9. Alternative 5 (Partial Underground): Impacts and Mitigation Measures

The following section describes Geology, Soils, and Paleontology impacts of Alternative 5 (Partial Underground Alternative), as determined by the significance criteria listed in Section 4. Mitigation measures are introduced where necessary in order to reduce significant impacts to less-than-significant levels.

9.1 Direct and Indirect Effects Analysis

The significance criteria used to identify geology, soils, and paleontology impacts are introduced in Section 4.1 (Criteria for Determining Impact Significance). Impacts associated with this alternative are presented below under the applicable significance criterion.

As summarized below, the impacts and mitigation measures for Alternative 5 would be the same as those for Alternative 2. Although a portion of Alternative 5 would be installed underground, from approximately MP S8A-21.9 through the City of Chino Hills to approximately MP S8A-25.8, the route of this alternative would be identical to that of Alternative 2 and would therefore be within the same geologic materials and terrain. However, the construction of underground transmission lines would require more extensive amounts of ground disturbance and increased duration of construction activities required than for the equivalent aboveground portions of Alternative 2. Therefore, the potential for some geology, soils, and paleontology impacts to occur would be incrementally increased compared to Alternative 2.

Unique geologic features (Criterion GEO1)

No unique geologic features or geologic features of unusual scientific value for study or interpretation would be disturbed or otherwise adversely affected by Alternative 5. No impact would occur.

Known mineral and/or energy resources (Criterion GEO2)

Impacts associated with Criterion GEO2 for Alternative 5 would be the same as impacts associated with this criterion for the proposed Project, as presented in Section 6.1, and summarized below.

Impact G-1 (Project activities could interfere with access to known energy resources) would be the same as for Alternative 2. Therefore, where the portions of Alternative 5 equivalent to Segments 7, 11, and 8 would cross the Montebello oil field and where the Segment 8 equivalent would cross the northern edge of the Brea-Olinda oil field, there is a potential for Project construction activities to interfere with oil field operations. Impact G-1, as described in Section 6.1, for Alternative 5 would require implementation of Mitigation Measure G-1 (Coordination with oil field operations) to reduce potential impacts to less than significant (Class II).

Triggering or acceleration of geologic processes, such as landslides, soil erosion, or loss of topsoil, during construction (Criterion GEO3)

Impacts associated with Criterion GEO3 for Alternative 5 would be similar to the impacts associated with this criterion for Alternative 2. The underground portion of the alignment would require excavation and grading of transition stations at either side of the underground portion (approximately 1.8 acres each), that

would equal more ground disturbance than that required for the towers that would be replaced by construction of the underground portion of Alternative 5, resulting in incrementally greater ground disturbance compared to Alternative 2 and would result in increased opportunity to cause construction triggered erosion. Construction of the tunnel and transition stations would incrementally decrease the potential of construction triggered landslides due to the decreased number of construction sites along potentially unstable slopes underlain by landslide prone Puente Formation. These impacts and their associated mitigation measures that fall under Criterion GEO3 are summarized in the following paragraphs. Please see Section 6.1 (Direct and Indirect Effects Analysis) for a detailed description of these impacts, as they are similar but have greater potential for significant impact than Alternative 2.

Impact G-2 (Erosion could be triggered or accelerated due to construction activities) would be greater under Alternative 5 than it would for Alternative 2 (please see Section 6.1). The proposed underground portion of Alternative 5 and the associated transition stations are located along moderate to gentle hillside areas on the eastern slopes of the Chino Hills on soils with severe to very severe erosion potential. Alternative 5 would require the excavation and grading of large transition stations at either side of the underground portion (approximately 1.8 acres each), resulting in a slightly greater potential for erosion along Alternative 5 due to the smaller amount of ground disturbance that would be required for construction of the towers for the equivalent section of Alternative 2. Therefore, there is substantial potential for erosion caused by construction. The remaining portion of Alternative 5 is identical to Alternative 2 and the potential of erosion triggered or accelerated due to construction activities is the same as presented in Section 6.1, and would require implementation of Mitigation Measure H-1a (Implement an Erosion Control Plan and demonstrate compliance with water quality permits). With implementation of this measure, as described in Section 6.1, Impact G-2 of Alternative 5 would be less than significant (Class II).

Impact G-3 (Excavation and grading during construction activities could cause slope instability or trigger landslides) for Alternative 5 would be incrementally less than it would for Alternative 2 (see Section 6.1). Although Alternative 5 is located in hillside areas with mapped landslides and substantial potential for slope failure identical to the equivalent portion of Alternative 2, the tunneling required to complete the underground installation of transmission lines for Alternative 5 would bypass slopes underlain by potentially unstable Puente Formation where tower foundations would otherwise be constructed, thus decreasing the potential that Project excavation would result in slope instability or landslides along the underground portion of the alignment. The remaining portion of Alternative 5 is identical to Alternative 2 and the potential of slope failure or triggered landslides due to construction activities is the same as presented in Section 6.1, and would require implementation of Mitigation Measure G-3 (Conduct geological surveys for landslides and protect against slope instability). With implementation of this measure, as described in Section 6.1, Impact G-3 of Alternative 5 would be less than significant (Class II).

