1.0 EXECUTIVE SUMMARY

During 2003, Southern California Edison's (SCE) Raptor Protection Program was reviewed. A review of the designs of the Big Creek ALP transmission and Project powerlines under 33 kV was performed to determine if they meet the guidelines set forth in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC 1996). Overall, SCE's Raptor Protection Program is consistent with the recommendations made in APLIC (1996). SCE has a system of reporting raptor mortalities, and the information is used to determine which power line structures pose a risk to raptors. SCE attempts to modify power line structures that pose a risk to raptors within 30 business days. SCE's Raptor Protection Program also includes annual training that educates SCE employees on the topics of raptor identification, pertinent environmental regulations, protocol for reporting raptor mortalities, protocol for working in areas with raptor nests, and modifications that can be used to decrease the risk of raptor electrocutions. SCE has worked well with resource agencies, including the California Department of Fish and Game (CDFG), the U.S. Forest Service (USFS), and the U.S. Fish and Wildlife Service (USFWS), in regards to reducing the risk to raptors.

Two transmission lines were evaluated in the Big Creek ALP study area. These include the Big Creek No. 1 to the Eastwood Powerhouse line and the Mammoth Pool Powerhouse to Big Creek No. 3 line. Both of these transmission lines are 220 kilovolts (kV). Transmission line structures with voltages above 69 kV are not commonly known to electrocute raptors, except in isolated and rare events (APLIC 1996). The distances between energized surfaces and energized surfaces and grounded surfaces on these structures are great enough that raptors are unlikely to make contact with two energized surfaces simultaneously.

The Portal Powerhouse Grid Interconnect Sub-transmission line was also evaluated. This sub-transmission line is part of the Portal Power Plant Project (FERC No. 2174) and is connected to the Big Creek Portal Transmission line, which is part of SCE's distribution system and not included in SCE's relicensing of the Big Creek System. The Portal Powerhouse Grid Interconnect is a three-phase design, which increases the chance for raptor electrocution. It also has a voltage of 33 kV, which is within the range of 1 to 69 kV, which poses the greatest risk to raptors (APLIC 1996). The phase spacing on this line is close enough that raptors could make contact, resulting in electrocution. However, SCE Corporate Environmental, Health, and Safety evaluated the poles surrounding Huntington Lake in 2002, and did not find the Portal Powerhouse Grid Interconnect poles to pose a risk of electrocution to raptors, due to location. There are other aspects of power lines and the supporting poles, such as location on ridges or hilltops or adjacency to meadows, which also affect whether these structures pose a significant hazard to raptors. The Portal Powerhouse Grid Interconnect consists of only two poles, neither of which have a history of raptor electrocutions, and is located across Kaiser Pass Road about 1,000 feet from Huntington Lake without a vantage view of the lake for raptors foraging on the water (e.g., osprey and bald eagle).

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A review of the designs of the Big Creek ALP Project power lines under 33 kV was performed to determine if they are consistent with guidelines set forth in APLIC (1996). These distribution lines are: (1) East Incline, (2) Portal Forebay, (3) Jumbo, (4) Musick, (5) Manifold, (6) Grouse, (7) Stevenson, and (8) Cascada. None of the eight Project power lines under 33 kV currently meet APLIC's (1996) recommended 60-inch minimum distance between phases or between phase and groundwires. Seven of the eight distribution lines fall within the 1 to 69 kV range, which could pose a potential risk to raptors. Some poles that do not meet the APLIC guidelines may only pose a slight hazard to raptors because of the physical location of the power line poles as described above. The Portal Forebay Distribution Line is below 1 kV, and does not appear to pose a risk for raptor electrocutions, despite having energized surfaces less than 60 inches apart, because voltages below 1 kV are not known to electrocute raptors (APLIC 1996).

According to SCE's Raptor Protection Program, if a raptor electrocution is reported, SCE biologists will evaluate power line structures in the vicinity and recommend installation of raptor protection devices on all appropriate poles within 30 days.

2.0 STUDY OBJECTIVES

- Determine the presence of appropriate foraging and nesting habitat for raptors near Project facilities and bypass and flow-augmented reaches.

- Determine if the design of Big Creek Hydroelectric Project transmission lines follows guidelines set forth in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC 1996).

3.0 STUDY IMPLEMENTATION

3.1 STUDY ELEMENTS COMPLETED

- Reviewed SCE's Raptor Protection Program and determined the adequacy of the program for the Big Creek ALP.

