areas, large number of residences and other structures, such as schools, in densely populated areas would be affected.

Because this option would require a new R-O-W in a new corridor through the ANF, the establishment of new access and spur roads in the ANF would result in greater environmental impact than the retained alternatives for Segments 6 and 11 (see Section 2.4.1) for which only approximately 3 miles of R-O-W widening are required. The Mira Loma – Vincent 500 kV T/L section, between Vincent and the City of Duarte, and Mesa – Vincent No. 2 500/220 kV T/L section, between Vincent and the Gould Substation, under this option is longer than constructing them under the retained Segment 6 and Segment 11 (approximately 45 miles, as compared to 27 miles for the Mira Loma – Vincent 500 kV T/L, and approximately 58 miles, as compared to 22 miles for the Mesa – Vincent No. 2 500/220 kV T/L). Because this option would result in transmission line sections that are approximately twice as long as the retained alternative, transmission capability would be reduced. In addition, this option would require the establishment of a new corridor and access roads between the City of Azusa and a point south of the Gould Substation, resulting in construction in previously undisturbed territory in the ANF and potentially in developed urban areas. To avoid residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. The east-west orientation of the new transmission lines between the City of Azusa and the City of Duarte south of the ANF and between the City of Duarte and a point south of the Gould Substation would also result in greater visual impacts in the foothills of the ANF.

When compared to the retained alternatives for Segment 6 and Segment 11, this option could inhibit full integration of 4,500 MW of wind generation into SCE's transmission system, thus potentially compromising meeting Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner. Implementation of this option may not adequately improve the South of Lugo transmission constraints, thus compromising meeting Objective 5 – Increase Reliability in the LA Basin. Implementation of this option would require a new corridor, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through the ANF and potentially through urban areas, not meeting Objective 7 – Minimize Environmental Impacts. Routing the transmission lines through a new corridors will require a longer route and would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or would potentially compromise meeting, Objective 1 and Objectives 5 through 9, it was eliminated.

2.4.2.3.4 RA Eliminated 4 – Route a New Corridor along Highway 14 (Alternative to Segments 6 and 11).

Description. This alternative would locate two 500 kV transmission lines within a new corridor outside of the ANF and along California State Highway 14. To support this alternative, it would be necessary to acquire a new 300-foot R-O-W between the Vincent Substation and the Rinaldi Substation area (located near the interchange of Interstate 5 and Highway 210) as well as a new 300-foot R-O-W between the Rinaldi Substation area and the City of Duarte, traversing the City of La Cañada Flintridge. To complete the new Mira Loma – Vincent 500 kV T/L, proposed transmission upgrades between the City of Duarte and the Mesa Substation (proposed Segment 7, see Section 2.4.1), and between the Mesa Substation and the Mira Loma Substation (proposed Segment 8, see Section 2.4.1) would still be required. In addition, removal of the existing Antelope – Mesa 220 kV T/L in Segment 6 would be required, as this transmission line would be disconnected. The remaining two existing transmission lines in the ANF located through Segment 6 and the two existing 220 kV transmission lines in the ANF located through Segment 11 would continue to be operated as under current conditions.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this alternative would result in two transmission lines in Segment 6 (one 500 kV and one 220 kV) and two transmission lines in Segment 11 (two 220 kV), in two separate existing designated utility corridors. In addition, two new 500 kV transmission lines would be added in a new 300-foot corridor outside the ANF between the Vincent Substation and the City of Duarte south of the ANF. To completely route the new 300-foot corridor outside of the ANF, it would need to be routed through urban areas, and large number of residences and other structures, such as schools, in densely populated areas would be affected. These urban areas potentially include areas in the cities of Altadena, Arcadia, Duarte, Glendale, La Cañada Flintridge, Los Angeles, Monrovia, Pasadena, Santa Clarita, Shadow Hills, Sierra Madre, and Sunland-Tujunga.