Exposure to potential risk of loss or injury due to earthquake-related ground rupture (Criterion GEO4)

Impacts associated with Criterion GEO4 for Alternative 5 would be the same as impacts associated with this criterion for Alternative 2, as presented in Section 6.1, and summarized below.

Impact G-4 (Project structures could be damaged by surface fault rupture at crossings of active faults exposing people or structures to hazards) would be similar for Alternative 5 as it would for Alternative 2 (see Section 6.1). The trend to the active Chino fault, see Figure 2-10, potentially places the fault within

or adjacent to the planned location for the eastern transition station for the underground portion of Alternative 5, which results in a potential for damage at these facilities due to surface fault rupture. The remainder of the Alternative 5 alignment would be identical to Alternative 2 and have the same fault rupture impacts. Therefore, at the eastern transition station and along the portions of Alternative 5 corresponding to Segments 5, 6, 7, 11, and 8A where it crosses the active San Andreas (Segment 5), San Gabriel (Segments 6 and 11), Clamshell-Sawpit (Segment 6), Sierra Madre (Segments 7 and Segment 11 north of S11 MP 19), East Montebello Hills (Segments 7 and 8A), Whittier (Segment 8A), Chino (Segment 8A), and Central Ave (Segment 8A) faults, implementation of Mitigation Measures G-4 (Avoid placement of Project structures within active fault zones) would be required to reduce potential impacts to less than significant (Class II).

Exposure to potential risk of loss or injury due to seismically induced ground shaking, landslides, liquefaction, settlement, lateral spreading, and/or surface cracking (Criterion GEO5)

Impacts associated with Criterion GEO5 for Alternative 5 would be the same as impacts associated with this criterion for Alternative 2, as presented in Section 6.1, except for the underground portion of Alternative 5. The impact and associated mitigation measure that is the same as Alternative 2 and that falls under Criterion GEO5 is summarized in the following paragraph. Construction of the underground portion of Alternative 5 would introduce one new impact related to the deep excavations for the transition stations and tunneling for the underground transmission line, Impact G-9 (Existing structures could be damaged by ground settlement along the tunnel exposing people or structures to hazards).

Impact G-5 (Project structures could be damaged by seismically induced groundshaking and/or ground failure exposing people or structures to hazards) would be the same under Alternative 5 as it would for Alternative 2 (see Section 6.1). The potential for strong to severe groundshaking, liquefaction, and earthquake induced slope failures along Alternative 5 are identical to Alternative 2 (see Section 6.1). Local strong to severe groundshaking may occur along the Alternative 5 alignment that corresponds to portions of Segments 4, 5, 6, 7, 9, and 11 and would require implementation of Mitigation Measure G-5a (Reduce effects of groundshaking). Portions of Alternative 5 equivalent to the portions of Segments 5, 7, 11, 8A, 8B, and 8C that cross young alluvial deposits in the Leona Valley, San Gabriel Valley, and active river washes and streams would require implementation of Mitigation Measure G-5b (Conduct geotechnical investigations for liquefaction). Portions of Alternative 5 equivalent to Segments 5, 6, 11, and 8A where they are located along hillsides or ridgelines in geologic units of moderate to steep slopes that are susceptible to slope failures would require implementation of Mitigation Measure G-3 (Conduct geological surveys for landslides and protect against slope instability). Implementation of these measures, as described in Section 6.1, would reduce Impact G-5 of Alternative 5 to less than significant (Class II).

Impact G-9: Existing structures could be damaged by ground settlement along the tunnel exposing people or structures to hazards.

Short term (days) and long term (years) settlement of the ground surface could occur during construction and operation of the tunnel and shafts of Alternative 5. There is potential for tunneling activities to encounter unstable geologic units or cause geologic units to become unstable and cause local subsidence and settlement of the overlying ground surface and result in damage to structures adjacent to the alignment. Tunneling through the unconsolidated alluvium from approximately MP S8A-24.5 to 25.5 could encounter flowing or running sands although the use of an earth-pressure balance tunnel boring

machine (EPB TBM) or slurry-pressure balance machine (SPB TBM) to create a pressurized-face will effectively control rapid or excessive inflows. Similarly, excavation of the large eastern access shaft in saturated unconsolidated alluvium could encounter soft sediment or flowing sands. The access shaft excavation will be advanced as the permanent shoring is set and grouted to prevent entry of groundwater. This approach would effectively control inflows and limit the amount of ground settlement around the perimeter of the shaft. Excavation of the tunnel and shafts in the Tertiary age bedrock of eastern Chino Hills (MP S8A-21.9 to 24.5) is not anticipated to cause ground settlement and the use of a conventional (non-pressure balance) TBM may be adequate.