- Reviewed the designs of the Big Creek ALP transmission and Project power lines under 33 kV to determine if they are consistent with guidelines set forth in the *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC 1996).

3.2 OUTSTANDING STUDY ELEMENTS

There are no outstanding study elements.

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4.0 STUDY METHODOLOGY

4.1 REVIEW OF RAPTOR PROTECTION PROGRAM

A literature review of SCE's Raptor Protection Program was performed to determine compliance with accepted practices for raptor safety. The literature review consisted of: (1) SCE's *Operation and Maintenance Policy and Procedures Manual* (SCE 2002a); (2) SCE's *Raptor Protection Program Manual* (SCE 2002b; Appendix A); (3) *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC 1996); and other sources that are referenced as appropriate.

Personal communication consisted of conversations with Tracy Alsobrook (SCE, Corporate Environmental Health and Safety Division) who explained the procedures required of SCE employees for SCE's Raptor Protection Program and provided SCE's *Raptor Protection Program Manual* (SCE 2002b).

4.2 REVIEW OF BIG CREEK ALP TRANSMISSION LINE DESIGNS

A literature review was performed to determine if SCE's Big Creek ALP transmission line designs were consistent with accepted practices for power line design and raptor safety. These transmission lines include the Big Creek No. 1 to Eastwood Powerhouse Transmission Line (approximately 4.5 miles in length), the Mammoth Pool Powerhouse to Big Creek No. 3 Transmission Line (approximately 6.5 miles in length), and the Portal Powerhouse Grid Interconnect Sub-transmission Line (approximately 125 feet in length). The Portal Powerhouse Sub-transmission line is part of the Portal Power Plant Project (FERC No. 2174), and is not part of the ALP. A map showing the locations of these transmission lines is provided in Figure TERR 8-1.

Personal communication supplemented the initial literature review, which consisted of conversations with SCE staff, who provided the *Distribution Design Standards* (SCE 2003a); the *Electric Distribution; Overhead Construction Standards* (SCE 2001); the *Operation and Maintenance Policy and Procedures Manual* (SCE 2002a); and the *Transmission Overhead Manual* (SCE 2002c). SCE also supplied photographs, measurements, and voltage specifications for the transmission lines.

4.3 REVIEW OF BIG CREEK ALP PROJECT POWER LINE UNDER 33 KV DESIGNS

A literature review was performed to determine if SCE's Big Creek ALP Project power lines under 33 kV designs were consistent with accepted practices for power line design and raptor safety. These distribution lines include: (1) the East Incline Distribution Line, which is located just north of the town of Big Creek, and approximately 1,000 feet in length; (2) the Portal Forebay Distribution Line, which begins at the Portal Forebay and runs southwest for approximately 2.1 miles; (3) the Jumbo Distribution Line, which runs from Powerhouse No. 8 to the Eastwood School site, and is approximately 0.7 mile in length; (4) the Musick Distribution Line, which runs from Powerhouse No. 2 uphill to the Powerhouse No. 2 vent stack, and is approximately 1 mile in length; (5) the Manifold Distribution Line, which is within the Big Creek No. 3 Community and approximately 0.5

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mile in length; (6) the Grouse Distribution Line, which runs from near the Powerhouse No. 1 vent stack to Huntington Lake Dam 1, and is approximately 2 miles in length; (7) the Stevenson Distribution Line, which runs from the Big Creek No. 3 Powerhouse along the San Joaquin River to north of Rock Creek, and is approximately 13.5 miles; and (8) the Cascada Distribution Line, which runs from Big Creek Powerhouse No. 1 to Dam 4, and is approximately 1 mile in length. A map showing the locations of these distribution lines is contained in Figure TERR 8-2.

5.0 STUDY RESULTS AND ANALYSIS

5.1 REVIEW OF SCE'S RAPTOR PROTECTION PROGRAM

5.1.1 LITERATURE REVIEW

According to APLIC (1996), the first step in reducing raptor electrocutions is to predict which power line poles are the most hazardous so that management actions can be planned. Some factors that are helpful predictors include hazardous pole designs, topography, migration pathways, and habitat. APLIC (1996) suggests that utility companies and resource management agencies cooperate to identify hazardous power line structures. Hazardous pole designs can be identified by recording information regarding raptor mortalities into a database. This information can be collected by utility company employees while performing other work-related activities, including routine maintenance surveys or work related to power outages (APLIC 1996). Once a hazardous power line design is identified, a site visit will allow for an assessment of the best management actions to be taken. APLIC (1996) suggests that site visits be conducted with representatives from the utility company and resource agencies.