With the establishment of new access and spur roads associated with the new R-O-W along Highway 14 and in the ANF, greater environmental impact is anticipated to occur under this alternative than the retained alternatives for Segments 6 and 11. The Mira Loma – Vincent 500 kV T/L section, between the Vincent Substation and the City of Duarte, and Mesa – Vincent No. 2 500/220 kV T/L section, between the Vincent and Gould substations, under this alternative is longer than constructing them under the retained Segment 6 and Segment 11 (approximately 50 miles, as compared to 27 miles for the Mira Loma – Vincent 500 kV, and approximately 47 miles, as compared to 22 miles for the Mesa – Vincent No. 2 500/220 kV). Because this alternative results in transmission line sections that are twice as long, transmission capability is reduced. In addition, this alternative would require the establishment of a new corridor and access roads between the Rinaldi Substation area and the

City of Duarte south of the ANF, resulting in construction in developed urban areas. To avoid residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. The west-east orientation of the new transmission lines would also result in greater visual impacts in the foothills of the San Gabriel Mountains.

When compared to the retained alternatives for Segment 6 and Segment 11, this option could inhibit full integration of 4,500 MW of wind generation into SCE's transmission system, thus potentially compromising meeting Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner. Implementation of this option may not adequately improve the South of Lugo transmission constraint thus compromising meeting Objective 5 – Increase Reliability in the LA Basin. Implementation of this option would require creating two new corridors, one along State Highway 14 and the other from the Rinaldi Substation area to the City of Duarte, thus not meeting Objective 6 – Maximize Use of Existing R-O-W and Corridors. The new corridor would have to be routed through urban areas, not meeting Objective 7 – Minimize Environmental Impacts. Routing the transmission lines adjacent to State Highway 14 will require a longer route and would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or would potentially compromise meeting, Objective 1 and Objectives 5 through 9, it was eliminated.

2.4.2.3.5 RA Eliminated 5 – Route T/L through Cajon Pass (Alternative to Proposed Segments 6, 7, and 8).

Description. Cajon Pass (Pass) is a saddle, located between the peaks of higher elevations in the SBNF. The Pass is characterized by several transportation and utility corridors, such as the separated north-bound and south-bound directions of Interstate 15, two railway lines, three existing SCE 500 kV R-O-Ws, and two existing LADWP 287 kV R-O-Ws. This alternative would route the proposed Mira Loma – Vincent 500 kV T/L from SCE's existing Vincent Substation east, towards the existing Lugo Substation where the route would turn south and travel through the Cajon Pass to the Mira Loma Substation. The alternative would add a new 500 kV transmission line R-O-W to the utility and transportation corridors crossing the Pass. This alternative would render portions of the existing Antelope – Mesa 220 kV T/L through the ANF unutilized; the transmission line and structures of this unutilized transmission line would be removed. All other currently existing transmission line structures in the ANF would remain.

Project Objectives, Feasibility, and Environmental Considerations. This alternative would establish a new R-O-W between the Vincent Substation and the Lugo Substation area and

within the SBNF. Creating a new R-O-W through the SBNF would result in greater environmental impact than the retained alternative, which would use an existing, established utility R-O-W in the ANF.

The Pass is subject to annual fires which coincide with maximum power flow (e.g., to satisfy demand for energy to run air conditioning systems during the summer months) on the transmission lines located in this corridor. The fires shut down or damage the transmission lines (outage). Under existing conditions, an outage in this corridor could potentially result in widespread uncontrolled outages that could affect neighboring utilities. SCE has installed a special protection system (SPS) that sheds electric load upon loss of transmission lines in this corridor (see Section 1.1.7). This load shedding currently affects power to several cities in eastern Los Angeles County, northern Orange County, and southwestern San Bernardino County. As discussed below, construction of a new transmission line would not alleviate the outages. Instead it would require either establishing a new 500 kV corridor to the LA Basin elsewhere to provide needed reliability, or a more complex SPS that would turn off power to a much greater area than under the current SPS and require the tripping of generation resources in order to maintain a balance between load and generation. Load and generation balance is required to ensure system frequency is controlled to within the required bandwidth. Since implementation of such a complex SPS is not practical, would not comply with reliability planning criteria, and would not pass the established CAISO SPS Guidelines⁸, the use of an SPS is not a viable means for mitigating the increased impacts associated with loss of an additional 500 kV transmission line in the Pass. Therefore, constructing a new transmission in the Cajon Pass would not result in increasing the overall system capability without the construction of additional new transmission facilities.

