Barren Ridge Renewable Transmission Project
Alternatives Development Report

PREPARED FOR:
LOS ANGELES DEPARTMENT OF WATER AND POWER
USDA, FOREST SERVICE
DOI, BUREAU OF LAND MANAGEMENT

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INTRODUCTION

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

It has been determined that this Project is a major state and federal action that may significantly affect the quality of the human environment, therefore requiring preparation of an Environmental Impact Statement (EIS) as required by the National Environmental Policy Act (NEPA) and an Environmental Impact Report (EIR) as required by the California Environmental Quality Act (CEQA). As recommended by both Council of Environmental Quality NEPA Regulations (40 C.F.R. 1506.2) and CEQA Guidelines (Section 15170) a joint EIS/EIR document will be prepared for the Project. The EIS/EIR is an informational disclosure document used to inform public agency decision makers and the public of the environmental effects of a project, identify possible ways to eliminate or minimize the potential significant or adverse effects, and describe reasonable alternatives to the Proposed Action /Project. The U.S. Department of Agriculture, Forest Service (Forest Service) and the U.S. Department of the Interior, Bureau of Land Management (BLM) are the responsible lead agencies for preparation of the EIS; LADWP is the responsible lead agency for preparation of the EIR.

This Alternatives Development Report (1) documents the range of alternatives that have been considered and evaluated, (2) describes the approach and methods used in evaluating potential alternatives according to guidelines established under the NEPA and the CEQA, (3) provides rationale for recommendation to eliminate or retain alternatives for further study in the EIS/EIR, and (4) recommends reasonable alternatives that would meet the purpose and need for the Project. The lead agencies’ responsible authorities will decide the final alternatives that will be carried forward for full analysis in the EIS/EIR.

Environmental resource Technical Reports are being prepared for agency review. The Technical Reports will include full detailed impact analysis of each alternative that is currently under consideration as identified within this report, including the No Action alternative and a cumulative impact analysis. The Technical Reports will then serve as the basis for developing the EIS/EIR impact analysis for those alternatives approved by the lead agencies that will be carried forward for detailed consideration for the Project. This Alternatives Development Report includes preliminary environmental impact results from the Technical Reports.
1 PROJECT DESCRIPTION

The BRRTP is located in Kern and Los Angeles counties. It is approximately 75 miles in length and extends from the Barren Ridge Switching Station to Rinaldi Substation, and extends approximately 17 miles from the Castaic Power Plant to the proposed Haskell Canyon Switching Station. The proposed BRRTP includes the following:

1) Construction of approximately 60 miles of a 230 kilovolt (kV) double-circuit transmission line from the LADWP Barren Ridge Switching Station to Haskell Canyon;
2) Addition of approximately 12 miles of a 230 kV circuit on the existing double-circuit structures from Haskell Canyon to the Castaic Power Plant;
3) Upgrade of approximately 75 miles of the existing Barren Ridge-Rinaldi (BR-RIN) 230 kV transmission line with larger capacity conductors between the Barren Ridge Switching Station and the Rinaldi Substation;
4) Construction of a new electrical switching station in Haskell Canyon;
5) Expansion of the existing Barren Ridge Switching Station.

1.1 CONSTRUCTION OF NEW 230 KV TRANSMISSION LINE

The proposed double-circuit 230 kV transmission line in the BRRTP would carry two Alternating Current (AC) lines from the Barren Ridge Switching Station to the proposed Haskell Canyon Switching Station in Haskell Canyon.

The proposed tower structures for the new lines are self-supporting double-circuit steel lattice towers fabricated from unpainted galvanized steel members. Depending on the environmental conditions of the surrounding terrain, the height of the proposed lattice structures would range from approximately 100-195 feet, with an average tower-to-tower span of 1,000 to 1,100 feet. Exact structure placement would be determined during engineering surveys and detailed design studies for the preferred route. A variety of engineering, constructability, existing access, and environmental issues are considered during structure siting within permitted rights-of-way.

Self-supporting, tubular steel poles (TSP) would be used for mitigating purposes where appropriate to reduce potential impacts, such as conflicts with cultivation on agricultural lands. The TSPs would have an average height range between 95-180 feet, depending on the conditions of the surrounding terrain, with an average tower-to-tower span of 700 to 800 feet.

The alignment of a tower along a transmission line determines whether it is a suspension, angle, or dead-end tower. Towers along the straight portion of a transmission line are known as suspension towers, and sometimes referred to as tangent towers. Angle towers are of the same basic configuration as suspension towers; however, they are located at angles in the transmission line and are designed to resist angular cable pulls. The main difference is in the tower “arms,” insulator systems, and tower weights. At the end of a transmission line, large angle turn, or each side of a major crossing such as a large river, highway, or large valley, dead-end towers would be required to add longitudinal strength along the transmission line. They are built to be stronger, and often have a wider base and stronger insulator strings than the suspension towers that are located along a majority of the transmission line.

Between Power Plant #2 and the proposed Haskell Canyon Switching Station, existing four-circuit structures would be utilized for both the new double-circuit 230 kV transmission line and the reconductoring of the existing BR-RIN transmission line. To accommodate the additional weight, some of the existing towers may require minor modifications, such as replacement of steel members or reinforcement of footings.

The BRRTTP will utilize self-supporting steel lattice structures and TSPs requiring concrete foundations. Steel lattice structures would require four footings (one for each leg); TSPs would require a single larger footing. Footings would be of the steel-reinforced concrete pier type and be cast in place. The concrete
footings for lattice structures would be between 2.5 and 5.0 feet in diameter with an average depth of 20 feet depending on soil conditions. Single foundations for TSPs would consist of augured holes approximately five to seven feet in diameter and 15 to 30 feet deep, depending on conditions. Formwork and galvanized steel reinforcing would be assembled in the hole prior to casting concrete in place. Reinforcing steel would become integral to the lower leg of the steel lattice structure during installation. An above-ground concrete form placed over each hole would result in a final concrete foundation height of 0.5 to 2.0 feet above ground level.

The conductor (or “wires”) being considered for the new double-circuit 230 kV transmission line and installation of the Castaic – Haskell Canyon #4 circuit on existing structures is a bundled 715.5 kcmil “Starling” ACSS/AW (aluminum conductor steel supported/aluminum-clad steel wire). The reconductoring of the BR-RIN transmission line between Barren Ridge Switching Station and Rinaldi Substation would require a bundled 1,433.6 kcmil “Merrimack” ACSS/TW/HIS (aluminum conductor steel supported/trapezoidal wires/high strength) conductor.

Each circuit would consist of three phases (or conductors). To increase the current-carrying capability of the transmission lines and reduce power loss, the proposed Project would utilize bundled conductors installed for each phase. Bundled conductors consist of two or more conductor cables connected by a non-conducting spacer. The new double-circuit 230 kV transmission line utilizing double-bundled conductors would utilize a total of 12 conductors.

LADWP follows many of the standards established by the California Public Utilities Commission and the minimum conductor height above the ground, under normal operation of the line, is 31 feet (General Order 95). Greater clearances may be required in certain areas. Minimum conductor clearance would dictate the exact height of each tower based on topography and safety clearance requirements.

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

To shield conductors from the hazard of direct lightning strikes by transferring lightning currents into the ground, overhead ground wires (open shield wires) would be installed on the tops of new structures.

Construction of a transmission line involves the following general sequence of events: surveying the centerline; identifying and constructing access roads; clearing right-of-way and tower sites (including construction yards and batch plants); installing foundations; assembling and installing the towers; clearing, pulling, tensioning, and splicing sites; installing ground wires and conductors; installing counterpoise/ground rods; and cleanup and site reclamation. Various phases of construction would occur at different locations throughout the construction process. This would require several crews operating at the same time and in different locations.

Existing paved and unpaved highways and roads would be used where possible. Where new access roads are required, they would be constructed to support the weight of these vehicles and would typically be 16 feet wide, consisting of a 12- to 14-foot driving surface with a side drainage system between one and two feet in width. Permanent roads would be constructed where necessary for operation or maintenance, or where it is required by the landowner or land managing agency. Dependent upon final design and mitigation, some temporary access roads maybe constructed as part of the Project. These would typically be 16 foot wide roads, and would likely have no improved ditch drainage systems. Most temporary roads would be constructed by crushing vegetation. In some areas, material and topsoil from the temporary
roads would be bladed to one or both sides to facilitate rehabilitation. Following construction, bladed material can be re-spread across the disturbed road section.

It is anticipated that several construction yards or staging areas would be required for storing materials, construction equipment, construction vehicles, and temporary construction offices. Staging areas would be approximately five acres, and located near each end of the transmission line and at various locations approximately every 15 miles along the proposed line route.

1.2 ADDITION OF NEW 230 KV CIRCUIT
Between the proposed Haskell Canyon Switching Station and the existing Castaic Power Plant, LADWP proposes the addition of approximately 12 miles of a new 230 kV transmission circuit onto existing Castaic – Olive 230 kV Transmission Line structures (towers 1-1 through 12-1). This new circuit would be called Castaic – Haskell Canyon #4 and would utilize the same conductor (2,156 kcmil “Bluebird” ACSS/AW) as that proposed for the new 230 kV transmission line.

The addition of a new circuit on existing towers would require many of the same activities of a new transmission line (surveying of right-of-way, rehabilitation of existing access and spur roads, clearing of right-of-way, conductor installation, ground rod installation, and cleanup). However, all work would be within existing right-of-way and no new towers would be constructed. Some towers may need to be modified or reinforced to carry the additional weight of the new conductor.

1.3 RECONDUCTORING OF EXISTING TRANSMISSION LINE
LADWP proposes the reconductoring of approximately 75 miles of the existing BR-RIN 230 kV transmission line with larger conductors from the Barren Ridge Switching Station to Rinaldi Substation (towers 176-1 through 251-1). The existing conductors (954/2,312 kcmil) would be replaced with a new 1,433.6 kcmil “Merrimack” ACSS/TW/HS conductor.

The upgrade of the existing BR-RIN would also require many of the same activities of the new transmission line (surveying of right-of-way, rehabilitation of existing access and spur roads, clearing of right-of-way, conductor installation, ground rod installation, and cleanup). The existing conductor would be pulled out using a pulling line, and this line would then be used to pull in the new conductor. All work would remain within the existing right-of-way, with no additional right-of-way required. Some of the towers will need to be modified, replaced, and/or foundations reinforced/replaced to carry the additional weight of the new heavier conductor.

1.4 CONSTRUCTION OF NEW SWITCHING STATION
As a component of the BRRTP, LADWP proposes the construction of a new switching station in Haskell Canyon, south of the Angeles National Forest. It would be constructed on LADWP-owned property at the convergence of several existing and proposed 230 kV transmission lines (the existing BR-RIN, the proposed double-circuit Barren Ridge-Haskell Canyon, the existing Castaic-Northridge, Castaic-Sylmar, and Castaic-Olive, and the proposed Castaic to Haskell Canyon).

The station would be approximately 400 feet by 600 feet to accommodate the necessary equipment such as steel support structures, circuit breakers, disconnect switches, and associated equipment, and a relay house and control house. The relay and control houses would each be approximately 30 feet long by 12 feet wide by 10 feet high and constructed of gray concrete block. The station yard would include a paved internal access road approximately 16 feet wide, and would be enclosed by chain-link fencing with barbed-wire extension for security.
Construction of the new Haskell Canyon Switching Station would consist of preconstruction surveys, clearing and grading of access roads, site grading and drainage development, installation of concrete foundations and steel support structures, installation of below- and above-ground electrical conduits for equipment power and control, installation of below- and above-grade grounding conductors, and installation of control and relay houses. Equipment required for station construction would include graders and excavators, backhoes, drill rigs, concrete trucks, water trucks, trucks and flatbed trailers. Cranes, man-lifts, portable welding units, line trucks and mechanic trucks would also be required. Construction would require an estimated 12 months and approximately 60 workers.

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

Following site grading and development, reinforced concrete foundations would be installed to support the steel structures and electrical equipment and control facilities. It is estimated that approximately 1,500 cubic yards of concrete would need to be delivered to the switching station site for the foundations. Foundation work would require approximately 180 trips to the site by 40-ton, 10-yard capacity concrete trucks over an approximate 60 day working period. Subsequent to the foundation installation, trenches would be dug to facilitate placement of copper conductors for the station grounding mat.

Multiple transmission lines would connect into the switching station (e.g., the new and existing Barren Ridge-Haskell and Castaic-Haskell Canyon transmission lines) and would need support and require the installation of galvanized steel structures. High-voltage bus work consisting of aluminum jumpers and tubing would be installed.

1.5 EXPANSION OF EXISTING SWITCHING STATION

The existing Barren Ridge Switching Station is approximately 250 feet by 500 feet and contains three existing positions occupied by the Pine Tree Wind Development and BR-RIN Transmission Line; no additional positions are available.

During scoping, the original project description did not include the expansion of the Barren Ridge Switching Station. However, to allow connection of a new double-circuit transmission line and allow interconnections of future renewable energy projects in the Tehachapi Mountains and Mojave Desert area, LADWP is proposing to expand the existing station to the east side by 235 feet by 500 feet. The station would almost double in size (485 feet by 500 feet or approximately 5.6 acres) to include electrical structures and equipment for the addition of transmission lines, a material staging area, roadway within the station, and drainage area.

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

It is estimated that approximately 700 cubic yards of concrete would need to be delivered to the switching station site for the foundations. Foundation work would require approximately 80 trips to the site by 40-ton, 10-yard capacity concrete trucks over an approximate 45 day working period. Equipment required for station construction would include graders and excavators, backhoes, drill rigs, concrete trucks, water
trucks, trucks and flatbed trailers. Cranes, man-lifts, portable welding units, line trucks and mechanic trucks would also be required. An estimated eight months with approximately 60 workers would be required to expand the station.

1.6 CONSTRUCTION WORK FORCE AND SCHEDULE

Construction for the BRRTP is anticipated to commence in early 2012. The NEPA Lead Agencies’ Record of Decision and CEQA Lead Agency Notice of Determination (anticipated in fall of 2010) must be made prior to right-of-way procurement and construction. The target date for commercial operation of the Project is Fall/Winter 2013.

The construction of the new double-circuit 230 kV transmission line from the Barren Ridge Switching Station to the proposed Haskell Canyon Switching Station would take approximately 12.5 months to construct and require a total of approximately 134 workers, with a peak of 131 workers on any given day. The installation of a 230 kV circuit on existing double-circuit towers from the Castaic Power Plant to the proposed Haskell Canyon Switching Station would take approximately a month and a half and approximately 35 workers would be needed for this portion of the Project. The upgrade and reconductoring of the existing BR-RIN would take approximately eight months and a total of approximately 155 workers to construct, with a peak of 120 workers on any given day. The construction of a new 400 foot by 600 foot Haskell Canyon Switching Station would take approximately 12 months to construct and require a total of approximately 60 workers, with a peak of 38 workers on any given day. The expansion of the existing Barren Ridge Switching Station would take approximately eight months and a total of approximately 60 workers, with a peak of 38 workers on any given day.

The BRRTP components are anticipated to be constructed in the staggered sequence illustrated below in Figure 1 and Table 1. The construction of all Project components would take approximately two years to construct. Approximately 447 total workers would be required with a peak of 173 workers on any given day during construction. Table 1 summarizes the BRRTP’s construction workforce and schedule. To allow for any delays in the Project, three weeks of float time were included for the new 230 kV transmission line and reconductoring efforts, and an additional two weeks were included for the stringing of the second circuit between Castaic and Haskell Canyon.

**FIGURE 1. ANTICIPATED CONSTRUCTION SEQUENCE**

<table>
<thead>
<tr>
<th>PROJECT COMPONENT</th>
<th>ANTICIPATED CONSTRUCTION SEQUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>New 230 kV Transmission Line</td>
<td>Weeks 1 – 54</td>
</tr>
<tr>
<td>New Haskell Canyon Switching Station</td>
<td>Weeks 1 – 46</td>
</tr>
<tr>
<td>Expansion of Barren Ridge Switching Station</td>
<td>Weeks 47 - 77</td>
</tr>
<tr>
<td>Addition of 230 kV Circuit</td>
<td>Weeks 53 - 88</td>
</tr>
<tr>
<td>Reconductor BR-RIN</td>
<td>Weeks 55 - 88</td>
</tr>
</tbody>
</table>
### Table 1. Construction Workforce and Schedule

<table>
<thead>
<tr>
<th>PROJECT COMPONENT</th>
<th>CONSTRUCTION (START AND END WEEKS)</th>
<th>CONSTRUCTION DURATION (MONTHS)</th>
<th>TOTAL # OF WORKERS</th>
<th>PEAK # OF WORKERS AT ANY GIVEN TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>New 230 kV Transmission Line</td>
<td>1 – 54</td>
<td>12.5</td>
<td>134</td>
<td>131</td>
</tr>
<tr>
<td>New Haskell Canyon Switching Station</td>
<td>1 – 46</td>
<td>12</td>
<td>63</td>
<td>38</td>
</tr>
<tr>
<td>Expansion of Barren Ridge Switching Station</td>
<td>47-77</td>
<td>8</td>
<td>60</td>
<td>38</td>
</tr>
<tr>
<td>Addition of 230 kV Circuit</td>
<td>51 – 56</td>
<td>1.5</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Reconductor BR-RIN</td>
<td>55 – 88</td>
<td>8</td>
<td>155</td>
<td>120</td>
</tr>
<tr>
<td><strong>ALL COMPONENTS</strong></td>
<td><strong>Weeks 1 – 88</strong></td>
<td><em><em>22</em> months</em>*</td>
<td><strong>412 Total Workers</strong></td>
<td><em><em>173</em> Peak Workers</em>*</td>
</tr>
</tbody>
</table>

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

### 2 NEPA & CEQA Requirements for Alternatives

NEPA and CEQA both require consideration of a reasonable range of alternatives to the proposed Project that would feasibly attain most of the basic objectives of the Project, but avoid or substantially lessen any of the significant or adverse effects of the Project. The NEPA and CEQA requirements for the identification of Project alternatives are described in Sections 2.1 and 2.2.

#### 2.1 NEPA

The Council on Environmental Quality’s NEPA Regulations (40 C.F.R. 1502.14) require an EIS to present the environmental impacts of the proposed action and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision makers and the public. The alternatives analysis shall:

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

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

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

(d) Include the alternative of no action.

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

(f) Include appropriate mitigation measures not already included in the proposed action or alternatives.
2.2 CEQA
CEQA Guidelines (Section 15126.6) state the following:

(a) An EIR shall describe a range of reasonable alternatives to the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives.

(b) The discussion of alternatives shall focus on alternatives to the project or its location which are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly.

(c) The EIR should briefly describe the rationale for selecting the alternatives to be discussed. The EIR should also identify any alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process and briefly explain the reasons underlying the lead agency’s determination. Among the factors that may be used to eliminate alternatives from detailed consideration in an EIR are: (i) failure to meet most of the basic project objectives, (ii) infeasibility, or (iii) inability to avoid significant environmental impacts.

(d) The EIR shall include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the proposed project.

(e) The EIR shall include the evaluation of the “No project” alternative.

(f) The alternatives shall be limited to ones that would avoid or substantially lessen any of the significant effects of the project. Of those alternatives, the EIR need examine in detail only the ones that the lead agency determines could feasibly attain most of the basic objectives of the project. The range of feasible alternatives shall be selected and discussed in a manner to foster meaningful public participation and informed decision making.

3 IDENTIFICATION OF TRANSMISSION LINE SEGMENTS

A range of transmission routing segments were identified through a siting study, the scoping process, and supplemental studies and consultations. These studies were conducted to identify potential geographical routes (or segments) that could be further studied for the proposed double-circuit 230 kV transmission line between Barren Ridge and Haskell Canyon.