Subsidence caused by dewatering during construction would not occur as dewatering is not expected due to the use of a pressure-face TBM. Dewatering is also not anticipated at the shafts, which would use water-tight boxes.

Post-construction or operational settlement, including seismically-induced, could occur locally due to a loss of soil strength resulting from the tunneling process. Advancement of the TBM in full-pressure mode will not result in loss of soil strength above or around the tunnel. The project specifications will require that the contractor conduct the tunneling process under pressure at all times to prevent soil loss and the development of narrow chimneys that may migrate to the surface. Maintaining the soil properties will not increase the potential for seismically-induced settlements which existed before tunneling. Although settlement of the ground surface is estimated to be low due to the construction method (EPB or SPB TBM), an analysis of the settlement will be completed during design.

Mitigation Measure for Impact G-9

G-9 **Conduct geotechnical analysis of settlement potential during design and implement a Subsidence Monitoring Program during construction to protect against ground settlement.** The potential for ground subsidence to occur during tunneling should be identified during design, and will identify Project-specific trigger levels that would require corrective action should subsidence occur. The settlement analysis would evaluate conditions along the tunnel alignment and at and adjacent to the proposed access shafts. Development and implementation of a Subsidence Monitoring Program is standard practice during construction of large diameter tunnels and access shafts in urban areas. As determined to be necessary, SCE or the tunnel contractor shall implement a subsidence monitoring program during shaft excavation and tunneling to detect subsidence, including measurements of groundwater levels, surface and subsurface settlement, ground movement and displacement, and movement in existing infrastructure as needed. SCE or the contractor will implement corrective actions, such as additional advance grouting or increased tunnel support, if measured displacement reaches the specified trigger levels. In addition, the Project specifications will require that the contractor conduct the tunneling process under pressure at all times to prevent soil loss and the development of narrow chimneys that may migrate to the surface. The results of the geotechnical analysis of settlement, Subsidence Monitoring Plan, and the relevant construction specifications shall be provided to the CPUC for review and approval at least 60 days prior to the start of construction (shaft excavation).

CEQA Significance Conclusion

During final design of the transition station facilities, access shafts, ventilation shafts, and tunnel of the Partial Underground Alternative, SCE shall conduct geotechnical analyses of the settlement potential, develop tunnel specifications, and develop and implement a Subsidence Monitoring Program to limit the amount of ground settlement. Implementation of Mitigation Measure G-9 (Conduct geotechnical analysis

of settlement potential and implement Subsidence Monitoring Program), add specific requirements to the planned geotechnical investigations to be completed prior to final Project design. These specific requirements would ensure that potentially significant impacts from ground settlement along the Alternative 5 route are reduced to less-than-significant levels (Class II).

Exposure to potential risk of loss or injury where corrosive soils or other unsuitable soils are present (Criterion GEO6)

Impacts associated with Criterion GEO6 for Alternative 5 would be identical to those associated with this criterion for Alternative 2, as described in Section 6.1, and there would be no change in the potential for damage to Project structures due to unsuitable soils. This impact and its associated mitigation measure that falls under Criterion GEO6 are summarized in the following paragraphs.

Impact G-6 (Project structures could be damaged by problematic soils exposing people or structures to hazards) would be the same for Alternative 5 as the alignment crosses the same soil types as the Alternative 2 alignment. Soils along the alignment have a potential to corrode steel and concrete ranging from low to high and expansion potential ranging from low to high. Corrosive and/or expansive soils can cause damage to structure foundations, potentially comprising the structural integrity of the structure, a significant impact (see Section 6.1). Therefore, Alternative 5 would require implementation of Mitigation Measure G-6 (Conduct geotechnical studies to assess soil characteristics and aid in appropriate foundation design), as described in Section 6.1, to reduce impacts to less than significant (Class II).

Damage to Project structures due to slope failure (Criterion GEO7)

Impacts associated with Criterion GEO7 for Alternative 5 would be incrementally less than it would be for Alternative 2, as presented in Section 6.1, and summarized below.