The NERC Planning Standards define the reliability of the interconnected bulk electric system by considering adequacy and security. Adequacy is the ability of the electric system to supply the aggregate electrical demand and energy requirements of their customers at all times, taking into account scheduled and reasonably expected unscheduled outage of system elements. Security is the ability of the electric systems to withstand sudden disturbances such as anticipated loss of system elements. To ensure both the adequacy and security aspects of the planning standards are met, electric systems must be planned to withstand the more probable forced and planned outage system conditions at projected customer demand and projected electricity transfer levels. Extreme, but less probable, outages measure the robustness of the electric systems that should be evaluated for risks and consequences.

Locating new transmission in an area that has historically had a high probability of outages does not comply with the NERC Planning Standards, if under such outage conditions the system cannot perform its intended function within the specified performance criteria. SCE

⁸ <http://www1.caiso.com/docs/09003a6080/14/37/09003a608014374a.pdf>

must comply with the criteria specified in the WECC Disturbance-Performance Table of Allowable Effects on Other Systems⁹, which provides minimum system performance parameters for various disturbance situations. SCE considers the use of an SPS as a means to meet the minimum system performance parameters, if such a system can be implemented. As stated in the NERC/WECC Planning Standards, the function of an SPS is to “detect abnormal system conditions and take pre-planned, corrective action (other than the isolation of faulted elements which is the function of standard system protection) to provide acceptable system performance.” The CAISO has recognized that the use of an SPS is a solution that can normally be implemented quickly and at a much lower cost, but has also identified that use of an SPS has limitations. In particular, the use of an SPS results in increased transmission system utilization that translates into the potential for more criteria violations. Such increases in criteria violations directly affect grid operation and consequently adversely affect system reliability. As a result, the CAISO has established guidelines to allow the use of an SPS to maximize the capability of the existing transmission facilities while maintaining system reliability and operability. Applying these guidelines results in a determination that the use of an SPS is not an acceptable means for mitigating expected criteria violations associated with routing Segments 6, 7, and 8 through the Cajon Pass.

Routing Segments 6, 7, and 8 through the Cajon Pass would not result in sufficient system capability to interconnect and deliver up to 4,500 MW of generation resources from the TWRA; the alternative thus does not meet Objective 1 – Reliably Interconnect TWRA and Comply with RPS in an Expedited Manner. The construction of a new transmission line in this corridor would not meet the applicable planning and reliability criteria, thus not meeting Objective 2 – Comply with Reliability Planning Criteria. Implementation of this alternative would result in an increase to the maximum amount of transfer capability to the LA Basin from the north and would thus not meet Objective 5 – Increase Reliability in the LA Basin. Construction of this alternative would require establishment of a new R-O-W through undisturbed land in SBNF, not meeting Objective 6. Because this alternative does not meet Objectives 1, 2, 5 and 6, it was eliminated.

2.4.2.3.6 RA Eliminated 6 – Alternative Routing through Chino Hills (Alternative to Section within Segment 8A). SCE considered several options for routing new transmission lines through the Chino Hills area. Table 2-6 summarizes the existing and proposed conditions as well as the options for routing the transmission lines in the vicinity of Chino Hills. The options would entail replacement of existing transmission lines with a new transmission line in Chino Hills State Park and the addition of new transmission lines. The proposed conditions are discussed in Section 2.4.1, under the descriptions for Segment 8A. The options and the rationale for eliminating them are further discussed below.