3.1 SITING AND ROUTING EVALUATION

In May of 2007, LADWP completed a 230 kV Transmission Line Siting Study. The study evaluated a number of environmental resources and engineering constraints in order to identify reasonable routing segments for the proposed Barren Ridge – Castaic 230 kV Transmission Project (the project name was changed to the Barren Ridge Renewable Transmission Project in March 2008).

A study area for the siting of an electrical transmission line was identified by utilizing physical features of the area to create boundaries. Interstate 5 became the western boundary, the northern boundary followed the Tehachapi Mountains, State Route 14 and Edwards Air Force Base created an eastern boundary, and the Santa Clara River and San Gabriel Mountains formed the southern boundary. The area measured approximately 819,000 acres (approximately 1,280 square miles) and was utilized as the basis for data inventory and mapping and sensitivity analyses (see Figure 2).
Environmental resource data was gathered within the study area for six disciplines: land use, visual resources, biological (wildlife and botanical) resources, cultural resources, water resources, and geohazards. Resource data was then mapped utilizing a geographic information system (GIS), and ground reconnaissance was completed to verify and supplement inventory mapping.

Resource sensitivity was developed for the following environmental resources: land use, cultural resources, biological resources, water resources, visual resources, and geohazards. Sensitivity is defined as a measure of probable adverse response of a resource to direct and indirect impacts associated with the construction, operation, and maintenance of the proposed high-voltage transmission line. Sensitivity levels were categorized as exclusion, high avoidance, moderate avoidance, or low avoidance. Areas of low sensitivity and linear features (highways, existing transmission lines, pipelines, aqueducts, etc.) were considered siting opportunities for the new 230 kV transmission line. The sensitivity levels for each of the environmental resources may be found in Appendix A.

Following the mapping of resource sensitivity constraints, GIS layers were overlaid to create a composite sensitivity map (see Figure 2). Exclusion areas are identified on the map with the color red, orange represents areas of high sensitivity, yellow denotes moderately sensitive areas, and gray represents low sensitivity or areas of opportunity for the siting of a new 230 kV transmission line.

The composite sensitivity map was used as a basis for identifying areas that provided the fewest constraints for the siting of a new transmission line. These areas are shaded in green in Figure 3 (Siting Study Corridor Map) and are generally within existing utility corridors. These corridors were further refined to consider reliability constraints and reasonable routing options for the new 230 kV transmission line from the Barren Ridge Switching Station to the proposed Haskell Canyon Switching Station. For example, the Eastern “Acton” Corridor, located on the southern portion of Figure 3 from Vincent Substation to the Proposed Haskell Canyon Switching Station, was eliminated from further consideration because this corridor was already congested and there was no need to connect into the Vincent Substation. Another example was the Midway to Vincent Corridor that traversed west to east, instead of north (Barren Ridge Switching Station) to south (Rinaldi Substation). This corridor would be much longer and has the potential to impact the greatest amount of sensitive habitat on the Angeles National Forest.

The Composite Sensitivity Map did not reflect reconductoring of the existing BR-RIN transmission line from Barren Ridge Switching Station to Rinaldi Substation because routing alternatives for reconductoring were not considered. Later, the study area boundary was extended to the Rinaldi Substation.
FIGURE 2. SITING STUDY COMPOSITE SENSITIVITY MAP.
FIGURE 3. SITING STUDY CORRIDOR MAP.
3.1.1 **Siting and Routing Evaluation Results**

Following the identification of potential transmission line corridors as shown on Figure 3, a field review was conducted to verify the feasibility of those corridors. Several potential corridors were eliminated from further consideration due to dense urban development, other conflicting land uses, transmission reliability constraints, or the potential to add significant length to the proposed transmission line. As a result, over 200 miles of preliminary routing opportunities or corridors (also known as Segments A through K) were identified for the siting of a new 230 kV transmission line, reconductoring of an existing transmission line, and addition of a new 230 kV circuit. A brief discussion of the Segments are included below and illustrated in Figure 4 (Proposed Project and Preliminary Alternative Corridors Map). Table 2 summarizes the total length and miles of private and public lands traversed by each segment. The segments were established using existing transmission lines, where present, as the centerline of the half-mile-wide corridors. The Segments were considered routing opportunities for the proposed Project. These segments were later combined to create end-to-end routing “alternatives” as discussed further in this report, in Section 6.0.

**Segment A** is 13 miles long; it traverses 4 miles of BLM-managed lands and 9 miles of privately owned lands. It runs from LADWP’s Barren Ridge Switching Station to just north of Mojave and is located on approximately four miles of BLM-managed lands. It contains LADWP’s existing 230 kV Barren Ridge – Rinaldi Transmission Line (BR-RIN) and 500 kV Pacific Direct Current Intertie (PDCI).

**Segment B** is 27.5 miles long and traverses privately owned lands the entire length. It starts just north of Mojave, CA and heads south towards the Antelope Valley California Poppy Reserve. It also contains LADWP’s existing 230 kV BR-RIN and 500 kV PDCI.

**Segment C** is 22 miles and traverses privately owned lands the entire length. It also starts just north of Mojave and heads southwest to approximately Cottonwood Creek. This corridor would be located parallel to the Los Angeles Aqueduct.

**Segment D** is 48 miles long; traverses 0.3 miles of California Department of Fish and Game-managed lands, 16 miles of USFS-managed lands, and 32 miles of privately owned lands. It generally parallels the Los Angeles Aqueduct from about Cottonwood Creek and heads south to Lancaster Road, and then west to the Interstate 5 utility corridor within the Angeles National Forest. Five high-voltage transmission lines and oil and gas pipelines occur along the Interstate 5 section of the segment.

**Segment E** is 11 miles long and traverses privately owned property the entire length. It starts just south of Cottonwood Creek and heads southeast towards the Antelope Valley California Poppy Reserve. Two existing high-voltage transmission lines occur in this corridor.

**Segment F** is the shortest corridor at 4 miles long and traverses privately owned property the entire length. It and extends from the Antelope Valley California Poppy Reserve to Southern California Edison’s (SCE’s) Antelope Substation. Two existing high-voltage transmission lines also occur in this segment.

**Segment G** is 21 miles long and traverses 8 miles of privately owned lands, and 13 miles of USFS-managed lands. It runs from the Antelope Valley California Polly Reserve to Haskell Canyon. LADWP’s existing 230 kV BR-RIN and 500 kV PDCI also occur along this segment.

**Segment H** is 20 miles long and traverses 7 miles of privately owned lands and 13 miles of USFS-managed lands. It runs mostly parallel to SCE’s Antelope-Pardee line (that was recently constructed). The last 1.5 miles follow the route of the old SCE 66 kV Saugus-Pardee line, which has been removed, and fall outside the designated Forest Service corridor in order to take a more direct route into the Haskell site.

**Segment I** is 31 miles long and traverses 27 miles of privately owned lands and 4 miles of USFS-managed lands. It starts at the Antelope Substation headed southeast to Palmdale (four existing high-voltage transmission lines occur along this portion), then makes a sharp turn and heads southwest to
Haskell Canyon (two of LADWP’s existing high-voltage transmission lines occur along this portion). A majority of this segment would be located outside of NFS lands. 

**Segment J** is 12 miles long and traverses 4.7 miles of privately owned lands and 7.3 miles of Los Angeles County Department of Parks and Recreation (LAP & R)-managed lands. It runs parallel to LADWP’s existing Castaic to Rinaldi 230 kV transmission line from the Castaic Power Plant to Haskell Canyon.

**Segment K** is 15.4 miles long and traverses 14. miles of privately owned lands, and 0.8 miles of Mountains Recreation and Conservation Authority (MRCA)-owned lands. It starts at Haskell Canyon and heads south to LADWP’s Rinaldi Substation. This segment has seven existing LADWP transmission lines.

### Table 2. Segment Lengths and Jurisdictions Traversed.

<table>
<thead>
<tr>
<th>Segment</th>
<th>Total Length (miles)</th>
<th>Jurisdiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13</td>
<td>4 miles BLM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 miles private</td>
</tr>
<tr>
<td>B</td>
<td>28</td>
<td>28 miles private</td>
</tr>
<tr>
<td>C</td>
<td>22</td>
<td>22 miles private</td>
</tr>
<tr>
<td>D</td>
<td>48</td>
<td>0.3 CDFG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16 miles USFS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32 miles private</td>
</tr>
<tr>
<td>E</td>
<td>11</td>
<td>11 miles private</td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>4 miles private</td>
</tr>
<tr>
<td>G</td>
<td>21</td>
<td>13 miles USFS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 miles private</td>
</tr>
<tr>
<td>H</td>
<td>20</td>
<td>13 miles USFS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 miles private</td>
</tr>
<tr>
<td>I</td>
<td>31</td>
<td>27 miles of private</td>
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<td></td>
<td></td>
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<td>J</td>
<td>12</td>
<td>7 miles LAP&amp;R</td>
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<tr>
<td></td>
<td></td>
<td>4 miles private</td>
</tr>
<tr>
<td>K</td>
<td>15</td>
<td>1 mile MRCA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 miles private</td>
</tr>
</tbody>
</table>
FIGURE 4. PROJECT COMPONENTS AND PRELIMINARY ALTERNATIVE CORRIDORS MAP.
3.2 SCOPING PROCESS
In Spring 2008, public scoping for the BRRTP was conducted to determine the scope of issues to be addressed, and identify the range of actions, alternatives, mitigation measures, and environmental effects to be analyzed in the Draft EIS/EIR.

Scoping was initiated by publication in the Federal Register of a Notice of Intent (NOI) to prepare a joint EIS/EIR. A similar Notice of Preparation (NOP) was filed with the California State Clearinghouse on April 7, 2008. The NOI/NOP requested all comments be received by May 7, 2008. It described the proposed Project, the agencies’ scoping and environmental review process, and contact information. It served as an invitation for state, local, and other federal agencies, as well as the general public, to provide comments on the scope and content of the EIS/EIR. Approximately 500 NOPs were distributed to federal, state, regional, and local agencies, elected officials, organizations and Native American groups.

In addition to the distribution of the NOP and publication of the NOI, approximately 7,200 newsletters were sent to agency representatives, elected officials, Native American Tribes, interested parties and organizations, and property owners within 500 feet of both sides of the proposed Project and preliminary alternatives in Los Angeles and Kern Counties. The newsletters contained the Project description, purpose and need for the Project, and map, described the environmental review process, announced public scoping meetings, and contained contact information, in both English and Spanish.

The Forest Service, BLM and LADWP conducted seven public scoping meetings from April 22 to May 1, 2008 in the following locations: Santa Clarita, Castaic, Agua Dulce, Lake Hughes/Elizabeth Lake, Lebec, Palmdale, and California City. The scoping meetings provided an opportunity to share information regarding the proposed Project and the decision-making processes, and listen to public and agency views on the range of issues and alternatives to be considered during the preparation of the Draft EIS/EIR. All meetings were conducted in an “open house” format to allow participants to attend any time between 5:30 p.m. and 8:30 p.m. A brief presentation video was shown by the Project team at 7 p.m. followed by a general “comment and question” session.

Additional opportunities for public input and information sharing throughout the scoping process were provided via a Project website, an e-mail address, a toll-free hotline, and formal press releases by the lead agencies. Meetings with several local town councils were also attended by representatives of the lead agencies.

3.2.1 Scoping Process Results
The scoping process indicated a number of primary concerns about potential impacts of the proposed Project or alternatives. These concerns covered a broad range of input, and included opposition to the Project, support for Project objectives but opposition to certain routes, information on both environmental and social impacts, concerns over the process used to involve the public, suggestions for alternatives to the proposed Project, and suggestions for mitigating impacts. Details of the input received during public scoping can be found in the Barren Ridge Renewable Transmission Project Scoping Report.

The comments received at the scoping meetings, as well as via phone, email and mail, were analyzed to identify the significant issues and formulate alternatives that would avoid or minimize adverse impacts to environmental resources. Issues are defined as “a point of disagreement, debate, or dispute about the proposed action based on effects identified through scoping.” Issues were considered non-significant if they were: 1) outside the scope of the proposed action; 2) irrelevant to the decision to be made; 3) already decided by law, regulation, or policy; or 4) conjectural or not supported by scientific evidence. It is important to note that the source of these issues was both internal (inter-agency) and external (elected officials and public). Information from the draft technical reports was also considered in determining if issues are non-significant based on preliminary resource impacts. Analysis of this scoping information
identified significant issues associated with the following resources: biological resources, cultural resources, earth resources, water resources, land use, and recreation. These resources and their associated significant issues have been considered in the development of alternatives to the proposed action and will drive the analysis in the EIS/EIR. See Table 3 in Section 4.2 for a list of the significant issues identified through this scoping process and post-scoping public input.

The public suggested a number of alternatives to the proposed Project. Some residents in the Project area recommended the use of tubular steel mono poles instead of lattice steel structures, or suggested undergrounding of transmission lines. Some residents recommended the use of a single-tower system (multi-circuit towers) to accommodate the need for existing and proposed towers, as well as to minimize right-of-way expansion by combining new and existing lines on one set of structures. Direct Current (DC) lines were recommended as an alternative to the proposed alternating current (AC). Residents also requested the use of Niobium wire as an alternative to aluminum or copper wire. Electrical generation within the City of Los Angeles was recommended to avoid long distance electrical transmission distribution and impacts to rural communities. The BLM and Forest Service inquired about upgrading the electrical transmission system to a 500 kV instead of 230 kV transmission system.

Two localized routing alternatives were proposed by the public during the scoping period. The first, referred to as the Green Valley Re-route, was proposed by Green Valley residents and is located approximately one quarter-mile west of Green Valley along an existing fire road through NFS lands. This re-route would avoid possible impacts to the Green Valley community. The second routing suggestion, referred to as the 110th Street Re-route, was proposed by the residents along Segments F and H. The modification of Segment F would parallel 110th Street and connect Segments F and H instead of following along the existing transmission lines to Antelope Substation. This modification was proposed to follow property lines and avoid bisecting private property in the area. Please refer to Figure 5 for an enlarged view of the proposed reroutes.
FIGURE 5. PROPOSED RE-ROUTE MAP.
3.3 INTERDISCIPLINARY ROUTE IDENTIFICATION MEETING

In January 2009, the BRRTP interdisciplinary team, comprised of resource specialists from the Forest Service, BLM, LADWP, and the third-party environmental consultants, conducted a two-day workshop to identify end-to-end routing alternatives for the proposed double-circuit 230 kV transmission line from Barren Ridge Switching Station to the proposed Haskell Canyon Switching Station. A total of nine environmental resource groups were involved (air quality, biological resources, cultural resources, earth resources, engineering, land use/recreation, public involvement, visual resources and water resources). This workshop did not consider the no action alternative, alternative system configurations, construction methods, or detailed engineering and design.

Within this workshop, key members from the Forest Service, BLM, LADWP, and the third-party environmental consultants, referred to as the Steering Committee, shared information with the team on their recommendation for elimination of Segment D and the Green Valley Modification from further study in the EIS/EIR. Segment D was initially recommended for elimination because it would create overloading of existing electrical facilities south of the Castaic Power Plant, require significant modifications to the Castaic Power Plant and expansion of right-of-way south of Castaic, result in potential impacts to the Old Ridge Route (an eligible historical district on the National Register of Historic Places), and face difficulties in construction of new towers on unstable terrain on the Angeles National Forest. This recommendation was later reconsidered and Segment D was brought back into consideration based on public input during the post-scoping public involvement meetings (see Section 3.4). The Green Valley Re-route was also recommended for elimination from detailed study because it would create environmental impacts to Angeles National Forest lands that would be over a mile from the designated utility corridor. These impacts included crossing the Pacific Crest Trail over a mile from the existing lines, and construction disturbance along a relatively undisturbed and intact riparian area, South Portal Canyon. To minimize impacts to the community of Green Valley, LADWP proposed siting the new 230 kV transmission line a few hundred feet north of the existing lines to avoid the residences within the community, which was the objective of the original Green Valley Re-route.

Prior to the workshop, the BRRTP interdisciplinary team gathered into environmental resource groups and compiled their inventories and potential impacts of the remaining routes into impact tables. Maps were developed for each resource showing the levels of impact, represented by changes in color along the centerlines. At the meeting, each resource group presented potential impacts to their resource to the interdisciplinary team. The team took into consideration the potential significant issues from the construction, operation and maintenance of the proposed Project. The significant issues were then used to identify and assess the reasonable combinations of routing alternatives to the proposed action that would avoid or minimize adverse effects.

To identify end-to-end routing opportunities of the new 230 kV transmission line, localized sub-routes that had common endpoints were identified and compared utilizing the physiography of the Project. The northern portion of the Project area consists of flat desert areas of the Mojave Desert and Antelope Valley, and the southern portion contains the mountains of the Angeles National Forest. For example, the Antelope Valley sub-routes consisted of 1) Segments C and E or 2) Segment B. The sub-routes through the Forest were 1) Segment G, 2) Segments F and H, or 3) Segments F and I. (Segment D was recommended for elimination and not considered in the sub-route comparison.) The process of building end-to-end routing alternatives for the new 230 kV transmission line included comparisons of significant issues, tradeoffs, and agency concerns regarding the segments.

3.3.1 Route Identification Results
Six routing alternatives for the siting of a new 230 kV transmission line were identified for further study as a result of the interdisciplinary meeting. Refer to Figure 6 for the location of the routing alternatives.
The other Project components (reconductoring of the existing Barren Ridge-Rinaldi Transmission Line, addition of a new 230 kV circuit, and expansion of the existing Barren Ridge Switching Station) would utilize existing facilities and rights-of-way; therefore, these components do not have routing alternatives. These six routing alternatives, and others associated with the reconsideration of Segment D, are discussed in detail in section 6.0, with recommendations addressing their feasibility, ability to meet purpose and need, and potential to reduce environmental effects.
**Figure 6. Preliminary Alternative Routes for the New 230 kV Transmission Line.**

The map shows preliminary alternatives that were recommended to be carried forward in the Draft EIS/EIR but were revised in Spring 2009 due to input from the public and further modifications of the routing alternatives.
3.4 INFORMATIONAL PUBLIC MEETINGS

In February 2009, LADWP conducted five informational public meetings in Lake Hughes, Mojave, Agua Dulce, Saugus, and Leona Valley. The public received updates regarding scoping results, preliminary resource studies, and the evaluation of alternative transmission line routes. These meetings also provided the public with additional opportunities to provide comments about the Project. The Project team presented the six routing alternatives for the new 230 kV transmission line identified for further study in the EIS/EIR, along with the recommendation to eliminate Segment D and the Green Valley Re-route from further study.

Public involvement is an integral part of the environmental review process. Although the scoping period ended in May 2008, all comments received via mail, email, and the Project hotline, and at the informational public meetings, have been accepted and considered by the Project Team. The comments received were very similar to those received during the scoping period. Residents in the Project area suggested localized alternatives to the proposed Project, consideration of in-basin generation of renewable resources, and sharing of transmission lines and renewable resources with other utility companies. Residents in Green Valley and Elizabeth Lake recommended the use of multi-circuit towers instead of numerous double- or single-circuit towers. Undergrounding was suggested along Segments B, C, and E, and in Elizabeth Lake, Green Valley, Leona Valley, and the Antelope Valley. Tubular steel poles (also known as monopoles) were recommended in Antelope Valley. To minimize the number of new transmission line corridors, residents in Quartz Hill recommended moving the 110th Street Reroute to 115th Street (following SCE’s Tehachapi Renewable Transmission Project’s proposed alignment through the area). The public also requested consideration of a 500 kV transmission line system instead of the proposed 230 kV transmission line system. Residents along Segment D suggested utilization of existing transmission line corridors instead of impacting undisturbed areas. Questions were asked about electromagnetic fields (EMF), eminent domain, and property values. Mitigation to purchase land around Lake Elizabeth was also suggested. The public as well as elected officials strongly recommended reconsideration of Segment D to avoid impacts to the communities of Elizabeth Lake, Green Valley, Leona Valley, and Agua Dulce.