Training programs that include written information such as flyers or pamphlets, videos, or a formal presentation will help employees have a clear understanding of the issue. These types of training programs typically help to increase the number of raptor mortality reports created, as well as improve the thoroughness of these reports (APLIC 1996).

5.1.2 EVALUATION OF SCE'S RAPTOR PROTECTION PROGRAM

SCE's Raptor Protection Program meets the goals set forth by APLIC (1996). SCE employees are informed about the Raptor Protection Program through posters, written literature (Appendix A), wallet-sized cards, and a formal presentation that discusses pertinent environmental regulations, raptor identification, reporting procedures for the discovery of a dead raptor, protocols for working in areas with raptor nests, and modifications that can be made to power line structures to lower the risk of raptor electrocutions. This training is conducted once a year as part of SCE's Environmental Awareness Training for SCE employees (SCE 2002a; 2002b).

SCE's Operation and Maintenance Policy and Procedures Manual (SCE 2002a) states that SCE employees are required to report all raptor mortalities that they become aware of, regardless of cause, to SCE's Environmental Health and Safety Office within 24 hours. Refer to Appendix B for SCE's Animal/Bird Mortality Report Form. SCE

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employees utilize an opportunistic approach in which information on mortalities is recorded incidentally during other work-related activities, including routine maintenance surveys or work related to power outages. Transmission lines are inspected annually, and distribution lines are inspected every one to two years (SCE 2002c). SCE employees are not required to document cases where no raptor mortalities are found. If clusters of electrocutions, involving three or more electrocutions per United States Geological Surveys (USGS) quad, or two or more electrocutions per circuit, are reported, the power lines are to be examined for retrofitting. The Environmental Health and Safety Office identifies these clusters, and determines which poles may need to be retrofitted, and the appropriate retrofit required. It is the goal of SCE to make all necessary retrofits within 30 business days from the date that the hazardous poles were first detected (SCE 2002a; 2002b).

The reporting of raptor mortalities by SCE employees in the field is necessary for SCE's Environmental Affairs Office to determine which power line structures are hazardous to raptors and require modifications. There have been no raptor mortalities reported by SCE employees in the Big Creek ALP study area. The only raptor mortality that has been reported to SCE involves the bald eagle (*Haliaeetus leucocephalus*) that was electrocuted on the Big Creek Portal Transmission Line, near Huntington Lake. The Portal Transmission Line is part of SCE's distribution system and is not included in the SCE relicensing for the Big Creek system. This mortality was reported to SCE and USFWS by CDFG on June 26, 2002. Refer to the 2002, TERR 9, Bald Eagle and Osprey, Technical Study Report (SCE 2003b) for more information.

There has been active cooperation and communication between SCE and resource agencies, including CDFG, USFS, and USFWS in regards to raptor electrocutions. The electrocuted bald eagle near the Big Creek Portal Transmission Line was reported by CDFG to SCE and USFWS on June 26, 2002. The USFWS forensics lab in Ashland, Oregon, determined that the cause of death was electrocution (USFWS 2002). SCE modified two poles on July 31, 2002, including the pole that was suspected to have electrocuted the bald eagle, and informed CDFG and USFWS of the modifications on August 16, 2002. SCE provided a formal summary of the incident for the USFWS on August 22, 2002.

All work activity involving active nests on SCE facilities are coordinated with SCE's Environmental Affairs Office. SCE employees are required to report all raptor nests on power line poles. Prior to trimming trees, line clearing personnel are required to inspect the trees for nests during the nesting season (January through August), and avoid any trees with active nests (SCE 2002a; 2002b).

5.1.3 CONCLUSIONS

SCE's Raptor Protection Program meets the recommendations made by APLIC (1996). No revisions are recommended at this time.

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5.2 REVIEW OF BIG CREEK ALP TRANSMISSION LINE DESIGNS

5.2.1 LITERATURE REVIEW

Avian fatalities have been caused by collisions with distribution, transmission, and ground wires (CEC 2002a). Raptor mortalities due to collisions are rare, as raptors have keen eyesight and better flight maneuverability than most avian species (CEC 2002a).