⁹ http://www.wecc.biz/documents/library/procedures/planning/WECC-NERC_Planning%20Standards_4-10-03.pdf

TABLE 2-6
TRANSMISSION LINE ROUTING WITHIN
SEGMENT 8A – CHINO HILLS OPTIONS

| Option | Corridor Routing | |
|---|---|---|
| | Northern (through Chino Hills Residential Area) | Southern (through Chino Hills State Park) |
| Existing Conditions | De-energized single-circuit 220 kV | Existing double-circuit 220 kV |
| Proposed Segment 8A ¹ | New double-circuit 500 kV | Existing double-circuit 220 kV |
| Option 1 – 220 kV and 500 kV T/Ls through Chino Hills State Park | De-energized single-circuit 220 kV removed | Existing double-circuit 220 kV New double-circuit 500 kV |
| Option 2 – 500 kV T/L in Chino State Park; 220 kV T/L through Chino Hills; New 220 kV Switching Station | New double-circuit 220 kV | New double-circuit 500 kV |

Notes:

¹ Described in Section 2.4.1.

Option 1 – 220 kV and 500 kV T/Ls through Chino Hills State Park.

Description. This alternative would route the new 500 kV double-circuit transmission line through the Chino Hills State Park (Park). Beginning at the Mesa Substation, the route would be identical as the proposed Project until it crosses Toner Canyon Road (east of State Highway 57) where the route would head in a southeast direction, entering the Park just south of Lions Canyon. The route would continue in a southeast direction before heading east then northeast near McDermont Spring, exiting the Park in a northeast direction. The route would then continue in a northeast direction, following the existing R-O-W for the Mira Loma – Olinda and Mira Loma – Walnut double-circuit 220 kV T/Ls, until it crosses California State Highway 71. At this point, the route would head north, following the existing R-O-W for the Chino – Serrano and Chino – Viejo 220 kV double-circuit T/L. Approximately 12 miles of the existing R-O-W for the Mira Loma – Olinda and Mira Loma – Walnut 220 kV T/Ls, and the existing R-O-W for the Chino – Serrano and Chino – Viejo 220 kV T/Ls, would be widened by up to 200 feet to accommodate the new double-circuit 500 kV T/L. Upon completion, the existing idle Chino – Mesa 220 kV T/L would be removed.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this option would result in two double-circuit transmission lines (one 500 kV and one 220 kV) through the Chino Hills State Park that presently contains a portion of the existing Mira Loma – Olinda and Mira Loma – Walnut double-circuit 220 kV T/Ls. The new double-circuit 500 kV transmission line would be placed parallel to existing utility corridors. The widened corridors from near the intersection of Pine Ave and State Highway 71, in Chino, to

the Chino Substation would be routed through the developed areas in Chino. Approximately 5 miles of R-O-W widening would be required through the Park. To route the new widened corridor through urban areas, residences and other structures will be affected.

System reliability would be lesser compared to the reliability achieved with implementation of the retained options for Segment 8A (see Section 2.4.1). Under this alternative, the 220 kV and the 500 kV transmission lines would be located within the same corridor for the entire 12 miles. In addition the new double-circuit 500 kV transmission line and two existing 500 kV transmission lines between Mira Loma and Serrano would be contained within the same corridor for approximately 3 miles (1.2 miles of these are located in the Park). However, unlike the Cajon Pass, the risk of simultaneous outage of these four 500 kV transmission lines is significantly less because most of the common R-O-W is outside of a high fire zone. Furthermore, the consequences associated with simultaneous outage of all four 500 kV transmission lines in this area is within Planning Criteria due to the fact that other transmission lines in this area provide for redundancy. With the establishment of new access and spur roads associated with the widened R-O-W in the Park, greater environmental impact in undeveloped areas is anticipated to occur under this option than the retained alternatives for Segment 8A. Under this option, the 500 kV transmission line section between the Mesa and Chino substations would be longer than constructing the retained Segment 8A (approximately 29 miles as compared to 26 miles). To avoid certain features in the Park and residential and other structures, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. Routing an additional transmission line through the Park would also result in greater visual impacts from viewpoints in the Park.