As a result of the public meetings, BLM, the Forest Service, and LADWP modified Segment D. This modification made the segment feasible for the Project and is thus being carried forward into a routing alternative for consideration in the EIS/EIR. Further discussion on Segment D may be found in Section 5.3.2. Also, the list of significant issues was revised to include EMF, fire suppression, and potential for loss of habitat.

4 ALTERNATIVES EVALUATION METHODOLOGY

To determine which alternatives would be analyzed in the Draft EIS/EIR, alternatives were evaluated to determine whether they would:

1. Attain the purpose and need of the Project, as well as most of the basic objectives of the Project.
2. Have the potential to avoid or substantially lessen any of the significant or adverse effects of the Project.
3. Be considered feasible.

4.1 MEETING THE PURPOSE AND NEED

Each Lead Agency has its own purposes to consider in evaluating a proposed project/action and the alternatives to the proposed project/action. NEPA (CFR Title 40 Section 1502.13) and CEQA (Guidelines Section 15124(b)) explain that an agency’s statement of objectives or purpose and need should describe the underlying purpose of the proposed project or need for action. Each agency’s jurisdiction is unique
and the decision it is called upon to make is also unique; thus, each agency’s statement of objectives or purpose and need is different. Therefore, the three Lead Agencies for the BRRTP have prepared their own purpose and need statements for the BRRTP, which are summarized below. Detailed purpose and need statements by the lead agencies may be found in Chapter 1 of the EIS/EIR.

4.1.1 **LADWP’S Purpose and Need**

LADWP’s purpose and need for BRRTP is to:
- Reduce the environmental impacts associated with greenhouse gas emissions and create a more sustainable environment.
- Assist LADWP to meet Renewable Portfolio Standard (RPS) goals.
- Meet the growing electrical energy demands of the City of Los Angeles.
- Allow interconnection and expansion of LADWP’s renewable energy in the Tehachapi Mountains and Mojave Desert areas.
- Increase LADWP’s system reliability and flexibility in the utilization of renewable energy sources.
- Enable the delivery of renewable energy.

4.1.2 **BLM’s Need for Action**

BLM’s purposes in authorizing the proposed action, or an alternative, are the following:
- Minimize adverse environmental effects to BLM managed lands, such as the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values.
- Promote increased use of renewable energy and more efficient use of existing energy corridors, and designate new corridors to ease congestion.
- Avoid or minimize impacts to Areas of Critical Environmental Concern (ACEC—an area where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards).

4.1.3 **Forest Service’s Need for Action**

Pursuant to the Federal Land Policy and Management Act (FLPMA) of 1976 (as amended), the Forest Service’s need for action is to respond to applications from LADWP for a Special Use authorization to construct, maintain, and use transmission lines (and ancillary improvements) through the Santa Clara/Mojave Rivers Ranger District of the Angeles National Forest. The Forest Service will consider the application for use of NFS (National Forest System) lands to ensure that the proposed action is in the public interest and is appropriate based on the governing land management plan. FLPMA provides the authority to the Secretary of Agriculture (Forest Service) to issue, renew, or grant authorizations to occupy, use, or traverse NFS lands for the generation, transmission, and distribution of electrical power (43 U.S.C. 1761).

The Forest Service’s purposes in authorizing the proposed action, or an alternative, are the following:
- Minimize adverse environmental effects to Natural Forest System lands, such as impacts to the following resources: visual, biological, cultural, recreation, air, soil, and water, among others as applicable (Forest Plan, Part 1, pp. 38 and 47; Part 2, pp. 7, 32, 35, 69, and 79);
- Review the eligible San Francisquito Canyon as a Wild and Scenic River. If the proposed action could compromise the outstandingly remarkable value(s), potential classification, or free-flowing character of an eligible wild and scenic river segment, a suitability study will be completed for that eligible river segment prior to initiating activities (Forest Plan, Standard 59, Part 3, p. 13);
- Minimize the effects of urbanization, or negative effects to open space and natural settings, on the Angeles National Forest (Forest Plan, Part 2, pp. 35, 67-70);
Ensure that future Forest management activities such as wildland fire fighting, among others, are not detrimentally affected by the location and/or design of the proposed action (Region 5 Supplement FSM 2726.43; Forest Plan, Part 1, p. 19; Part 2, p. 37); and

Ensure that the location of the transmission line on NFS lands maximizes the accommodation of future utility needs (Forest Plan, Part 2, p. 121; Part 3, p. 59).

4.2 POTENTIAL TO AVOID OR MINIMIZE ENVIRONMENTAL EFFECTS

Per NEPA Regulations (40 C.F.R. Section 1500.2(e)), the NEPA process is used to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment. CEQA Guidelines (Section 15126.6(b)) also state that the discussion of alternatives shall focus on alternatives to the project or its location which are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly.

Through scoping, subsequent public involvement efforts, and preparation of preliminary technical reports, the following potentially significant issues were identified with the construction, operation and maintenance of the proposed BRRTP.

**TABLE 3. SIGNIFICANT ISSUES OF THE BRRTP**

<table>
<thead>
<tr>
<th>RESOURCE</th>
<th>POTENTIAL SIGNIFICANT ISSUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Resources</td>
<td>Potential for adverse effects to rare, threatened, and endangered and special-status species. Considerable concern for Riparian Conservation Areas and the spread of noxious weeds throughout Angeles National Forest lands. Impacts to avian species and increased raptor predation of sensitive species due to the use of lattice towers. Potential for loss of habitat.</td>
</tr>
<tr>
<td>Cultural Resources</td>
<td>Impacts to historical, cultural and archaeological resources in the Project area.</td>
</tr>
<tr>
<td>Earth Resources</td>
<td>Adverse impacts to soils throughout the proposed Project area, including sedimentary rocks and fossils.</td>
</tr>
<tr>
<td>Water Resources</td>
<td>Impacts to drainages, wetlands, Waters of the State, Waters of the U.S., and blue-line streams.</td>
</tr>
<tr>
<td>Land Use</td>
<td>Acquisition of private property, eminent domain, and the expansion of transmission line right-of-way and easements. Decreased property values with additional transmission lines. Conflicts with land use and recreation policies of the Forest Plan.</td>
</tr>
<tr>
<td>Fire Management</td>
<td>Impacts to fire suppression efforts.</td>
</tr>
<tr>
<td>Recreation</td>
<td>Impacts to recreational facilities and trails. Impacts to the quality of the Antelope Valley California Poppy Reserve, Pacific Crest Trail, Wild and Scenic River Corridor, and wilderness.</td>
</tr>
<tr>
<td>Visual Resource</td>
<td>Adverse affects to visual resources of the area, especially those important to the character of the ridgelines, as well as from homes, communities, businesses, trails, State Parks, Angeles National Forest, BLM-managed lands, and other public lands.</td>
</tr>
</tbody>
</table>

4.3 FEASIBILITY

CEQA Guidelines (Section 15126.6(f)(1)) state that a number of factors may be considered in determining which alternatives are feasible. These include, but are not limited to, the following:

- Suitability;
- Economic viability;
availability of infrastructure;
general plan consistency;
other plans or regulatory limitations;
jurisdictional boundaries; and
whether the proponent can reasonably acquire, control or otherwise have access to the alternative site
(or the site is already owned by the proponent).

According to NEPA’s Forty Most Asked Questions No.2a, reasonable alternatives include those that are practical or feasible from a technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant.

4.4 RECOMMENDATION FOR ANALYSIS IN EIS/EIR

A number of alternatives to the proposed Project were identified, and some of these alternatives did not meet the purpose and need for the Project or provide the potential to avoid or minimize adverse environmental effects, or were considered infeasible through additional study and evaluation. A rationale for each alternative’s ability to meet the criteria is provided in the following section, along with a recommendation for elimination or retention of the alternative for full analysis in the EIS/EIR.

5 ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED ANALYSIS

NEPA and CEQA require an EIS/EIR to consider a reasonable range of alternatives to the project that would feasibly attain most of the basic objectives of the project, but avoid or substantially lessen any adverse effects of the proposed project. The scoping process, informational public meetings, and preliminary studies identified fourteen alternatives for the proposed Project.

To determine which alternatives would be considered for full analysis in the EIS/EIR, the alternatives were categorized as system, design, or routing alternatives. A brief description of each alternative is provided, the alternative’s ability to meet the screening criteria described in Section 4.0 is disclosed, and a rationale for the recommendation to retain or eliminate an alternative from full analysis in the EIS/EIR is provided.

5.1 SYSTEM ALTERNATIVES

5.1.1 Energy Conservation and Demand-Side Management

Alternative Description

This alternative would involve increased energy conservation and demand-side management within the LADWP service area instead of interconnecting to generation from the Tehachapi Mountains and Mojave Desert.

Energy conservation and demand-side management are currently an integral part of LADWP’s strategy to meet customer needs. Energy-saving and efficiency efforts include the Consumer Rebate Program, the Refrigerator Exchange and Retire Program, Low Income Refrigerator Exchange Program, Trees for a Green LA, the Small Business Direct Install Program, and the Compact Fluorescent Light Bulb Delivery Program. This alternative would continue these existing programs and invest in expanding them.

Meeting the Purpose and Need

This alternative would generally reduce the need for additional power and could thus reduce greenhouse gas emissions, but would not assist in meeting the Renewable Portfolio Standard Goals or allow for the interconnection and expansion of LADWP’s renewable energy in the Tehachapi Mountains and Mojave Desert. Nor would it increase system reliability and flexibility in the utilization of renewable resources or
enable the delivery of renewable energy. In 2007, Los Angeles Mayor Antonio Villaraigosa committed that power contracts from coal-fired plants would not be renewed and LADWP would secure other generation sources. Energy conservation and demand-side management alone will not meet the electrical demand.

Potential to Avoid and Minimize Environmental Effects
Energy conservation and demand-side management would decrease energy demand which, if other contributing factors such as population growth were static, given a static demand would decrease the need for power generation and transmission. Decreased power generation could lead to avoiding environmental impacts associated with power generation from existing facilities (e.g., to Air Quality, Water Resources, Hazards and Hazardous Materials) and avoid impacts associated with the development of new power facilities and transmission (e.g., to Biological Resources, Cultural Resources, Earth Resources, Water Resources, Land Use, Recreation, Visual Resources). This alternative would eliminate nearly all of the significant issues identified by not constructing, operating, or maintaining the BRRTP. However, it is assumed that if Barren Ridge were not built, other transmission projects with similar impacts may be proposed to meet the electrical demands, RPS goals, and greenhouse gas emission reductions.

Feasibility
Since 2000, LADWP has successfully implemented a number of conservation and energy efficiency programs and reduced peak load by approximately 176 MW. While energy conservation and demand-side management is feasible and may reduce electricity demand, the reductions alone are not sufficient to meet current and future electrical demands or RPS goals.

Recommendation for Analysis in EIS/EIR
ELIMINATION. Energy conservation and demand-side management alone will not meet the electrical energy demands, meet RPS goals, or achieve greenhouse gas emission reduction goals. While it could lead to avoidance and minimization of environmental effects from the construction of a new transmission line, it is not feasible to rely solely on this strategy to meet the electrical energy demands and meet RPS and greenhouse gas reduction goals.

5.1.2 Distributed Generation and In-basin Generation Expansion

Alternative Description
This alternative would involve the increased expansion of distributed generation, including solar facilities and fuel cells within the LADWP service area, and the development of additional large scale in-basin generation instead of interconnecting to generation from the Tehachapi Mountains and Mojave Desert. Distributed generation entails the installation of new small electrical generating plants, typically less than 20 megawatts, at or near electric load centers. New in-basin generation could include facilities such as new gas, biogas, small hydro-electric, solar, and geothermal power plants.

Increased distributed generation and small solar generation is already an integral part of LADWP’s approach to meeting energy needs and RPS goals. Some of the programs that LADWP has implemented are the Distributed Generation Program, Customer Generation Rebate Program, and Residential Solar Initiative Program. In addition, LADWP has also recently upgraded a number of their generating stations to make them more efficient.

Meeting the Purpose and Need
To the extent that the new generation would be renewable in nature, this alternative could assist LADWP to meet RPS goals and reduce greenhouse gas emissions. The existing programs currently being implemented by LADWP have already been included within its projected RPS goals. These programs and
projects alone, however, will not meet the long-term RPS goals. It would not allow interconnection and expansion of LADWP’s renewable energy in the Tehachapi Mountains and Mojave Desert, or delivery of renewable resources. System reliability and flexibility of the existing high-voltage transmission system would not increase. It would, however, minimize effects to ANF and BLM managed lands.

Potential to Avoid and Minimize Environmental Effects
New sources of in-basin generation would avoid impacts associated with the proposed Project, but would also result in site-specific impacts associated with the construction and installation of new distributed solar facilities, gas, hydro-electric, solar and/or geothermal power plants, including impacts to air quality, biological resources, cultural resources, land use, noise, traffic, transportation, socioeconomics, and visual resources. Electrical transmission upgrades would also be required to integrate these new resources into the transmission system, and although their locations and specific impacts are unknown, it is assumed that impacts of additional transmission and generation projects would be similar enough to BRRTP that they may, on balance, cancel any environmental benefits of this alternative.

Feasibility
Building distributed generation and expansion of in-basin generation resources is feasible.

Recommendation for Analysis in EIS/EIR
ELIMINATION. LADWP has implemented a number of distributed generation and in-basin generation programs. This alternative alone will not meet the electrical energy demands, meet RPS goals, achieve greenhouse gas emission reduction, or increase overall system reliability, nor would it provide delivery of renewable energy at a level and within a timeframe necessary to meet purpose and need.

5.1.3 Solar Alternative
Alternative Description
The solar alternative would involve the increased use of solar energy. LADWP has a Solar Energy Plan that consists of the following five programs that are mainly in the Los Angeles Basin:

1. The Solar Incentive Program (SIP), which encourages LADWP ratepayers to install solar panels on their roofs. The goal is to install 130 MW of customer-owned solar systems by 2020;

2. Feed-in Tariff (FiT) would allow a solar developer in the City of Los Angeles to sell wholesale power directly to LADWP through a long-term contract between the private seller and LADWP. The goal is to obtain 150 MW of solar power from developers by 2016;

3. The new SunShares Program would provide residential customers the opportunity to invest in an LADWP solar power plant. The goal is to obtain approximately 100 MW of solar power from a SunShares power plant by 2020;

4. The Utility Built (LADWP-owned Solar Projects) program would involve the installation of solar systems on LADWP-owned rooftops, reservoirs and parking lots. LADWP has a goal of obtaining 400 MW of solar power from City-owned systems by 2014; and

5. The Large-Scale Solar Program would involve LADWP procuring large-scale power purchase agreements from third-party solar developers. LADWP has a goal of obtaining 500 MW of utility-scale solar power from developers in the Mojave Desert by 2020.
The Solar Incentive Program, SunShares, and Feed-in-Tariff programs would be within the Los Angeles Basin. The Utility Built program would be mostly in-basin as well. The Large-Scale Solar Program (or power purchase agreements) would largely be out-of-basin in order to access solar resources in the Mojave Desert and require transmission to the City of Los Angeles.

Meeting the Purpose and Need
The increased utilization of solar energy would provide LADWP with approximately 10% of its RPS goals and would reduce greenhouse gas emissions. However, the solar programs alone would not meet LADWP’s RPS goal of 35% by 2020. System reliability and flexibility of the existing high-voltage transmission system would not increase. Without the construction of a new 230 kV transmission line from Barren Ridge to Haskell Canyon, the delivery of solar energy from the Mojave Desert area would be limited.

Potential to Avoid and Minimize Environmental Effects
In-basin solar generation would avoid the need to construct a new 230 kV transmission line and reconductor an existing transmission line. However, the Large-Scale Solar Program and Solar Incentive Program may result in site-specific impacts associated with the construction and installation of new solar facilities and require electrical transmission upgrades to integrate these new resources into LADWP’s electrical system.

Feasibility
Accessing solar energy is feasible, as evidenced by the solar program proposals by LADWP listed above.

Recommendation for Analysis in EIS/EIR
ELIMINATION. LADWP currently has a Solar Energy Plan that proposes a number of solar programs that would provide approximately 10% of LADWP’s electrical demand. Although this alternative may avoid or minimize impacts of the proposed Project, this alternative alone would not meet the electrical energy demands or RPS goals. Additional transmission capacity may also be required to transfer solar energy from the Large-Scale Solar Program in the Mojave Desert area to the Los Angeles Basin.

5.1.4 Reconductor Existing Transmission Line (No New Transmission Line)
Alternative Description
To minimize impacts of a new transmission line and right-of-way expansion, LADWP considered an alternative that would upgrade the existing electrical system. This alternative would have all the same project components as the Proposed Project (reconductoring the existing BR-RIN transmission line, addition of a new 230 kV circuit on existing structures, construction of Haskell Canyon Switching Station, and expansion of Barren Ridge Switching Station), except the construction of a new double-circuit 230 kV transmission line from the Barren Ridge Switching Station to the proposed Haskell Switching Station.

The BR-RIN’s existing conductors would be replaced with a 1,433.6 kcmil “Merrimack” ACSS/TW/HS (aluminum conductor steel supported/trapezoidal wires/high strength). A new circuit, consisting of a bundled 715.5 kcmil “Starling” ACSS/AW conductor, would be placed onto existing structures from the Castaic Power Plant to the proposed Haskell Canyon Switching Station.

Reconductoring of the existing BR-RIN transmission line would take approximately one year and would require the transmission line to be taken out of service. However, north of Barren Ridge Switching Station, seven LADWP hydroelectric power plants along the Los Angeles Aqueduct transmit their electrical energy output onto the BR-RIN transmission line. The power plants do not have by-pass
capabilities and are required to generate energy to avoid deterioration to the electrical turbines. Therefore, since there is no means for bypassing the power plants or halting the electrical output, a temporary transmission line would be required in order to reconductor the existing BR-RIN transmission line between Barren Ridge and Haskell Canyon. This temporary transmission line, sometimes referred to as a shoe-fly, would typically consist of temporary wood poles used to carry the existing energized conductors along the entire stretch of the BR-RIN corridor. Construction of the temporary shoe-fly would require approximately 80 – 100 feet of temporary right-of-way adjacent to the existing BR-RIN line. The construction would require surveying of right-of-way, rehabilitation of existing access and spur roads, clearing of right-of-way where necessary, installation of temporary poles, conductor relocation and installation, and cleanup.

To the maximum extent possible, the same access and spur roads utilized for the construction of a temporary shoe-fly would be also be utilized for the reconductoring of the BR-RIN. To carry the additional weight of the new heavier conductor, some existing BR-RIN towers may require modification, replacement, or foundation reinforcement. The existing conductor would be used as a pulling line for the new conductor. Once the transmission line is reconducted and in service, the temporary shoe-fly would be removed.

The addition of a new circuit from the Castaic Power Plant to the proposed Haskell Canyon Switching Station would require surveying of right-of-way, rehabilitation of existing access and spur roads, clearing of right-of-way where necessary, installation of conductor, and cleanup. All work would occur within the existing right-of-way.