Raptors are attracted to power lines because power poles and towers can be used as perches from which to hunt, rest, feed, and establish territorial boundaries. Power line structures are also used by many avian species as nesting substrates (APLIC 1996). Several raptor species may potentially occur in the study area. These include bald eagle, golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperi*), northern goshawk (*Accipiter gentilis*), merlin (*Falco columbarius*), prairie falcon (*Falco mexicanus*), American peregrine falcon (*Falco peregrinus anatum*), short-eared owl (*Asio otus*), long-eared owl (*Asio flammeus*), great gray owl (*Strix nebulosa*), and California spotted owl (*Strix occidentalis occidentalis*).

Raptor electrocution by power lines can be caused by a combination of biological factors, including raptor morphology, behavior, life history, habitat use, and distribution. Other factors include weather, geography, pole design, and system configuration (CEC 2002b). These factors are discussed below, under Biological Factors, Habitat, and Pole Design Factors.

Biological Factors

The size of a raptor is a crucial factor in determining susceptibility to electrocution. Eagles, such as golden eagle and bald eagle, and *Buteos*, such as ferruginous hawk (*Buteo regalis*) and red-tailed hawk, are more vulnerable to electrocutions because of their larger size and greater wingspans, which increase the likelihood of skin-to-skin contact between the energized surfaces of a power line (APLIC 1996; CEC 2002b). Golden eagles are electrocuted more often than any other North American raptor (APLIC 1996). Large, soaring hawks (*Buteos* sp.) make up the largest non-eagle group of power line electrocutions (APLIC 1996). Raptors with small wingspans are less likely to be electrocuted on a power line. The American kestrel (*Falco sparverius*), for example, has a small wingspan of 21 to 24 inches, and is rarely electrocuted. In contrast, the golden eagle has a wingspan that varies from 6 to 7.5 feet, which results in a much higher likelihood of electrocution.

Nesting behavior also affects raptor electrocution. Raptors that nest on the ground, such as northern harrier (*Circus cyaneus*) and short-eared owl are electrocuted infrequently (APLIC 1996). Raptors that are likely to use power line poles for nesting increase their risk of electrocution, particularly for juveniles with less flight experience (APLIC 1996).

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Other factors that affect raptor electrocution include age, experience, weather, and time of year (APLIC 1996). Younger birds have less developed flight skills, and are more likely to be electrocuted while landing on or taking off from a power line. Inclement weather leads to higher instances of electrocution because of difficulty in landing due to high winds, and the increased conductivity in wet feathers. The hazard to wet birds is increased even more because the bird will lose some flight capability and control (APLIC 1996). Wintertime poses the greatest risk of electrocution to raptors because of winter storms and the associated increase of inclement weather.

Owls have lower percentages of reported electrocutions when compared to diurnal raptors. The great horned owl (*Bubo virginianus*) is the most commonly electrocuted nocturnal raptor, though numbers are low in comparison to diurnal species (APLIC 1996). Electrocutions of forest dwelling owls, such as the spotted owl and great gray owl, are rare (APLIC 1996).

Habitat

Habitat use affects raptor electrocution. Raptors that utilize forest habitats, such as Cooper's hawk, northern goshawk, and spotted owl, are less likely to perch on power lines and poles because of the abundance of natural perches in forested areas. In contrast, raptors that inhabit shrublands and grasslands are more likely to use power poles for perching because of the relative scarcity of natural perches (APLIC 1996, CEC 2002).

Pole Design Factor

Pole design and system configuration play an important role in determining the potential for raptor electrocution. The amount of voltage, spacing of conductors, and bonding and grounding systems are significant factors that can cause raptor electrocutions.

Most power lines involved in raptor electrocution incidents are energized at voltage levels between 1 kV and 69 kV (APLIC 1996; CEC 2002). Power lines with voltages less than 1 kV are not known to electrocute raptors (APLIC 1996). Raptor electrocutions from power lines with voltages greater than 69 kV have been reported only on rare occurrences (APLIC 1996; CEC 2002). Raptors are less likely to be electrocuted by power lines with higher voltages because distances between conductors and conductors and grounded surfaces are increased as voltages are increased. Raptors are more susceptible to power lines with voltages less than 69 kV because the energized surfaces are closer together, increasing the chances of skin-to-skin contact. Because the spacing is smaller, the addition of wires, transformers, switches, and grounding cables increases the potential for electrocution (APLIC 1996).

In general, three types of power line designs have been determined to be the most hazardous to raptors: (1) single-phase with a top conductor; (2) three-phase with a single cross-arm; and (3) corner poles. These designs have close distances between energized phases and/or grounding structures. If these energized surfaces are shorter in distance than a raptor's wingspan or length from the tip of the beak to the tip of the

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tail, the raptor is at risk of being electrocuted (CEC 2002). A discussion of these pole designs follows.