Implementation of this option would require construction of a new double-circuit 500 kV transmission line through a State Park, thus not meeting Objective 7 – Minimize Environmental Impacts. It would also result in a longer route than under retained Segment 8A (see Section 2.4.1) and would not meet Objective 8 – Select the Shortest Feasible Route. This option would result in greater costs and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or would potentially compromise meeting, Objectives 7, 8, and 9, it was eliminated.

Option 2 – 500 kV T/L through Chino State Park; 220 kV T/L through Chino Hills.

Description. This alternative would reroute the existing 220 kV double-circuit transmission line section in the Chino Hills State Park and install a new 500 kV transmission line section in its place and construct a new 220 kV switching station. To allow use of the existing R-O-W in order to minimize the amount of new R-O-W required through the Chino Hills State Park, the existing section of the Mira Loma – Olinda 220 kV and Mira Loma –

Walnut 220 kV T/Ls would be relocated to the proposed Chino Hills R-O-W where an idle 220 kV transmission line would be removed and terminated at the Chino Substation. A new switching station will be required near Pine Ave and State Highway 71, in Chino to provide connectivity for the remaining portion of the Mira Loma – Olinda 220 kV and Mira Loma – Walnut 220 kV T/Ls. Both existing Chino – Serrano 220 kV and Chino – Viejo 220 kV T/Ls will be connected to this new 220 kV switching station. Once the relocation is complete, the existing 220 kV R-O-W through the Chino Hills State Park would be widened by up to 100 feet to accommodate a new double-circuit 500 kV transmission line. In addition, a new 500 kV transmission line corridor would be required from the point near the intersection of Pine Ave and State Highway 71, in Chino, and the Chino Substation to allow for the new 500 kV transmission line to continue towards Mira Loma along the proposed Segment 8C.

Project Objectives, Feasibility, and Environmental Considerations. Implementation of this option would result in removing existing and constructing new transmission lines in two different corridors. The corridor through Chino Hills will be upgraded with a new double-circuit 220 kV transmission lines while the corridor through the Chino Hills State Park will need to be widened and upgraded with a new double-circuit 500 kV transmission line. In addition, the new 500 kV T/L would be routed through the developed areas of Chino for approximately four miles and a new switching station will be required in the developed areas of Chino; To route the new 500 kV transmission line through urban areas in Chino and locate a new switching station in this area, residences and other structures, such as schools, in densely populated areas would be affected.

With the establishment of new access and spur roads associated with the widened R-O-W in the Chino Hills State Park, greater environmental impact in undeveloped areas is anticipated to occur under this option than the retained alternatives for Segment 8A. Under this option, the 500 kV transmission line section between the Mesa and Chino substations would be longer than constructing it under the retained Segment 8A (approximately 29 miles as compared to 26 miles). To avoid certain features in the Chino Hills State Park and residential and other structures in urban areas, the corridor might not be routed in a straight line, i.e., the shortest route possible. It is possible that public opposition would affect the implementation schedule. Routing a larger transmission line through the Chino Hills State Park would also result in greater visual impacts from viewpoints in the Park. Removal of the currently idle 220 kV T/L and replacement with a new double-circuit 220 kV transmission line is not anticipated to result in any additional land disturbance relative to the retained alternative.

Implementation of this option would require removal and replacement, in a different corridor, of existing 220 kV transmission lines to allow for construction of a double-circuit 500 kV transmission line through the Chino Hills State Park, thus not meeting Objective 7 – Minimize Environmental Impacts. It would also result in a longer route than under retained Segment 8A (see Section 2.4.1) and would not meet Objective 8 – Select the Shortest

Feasible Route. This option would result in greater costs due to additional scope of work and route lengths and might require a longer implementation period than the retained alternatives, thus not meeting Objective 9 – Meet Project Needs in a Cost-effective and Timely Manner. Because this option would not meet, or would potentially compromise meeting, Objectives 7, 8, and 9, it was eliminated.