The new proposed Haskell Canyon Switching Station and expansion of the Barren Ridge Switching Station would be located on LADWP-owned land. The construction of a new switching station and expansion of the existing switching station would require the following activities: preconstruction surveys, clearing and grading of access roads, site grading and drainage development, installation of concrete foundations and steel support structures, installation of below- and above-ground electrical conduits for equipment power and control, installation of below- and above-grade grounding conductors, installation of electrical equipment, and installation of control and relay houses.

Meeting the Purpose and Need
The existing BR-RIN transfers approximately 110 MW of hydropower. In the mountains northeast of Tehachapi, LADWP has two wind projects (Pine Tree, which has recently completed construction, and the proposed Pine Canyon) that would total 270 MW. The power generated from these wind projects will be transferred through the BR-RIN transmission line, thus creating a total generation transfer of 380 MW. Even with the increased capacity from reconductoring, the upgraded transmission line would not be sufficient to deliver future renewable energy from the Tehachapi Mountains and Mojave Desert areas.

Without the construction of a new double-circuit 230 kV transmission line, the amount of renewable energy transferred from the Tehachapi Mountains and Mojave Desert areas to the Los Angeles basin would be very limited. Also, any disruption of service along the reconducted transmission line would cease transmission of renewable energy from the Project Area. The existing Pacific Direct Current Intertie is adjacent to the BR-RIN; however, it operates as a bipolar direct current 500 kV transmission line and it is very difficult for renewable resources to tap into and interconnect.

Limiting LADWP’s ability transfer renewable energy would also limit its ability to reduce greenhouse gas emissions, meet RPS goals, ensure reliability and flexibility in the utilization of renewable energy sources, and conduct interconnections and expansion of renewable energy sources. Elimination of the new transmission line would minimize long-term permanent impacts to federal lands managed by the
BLM and USFS. However, this alternative would not maximize the accommodation of future utility needs, nor would it increase system reliability along the Barren Ridge to Haskell Canyon utility corridor.

**Potential to Avoid and Minimize Environmental Effects**

The reconductoring of the existing BR-RIN and addition of a new circuit between Castaic and Haskell Canyon would maximize the use of existing right-of-way and minimize the permanent acquisition of private property. It would also minimize potential permanent impacts to lands federally managed by the BLM and USFS. The construction of a temporary shoe-fly would likely have less impact than the addition of a new double-circuit transmission line, due to its temporary nature and because the footprint of the shoe-fly is smaller than that of a double-circuit tower. However, the removal of the temporary towers would also contribute to temporary disturbance. It is assumed that if the new Barren Ridge-Haskell Canyon double-circuit transmission line were not built, other transmission projects with similar impacts to the proposed Project would be proposed by LADWP to meet the future electrical demands, RPS goals, and greenhouse gas emission reductions goals. Therefore, environmental impacts may not be minimized without the construction of a new transmission line.

**Feasibility**

This alternative is feasible.

**Recommendation for Analysis in EIS/EIR**

*ELIMINATION.* Without a new double-circuit 230 kV transmission line, the transfer capacity of the utility corridor from Barren Ridge to the proposed Haskell Canyon Switching Station would be constrained, thereby limiting LADWP’s ability to deliver renewable energy, meet future electrical demands, RPS goals, greenhouse gas reductions goals, and interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas. The permanent impacts of this alternative would be less than that of the proposed Project; however, the construction of a temporary shoe-fly and need for additional transmission capacity would not minimize or avoid impacts to environmental resources.

### 5.1.5 New 230 kV Transmission Line (No Reconductoring of BR-RIN)

**Alternative Description**

Another variation of the proposed Project would be the construction of four of the five proposed Project components. This alternative would eliminate the reconductoring of the existing BR-RIN transmission line. This alternative would include construction of a new 230 kV double-circuit transmission line from Barren Ridge Switching Station to the proposed Haskell Canyon Switching Station, addition of a new 230 kV circuit on existing structures from the Castaic Power Plant to the proposed Haskell Canyon Switching Station, construction of the Haskell Canyon Switching Station, and expansion of the Barren Ridge Switching Station.

Construction of the new transmission line would require a 200 foot right-of-way and involve the following general sequence of events: surveying the centerline; identifying and constructing access roads; clearing right-of-way and tower sites (including construction yards and batch plants); installing foundations; assembling and installing the towers; clearing, pulling, tensioning, and splicing sites; installing ground wires and conductors; installing counterpoise/ground rods; and cleanup and site reclamation.

The addition of a new circuit between Castaic and Haskell Canyon would require surveying of right-of-way, rehabilitation of existing access and spur roads, clearing of right-of-way, installation of conductors, and cleanup. All work would occur within existing right-of-way.
The construction of the new proposed Haskell Canyon Switching Station and expansion of the existing Barren Ridge Switching Station would require the following activities: preconstruction surveys, clearing and grading of access roads, site grading and drainage development, installation of concrete foundations and steel support structures, installation of below- and above-ground electrical conduits for equipment power and control, installation of below- and above-grade grounding conductors, installation of electrical equipment, and installation of control and relay houses.

**Meeting the Purpose and Need**

The construction of a new double-circuit transmission line, installation of a new circuit, construction of a new switching station, and expansion of the existing switching station would increase transmission of renewable energy from the Tehachapi Mountains and Mojave Desert areas to the Los Angeles Basin. However, without reconductoring the existing BR-RIN, LADWP would be limited by its ability to transfer renewable energy to the Los Angeles Basin and meet projected future electrical demands. Removing the reconductoring component would also limit LADWP’s ability to meet RPS and greenhouse gas reduction goals.

Utility companies must provide a reliable system and therefore must plan for disruptions in service. In the event that a transmission line was out of service, referred to as an N-1 situation, the energy would be transferred to adjacent transmission lines. Generally, planning for an N-1 situation takes into account the loss of the largest line within a corridor. Therefore, the lowest-capacity transmission line within a corridor would become the limiting factor. Reconductoring the existing BR-RIN transmission line would reduce the potential of the two new Barren Ridge-Haskell Canyon circuits’ transfer capacity significantly in order to avoid the overloading of the BR-RIN transmission line in an N-1 scenario. This alternative would also reduce the potential transmission capacity of the entire corridor between Barren Ridge and Haskell Canyon.

The elimination of the reconductoring component of the proposed Project would minimize impacts to federal lands managed by the BLM and USFS. However, it may not meet LADWP’s future electrical demands related to meeting RPS goals.

**Potential to Avoid and Minimize Environmental Effects**

Removal of the reconductoring component of the Project would minimize environmental impacts to air quality, biological resources, cultural resources, traffic and transportation, and water resources. It would also reduce cumulative impacts of the proposed Project.

**Feasibility**

Construction of the proposed project, minus reconductoring of the existing BR-RIN is feasible to construct.

**Recommendation for Analysis in EIS/EIR**

*ELIMINATION.* This alternative would allow LADWP to access renewable resources in the Tehachapi Mountains and Mojave Desert areas. By removing the reconductoring portion of the proposed Project, it would minimize the potential for impacts to environmental resources and reduce cumulative impacts of the proposed Project. However, it would limit LADWP’s ability to transfer renewable energy, meet future electrical energy demands, meet RPS goals, and reduce greenhouse gas emissions.
5.2 DESIGN ALTERNATIVES

5.2.1 Direct Current Transmission

Alternative Description
This alternative would utilize direct current (DC) for power transmission rather than alternating current (AC). DC conductors can transfer approximately twice the power than the proposed AC conductors and may also allow power transmission between unsynchronized AC distribution systems. This increases system stability by preventing cascading failures from propagating within a wider power transmission grid. The magnitude and direction of power flow through a DC transmission line can be directly commanded, and changed as needed to support the AC networks at either end of the DC link.

LADWP’s existing transmission network contains both AC and DC transmission. Parallel to the BR-RIN is the existing ±500 kV Pacific Direct Current Intertie (PDCI) that utilizes direct current technology. The PDCI is operating at capacity and cannot accommodate additional energy. In order to fully incorporate a new DC line into the existing AC system, conversion facilities would have to be built at the terminal ends (Barren Ridge Switching Station and the proposed Haskell Canyon Switching Station). The converter stations would be approximately 30 acres and include an inverter, three-phase alternating current switchgear, transformers, capacitors or synchronous condensers, filters for harmonics, and direct current switchgear.

The DC conductors have the ability to transfer a greater capacity than AC conductors. Therefore, in this alternative a new DC line would replace the proposed double-circuit 230 kV transmission line and existing BR-RIN. The DC towers would require similar right-of-way, tower heights, footprints, and tower-to-tower spans as that of the proposed 230 kV transmission line. The main difference would be that the DC system would also require two-phase conductors versus the three-phase conductors of an AC system.

The construction sequence of a DC transmission line would be very similar to that of a new AC transmission line. Once the new DC line was constructed, the existing BR-RIN 230 kV transmission line would be removed.

DC Technology
Technological advances within the last decade have made High Voltage Direct Current (HVDC) transmission more economically feasible and advantageous. Conventional HVDC utilizes Current-Source Converters (CSC) to rectify or invert power from AC to DC and back to AC. New technology uses what is known as Voltage-Source Converters (VSC). Typically, using VSC technology results in a much reduced converter station size when compared to conventional CSC systems. This generation technology is referred to as HVDC Light or HVDC Plus. To date, HVDC Light or HVDC Plus technology has seen limited application for power transfer levels up to about 1,000 MW and 150 kV DC.

The conventional CSC stations required at each end of the HVDC line would house the HVDC equipment in large buildings with open air AC line terminal equipment. The converter stations are estimated to encompass an area approximately 2,000 feet by 1,200 feet with structures and buildings 75 to 90 feet tall. Typical High Voltage Alternating Current (HVAC) stations would occupy approximately 500 feet by 500 feet for a double-circuit 230 kV line. Due to greater long-term impacts associated with the larger HVDC converter stations (e.g., visually more obtrusive and greater permanent land disturbance), HVAC would be the preferred technology for this Project because it requires smaller transition stations.

Meeting the Purpose and Need
As this alternative would involve the construction of a transmission line that would convey the same amount of power as the proposed action, it would meet much of the action’s basic purpose and need to
deliver renewable energy, meet electrical energy demands, and increase system reliability and flexibility. However, due to the high cost of interconnections and the need for converter stations at Barren Ridge and Haskell Canyon, constructing a DC system could potentially limit connection to future wind and solar facilities that may be developed in the area. The ability to transmit a greater amount of power on one transmission line versus two transmission lines in the proposed action would minimize impacts to federal lands managed by the BLM and USFS.

**Potential to Avoid and Minimize Environmental Effects**

The primary construction impacts for a transmission line are very similar for overhead AC and DC transmission lines. However, the DC conductor has the ability to transfer a greater amount of power than the proposed AC conductors and therefore could transmit the power on one transmission line, rather than the proposed two AC transmission lines (new double-circuit and existing BR-RIN). The DC transmission line would have a smaller footprint and require less right-of-way than the proposed Project and, therefore, would minimize long-term impacts to environmental resources, especially land use, visual resources, and air quality. However, impacts associated with the removal of the existing BR-RIN transmission line would be similar to that of reconductoring this same transmission line as proposed by the proposed action.

The terminal converter stations required for a DC transmission line would be approximately 30 acres each, which is significantly larger than the proposed new Haskell Canyon Switching Station and expansion of the existing Barren Ridge Switching Station (approximately five acres each). The construction of the converter stations would increase the potential for impacts to air quality, land use, biological resources, cultural resources, earth resources, water resources, and visual resources.

**Feasibility**

DC transmission systems generally are considered less expensive and suffer lower electrical losses than AC systems for very long distance transmission lines (typically 400 miles or more). However, the considerably higher cost of DC conversion equipment (terminal stations that convert DC to AC, and vice versa) and decreased efficiency over shorter distances compared to an AC system make AC transmission generally preferable. LADWP is proposing a new 60 mile 230 kV transmission line and DC transmission is rarely suitable for projects of this voltage and length.

DC transmission systems are typically point-to-point transmission systems, and “tapping” DC systems with interconnections of solar and wind generation within the Mojave and Tehachapi areas to create a multi-terminal DC system is technically and economically not feasible; furthermore, tapping into the middle of such a line is generally considered non-viable. AC systems allow for more flexibility with these interconnections of renewable power sources.

AC is preferable because it has a shorter construction schedule and substantially lower costs, and would allow more flexibility for future connections to other systems. The costs to construct the converter stations for a new DC line would be significantly more than the proposed Project, and would also take significantly more time to construct than a typical AC switching station. Without clearly demonstrated benefits, LADWP would be unable to justify the considerably greater costs associated with this alternative.

**Recommendation for Analysis in EIS/EIR**

**ELIMINATION.** The DC system would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS goals, greenhouse gas reduction goals, and electrical energy demands. Although this alternative would minimize the number of transmission line towers and reduce the need for right-of-way, converter stations would be required that may increase the potential for impacts to air quality, land use, biological resources, earth resources, water resources, and visual resources. The
DC system is a point-to-point system, and tapping into it to create a multi-terminal system is technically and economically not feasible and therefore may limit the future interconnections into the system and the amount of renewable energy available for LADWP in meeting RPS goals. The converter stations also come at considerably higher costs without clear benefits as compared to an AC system, and therefore make this alternative infeasible for LADWP.

5.2.2 Quad-Circuit Towers

Alternative Description
LADWP considered the use of quad-circuit towers along the existing BR-RIN corridor instead of the proposed double-circuit tower and existing BR-RIN towers. The towers would be constructed adjacent to the existing transmission towers within new right-of-way and would require a 50 foot by 40 foot tower footprint, and be approximately 120 feet in height, with tower-to-tower spans of 1,000 ft (which is very similar to that of the proposed double-circuit towers). The reconducted BR-RIN circuit and two new proposed circuits would be combined onto the same quad-circuit towers. Once the quad-circuit towers were constructed with the two new circuits, the new BR-RIN conductor would be transferred onto the new quad-circuit towers, and the existing BR-RIN towers would be removed. One position on the new towers would remain vacant for a possible future circuit. The quad-circuit towers would reduce the number of towers and reduce right-of-way needs by approximately 65 feet in comparison to the Proposed Action, which would require 200 feet of new right-of-way.

LADWP does not have existing 230 kV transmission lines along Segments C, D, E, F, H, and I, and therefore the use of quad-circuit towers would not be considered along these corridors. The new quad-circuit towers would be constructed adjacent to the existing ±500 kV PDCI and require an additional 135 foot right-of-way.

A portion of the BR-RIN conductors, from Power Plant #2 to Haskell Canyon, are hung on existing quad-circuit towers. To accommodate the weight of the proposed new Barren Ridge to Haskell Canyon transmission line (two circuits) and the reconducted BR-RIN, the existing towers would need to be raised approximately 20 feet. To avoid an interruption of service along the BR-RIN, a temporary shoe-fly would need to be constructed, which would require a temporary 80-100 foot right-of-way.

After the construction of the new quad-circuit towers, the existing BR-RIN conductor would be transferred onto the new quad-circuit towers and the shoe-fly and existing BR-RIN tower would be removed.

Meeting the Purpose and Need
The reduction of transmission line towers and right-of-way expansion would meet BLM’s and Forest Service’s purposes of minimizing the effects of utility corridors on federally managed lands. However, LADWP is interconnected into the Western Grid and follows the Western Electricity Coordinating Council (WECC) and the North American Electric Reliability Corporation (NERC) standards for system reliability criteria. In the event of a structure loss, the placement of multiple circuits on single structures would lessen reliability by increasing potential for loss of multiple circuits. This alternative would include all three circuits on a single structure for the entire length of the transmission line from Barren Ridge to Haskell Canyon. WECC regulations would limit the transfer capacity on the towers and, therefore, a limited amount of renewable energy would be transmitted in comparison to the proposed action. This would limit LADWP’s greenhouse gas emission reduction, along with the ability to meet RPS goals and electrical demands.
Potential to Avoid and Minimize Environmental Effects
Construction of a new multi-circuit tower and the removal of the existing BR-RIN would have similar temporary impacts to biological resources, recreation, and visual resources. However, the use of multi-circuit towers would minimize the right-of-way needs and eliminate existing structures by combining circuits onto one tower and, therefore, would minimize permanent impacts to land use and visual resources. The elimination of existing towers and placement of conductors from both existing and new lines onto single structures would minimize permanent impacts to visual resources.

Feasibility
Construction of multi-circuit towers is feasible.

Recommendation for Analysis in EIS/EIR
ELIMINATION. Although this alternative would require less permanent right-of-way and minimize permanent impacts to visual resources and to Forest Service- and BLM-managed lands, it would increase land use impacts. The multi-circuit structures would not meet the purpose and need to increase LADWP’s system reliability and flexibility, increase delivery of renewable energy, or meet future electrical demands. It would also limit LADWP’s ability to reduce greenhouse gas emissions, meet RPS goals, and allow interconnection and expansion of renewable energy resources. Greater temporary impacts would result to construct the large quad-circuit towers and remove the existing BR-RIN.

5.2.3 Alternative Voltages

Alternative Description
The voltage of a transmission line determines the line’s ability to transmit electricity. The resistive power loss of a transmission line can be reduced by increasing the operating voltage of a transmission line. Long-distance transmission is most economically served at high voltages. In general, as the voltage increases, the height of the supporting towers, footprint of the towers, size of the insulators, distance between conductors on a towers, and right-of-way widths increase.

A single-circuit 500 kV transmission line tower structure would be an average height of 150 feet, and require a 50 foot square footprint and approximately 200 foot wide right-of-way. The ability to transfer a greater capacity would allow LADWP to transfer energy onto one tower instead of reconductoring the BR-RIN and building a new 230 kV transmission line. The existing BR-RIN would be removed upon completion of the new 500 kV transmission line.

The existing Barren Ridge and proposed Haskell Canyon Switching Stations would need to be converted into substations and would require the incorporation of transformers and a 500 kV switchyard (approximately 600 feet by 600 feet). This would increase the size of the Barren Ridge and Haskell Canyon 500/230 kV Substations to be approximately 1,000 feet by 600 feet each.

To avoid additional impacts, the two sets of existing 230 kV transmission line towers located in the Castaic Transmission Corridor would remain and would not be upgraded to a 500 kV transmission line. Similar to the proposed Project, this alternative would also include the addition of a new circuit on existing structures.

The 500 kV double-circuit transmission line has the potential to increase environmental impacts and deliver a capacity well beyond the needs of LADWP, and is therefore not considered. Lower voltage lines, such as double-circuit 115 kV or 69 kV transmission lines, have lower transfer capacities; they do not have the power transfer capability as the proposed Project and are therefore not considered for the proposed Project.
Meeting the Purpose and Need
The single-circuit 500 kV transmission line is capable of delivering the capacity required for the BRRTP and would meet the purpose and need of the Project. It would reduce greenhouse gas emissions, meet RPS goals, enable delivery of renewable energy, increase reliability and flexibility in the utilization of renewable energy sources, and increase the use of existing energy corridors.

Potential to Avoid and Minimize Environmental Effects
The 500 kV transmission line has the potential to minimize visual and land use impacts, because it has the ability to transfer a greater amount of power on one transmission line instead of two transmission lines in the proposed Project (new 230 kV double-circuit transmission line and reconducted BR-RIN). Although the towers would be slightly taller and have a larger footprint, this alternative would require fewer towers than the proposed Project.

However, the conversion of the switching stations into 500/230 kV substations would more than double the proposed size of the stations and increase the potential for impacts to air resources, biological resources, cultural resources, earth resources, land use, water resources, and visual resources.