Single-phase systems are used for distribution lines only. Single-phase power lines may be a problem when a ground wire extends close to the top of the pole, where a raptor may perch on an energized surface and touch the ground wire with its tail feathers (APLIC 1996). The tail feathers of an eagle can reach up to ten inches, so APLIC recommends a 12-inch minimum space between an energized perch and energized surfaces below the perch, such as ground wires (APLIC 1996). If ground wires are necessary, APLIC recommends that they be insulated from the top of the pole down to at least 12 inches below the pole.

Three-phase systems are used for both distribution and transmission lines. Three-phase pole designs proportionally kill more eagles than other raptor species (APLIC 1996). This type of configuration provides excellent perching opportunities on the cross-arms between phases, but unfortunately may not offer enough spacing between phases. Three-phase power lines become a hazard when conductor spacing is insufficient, or when bonded hardware and grounded metal cross-arm braces are too close to energized conductors, so that phase-to-ground contact may occur (APLIC 1996). There should be a 60-inch minimum between phases, phase to ground, or other energized surfaces to accommodate the wingspan of larger raptors such as golden or bald eagles. For three-phase pole designs with multiple cross arms, there should be a 43-inch minimum in height between energized surfaces to prevent a raptor from perching on an energized surface and touching their head or breast against another energized surface above it.

Corner poles that are designed to accommodate directional changes in power lines create hazards for perching raptors because of the increase in jumper wires, grounded metal cross arm braces, and less spacing between conductors (APLIC 1996). Again, there should be a 60-inch minimum between energized surfaces to accommodate the wingspan of larger raptors, and a 43-inch minimum in height between energized surfaces to prevent a raptor from perching on an energized surface and touching their head or breast against another energized surface above it.

There are several remedial measures available to correct these problems: (1) longer cross arms can be used to maintain a sufficient distance between phases; (2) insulation of metal braces, protective covering on jumper wires, installation of bushing covers on transformers, or other appropriate modifications can be made; or (3) perch guards can be utilized to minimize the horizontal surface raptors need for perching and nesting.

5.2.2 Evaluation of SCE's Big Creek ALP Transmission Lines

There are a variety of vegetation communities that occur along the transmission lines within the Big Creek ALP study area. See Table TERR 8-1 for a summary of vegetation communities that occur along each transmission line within the Big Creek ALP study area. Because open vegetation communities do not offer an abundance of natural perches, power lines that occur in these vegetation communities pose a higher risk to

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raptors than power lines that occur in forested vegetation communities. Vegetation communities with open habitat that occur along the Big Creek ALP transmission lines include blue oak woodland, gray pine-chaparral woodland, meadows, chaparral, open ground, developed, ruderal, and water.

The Big Creek No. 1 to Eastwood Powerhouse Transmission Line and the Mammoth Pool Powerhouse to Big Creek No. 3 Transmission Line are both 220 kV and pose minimal risk for raptor electrocution. Both of these transmission lines have phase-to-phase distances of 24 feet and phase-to-ground distances of 8 feet. These distances are great enough to prevent raptors from contacting two energized surfaces simultaneously. There is one known raptor nest on the Big Creek 1 to Eastwood Powerhouse 3 Transmission Line, near Balsam Meadows (Figure TERR 8-3). However, the nest was not active when it was detected on September 9, 2003, so species could not be determined.

The Portal Powerhouse Grid Interconnect Sub-transmission line is a 33 kV three-phase design and is comprised of two poles, with less than 125 feet of line. The majority of raptor electrocutions occur on power line structures with 1 to 69 kV. This line is also a three-phase design, which poses greater risk to raptors than other pole designs (e.g., two-phase pole designs). Phase-to-phase distances on some of the pole structures are 54 inches, which is less than the 60-inch minimum suggested by APLIC (1996). Phase-to-ground distances are 24 inches for all structures, which is less than the 43-inch minimum suggested by APLIC (1996). This line is connected to the Big Creek Portal Transmission Line. The Portal Powerhouse Grid Interconnect Sub-Transmission line borders Huntington Lake, an area known to be inhabited by bald eagles. There have been no recorded electrocutions in the Huntington Lake area, except for one bald eagle. An SCE biologist subsequently visited the area where this electrocution occurred and modifications to poles which the biologist considered hazardous were made at that time. SCE installed raptor hoods on two of the power line structures of the Big Creek Portal Transmission Line that were determined to be hazardous to raptors (Figure TERR 8-4). The SCE biologist did not find the Portal Powerhouse Grid Interconnect poles to pose a risk of electrocution to raptors, due to location. The Portal Powerhouse Grid Interconnect consists of only two poles, neither of which have a history of raptor electrocutions, and is located across Kaiser Pass Road about 1,000 feet from Huntington Lake without a vantage view of the lake for raptors foraging on the water (e.g., osprey and bald eagle).