Impact G-7 (Transmission line structures could be damaged by landslides, earth flow, or debris flows, during operation) would be the incrementally less than it would for Alternative 2 (see Section 6.1). Although Alternative 5 is located in hillside areas with mapped landslides and substantial potential for slope failure identical to the equivalent portion of Alternative 2, the tunneling required to complete the underground installation of transmission lines for Alternative 5 would bypass slopes underlain by potentially unstable Puente Formation where tower foundations would otherwise be constructed, thus decreasing the potential that slope instability or landslides could damage Project facilities along the underground portion of the alignment The remaining portion of Alternative 5 is identical to Alternative 2 and the potential for failure of existing unstable slope or landslides during operation of the Project is the same as presented in Section 6.1, and would require implementation of Mitigation Measure G-3 (Conduct geological surveys for landslides and protect against slope instability). With implementation of this measure, as described in Section 6.1, Impact G-7 of Alternative 5 would be less than significant (Class II).

Destruction of unique paleontological resources (Criterion GEO8)

Impacts associated with Criterion GEO8 for Alternative 5 would be greater than the impacts associated with this criterion for Alternative 2. The underground construction would result in greater ground disturbance with the paleontologically sensitive Puente Formation as compared to Alternative 2 and would result in increased opportunity to destroy scientifically important paleontologic resources. Impact G-8 (Grading and excavation could destroy paleontologic resources) would be greater under Alternative 5 than it would for Alternative 2 (please see Section 6.1) due to the greater amount of ground disturbance.

Although construction could disturb unique paleontologic resources, as with Alternative 2 application of SCE's planned APMs would reduce the potential for destruction of these resources to less than significant, resulting in no change in the potential for Impact G-8 to occur. With implementation of these APMs, as described in Section 6.1, Impact G-8 of Alternative 5 would be less than significant (Class III).

9.2 Cumulative Effects Analysis

This section addresses potential cumulative effects that would occur as a result of implementation of Alternative 5. This alternative would utilize underground construction in place of the proposed overhead line construction following generally the same routes as the proposed Project. New underground facilities would replace existing aboveground facilities, and transition stations would be required at each end of an underground segment to transfer the transmission lines from overheard to underground and vice versa.

This alternative was developed to provide less visual impact in residential areas. The remainder of this alternative route (which totals approximately 159 miles) would be identical to that of the proposed Project and would, therefore, result in substantially similar or identical impacts as the proposed Project. As a result, this alternative traverses the same or similar land uses as the portion of the proposed Project route it is proposed to replace, would require the same types of construction activities to build (in addition to utilizing underground construction techniques), and would result in the same operational capacity as the proposed Project.

Based on the substantial similarity of Alternative 5 to the proposed Project, this alternative's contribution to cumulative impacts would be similar or identical to that of the proposed Project. However, when compared to the proposed Project, each alternative's contribution to certain cumulative impacts may be incrementally increased or decreased as a result of the change in construction (underground versus overhead). Such increases or decreases would result from:

- The nature of the alternative (e.g., underground or overhead);
- The location of the alternative with respect to land uses and specific resources; or
- The location of past, present, or reasonably foreseeable projects with which impacts of the alternative route would have the potential to combine (i.e., the other projects are located such that their impacts would or would not combine with impacts of the alternative, as compared to the proposed Project).

9.2.1 Geographic Extent

The geographic extent for the analysis of cumulative impacts related to geology, soils, and paleontology is limited to the Project site and the immediate vicinity surrounding Project substations, laydown areas, and the transmission line ROWs occupied by the proposed alignment. These geographic limits are appropriate to consider the potential cumulative impacts as the geologic materials and terrain at the Project site and directly adjacent to the Project site are the most significant factors to evaluate the potential for geologic hazards, unsuitable soil and paleontologic resources at a project site. Impacts would have the potential to occur during construction and operation and would be limited to the areas where concurrent construction is occurring. The geographic extent for Alternative 5 is identical to the proposed Project, as presented in Section 6.2.1.

9.2.2 Existing Cumulative Conditions

The existing cumulative conditions of Alternative 5 are identical to the proposed Project as discussed in Section 6.2.2.

9.2.3 Reasonably Foreseeable Future Projects and Changes

Reasonably foreseeable future projects and changes to the cumulative scenario for Alternative 5 would be exactly the same as Alternative 2, described in Section 6.2.3.

9.2.4 Cumulative Impact Analysis

As discussed for the proposed Project in Section 6.2.4, Impacts G-1 through G-3 of Alternative 5 would not have the potential to combine with impacts of other past, present and reasonably foreseeable projects for the same reasons discussed in Section 6.2.4. Impacts G-4 through G-9 for Alternative 5 would combine but not be cumulatively significant (Class III) with impacts of other past, present and reasonably foreseeable projects for the same reasons discussed in Section 6.2.4.

9.2.5 Mitigation to Reduce the Project's Contribution to Significant Cumulative Effects

Mitigation measures introduced for the proposed Project in Section 6.1 (Direct and Indirect Effects Analysis) would help to reduce Alternative 5's incremental contribution to cumulative impacts. However, there are no impacts or significant cumulative effects of Alternative 5 related to Geology, Soils, and Paleontology and no additional mitigation is required.