Feasibility
LADWP facilities within the Project area, including the Castaic Power Plant, currently operate at 230 kV. Utilization of an alternative voltage would require significant upgrades, expansion, and modifications to the existing Barren Ridge Switching Station. The proposed Haskell Canyon Switching Station would instead become a significantly larger substation. The feasibility of constructing such a large substation within Haskell Canyon, or in close proximity, would be very challenging. LADWP estimates upgrading of the substations would add significant cost and time to construct.

Recommendation for Analysis in EIS/EIR
ELIMINATION. The use of an alternative single-circuit 500 kV transmission line would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS, greenhouse gas reduction goals, and electrical energy demands. However, it may not be feasible to construct a 500/230 kV substation within Haskell Canyon. The increased footprint of the substations also has the potential to increase environmental impacts.

5.2.4 Underground Transmission
Alternative Description
This alternative would use existing technology to install the transmission line underground, instead of conventional construction using steel towers and overhead conductors. Underground transmission systems in the United States are generally used in urban areas for lower-voltage distribution lines. High voltage (115 kV and above), short distance, underground installations have been constructed where overhead lines were not feasible (e.g., in the vicinity of airports, urban centers).

The construction of underground transmission lines requires grading and clearing of trees and vegetation along the right-of-way prior to excavation of the entire length of the transmission line. Large areas of disturbance would result from the excavation and associated activities, such as heavy equipment use and soil storage. Underground construction is more difficult and results in greater clearing, grading, and land disturbance than overhead transmission line construction.

The land required for operation and maintenance of underground transmission lines must remain free of secondary surface development or lengthy-rooted trees planted along the line route, and only vegetation that will not cause maintenance problems is permitted above the underground route throughout the life of
the proposed Project. This contributes to a land use similar to that of a secondary road. Also, duct banks, fluid reservoirs, stop joints, and/or retaining vaults are required for certain underground technologies, increasing the need for cleared land and continued all-weather access for operation and maintenance.

The installation of an underground transmission line would require more time than for construction of an equivalent length of overhead line because of the time required for excavating trenches and constructing the duct banks, fluid reservoirs, and/or stop joints, and the limitations on times of the year available for construction, which would be chosen to limit the impacts to the environment.

**AC or DC Technology**

Similar to overhead lines, underground transmission lines can be installed using AC or DC technology. Underground transmission lines can utilize either High Voltage Alternating Current (HVAC) or High Voltage Direct Current (HVDC). The primary differences between these two technologies are that HVDC would consist of two DC conductor positions, referred to as “poles,” instead of three AC conductor positions, referred to as “phases.” Because HVDC utilizes two poles and HVAC utilizes three phases, HVDC would utilize two-thirds of the cables necessary for a HVAC system; however, HVDC would require AC/DC converter stations at each end of any underground segment (similar to what was described in section 5.2.3).

Technological advances within the last decade have made HVDC transmission more economically feasible and advantageous. Conventional HVDC utilizes Current-Source Converters (CSC) to rectify or invert power from AC to DC and back to AC. New technology uses what is known as Voltage-Source Converters (VSC). Typically, using VSC technology results in a much reduced converter station size when compared to conventional CSC systems. This generation technology is referred to as HVDC Light or HVDC Plus. To date, HVDC Light or HVDC Plus technology has seen limited application for power transfer levels up to about 1,000 MW and 150 kV DC.

The conventional CSC stations required at each end of the HVDC line would house the HVDC equipment in large buildings with open air AC line terminal equipment. The converter stations are estimated to encompass an area approximately 2,000 feet by 1,200 feet with structures and buildings 75 to 90 feet tall. Typical HVAC stations would occupy approximately 500 feet by 500 feet for a double-circuit 230 kV line. Due to greater long-term impacts associated with the larger HVDC converter stations (e.g., visually more obtrusive and greater permanent land disturbance), HVAC would be the preferred technology for this Project because it requires smaller transition stations.

**Underground Technologies**

High-voltage underground transmission lines have markedly different technological requirements than lower-voltage underground distribution lines. The components of a typical solid dielectric cable consist of a stranded copper or aluminum conductor, conductor shield, solid dielectric insulation, insulation shield, moisture barrier sheath, and a protective jacket. The conductors would be several inches in diameter, depending on voltage. Switch stations are often required on underground transmission systems to control the circuit voltage, depending on length and voltage class.

There are four typical underground technologies for high voltage transmission lines:

1. **Self-Contained Fluid-Filled (SCFF)**

The self-contained cable system consists of three individual phases, each contained within a hermetically sealed metallic sheath that is typically extruded lead-alloy or aluminum. The cables are insulated with a high-quality taped insulation. Both kraft paper and laminated paper-polypropylene insulations are employed. The fluid pressure necessary to prevent ionization is maintained through a hollow core in the
The SCFF cable is pressurized with a dielectric liquid at 575 pound-force per square inch gauge (psig) (35-520 kilopascal [kPa]). Commercial installations have pressures as high as 400 psig (2760 kPa) using reinforced sheaths. Small liquid reservoirs are placed along the route. The presence of the dielectric liquid and reservoirs, plus the complexity of sheath bonding, are disadvantages of the SCFF cable system. SCFF cables may be directly buried, or they may be installed in ducts or in tunnels. An advantage of SCFF insulation cables compared to extruded-dielectric cables is that the insulation is thinner for the same conductor size and voltage class. This allows longer cable lengths on the same reel size and, in some instances, can provide the opportunity to install 230- to 275-kV-class cables into existing five-inch (125-mm) ID ducts.

2. High-Pressure Fluid-Filled (HPFF) Cables

A high-pressure fluid-filled (HPFF) cable system contains a pipe that is pressurized, usually with a dielectric liquid. Pipe-type cables have the three cable phases insulated with tapes of kraft paper or laminated paper polypropylene and installed in a common steel pipe. The three phases making up a line are pulled together into a previously installed coated and cathodically protected steel pipe, with distances commonly 3000 feet (980 m) between splices for 345 kV cables. After the entire line is installed, including splices and terminations, and the pipe welding is completed, the line is evacuated, then filled with a dielectric liquid. The liquid is pressurized to a nominal 200 psig (1380 kPa) using a pressurizing plant that also has a reservoir tank to accept volume changes due to system thermal expansion and contraction, as well as pumps, controls, and alarm systems. The presence of the dielectric liquid and need for a pressurizing plant must be taken into account for the HPFF cable system, but those considerations do not exist with a high-pressure gas-filled cable system.

Pipe-type cables have been the most commonly used transmission cable type in North America through the early twenty-first century for several major reasons:

- The pipe provides rugged protection against third-party damage.
- The system is reliable.
- The pipe can be installed in relatively short street openings, minimizing traffic disruption in crowded urban areas, and it can generally be installed more quickly than a concrete-encased duct bank.
- The dielectric liquid provides several options for cooling to improve the circuit rating.
- The laminated paper-polypropylene (LPP) insulation has a higher electrical strength and lower dielectric losses than kraft paper—its higher power transfer has permitted 345 kV cables to be installed in a nominal 8-inch (20-cm) pipe rather than a nominal 10-inch (25-cm) pipe used for 345 kV kraft paper insulated systems. The smaller pipe has many advantages, including cost, bending radii, trench size, and amount of dielectric liquid. Most newly installed 345 kV HPFF cable is now insulated with LPP, and it is used for many 230 kV and some 138 kV installations.
3. **Gas-Insulated Lines (GIL) Transmission Cables**

Gas-insulated lines (GIL) have been used in a few applications where high-power capabilities are required, such as in substation ties and through tunnels. The GIL system is inherently simple. The conductor and enclosure are made of aluminum tubing, cast-epoxy-resin spacers hold the conductor in place, and the gas gap insulation is typically SF₆ (sulfur hexafluoride) gas pressurized to 30-90 psig (200-600 kPa) or more recently a mixture of 90% nitrogen and 10% SF₆ at a higher pressure. The cable is supplied in rigid 40- to 60-foot (12- to 18-m) sections. Field joints are made between each section. There is minimal service experience in buried installations. The GIL system is normally installed aboveground or in underground troughs or tunnels. GIL are more costly than other cable types and have not yet been applied to long transmission lines.

Terminations consist of a cast resin insulator interfacing with SF₆-insulated switchgear bus bar or a porcelain shell similar in appearance to a conventional pothead. Internal stress control generally requires only a horn-shaped electrical grading shield in the shell. The same gas that pressurizes the bus also pressurizes the porcelain. Insulators for GIL cables are subject to distortion of the stress distribution through accumulation of space charge and particulate contamination, although manufacturers have developed particle traps to control contaminants. Since SF₆ is considered a greenhouse gas, care must be taken to minimize any leakage from the GIL system, hence the development of the 90% N₂, 10% SF₆ mixture.

4. **Solid Dielectric (XLPE) Transmission Cables**

Extruded-dielectric cables, also known as solid-dielectric cables, use crosslinked polyethylene (XLPE) insulation. XLPE cables are characterized by very small dielectric losses relative to paper and/or ethylene-propylene rubber cables. These losses are essentially constant up to emergency operating temperatures, in contrast to impregnated paper-insulated cables where dielectric losses can increase substantially at high temperatures.

At transmission voltages, the low dielectric loss of XLPE cables results in important improvements in ampacity and offers an additional safety factor against thermal runaway. Thermal runaway is the condition where a cable temperature increases, causing an increase in electrical losses that further raises the temperature, causing additional losses until the cable overheats and fails. The extruded-dielectric cable’s lower capacitance extends the critical line length (the length at which all current-carrying capacity is required to supply charging current) significantly and does not contribute as severely to overvoltage problems on weak transmission systems.

Extruded-dielectric cable installations are commonly used in duct banks, one cable per duct, because direct burial and tunnel installations have not proven feasible in city streets. Extruded-dielectric cables are considered less complicated in terms of installation and accessories than SCFF or pipe-type cables, but the sheath bonding/grounding system can be complex, as with SCFF cables.

XLPE technology is considered to be the preferred technology due to reduced and simplified operational and maintenance requirements. Although all underground construction requires similar techniques and results in similar impacts, the discussion below focuses primarily on the use of XLPE technology, as this would be the most likely technology to be utilized for a 230 kV transmission project like the BRRTP.

In addition to the reliability issues associated with the use of newer underground technologies, seismic considerations, slope considerations, and cost are also examined when designing an underground transmission line.
Underground Installation
Underground lines can be installed by direct bury or trenching methods.

Direct Bury
A direct buried cable installation is where the cable is laid into an open trench. The trench is backfilled directly over the cables with native soils or thermal backfill material. Concrete caps are placed over the cables to provide mechanical protection. Direct buried cable installations should only be employed in areas where future excavations are not likely, such as within a fenced boundary, inside electrical substations, or within commercial or industrial private property. Direct buried installations are not practical in locations such as existing road rights-of-way where numerous utilities or service laterals are being crossed, or where future underground utility installations are expected.

Trenching
Trenching to install the underground duct banks would commence after identification of all underground utilities along the proposed underground alignments. Actions to accomplish this would include notifying all applicable utilities via underground service alert to locate and mark existing utilities, and conducting exploratory excavations (potholing) as necessary to verify the location of existing utilities. If required, encroachment permits would be secured for trenching in public streets.

Two trenches, separated by 20 feet, would be excavated for the double-circuit 230 kV underground transmission line. The majority of the underground duct banks would be installed in a 2x2 or 3x3 duct configuration, depending on the electrical loading criteria, using open-cut trenching techniques. A duct bank configuration would generally place the three individual phase cables of the circuit in a pyramid, with two cables on the bottom and one cable stacked on top and separated by spacers. As loading requirements for the circuit increase, additional cables may be necessary, in which case the number would be increased in increments of three.

Trenching would be staged so that open trench lengths would not exceed that required to install the duct banks. A maximum of 300 to 500 feet would be open at one time at any one location, depending on applicable permit requirements. Where needed, open trench sections that are not under active construction would have steel plates placed over them in order to maintain vehicular and pedestrian traffic.

Provisions for emergency vehicle access would be arranged with local jurisdictions in advance of construction activities. Should groundwater be encountered, it would be pumped into a tank for disposal in accordance with Project permits.

Excavated materials not temporarily stored to use for backfill would be hauled offsite to a materials storage yard. Based on the anticipated rate of construction progress (300 to 500 feet open at one time), approximately 400 cubic yards of excavated material would be hauled away per day. Excavated materials would be tested for their suitability as a thermal backfill material in the trench.

Nearly all of the underground cable systems constructed for high-voltage transmission lines would be installed in conduit using open-cut trenching techniques unless site-specific conditions dictate that open-cut trenching cannot be utilized. The trench for the cable/conduit would normally be a minimum of five feet deep and four feet wide along the entire length of the underground sections.

Duct Bank Installation
As the trench for the underground transmission line is excavated, LADWP would begin to install the cable conduit, reinforcement bar, ground wire, and concrete conduit encasement, which collectively comprise the duct bank.
As described above, the duct bank for the 230 kV underground transmission lines would likely measure approximately 3.5 feet by 3.5 feet. The 230 kV lines would require two cables per phase (bundled). Two trenches would be required for the double-circuit 230 kV line, with one circuit per trench. Additionally, ducts for communication cables, which are required for system protection and communication purposes, would be installed in the same duct bank as the transmission cables.

Where the electrical transmission duct bank would cross or run parallel to other substructures that operate at normal soil temperature (gas lines, telephone lines, water mains, storm drains, sewer lines), a minimal radial clearance of 12 inches (for crossing) and 24 inches (for paralleling) would be required, respectively. Ideal clearances would range from two to five feet. Where duct banks cross or run parallel to substructures that operate at temperatures significantly exceeding normal soil temperature (other underground transmission circuits, primary distribution cables, steam lines, heated oil lines, etc.), additional radial clearance may be required. Clearances and depths would meet requirements set forth with Rule 33.4 of CPUC GO-128. Preliminary engineering investigations have not identified any underground utilities that operate at high temperatures.

After the duct bank has been installed in the trench, the next step would be to cover the duct bank with backfill and compact the backfill. Each duct bank would require a minimum cover of 36 inches. Finally, a road base or slurry concrete cap would be installed within the trench, and the disturbed surface would be restored in compliance with the locally issued permits. As sections of the trench are covered and restored, additional sections would then be opened for duct bank installation. This process would continue until all PVC conduits have been installed in the duct bank. Note that at this point, the PVC conduit does not contain the transmission line cable; see below (Cable Pulling, Splicing and Termination) for a description of how the underground transmission line would be installed.

Vault Installation
LADWP would excavate and install pre-formed concrete splice vaults or manholes during trenching for the duct banks. Initially, the vaults would be used to pull cable through the conduits and splice the cables together during construction of the BRRTP. During operation, the vaults would provide access to the underground cables for maintenance, inspections, and repairs. Vaults, with approximate dimensions of 25 feet long by seven to ten feet wide, would be constructed of prefabricated steel-reinforced concrete and designed to withstand the maximum credible earthquake in the area and heavy truck traffic loading. Vaults would occur approximately every 800 to 2000 feet along underground segments.

Installation of each vault would take place over a one-week period. First, the vault pit would be excavated and shored, followed by delivery and installation of the vault. Next, the excavated area would be filled with backfill and compacted. Finally, the excavated area would be restored, as required.

Cable Pulling, Splicing and Termination
Following conduit and vault installation, LADWP would pull cable through the duct banks, splice the cable segments at each vault, and terminate cables at the transition stations (where the line would transition from underground to overhead). To pull the cables through the duct banks, a cable reel would be placed at one end of the conduit segment, and a pulling rig would be placed at the opposite end. The cable from the cable reel would be attached to a rope in the duct bank, and the rope linked to the pulling rig, which would pull the rope and the attached cable through the duct banks. A lubricant would be applied as the cable enters the ducts to decrease friction and facilitate travel through the PVC conduits.

The electric and communication cables for the 230 kV circuits would be pulled through the individual ducts at a rate of two to three segments between vaults per day. After cable pulling is completed, the cables would be spliced, or fused together, at each vault. A splice trailer would be stationed at the vault
manhole opening with a power generator directly behind the trailer. Crews would enter the vault and splice the cables.

During splicing operations, the dryness of the vault must be continuously maintained to ensure that unfinished splices are not contaminated with water or impurities. It is estimated that splicing would take 50 hours per cable. As splicing is completed at a vault, the splicing apparatus (splicing trailer and power generator) would be moved to the next vault location, where splicing would resume.

Termination structures would be used for the solid dielectric cable to allow the transition from underground to overhead line sections or above-ground equipment.

Transition Structure Construction
At each end of an underground segment, the cables would rise out of the ground at transition structures, which accommodate the transition to overhead lines. Transition structures constructed as part of the proposed Project would consist of a tubular pole structure with an anchor-bolted pier foundation for each circuit set of three or six cables, depending on site parameters. The transition structure would support cable terminations, lightning arresters, and dead-end hardware for overhead conductors.

Special Construction Methods (Trenchless Technologies - Horizontal Boring and Directional Drilling)
In concert with the tasks outlined above, special construction methods (horizontal boring and/or directional drilling) may be required in areas where open trench construction is not feasible. These areas would include railroad and trolley tracks, large utility crossings, roads, drainage crossings, and other environmentally sensitive areas. LADWP would secure the necessary permits to conduct these specialized construction activities, such as a special use permit, encroachment permit, helicopter lift plan, explosives permit, etc.

Horizontal Boring
Horizontal boring (jack-and-bore) simultaneously pushes a steel casing through the crossing and removes the spoil inside the casing with a rotating auger. First, boring pits would be excavated at the sending (entrance) and receiving (exit) ends of the bore. The bore equipment is inserted into the bore pit at the sending end, where a 36- to 42-inch steel casing is pushed through the earth, under the crossing. Depending on soil conditions, water may be used to lubricate the auger during boring operations. Casings would be welded together incrementally and installed at least three to four feet below the crossing, or as required by local permits. Once the casing is in place, the duct banks would be installed using plastic spacers to secure them in place. The steel casings would remain to protect the conduit once it has been installed; however, use of fiber-reinforced mortar pipes may be preferred in areas where technically feasible. The duct banks and associated cables would consist of the same respective materials and strung by employing a similar method as those installed on the remainder of the underground portions of the BRRTP.

Directional Drilling
Directional drilling uses a jet bit that can be steered to cut through the earth, creating a small pilot hole. A drill rig and control booth would be set up on one side of the directional drill to facilitate drilling operations. A small containment pit would be excavated around the drill stem to contain any drilling fluids used during the drilling process. Once the jet bit has reached the opposite side of the crossing, a reamer along with the casing (if determined for use by final engineering) would be attached to the auger and pulled back through the pilot hole to widen it. Multiple reamers of increasing diameters would be used to incrementally increase the size of the hole to the diameter necessary to install the conduit casings.
Meeting the Purpose and Need
This alternative would convey the same amount of power as the proposed action, and would meet much of the action’s basic purpose and need. It would enable the delivery of renewable resources, reduce greenhouse gas emissions, assist LADWP in meeting its RPS goals, meet electrical energy demands, allow for interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas, and maximize the accommodation of future utility needs. However, effects to ANF and BLM managed lands would not be minimized.

Potential to Avoid and Minimize Environmental Effects
During construction, the environmental impacts of an underground transmission line would be similar to those for major pipeline construction. Potentially greater adverse environmental impacts could be expected because the entire right-of-way would be disturbed instead of disturbance only at tower and support locations along the alignment. Overhead construction has the flexibility to span sensitive features; construction typically would result only in disturbances at individual tower sites and at the ancillary facilities associated with access to the right-of-way. For underground installation in undeveloped areas, the right-of-way would be cleared of all trees, brush, and ground cover in order to establish the transmission line alignment and to permit construction.