2.4.2.3.7 RA Eliminated 7 – Whirlwind Substation to Cottonwind Substation to Windhub Substation (Alternative to Segment 10).

Description. This alternative would route the transmission line from Whirlwind Substation northwest, following existing R-O-W, toward the proposed Cottonwind Substation, which is currently under CEQA review by Kern County. From the Cottonwind Substation, the route would continue to the northwest following existing R-O-W until it reaches the foothills of the Tehachapi Range. At the foothills, the route would turn east towards the Windhub Substation requiring the acquisition of new R-O-W through undisturbed territory.

Project Objectives, Feasibility, and Environmental Considerations. This alternative would necessitate the establishment of a new R-O-W and associated access roads for the west-east portion of this alternative, crossing the foothill of the Tehachapi Range. Under the retained alternative, fewer miles of new access road would be required because roads already exist in the area. In addition, this alternative could potentially interfere with currently planned wind generation projects, thereby reducing the amount of generation that could be installed.

This alternative would require the establishment of a new R-O-W and associated access roads and would thus not meet Objective 6 – Maximize Use of Existing R-O-W and Corridors. In addition, the new corridor could interfere with wind generation projects planned in the area to meet the RPS, potentially interfering with meeting Objective 1. This alternative was eliminated because it would not meet Objective 6 and could interfere with planned development designed to meet the RPS.

2.4.3 No Project Alternative

Description. Under the No Project Alternative, there would be no facility upgrades or other changes to the electric transmission system. Proposed alternatives Segment 4 through Segment 11, including new and upgraded transmission lines and substations, would not be constructed.

Operating procedures are used to mitigate reliability problems on the existing 220 kV system that occur during heavy load conditions in the Antelope Valley. These operating procedures typically call for the dropping of area load during overload conditions. SCE transmission studies indicate that continued use of such operating procedures will be insufficient to mitigate thermal overload problems in the Antelope Valley. As a result of the continued

above-average electrical demand growth in the Antelope Valley, SCE currently forecasts that the bulk transmission system facilities in this area will experience reliability problems by 2011.

Three existing 500 kV transmission lines South of Lugo travel from the Victorville area down the Cajon Pass towards the Mira Loma area. The co-located transmission lines are subject to simultaneous, forced outage conditions on an annual basis. SCE has experienced numerous forced outages associated with forest fires in the Cajon Pass during the peak load demand periods, which coincide with the fire season. To minimize the risk of such forced outages, that can result in widespread, uncontrolled cascading outage conditions in the Western United States, SCE has implemented a special protection system which would automatically shed up to 2,500 MW of load demand served from the San Bernardino, Padua, Walnut and the Villa Park 220 kV substations.

As demand in the Project area increases over time, the electric transmission system in the Project area would become increasingly unreliable, and the likelihood of a system failure affecting the Western United States would increase.

Project Objectives, Feasibility, and Environmental Considerations. With implementation of the No Project Alternative, the reliability concerns in the Antelope Valley and South of Lugo areas would not be addressed. Key objectives that would not be met are the requirement that SCE interconnect and integrate power generation facilities into its electric system and that the RPS target goals are met. The No Project Alternative would not meet the objectives, purpose, and need of the proposed Project as described in Section 1.0.

The No Project Alternative would not meet the purpose of the proposed TRTP to provide the electrical facilities necessary to integrate levels of new wind generation. Inclusion of the No Project Alternative is prescribed by CEQA Guidelines. Although the No Project Alternative does not satisfy the purpose and need for the proposed Project, it serves as a baseline against which the impacts of the proposed Project can be evaluated.

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