Similar to overhead transmission line construction, the installation of underground transmission lines would require permitting, working around traffic and other surface activity that would include storm water control, trenching, laying cable, and avoiding underground utilities. However, the native soils, particularly in the desert, generally possess inferior thermal properties, partly due to inadequate soil moisture levels, which would allow the dissipation of heat away from the cables. The inability to dissipate heat in turn de-rates the cable circuit. It is reasonable to assume that large amounts of more thermally favorable soil or backfill would need to be imported for the Project. Underground construction may require up to five times longer than for overhead transmission lines, creating greater impacts to transportation and traffic.

The required excavation for underground transmission lines would have substantially greater impacts to soils and archaeological, cultural, and biological resources. Turns and bends to the underground transmission line would be very limited and constrained. The permanent placement of an underground line could affect sensitive habitats, such as wetlands and riparian conservation areas, and cultural sites. The potential for the spread of invasive plants, including noxious weeds, would increase. Groundwater flow could also be affected by the presence of an underground trench. Fertile lowland areas and floodplains have the greatest potential for impact to buried archaeological resources. The amount of excavation, use of heavy equipment, increased road use, and presence of large soil piles during construction would create greater impacts to air quality.

The major benefits of underground construction are the absence of overhead transmission towers and reduced long-term impacts to visual resources. The absence of towers would also eliminate risks to avian collision, impacts to fire suppression, and aircraft collisions. Underground transmission lines also require less right-of-way after construction and would therefore reduce long-term land use impacts. However, given the vast amount of existing overhead transmission within the Project area, the need to create new transmission corridors is very low. Routing alternatives for the Project would likely parallel existing transmission lines, therefore reducing the potential visual mitigating benefits of an underground system. Socioeconomic impacts could be greater due to the greater construction costs.
Feasibility
While underground transmission lines are relatively immune to weather conditions, they are vulnerable to cable/splice failure, washouts, seismic events, and incidental excavation. An underground line is relatively easy to operate and maintain although it is more difficult to troubleshoot and repair than an overhead transmission line. Once the problem area is identified, the portion of the line between two splicing vaults would need to be replaced and would require additional excavation and construction. The average downtime or failure for underground high voltage cable systems is 100 to 220 actual hours. Depending upon the nature of the emergency, it could easily require 30 days to conduct repairs of an XLPE cable system, and possibly six months or more if the spare parts are not in inventory or the shelf life of the materials is not current. Long-term outages would be unacceptable for a circuit carrying bulk electric power. Underground transmission lines also have a shorter lifespan than overhead lines due to the degradation of the cable’s surrounding insulation.

From a technical point of view, this area makes a poor candidate for an underground transmission line. Underground transmission is not suitable in areas of moderate to steep terrain (such as portions of the Angeles National Forest) and has a greater potential for damage from earthquakes and landslides. A portion of the transmission line would be located in close proximity to the San Andreas Fault zone and a seismic event could damage the underground cable, resulting in transmission loss. Placement of underground transmission lines on a slope for long distances may result in gravity, contraction and expansion effects, moving the cable down-slope. The native soils, particularly in the desert, generally possess inferior thermal properties, partly due to inadequate soil moisture levels, which would allow the dissipation of heat away from the cables. The inability to dissipate heat in turn de-rates the cable circuit. It is reasonable to assume that large amounts of more thermally favorable soil or backfill would need to be imported for the Project.

Access must be sufficient to accommodate the large construction equipment required for the excavation, installation and transport of materials. On steep slopes, access roads would need to be cut in switchback patterns for large construction vehicles.

The basic cost of undergrounding a high-voltage transmission line would be several times more expensive than the cost of overhead construction. The relatively high cost and installation requirements tend to prohibit the application of underground transmission systems for long-distance electric transmission.

Recommendation for Analysis in EIS/EIR
ELIMINATION. An underground high voltage transmission line would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS goals, greenhouse gas reduction goals, and electrical energy demands. The principle environmental advantage of undergrounding a transmission line would be the mitigation of adverse visual impacts of the transmission towers and conductors. However, an underground transmission line would still require above-ground ancillary facilities on or adjacent to the right-of-way, and result in substantially greater ground disturbance than overhead transmission lines and longer construction duration. It would create a greater potential for impacts to transportation, traffic, soils, socioeconomics, and archaeological, cultural, biological, and water resources. If an outage occurred, repair times could increase. An underground system would not result in any substantial reduction in other environmental effects, and is also infeasible for long distances. It is therefore not considered a reasonable alternative for the Project, and is recommended for elimination from detailed consideration for the Project components.
5.2.5 Superconductors

Alternative Description
Superconductors are high-capacity, low-impedance cables with either high-temperature superconductor (HTS) or low-temperature superconductor (LTS) wire. The superconductors use the phenomenon of superconductivity—zero electrical resistance is exhibited by many metals at near absolute zero temperature. The high-temperature superconductors operate at high temperatures and utilize liquid nitrogen for cooling. Lower-temperature superconductors operate at lower temperatures and require liquid helium for cooling. Liquid nitrogen is a cheap and abundant refrigerant; however, liquid helium is expensive and difficult to handle. Niobium is a type of material used in superconductors because it has the most favorable critical quantities of superconductivity and is practical to fabricate.

This alternative would use such superconductors in place of the proposed aluminum conductor material. The ability for superconductors to transfer much greater capacity than the proposed aluminum conductor would minimize the number of transmission lines required. Similar to the single-circuit 500 kV transmission line, this alternative would replace the two proposed transmission lines (new 230 kV and existing BR-RIN). The superconductors would be contained in a series of conduits to provide cooling of cables and would require an at-grade or underground installation.

Meeting the Purpose and Need
Superconductors would allow for the same amount of energy to be transmitted as the proposed overhead lines, and would therefore meet the purpose and need for the Project. They would enable the delivery of renewable resources, reduce greenhouse gas emissions, assist LADWP in meeting its RPS goals and electrical energy demands, allow for interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas, and maximize the accommodation of future utility needs. However, effects to Forest Service and BLM managed lands would not be minimized.

Potential to Avoid and Minimize Environmental Effects
The ability for superconductors to transfer a greater capacity has the potential to minimize the number of towers and right-of-way expansion, therefore minimizing impacts to visual and land use resources. However, superconductors must be contained within a series of conduits that provide cooling to the cable itself (to superconductor’s absolute zero, which may be negative 340 degrees Fahrenheit or colder). Therefore, the weight of this setup would require an at-grade or underground installation, thus causing similar impacts as conventional underground transmission.

Feasibility
Superconductors are generally utilized in distribution-level voltages (69 kV and under) or for very short distances (2,000 feet or less). The existing installations of superconductors are in controlled areas such as enclosed stations and test facilities. It would be very difficult to maintain uniform and reliable circulation of coolant in rolling and mountainous terrain for extended distances.

Recommendation for Analysis in EIS/EIR
ELIMINATION. Superconductors have the ability to transfer greater amounts of energy than the proposed aluminum conductors; however, they are still in the developmental stage. The longest high-voltage transmission line utilizing superconductors was only 2,000 feet long, and the technology is currently considered infeasible for long distances. The principle environmental advantage of superconductors would be the mitigation of adverse visual impacts of the transmission towers and conductors. However, superconductors would still require above-ground ancillary facilities on or adjacent to the right-of-way, and result in greater ground disturbance than overhead transmission lines and longer construction duration. It would create a greater potential for impacts to transportation, traffic, soils, socioeconomics,
and archaeological, cultural, biological, and water resources. It is therefore not considered a reasonable alternative for the Project, and is recommended for elimination from detailed consideration for the Project components.

5.3 TRANSMISSION ALTERNATIVES

5.3.1 Accessing Other Renewable Resource Areas

Alternative Description
The Renewable Energy Transmission Initiative (RETI) has identified a number of high quality renewable energy areas in Southern California—the Salton Sea/San Diego, Southeastern California, and Tehachapi/Owens Valley. The Salton Sea/San Diego resource area is rich with renewable resources, including substantial amounts of geothermal potential near the Salton Sea, solar resources throughout the area, and wind resources in local mountain ranges. LADWP would need to construct transmission lines to access this renewable resource area. The Southeast California area includes most of San Bernardino and Riverside counties; RETI has identified this resource area as having the largest quantity of potential resources (wind and solar). LADWP’s existing transmission lines to this resource area have limited capacity to transfer that energy to the Los Angeles Basin.

LADWP’s primary purpose and need for the BRRTP is to access the Tehachapi/Owens Valley resource area. The Mojave Desert has some of the highest solar insolation in the world, along with the most economical solar resources. Furthermore, the Tehachapi Mountains have excellent wind resources. LADWP’s existing BR-RIN transmission line currently accesses this renewable resource area; however, transmission capacity is limited.

This alternative would consider accessing the Salton Sea/San Diego and Southeast California resource areas.

Meeting the Purpose and Need
Accessing the Salton Sea/San Diego and Southeast California resource areas would meet LADWP’s purpose and need to access renewable resources. However, in order for LADWP to meet its RPS goals and reduce environmental impacts associated with greenhouse gas emissions, it must access a number of renewable resource areas. To effectively integrate wind and solar renewable resources into an electrical system, utility companies generally access a number of renewable resource areas to increase system reliability and flexibility. Concentrating a utility company’s resources in one or two renewable resource areas may decrease its system reliability and flexibility. This alternative would also limit LADWP’s ability to access renewable resources in the Tehachapi Mountains and Mojave Desert areas. In addition, LADWP also has the ability to integrate the Castaic Power Plant (a pump storage facility in the BRRTP area) to store intermittent renewable energy. LADWP does not have similar facilities in the other renewable resource areas.

Potential to Avoid and Minimize Environmental Effects
The potential environmental impacts associated with accessing these renewable resource areas involve or are likely to involve proposals for new transmission lines with much greater lengths than those proposed by the BRRTP, with associated impacts similar to or even greater than those of the BRRTP. Therefore, these would be likely to result in little to no avoidance of environmental effects when considered as a whole.

Feasibility
Accessing other renewable resource areas is feasible, as evidenced by current transmission line project proposals by LADWP. For example, the Southern Transmission System (STS) upgrade project would
access wind and geothermal energy from Utah. Another proposal is the Green Path North Project (GPNP) to access geothermal energy from the Salton Sea, and wind and solar from the Southern California Deserts.

**Recommendation for Analysis in EIS/EIR**

**ELIMINATION.** This alternative would access renewable energy and assist in meeting RPS and greenhouse gas reduction goals. However, to integrate intermittent renewable resources and maintain a reliable electrical system, LADWP should access a number of renewable resource areas. This alternative does not meet the purpose and need to deliver renewable energy sources from the Tehachapi Mountains and Mojave Desert areas. LADWP would also not be able to utilize existing facilities that would allow LADWP to store renewable energy. The need to access other renewable resource areas would likely involve the need for new transmission lines and therefore this alternative would be expected to have similar impacts to those of the proposed Project.

### 5.3.2 Segment D

**Alternative Description**

Segment D was initially identified in the siting study as a routing opportunity for the siting of a new double-circuit 230 kV transmission line from the Antelope Valley to the Castaic Power Plant. It would generally parallel the Los Angeles Aqueduct from about Cottonwood Creek and head southbound to Lancaster Road, and then west to the Interstate 5 freeway utility corridor within the Angeles National Forest. Five high-voltage transmission lines occur along the Interstate 5 section of the Segment. In addition to the high-voltage transmission lines are oil and gas pipelines. This routing opportunity would require a new 200 foot right-of-way.

After preliminary studies, a number of engineering and environmental issues were identified along Segment D. The Castaic Power Plant only had one available bay for connection of a single circuit. The BRRTP was proposing to add three new circuits into the Castaic Power Plant (a new double-circuit transmission line from the Barren Ridge Switching Station and the addition of a new circuit on existing structures from the power plant to Haskell Canyon). Expansion of the Castaic Power Plant to accommodate additional connection bays would require significant modification of the plant that would be well beyond the scope of the Project and cost hundreds of millions of dollars. Also, the area north of the power plant has very unstable terrain where it would be very difficult to construct a new transmission line. The construction of a new transmission line along Segment D has the potential for impacts to the Old Ridge Route, a historic district in very close proximity to the Castaic Power Plant.

In order for Segment D to connect to the Haskell Canyon Switching Station, it would also require the construction of a new double-circuit transmission line along Segment J. This would be in addition to the proposed addition of a circuit on existing structures along Segment J. Along Segment J would traverse the Castaic Lake State Recreation Area, managed by the County of Los Angeles Department of Parks and Recreation, and also a designated Land and Water Conservation Fund site. Expansion of right-of-way along the Land and Water Conservation Fund site would constitute a conflict with its provisions and would require a conversion of land. The conversion process of Land and Water Conservation Fund land from a recreational use to a non-recreational use may take up to 10 years and require compliance (monetary compensation, land, or both).

During the February 2009 Informational Public Meetings, LADWP, BLM and the Forest Service informed the public of a recommendation to eliminate Segment D due to constraints to the Castaic Power Plant, unstable terrain, constraints of right-of-way expansion on lands south of Castaic, and the potential for significant impacts to the Old Ridge Route. However, the public, as well as elected officials, expressed concern about impacts to the communities of Elizabeth Lake, Green Valley, Leona Valley,
Agua Dulce, and Antelope Acres. They recommended that the lead agencies reconsider studying Segment D and identify a way to make the route viable.

To make Segment D viable, the alignment was modified to terminate at the proposed Haskell Canyon Switching Station instead of at the Castaic Power Plant as originally proposed. The revised Segment D is approximately 48 miles long and generally parallels the Los Angeles Aqueduct, beginning near Cottonwood Creek and traveling south to Lancaster Road. No existing transmission lines occur along the portion of Segment D located north of the ANF. The segment then proceeds west to the Interstate 5 designated utility corridor, which contains five high-voltage transmission lines and oil and gas pipelines, and heads southeast paralleling LADWP’s existing Castaic-Rinaldi Corridor (Castaic-Northridge/Sylmar and Castaic-Olive 230 kV transmission lines) to the proposed Haskell Canyon Switching Station.

Meeting the Purpose and Need
Segment D is an alternative location for the siting of a new 230 kV double-circuit transmission line. Therefore, it would convey the same amount of power as the proposed action, and would meet much of the action’s basic purpose and need. It would enable the delivery of renewable resources, reduce greenhouse gas emissions, assist LADWP in meeting its RPS goals and electrical energy demands, allow for interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas, and maximize the accommodation of future utility needs.

The Land and Water Conservation Fund conversion process may take up to 10 years. Although the time delays to obtain Project approval and right-of-way, as well as to build and construct the Project, may hinder LADWP’s ability to meet its 2020 RPS goals, there is uncertainty as to the exact timing of the Land and Water Conservation Fund process.

Potential to Avoid and Minimize Environmental Effects
Segment D is located in an area with very few residential viewers and would avoid impacts to the communities of Elizabeth Lake, Green Valley, Leona Valley, Agua Dulce, and Antelope Acres. However, it has the potential to have greater visual impacts than the proposed Project. The portion of Segment D north of the Angeles National Forest does not contain existing high-voltage transmission lines and therefore would require the creation of a new utility corridor that would increase visual impacts. More roads would have to be improved or established than for the proposed Project. Also, the Old Ridge Route is listed as a historic district on the National Register. The construction of a new transmission line would alter the visual environment of the Old Ridge Route.

Segment D would avoid the San Francisquito Canyon, which is considered a particularly sensitive resource due to its eligibility for designation as a Wild and Scenic River. However, Segment D has a greater potential to impact land uses than the proposed Project. Sections of land on the Angeles National Forest, adjacent to Segment D, are designated roadless areas. Segment D would potentially contribute to greater degradation of roadless areas as the alignment is closer to them under Segment D than the Proposed Action. Segment D would also traverse the Castaic Lake State Recreation Area, which is also a Land and Water Conservation Fund site; it provides recreational opportunities such as hiking, backpacking, equestrian use, bicycling, mountain biking, and hunting. The addition of a new transmission line would not be in compliance with the provisions of the Land and Water Conservation Fund, and during construction activities the recreational area and trails would be temporarily restricted from public use. Segment D may also disrupt and disturb existing residential land uses associated with the Paradise Ranch Mobile Home Park, the community of Castaic, and development of the North Lake Specific Plan (an approved master-planned community in the Castaic area).

Biological resources also have the potential for greater impacts from Segment D than the proposed Project. Biological surveys conducted along Segment D identified Riparian Conservation Areas (RCAs)
that contain suitable habitat for the arroyo toad, California red-legged frog, southwestern willow flycatcher, and least Bell’s vireo, which are all federal- or state-listed special-status species. The need to construct or improve more access roads than for the proposed Project would increase the potential for impacts to suitable habitat and the special-status species supported within them. Segment D is more likely than the proposed Project to impact the California Condor due to its closer proximity to known condor use areas.

Finally, Segment D has the potential for greater geological resource impacts. This routing opportunity traverses unstable terrain that is prone to landslides, areas of severe erosion potential, areas with expansive soils and high corrosive potential, areas of groundwater less than approximately 25 feet deep, and areas with potential for inundation from dam failure or seiche. The terrain along this area would make construction of a new transmission line very difficult.

Feasibility
Construction of a new 230 kV double-circuit transmission line along Segment D is feasible. However, as mentioned above, the conversion of Land and Water Conservation Fund lands may be lengthy, and obtaining similar land with comparable value may be very difficult. Segment D’s unstable terrain also makes this routing opportunity much more difficult to construct.

Recommendation for Analysis in EIS/EIR
RETENTION. This routing opportunity would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS, greenhouse gas reduction goals, and electrical energy demands. However, in comparison to the proposed Project, it would have a potential for greater environmental impacts to visual resources, land use, biological resources, cultural resources, and geological resources. The required right-of-way through Land and Water Conservation Fund lands and unstable terrain may pose feasibility issues. At the request of the public and elected officials, this routing opportunity was retained to avoid impacts to the communities of Elizabeth Lake, Green Valley, Leona Valley, Agua Dulce, and Antelope Acres.

5.3.3 Midway to Vincent Corridor
Alternative Description
The Midway to Vincent Corridor is approximately 15.4 miles long and would traverse the ANF from the designated I-5 Utility Corridor to Segment G. The Midway to Vincent Corridor is also a designated Forest Service utility corridor that contains two existing Southern California Edison (SCE) 500 kV transmission lines (Midway-Vincent #1 and #2). During the siting study, it was identified as a potential routing opportunity for the siting of a new 230 kV transmission line. It was eliminated from further study because the alignment of the corridor traversed west to east across the Angeles National Forest. The purpose of the proposed Project was to transfer energy from the north (Barren Ridge Switching Station) to the south (Haskell Canyon). The greater length of this routing opportunity has the potential to pose reliability issues, and additional footprint across the Angeles National Forest would increase potential impacts to environmental resources.

After the 2009 Informational Public Meetings, the Midway-Vincent Corridor was reconsidered as a routing modification of a viable Segment D. It would avoid the constraints of the Castaic Power Plant, impacts to the Castaic Lake State Recreation Area and Land and Water Conservation Fund lands, and unstable terrain. The Midway to Vincent Corridor is not an end-to-end alternative; it is a routing opportunity through the Angeles National Forest from the Interstate 5 Utility Corridor to Segment G. In order for the Midway to Vincent Corridor to connect to the proposed Haskell Canyon Switching Station, this routing opportunity would require following Segment G south for 9.6 miles to the switching station (total distance of 25 miles).
Meeting the Purpose and Need
The Midway to Vincent Corridor is an alternative location for the siting of a new 230 kV double-circuit transmission line; therefore, it would convey the same amount of power as the proposed action, and would meet much of the action’s basic purpose and need.

Potential to Avoid and Minimize Environmental Effects
The Midway to Vincent Corridor is a designated utility corridor; however, it is relatively undisturbed, has very limited access, and would require the construction of new access and spur roads. The need to construct new access roads would increase the potential for impacts to air quality, biological resources, water resources, and cultural resources when compared to the proposed action, which has existing access. The Midway to Vincent Corridor is also adjacent to designated Back Country Non-Motorized land, and the construction of access roads in these areas would not comply with the Angeles National Forest Land Management Plan.

The Midway to Vincent Corridor has the potential to have the greatest impacts to biological resources in comparison to the other routing opportunities identified for the BRRTP (Segments A through K). The corridor contains the highest concentration of riparian conservation areas, and within the corridor suitable habitat has been identified for several special-status species (including the least Bell’s vireo, southwestern willow flycatcher, California red-legged frog, arroyo toad, and unarmored threespine stickleback). The Midway to Vincent Corridor would cross critical habitat for the arroyo toad and traverse a designated Critical Biological (CB) zone of the Angeles National Forest. The southern portion of Segment G that would connect this corridor to the Haskell Canyon Switching Station would not avoid crossing or approaching riparian areas potentially occupied by sensitive resident riparian-dependent wildlife, including the arroyo toad and red-legged frog.

The Midway to Vincent Corridor also has the potential for greater geological resource impacts similar to that of Segment D. It traverses unstable terrain that is prone to landslides, areas of severe erosion potential, areas with expansive soils and high corrosive potential, areas of groundwater less than approximately 25 feet deep, and areas with potential for inundation from dam failure or seiche. The steep and unstable terrain along this corridor would make construction of a new transmission line very difficult.

Although very few residential viewers would be impacted by the Midway to Vincent Corridor, it has the potential for greater visual impacts than the proposed action. The need to construct new access roads for a majority of the corridor would increase impacts to visual resources. Similar to Segment D, it is also in close proximity to the Old Ridge Route (a historic district on the National Register) and has the potential to alter the visual environment. Along the southern portion of Segment G, the San Francisquito Creek is a sensitive resource due to its eligibility for designation as a Wild and Scenic River and would not be avoided by the utilization of the Midway to Vincent Corridor.

Feasibility
Although feasible to construct, the need to build new access roads and a new transmission line in very steep and unstable terrain would pose significant constructability issues similar to those of Segment D.

Recommendation for Analysis in EIS/EIR
ELIMINATION. The Midway to Vincent Corridor would meet the purpose and need for the Project, but is recommended for elimination from further study in the EIS/EIR because it would not significantly reduce or avoid impacts to land use, cultural, biological, and visual resources, or geological hazards. The Midway to Vincent Corridor is much longer than the proposed action, and thus could potentially lead to more geographically extensive impacts. The increased length, steep topography and limited existing
access roads for construction could make the Midway to Vincent Corridor more difficult and costly to build in comparison to the proposed action.

5.3.4 **Bouquet Canyon Alternative (Segment H, including the 110th and 115th Street Modifications)**

**Alternative Description**
The Bouquet Canyon Alternative is a routing opportunity for the siting of a new 230 kV transmission line from the Antelope Valley to the proposed Haskell Canyon Switching Station. This routing opportunity would consist of Segment H and the minor 110th and 115th Street modifications; it is not an end-to-end alternative for the proposed Project.

Segment H was identified in the siting study as a routing opportunity from the Antelope Valley to the proposed Haskell Canyon Switching Station. A majority of Segment H would be located on Angeles National Forest System lands and would mostly parallel the newly constructed SCE Antelope-Pardee transmission line. The last 1.5 miles would follow the SCE 66 kV Saugus-Del Sur transmission line that was removed. Unlike with the other identified routing opportunities for the siting of a new transmission line, very limited access occurs along Segment H on the Angeles National Forest. To minimize impacts to the area, helicopter construction would be required to construct the new transmission line. All other routing opportunities for the proposed Project would be constructed via conventional ground construction (described in Section 1.1).

During the 2008 Public Scoping Meetings, residents in the western Lancaster area suggested the 110th Street modification to connect Segment F to Segment H, which would not follow the existing transmission lines to SCE’s Antelope Substation. This modification was proposed to avoid bisecting private property near the Antelope Substation.

In February 2009 at the Informational Public Meetings, the same residents requested re-routing the modification to follow SCE’s proposed Tehachapi Renewable Transmission Project’s alignment along 115th Street instead. This would minimize the creation of numerous new transmission line corridors and lessen impacts to residents. The 115th Street re-route is five miles long and no existing transmission lines are located along this route. It would require slightly more improvements to existing access roads than the original alignment along Segments F and H.

**Meeting the Purpose and Need**
The Bouquet Canyon Alternative would provide an alternative location for the siting of a new 230 kV double-circuit transmission line and therefore would convey the same amount of power as the proposed action, and would meet much of the action’s basic purpose and need. It would enable the delivery of renewable resources, reduce greenhouse gas emissions, assist LADWP in meeting its RPS goals and electrical energy demands, allow for interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas, and maximize the accommodation of future utility needs.

**Potential to Avoid and Minimize Environmental Effects**
In comparison to the proposed action, the Bouquet Canyon Alternative would avoid impacts to the Wild and Scenic River and minimize the potential for acquisition of private property. Visual impacts would also be minimized, because fewer residential viewers live in close proximity to this alternative. Helicopter construction on the Angeles National Forest would minimize the construction of access roads and result in less ground disturbing activities when compared to the proposed action. The potential for permanent adverse impacts to biological, cultural, visual, and water resources may be minimized.
SCE’s Antelope-Pardee 500 kV transmission line has just completed construction, and revegetation and rehabilitation are in progress. Construction of the BRRTP’s new transmission line would most likely occur soon after completion of the revegetation and rehabilitation, and many of the same Antelope-Pardee construction staging areas would be utilized. The construction of two transmission line projects in the same area has the potential to increase cumulative effects.

Road and structure construction would remove vegetation, including the root system and topsoil, and would cause further disturbance of an area trying to re-establish. Soil compaction caused by construction would decrease the ability of soil to absorb moisture, and also inhibit seedling establishment. Re-establishment of the construction staging areas following construction of the BRRTP would be very difficult.

Helicopter construction would require utilization of many of the same fly yards and construction staging areas. The large construction staging areas are located mainly on private property and in close proximity to residential areas. Therefore, helicopter construction of the Bouquet Canyon Alternative has the potential to increase land use, noise, and air quality impacts, and most of all cumulative effects to those resources.

SCE is also proposing the construction of another new 500 kV transmission line called the Tehachapi Renewable Transmission Project (TRTP). BRRTP’s Segment F and 115th Street modification would parallel TRTP’s Segment 4 alignment. A number of high-voltage transmission lines already occur along Segment F. The construction of three transmission lines (Antelope-Pardee, TRTP and BRRTP) in the same vicinity would increase cumulative effects to residences in the area, and transportation and traffic.

Feasibility
Helicopter construction of a second transmission line adjacent to an energized line presents a number of construction and safety hazards. The construction of a new transmission line on very steep terrain down-slope to an adjacent energized line is considerably more dangerous to construct than the proposed BRRTP or the first transmission line in the corridor. Special construction techniques may be required to ensure safe construction of a second transmission line. Where dangers cannot be mitigated, it may be necessary for the adjacent transmission line to be de-energized.

Construction of the BRRTP by helicopter in close proximity to the existing Antelope-Pardee transmission line creates safety concerns: (a) Helicopter construction next to the energized line will necessitate longer than normal lift lines that must be controlled to prevent them from swaying or blowing into the existing energized line; (b) Maintenance, close-up inspection, and security patrols of the proposed line will continually run into the same problems. The inability to perform such actions safely will necessitate outages on one or both lines, which are increasingly difficult to obtain, especially on high-capacity lines such as the two involved. Additionally, waiting for the outage will delay maintenance and/or inspections and could reduce the reliability of the line at times.

Matching of the spans for the existing 500 kV transmission line with that of the proposed 230 kV transmission line may also be difficult. This may create a problem in areas of large crossings. The mitigation for such a situation is to place additional structures at intermediate points between the spans. Also, helicopter construction of such places would involve height offsets far greater than the typical situation. An additional mitigation for such a condition is to use structures that are much larger and stronger in an attempt to duplicate the capabilities of the original line and match it span for span.

In locations where the structures or roads associated with the existing line require some form of slope stabilization, it may not be feasible to construct down-slope. If the problem could not be mitigated with retaining structures or other slope stabilization methods, an alternate location would be required for the
impacted structures on the proposed line. Conversely, design and construction of the new line would need to be careful to avoid creating problems for the existing line located upslope.

A majority of Segment H is relatively undeveloped and steep in many places. Very limited access roads exist and some new roads may be required. These roads would be longer than normal in order to negotiate the relatively steep terrain, but would also require more extensive grading and more aggressive slope stabilization work than would be expected along other segments. Flat areas required for tensioning sites and construction areas would also require more extensive grading and slope protection (higher cut/fill volumes) than would be expected on the Proposed Action. Structures built on the sides of slopes, especially steep slopes, need to be larger than those in the flatter areas found along other routing opportunities. The conductors on the uphill side of the structure must be sufficiently high above the ground to have electrical clearance with the rising nearby slope. This calls for a taller structure than would be required on flatter terrain. Additionally, the legs on the downhill side of the slope need to extend further to intercept the grade as it falls away. Since structures on slopes are most often viewed from the downhill side, which shows the longer legs, the structure appears larger. It is important to understand that since structure heights are often described in terms of the shortest leg, written descriptions of such structures or tabulated spreadsheets of these structures may not adequately describe the visual impact of the actual structure.

Helicopter construction of a new double-circuit 230 kV transmission line adjacent to an energized 500 kV transmission line in steep terrain would pose additional safety concerns in relationship to the proposed action, however this alternative is considered feasible.

Recommendation for Analysis in EIS/EIR

ELIMINATION. The Bouquet Canyon Alternative would meet the purpose and need for the Project. Ground disturbance and visual impacts would be minimized through the use of helicopter construction; however, impacts to air quality and noise would increase. Helicopter construction also poses construction and safety concerns that are not present for the proposed action. Cumulative effects for the Project would also increase because of the further disturbance of revegetated and rehabilitated areas and potential for impacts from three transmission line projects (Antelope-Pardee, TRTP and BRRTP) in the same vicinity.

5.3.5 Green Valley Modification (Alternative 2A)

Alternative Description
During the 2008 scoping meetings, Green Valley residents proposed the modification of Segment G to avoid impacts to their community. The localized modification would be located west of Green Valley, over the ridge, along an existing fire road, and would be approximately one mile from the existing BR-RIN transmission line. The routing modification would be within Angeles National Forest lands, but outside the Forest Service 1000-foot designated utility corridor.

Meeting the Purpose and Need
The Green Valley modification routing alternative would convey the same amount of power as the proposed action, and would meet much of the action’s basic purpose and need. It would enable the delivery of renewable resources, reduce greenhouse gas emissions, assist LADWP in meeting its RPS goals and electrical energy demands, allow for interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas, and maximize the accommodation of future utility needs.

Potential to Avoid and Minimize Environmental Effects
While this alternative eliminates or minimizes social and community impacts to Green Valley, it would not minimize overall environmental effects in comparison to the proposed BRRTP. The modification would be located over a mile west of the existing transmission lines and would require a new utility
The Green Valley Modification would minimize visual impacts to Green Valley residents; however, these visual impacts would occur over a wider area and would not comply with the Forest Land Management Plan (FLMP) direction to conserve the aesthetic, recreation, and open space values of “high-valued scenery such as scenic backdrops for local communities and increasingly rare values such as solitude.”

The Green Valley Modification area is relatively undisturbed except for the fire roads that loosely follow the ridge. Suitable habitat for special-status species, such as the arroyo toad, were found during the 2008 field season, and the area also supports unique habitat that is typically of limited areal extent in the region under study (e.g., riparian areas). This routing alternative would increase the significant impacts to biological resources in comparison to the proposed action.

Cultural sites involving multiple burials on private land along the proposed Segment G would be avoided with the Green Valley Modification. However, no cultural surveys have been conducted in the modification area, where there is a potential to uncover cultural sites and historic resources from aqueduct construction.

Feasibility
This routing alternative represents a change to the proposed action alignment and is considered feasible.

Recommendation for Analysis in EIS/EIR
*RETENTION.* The Green Valley Alternative was recommended for elimination during the Informational Public Meetings because it would create a new utility corridor within the Angeles National Forest and result in greater impacts to National Forest resources in comparison to the proposed action. To address the issues and concerns raised by the community of Green Valley and elected officials, LADWP realigned the proposed new 230 kV transmission line route to skirt the community and accomplish the primary objective of this alternative. However, the Green Valley Alternative as proposed by the community was modified to lessen impacts on the Angeles National Forest, and will also be considered in full detail within the EIS/EIR as a localized alternative to Alternative 2. This routing alternative will be designated Alternative 2a.

5.3.6 Antelope Valley Alternative (Segments C and E)

Alternative Description
The physiography of the Project area can be broken up into two different types: the northern portion of the project area consists of flat desert areas of the Mojave Desert and Antelope Valley, and the southern portion contains the mountains of the Angeles National Forest.

Two routing opportunities from the Mojave Desert area to Antelope Valley were identified for the siting of a new 230 kV transmission line: Segment B and the combination of Segments C and E (referred to as the Antelope Valley Alternative). Segment B is part of LADWP’s proposed action and is approximately 27 miles long. It starts just north of Mojave, California, parallel to LADWP’s existing 230 kV Barren Ridge – Rinaldi (BR-RIN) and 500 kV Pacific Direct Current Intertie (PDCI) transmission lines, and travels south towards the Antelope Valley California Poppy Reserve. The Antelope Valley Alternative is 33 miles long and would also start just north of Mojave, California, parallel the Los Angeles Aqueduct southwest to Cottonwood Creek, then turn southeast and parallel three existing SCE high-voltage transmission lines to the Antelope Valley California Poppy Reserve. To identify which routing opportunity through the northern portion of the Project would be carried forward in the EIS/EIR, Segment B and the Antelope Valley Alternative were compared.
Meeting the Purpose and Need
The Antelope Valley Alternative would convey the same amount of power as the proposed action, and would meet much of the action’s basic purpose and need. It would enable the delivery of renewable resources, reduce greenhouse gas emissions, assist LADWP to meet its RPS goals and electrical energy demands, allow for interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas, and maximize the accommodation of future utility needs.

Potential to Avoid and Minimize Environmental Effects
In comparison to the proposed action, the Antelope Valley Alternative has fewer residences in close proximity to the transmission line (250 feet or less from the proposed centerline) and would avoid impacts to residences. However, the Antelope Valley Alternative would require an additional six miles of transmission line and therefore be expected to have a greater amount of ground disturbance and potential for impacts to environmental resources than Segment B.

The Antelope Valley Alternative would increase visual impacts. Approximately 22 of the 33 miles would be within a new transmission line corridor; the remaining 11 miles of the alternative would parallel three existing SCE transmission lines. Segment B, however, would parallel two existing LADWP transmission lines for its entire length. The Antelope Valley Alternative would also cross the Pacific Crest Trail and come in close proximity to the Antelope Valley California Poppy Reserve.

The potential for impacts to biological and water resources would increase for the Antelope Valley Alternative in comparison to the proposed action. A greater number of stream crossings would occur along the alternative, and it would cross two Significant Ecological Areas (SEAs)—the Joshua Tree Woodlands and San Andreas Rift Zone—ecologically important or fragile land and water areas. It also has the potential to impact valuable plant and animal communities through removal and/or disturbance. The alternative would also generally parallel the Los Angeles Aqueduct; to avoid impacts to the aqueduct, LADWP must construct the new transmission line at least 200 feet from the aqueduct.

Existing access roads occur along the entire length of Segment B, whereas only 13 miles along the Antelope Valley Alternative have existing access. Four miles of the Antelope Valley Alternative would require construction of new access roads and 15 miles would require improvements to existing access roads. The construction and improvements to access roads would increase impacts to air quality and biological, cultural, visual and water resources.

Feasibility
The alternative represents a relatively minor change to the proposed action and is considered feasible.

Recommendation for Analysis in EIS/EIR
The Antelope Valley Alternative would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS and greenhouse gas reduction goals and electrical energy demands. It would avoid impacts to residences in close proximity to the proposed action’s Segment B, but would create a new transmission corridor and increase the potential for impacts to visual resources, biological resources, water resources, air quality, and cultural resources. This alternative would also require more new access roads and improvements to the existing access roads.

RETENTION of SEGMENT C. Although Segment C would require the creation of a new utility corridor and the construction and improvement of access roads, and has the potential to increase impacts to air quality, biological resources, cultural resources, visual resources, and water resources, it will be retained for further study to allow Segment D a northern connection to the Barren Ridge Switching Station.
ELIMINATION of SEGMENT E. Segment E would require an additional 6.5 miles in comparison to the proposed action and is recommended for elimination from further study in the EIS/EIR, because it would not significantly reduce or avoid significant impacts to air quality, biological, cultural, visual, and water resources.

5.3.7 Segment I

Alternative Description
Segment I was identified in the siting study as a routing opportunity for the siting of a new double-circuit 230 kV transmission line from the Antelope Valley to the proposed Haskell Canyon Switching Station. It is 31 miles long and traverses 27 miles of privately land and four miles of USFS-managed lands, and starts at the Antelope Substation headed southeast to Palmdale (four existing Southern California Edison high-voltage transmission lines occur along this portion), then makes a sharp turn and heads southwest to Haskell Canyon along two existing LADWP high-voltage transmission lines. This routing opportunity would require a new 200-foot ROW.

Just south of SCE’S Antelope Substation are six SCE high-voltage transmission lines. Multi-circuit towers are not an option since SCE owns the transmission lines in this portion of the segment. Crossing the lines would be very difficult in this area due to the required hierarchy of the various voltages: 230 kV would need to go under 500 kV lines but over 220 kV or 138 kV. Six different lines would need to be crossed, and SCE would need to raise up their its 500 kV line substantially to accommodate the 230 kV line traveling underneath. Also, weaving through the various transmission lines may cause reliability issues for both LADWP and SCE.

Meeting the Purpose and Need
Segment I would convey the same amount of power as the proposed action, and would meet much of the action’s basic purpose and need. It would enable the delivery of renewable resources, reduce greenhouse gas emissions, assist LADWP to meet its RPS goals and electrical energy demands, allow for interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas, and maximize the accommodation of future utility needs.

Potential to Avoid and Minimize Environmental Effects
To avoid and minimize acquisition of private property in Leona Valley, the Ritter Ranch re-route was considered, which would parallel SCE’s TRTP Segment 2 alignment around the Ritter Ranch Development to LADWP’s existing Victorville– Rinaldi and Adelanto– Rinaldi 500 kV transmission lines. There is also an area where the line goes south that would create a triangular “indefensible space”—an area trapped between transmission line corridors that is difficult or impossible for firefighters to access or defend in the event of a fire—and surrounds houses with transmission lines. Undergrounding in Ritter Ranch would be very difficult because of the terrain and need for conversion facilities.

In Agua Dulce, LADWP considered combining the existing 500 kV lines on a double-circuit tower and utilizing the existing ROW to construct the new 230 kV transmission line; additional ROW would be required to accommodate the taller towers and larger conductor swing area. However, LADWP’s reliability would be compromised by placing both 500 kV lines on single structures, since these lines deliver a significant portion of the city’s power.

To minimize acquisition of private property in Agua Dulce, re-routes were considered that would run along the foothills to skirt the community along the foothills and minor re-route would avoid residences. However, indefensible spaces would be created, and which it would increase the potential for impacts to fire suppression efforts. These re-routes would also have visual impacts to a movie ranch. The re-route that skirts the community would create a new corridor on NFS lands where there are no existing roads or structures, so helicopter construction would be used.
Segment I has a greater number of residences and residential viewers in close proximity to the proposed centerline than the Proposed Action. However, Segment I would avoid impacts to the communities of Elizabeth Lake and Green Valley, and avoid the San Francisquito Canyon (considered a particularly sensitive resource due to its eligibility as a designated Wild and Scenic River); as well as minimize impacts to the ANF. Therefore, Segment I was retained as a feasible alternative to the proposed Project.

Segment I has a greater potential to impact geological resources than the Proposed Action. It crosses a distinctive geologic feature (white tuff marker beds). Traverses the San Andreas fault zone diagonally and has the longest distance of departure from the high impact areas of all the routing opportunities through the ANF. Segment also has the most miles of high levels of earthquake ground shaking areas and highest ratio percentage of liquefaction zones and corrosive soil areas. (This is partly due to the longer distance of Segment I and the availability of existing geologic data.)

**Feasibility**

Construction of a new 230 kV double-circuit transmission line along Segment I is feasible.

**Recommendation for Analysis in EIS/EIR**

*RETENTION.* This routing opportunity would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS, greenhouse gas reduction goals, and electrical energy demands. However, in comparison to the proposed Project, it would have a potential for greater environmental impacts to visual resources, land use, and potential for geological hazards.

### 5.3.8 Haskell Canyon Switching Station Site B

**Alternative Description**

As a component of the BRRTP, LADWP proposes the construction of a new switching station in Haskell Canyon, south of the ANF, on LADWP-owned property at the convergence of several existing and proposed 230 kV transmission lines. The proposed site is referred to as Site A.

The station would be approximately 400 feet by 600 feet to accommodate the necessary equipment, such as circuit breakers, disconnect switches, relays, control cable, relay house, control house, and drainage area. The relay and control houses would each be approximately 30 feet long by 12 feet wide by 10 feet high and constructed of gray concrete block. The internal access road would be approximately 16 feet wide, and the facility would be enclosed by chain-link fencing for security.

Site B was identified as an alternative switching station site, and is located north of Santa Clarita, approximately one mile south of Site A. Figure 7 illustrates the locations of both sites. LADWP would have to acquire additional property to build Site B.
Figure 7. Haskell Substation Alternative Site Locations.
Potential to Avoid and Minimize Environmental Effects
The proposed Site A would be constructed within Haskell Canyon, approximately 1.5 miles north of residential communities of Saugus and Santa Clarita. Construction of the switching station at Site A would require significant grading and ground disturbing impacts and is anticipated to have a greater potential for impacts to air quality than Site B.

Site B would be located a half mile north of residences in Santa Clarita and would be visible to residents in nearby communities. A planned community development, Cooper Creek North (TR47760), is also planned in the same vicinity. There is also a greater potential for landslides and liquefaction at Site B than Site A.

Feasibility
The construction of a switching station at Site B is feasible; however, there is a potential for significant impacts to the switching station due to landslides and liquefaction. Also, there is a planned development in the same area and acquiring the property may not be feasible.

Recommendation for Analysis in EIS/EIR
ELIMINATION. Site B is in closer proximity to existing and planned residential communities and has the potential for greater impacts to visual resources and land use. There is also a very high potential for landslide and liquefaction within this area, and it would therefore not be feasible to construct the switching station at this site. Therefore, Site B is recommended for elimination from further study in the EIS/EIR.

5.4 SUMMARY TABLE OF ALTERNATIVES CONSIDERED AND ELIMINATED
The summary table below lists all alternatives that were considered for the proposed Project and identifies: 1) the alternative’s ability to meet the purpose and need of the Project; 2) the alternative’s potential to avoid or minimize environmental effects; 3) if the alternative is feasible; 4) recommendation for analysis in the EIS/EIR; and 5) rationale for retention or elimination.
### Table 4. Summary of Alternatives Considered and Eliminated

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Meets Purpose &amp; Need</th>
<th>Potential to Avoid or Minimize Environmental Effects</th>
<th>Feasibility</th>
<th>Recommendation for Analysis in EIS/EIR</th>
<th>Rationale</th>
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<tbody>
<tr>
<td>System Alternatives</td>
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<tr>
<td>Energy Conservation &amp; Demand-Side Management</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Elimination</td>
<td>This alternative alone will not meet the electrical energy demands, meet RPS goals, or achieve greenhouse gas emission reduction. It would avoid and minimize environmental effects from the construction of a new transmission line.</td>
</tr>
<tr>
<td>Distributed Generation &amp; In-basin Generation Expansion</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Elimination</td>
<td>This alternative alone will not meet the electrical energy demands, meet RPS goals, achieve greenhouse gas emission reduction, or increase overall system reliability, nor would it provide delivery of renewable energy at a level and within a timeframe necessary to meet purpose and need.</td>
</tr>
<tr>
<td>Solar Alternative</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Elimination</td>
<td>LADWP’s current Solar Energy Plan would provide approximately 10% of LADWP’s electrical demand. Although this alternative may avoid or minimize environmental effects from the proposed Project, this alternative alone would not meet the electrical energy demands or RPS goals. Additional transmission capacity may also be required to transfer solar energy from the Mojave Desert area to the Los Angeles Basin.</td>
</tr>
<tr>
<td>Reconductor Existing Transmission Line (No New Transmission Line)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Elimination</td>
<td>Transfer capacity of the utility corridor from Barren Ridge to the proposed Haskell Canyon Switching Station would be constrained, thereby limiting delivery of renewable energy, ability to meet future electrical demands, RPS goals, and greenhouse gas reductions goals, and interconnection and expansion of renewable energy in the Tehachapi Mountains and Mojave Desert areas. Construction of a temporary shoe-fly and need for additional transmission capacity would not minimize or avoid impacts to environmental resources.</td>
</tr>
<tr>
<td>New 230 kV Transmission Line (No Reconductoring)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Elimination</td>
<td>This alternative would allow LADWP to access renewable resources in the Tehachapi Mountains and Mojave Desert areas. By removing the reconductoring portion of the proposed Project, it would minimize the potential for impacts to environmental resources and reduce cumulative impacts of the proposed Project. LADWP’s ability to meet projected electrical energy demands would be limited.</td>
</tr>
</tbody>
</table>
# Barren Ridge Renewable Transmission Project—Alternatives Development Report

## Alternatives

<table>
<thead>
<tr>
<th>Design Alternatives</th>
<th>Meets Purpose &amp; Need</th>
<th>Potential to Avoid or Minimize Environmental Effects</th>
<th>Feasibility</th>
<th>Recommendation for Analysis in EIS/EIR</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Current Transmission</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Elimination</td>
<td>The direct current system would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS goals, greenhouse gas reduction goals, and electrical energy demands. The number of transmission line towers would be minimized and right-of-way expansion reduced. However, large converter stations may increase the potential for impacts to air quality, land use, biological resources, earth resources, water resources, and visual resources. A multi-terminal DC system is technically and economically not feasible and therefore may limit the future interconnections into the system. That converter stations also come at considerably higher costs without clear benefits as compared to AC make this alternative infeasible for LADWP.</td>
</tr>
<tr>
<td>Quad-Circuit Towers</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Elimination</td>
<td>Although this alternative would require less permanent right-of-way and minimize permanent impacts to visual resources, land use, and impacts to ANF- and BLM-managed lands, it would have limited transmission capacity to deliver renewable energy, and would therefore limit LADWP's ability to reduce greenhouse gas emissions, meet RPS goals and electrical demands, and allow interconnection and expansion of renewable energy resources. It would also create greater temporary impacts to construct the shoe-fly and remove the existing BR-RIN.</td>
</tr>
<tr>
<td>Alternative Voltages</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Elimination</td>
<td>The single-circuit 500 kV transmission line would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS goals, greenhouse gas reduction goals, and electrical energy demands. However, it may not be feasible to construct a 500/230 kV substation within Haskell Canyon. The need for 500 kV to 230 kV conversions may limit LADWP on the number of interconnections to renewable energy projects. The increased footprint of the substations also has the potential to increase environmental impacts.</td>
</tr>
</tbody>
</table>
### TRANSMISSION ALTERNATIVES

<table>
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<tr>
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<tr>
<td>Underground Transmission</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Elimination</td>
<td>An underground high-voltage transmission line would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS goals, greenhouse gas reduction goals, and electrical energy demands. The principle environmental advantage of undergrounding a transmission line would be the mitigation of adverse visual impacts of the transmission towers and conductors. However, it would still require above-ground ancillary facilities on or adjacent to the right-of-way, and result in greater ground disturbance than overhead transmission lines and longer construction duration. It would create a greater potential for impacts to transportation, traffic, soils, socioeconomics, and archaeological, cultural, biological, and water resources. If an outage occurred, repair times could increase. An underground system would not result in any substantial reduction in environmental effects, and is also infeasible for long distances.</td>
</tr>
<tr>
<td>Superconductors</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Elimination</td>
<td>Superconductors have the ability to transfer greater amounts of energy than the proposed aluminum conductors. However, they are still in the developmental stage and considered infeasible for long distances. The principle environmental advantage of superconductors would be the mitigation of adverse visual impacts of the transmission towers and conductors. However, superconductors would still require above-ground ancillary facilities on or adjacent to the right-of-way, and result in greater ground disturbance than overhead transmission lines and longer construction duration. It would create a greater potential for impacts to transportation, traffic, soils, socioeconomics, and archaeological, cultural, biological, and water resources.</td>
</tr>
<tr>
<td>Accessing Other Renewable Resource Areas</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Elimination</td>
<td>This alternative would access renewable energy and assist in meeting RPS and greenhouse gas reduction goals. This alternative does not meet the purpose and need to deliver renewable energy sources from the Tehachapi Mountains and Mojave Desert areas. LADWP would also not be able to utilize existing facilities that would allow LADWP to store renewable energy. The need to access other renewable resource areas would likely involve the need for new transmission lines and therefore this alternative would be expected to have similar impacts to those of the proposed Project.</td>
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</table>
### Alternatives Development Report

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<tbody>
<tr>
<td>Segment D</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Retention</td>
<td>This routing opportunity would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS goals, greenhouse gas reduction goals, and electrical energy demands. However, in comparison to the proposed Project, it would have a potential for greater environmental impacts to visual resources, land use, biological resources, cultural resources, and geological resources. The required right-of-way through Land and Water Conservation Fund lands and unstable terrain may pose feasibility issues. At the request of the public and elected officials, this routing opportunity was retained to avoid impacts to the communities of Elizabeth Lake, Green Valley, Leona Valley, Agua Dulce, and Antelope Acres.</td>
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<tr>
<td>Midway Vincent Corridor</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Elimination</td>
<td>The Midway to Vincent Corridor would meet the purpose and need for the Project, but is recommended for elimination from further study in the EIS/EIR because it would not significantly reduce or avoid impacts to land use, cultural, biological, and visual resources, or geological hazards. The Midway to Vincent Corridor is much longer than the proposed action, and thus could potentially lead to more geographically extensive impacts. The increased length, steep topography and limited existing access roads for construction could make the Midway-Vincent sub-route more difficult and costly to build in comparison to the proposed action.</td>
</tr>
<tr>
<td>Bouquet Canyon Alternative (Segments H, including 110th &amp; 115th Modifications)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Elimination</td>
<td>The Bouquet Canyon Alternative would meet the purpose and need for the Project. Ground disturbance and visual impacts would be minimized through the use of helicopter construction; however, impacts to air quality and noise would increase. Helicopter construction also poses construction and safety concerns that are not present for the proposed action or other routing opportunities. Cumulative effects for the Project would also increase because of the further disturbance of revegetated and rehabilitated areas and potential for impacts from three transmission line projects in the same vicinity.</td>
</tr>
<tr>
<td>ALTERNATIVES</td>
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<tr>
<td>Green Valley Modification</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Retention</td>
<td></td>
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<tr>
<td>(Alternative 2A)</td>
<td></td>
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<tr>
<td>Antelope Valley Alternative</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Segment C: Retention</td>
<td></td>
</tr>
<tr>
<td>(Segment C and E)</td>
<td></td>
<td></td>
<td></td>
<td>Segment E: Elimination</td>
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The Green Valley Modification would create a new transmission line corridor through the Angeles National Forest and add an additional crossing of the Pacific Crest Trail. This would increase the potential for impacts to visual resources, land use and recreation, fire suppression efforts, and biological resources. In response to the concerns of the community of Green Valley, LADWP has realigned the proposed new 230 kV transmission line route to skirt the community and accomplish the primary objective of this alternative; however, the routing alternative proposed by the community of Green Valley will also be carried forward for full analysis in the EIS/EIR.

The Antelope Valley Alternative would transfer renewable energy, and assist LADWP in meeting RPS goals, greenhouse gas reduction goals, and electrical energy demands. It would avoid impacts to residences in close proximity to the proposed action’s Segment B, but would create a new transmission corridor and increase the potential for impacts to visual resources, biological resources, water resources, air quality, and cultural resources. This alternative would also require more new access roads and improvements to the existing access roads.

**RETENTION of SEGMENT C.** Although Segment C would require the creation of a new utility corridor and the construction and improvement of access roads, and has the potential to increase impacts to air quality, biological resources, cultural resources, visual resources, and water resources, it will be retained for further study to allow Segment D a northern connection to the Barren Ridge Switching Station.

**ELIMINATION of SEGMENT E.** Segment E would require an additional 6.5 miles in comparison to the proposed project and is recommended for elimination from further study in the EIS/EIR, because it would not significantly reduce or avoid impacts to air quality, biological, cultural, visual, and water resources.
### Alternatives

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</thead>
<tbody>
<tr>
<td>Segment I</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Retention</td>
<td>RETENTION. This routing opportunity would meet the purpose and need of the Project to transfer renewable energy, and assist LADWP in meeting RPS, greenhouse gas reduction goals, and electrical energy demands. However, in comparison to the proposed Project, it would have a potential for greater environmental impacts to visual resources, land use, and potential for geological hazards.</td>
</tr>
<tr>
<td>Haskell Canyon Switching Station</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Elimination</td>
<td>Site B has the potential for greater impacts to visual resources and land use, because it is in closer proximity to existing and planned residential communities than Site A. Site B also has a greater potential for landslide and liquefaction and it may not be feasible to construct the switching station at this site.</td>
</tr>
</tbody>
</table>
6 ALTERNATIVES TO BE ANALYZED IN THE EIS/EIR

An EIS/EIR will be prepared as an informational disclosure document used to inform agency decision makers and the public of the environmental effects of the Project, identify possible ways to eliminate or minimize the potential significant or adverse effects, and describe reasonable alternatives to the proposed action/Project.

LADWP, the Forest Service and the BLM have identified that the proposed Project would have a potential to impact biological resources, cultural resources, earth resources, water resources, land use, public health and safety, recreation, and visual resources.

The following alternatives, as well as the no action alternative, were identified as a reasonable range of alternatives to the Project that would feasibly attain most of the basic objectives of the Project, but avoid or substantially lessen any of the significant or adverse effects of the Project.

6.1 NO ACTION ALTERNATIVE
NEPA Regulations (40 C.F.R. 1502.14(d)) and CEQA Guidelines (Section 15126.6(e)) require the analysis of the No Action Alternative. Under the No Action Alternative, the construction of a new 230 kV transmission line, the construction of a new Haskell Canyon Switching Station, or the expansion of the existing Barren Ridge Switching Station would not occur. The EIS/EIR must address the resulting environmental effects from taking no action and compare it to the effects of permitting the proposed action or an alternative to the proposed action.

6.2 ROUTING ALTERNATIVES TO BE EVALUATED IN THE EIS/EIR
The regional siting study identified nine routing opportunities (Segments A through I) for the new 230 kV transmission line. As discussed within earlier sections of this report, some of the routing opportunities were adjusted or modified based on public input and preliminary environmental review, and preliminary electrical system studies. Segments E and H were recommended for elimination in Section 5.3. The remaining seven routing opportunities (Segments A, B, C, D, F, G and I) were combined to create end-to-end routing alternatives for the proposed double-circuit 230 kV transmission line between Barren Ridge Switching Station and the proposed Haskell Canyon Switching Station (see Figure 9). Descriptions of these routing alternatives follow in the sections below.

In addition to a new double-circuit 230 kV transmission line from Barren Ridge to Haskell Canyon, Alternatives 1 though 3 would also include the addition of a new circuit on existing towers between the Castaic Power Plant and Haskell Canyon, reconductoring of the existing BR-RIN transmission line, construction of a new Haskell Canyon Switching Station, and expansion of the existing Barren Ridge Switching Station.
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FIGURE 8. ALTERNATIVES TO BE EVALUATED IN THE EIS/EIR

BRRTT Proposed Project and Alternatives

ALTERNATIVE ROUTES FOR 230 KV TRANSMISSION LINE
- Alternative 1
- Alternative 2 (Proposed Action)
- Localized Alternative 2a
- Alternative 3

PROJECT COMPONENTS APPLICABLE FOR EACH ALTERNATIVE
- New 230 kV Circuit
- Reconductoring of Existing 230 kV Transmission Line (Barren Ridge - Rinaldi)
- Expansion of Existing Switching Station
- New Switching Station
6.2.1 **Alternative 1 (Segments A, C, and D)**
Alternative 1 is comprised of Segments A, C, and D. It runs from the Barren Ridge Switching Station to Mojave while paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI transmission lines. It continues south-southeast to parallel the Los Angeles Aqueduct to Lancaster Road, where it travels west to the Interstate 5 utility corridor. It then runs southeast along LADWP’s existing Castaic – Rinaldi corridor to the proposed Haskell Canyon Switching Station. This alternative would avoid impacts to the communities of Elizabeth Lake, Green Valley, Leona Valley, Agua Dulce, and Antelope Acres.

6.2.2 **Alternative 2 (Segments A, B, and G) – LADWP’s Proposed Action**
Alternative 2, LADWP’s Proposed Action, is comprised of Segments A, B, and G. It begins at the Barren Ridge Switching Station and runs south, paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI transmission lines. It travels south from Mojave towards the Antelope Valley California Poppy Reserve. It continues south into National Forest System lands, remaining within designated utility corridors, and ends at the proposed Haskell Canyon Switching Station.

6.2.3 **Alternative 2a (Segments A, B, and G, with Localized Green Valley Alternative)**
Alternative 2a is comprised of Segments A, B, and G, and includes the localized Green Valley alternative. It begins at the Barren Ridge Switching Station and runs south, paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI transmission lines. It travels south from Mojave towards the Antelope Valley California Poppy Reserve. It continues south into National Forest System lands, bypasses the community of Green Valley, and over the ridge along an existing fire road. The routing modification would be within Angeles National Forest lands, but outside the Forest Service 1000-foot designated utility corridor. The Alternative connects back to Segment G south of Green Valley, and ends at the proposed Haskell Canyon Switching Station.

6.2.4 **Alternative 3 (Segments A, B, F, and I)**
Alternative 3 is comprised of Segments A, B, F, and I. It begins at the Barren Ridge Switching Station and runs south, paralleling LADWP’s existing 230 kV BR-RIN and 500 kV PDCI lines. It travels south from Mojave towards the Antelope Valley California Poppy Reserve. It then travels southeast past SCE’s Antelope Substation to Palmdale, paralleling SCE’s existing high-voltage transmission lines. It makes a sharp turn to the south-southwest to Haskell Canyon while paralleling LADWP’s existing Victorville-Rinaldi 500 kV and Adelanto-Rinaldi 230 kV transmission lines. This alternative would avoid potential impacts to the eligible Wild and Scenic River and minimize impacts to Angeles National Forest lands.