5.2.3 EVALUATION OF SCE'S BIG CREEK ALP DISTRIBUTION LINES

There are a variety of vegetation communities that occur along the distribution lines within the Big Creek ALP study area. See Table TERR 8-2 for a summary of vegetation communities that occur along each distribution line within the Big Creek ALP study area. As described above, power lines that occur in open vegetation communities could pose a higher risk to raptors than power lines that occur in forested vegetation communities, depending on the quality of foraging habitat and number of alternate perches available.

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The distribution lines in the study area were constructed following guidelines in SCE's *Electric Distribution; Overhead Construction Standards* (2001), which gives required minimum distances between phases for each type of power line. The document does not state maximum distances allowed between phases. When constructing a power line pole, SCE employees typically use the minimum required distances for placement of phases on cross arms when constructing distribution line poles (Mark Newquist, Personal Communication).

The Jumbo, Stevenson, and Cascada Distribution Lines have a voltage of 12 kV. For a 12 kV line, SCE (2001) requires that phases be separated by at least 4 feet (48 inches). The East Incline, Grouse, and Musick distribution lines have a voltage of 7 kV. SCE (2001) requires that phases be separated by 11.5 inches for 7 kV distribution lines. The Manifold Distribution Line has a voltage of 2.4 kV and the Portal Forebay Distribution Line has a voltage of 480 V. SCE (2001) does not state a minimum distance for phases on a 2.4 kV or 480 V distribution line, but it is unlikely to be a greater distance than a 7 kV line (11.5 inches), as spacing between phases generally decreases as voltages decrease (APLIC 1996).

The Portal Forebay Distribution Line is less than 1 kV, and should not pose a risk to raptors because distribution lines with less than 1 kV are not known to electrocute raptors (APLIC 1996). The other seven distribution lines have voltages between 1 and 69 kV, which increases the potential for raptor electrocution (APLIC 1996). They are also three-phase pole designs, and have less than 60 inches between phases. These characteristics also increase the potential risk to raptors. The actual combined risk of these structures is dependent on many factors, since avian power line interactions are so complex. The SCE Raptor Protection Program should be capable of dealing with any Big Creek ALP power line structures that become suspected hazards due to raptor electrocution reports and biologists' detailed evaluations.

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TABLES

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Table TERR 8-1. Vegetation Communities that Occur at Transmission Lines Within the Big Creek ALP Study Area.

	Vegetation Communities												
	BOW	**GPCW**	**MMC**	**SMCF**	**JP**	**JP/FF**	**RI**	**OG**	**WM**	**W**	**RU**	**D**	**OW**
Transmission Lines													
BC No. 1 - EPH			X	X						X	X	X	
MPPH – BC No. 3	X	X								X	X	X	
PPH Grid Interconnect						X	X			X	X		

Legend:

BOW = Blue Oak Woodland
GPCW = Gray Pine-Chaparral Woodland
MMC = Mixed- Montane Chaparral
SMCF = Sierran Mixed Confer Forest
JP/FF = Jeffrey Pine/Fir Forest
RI = Riparian
JP = Jeffrey Pine
OG = Open Ground
WM = Wet Meadow
W = Water
RU = Ruderal
D = Developed
OW = Oak Woodland

Table TERR-8-2. Vegetation Communities that Occur at Project Power Lines Under 33kV Within the Big Creek ALP Study Area.

	Vegetation Communities												
	BOW	**GPCW**	**MMC**	**SMCF**	**JP**	**JP/FF**	**RI**	**OG**	**WM**	**W**	**RU**	**D**	**OW**
Project Power Lines Under 33kV													
Cascada				X						X	X	X	X
Portal Forebay			X		X	X	X			X			
Grouse			X			X		X	X	X	X	X	X
East Incline				X						X		X	X
Jumbo		X					X			X		X	
Musick		X	X	X						X		X	
Stevenson	X	X	X	X			X			X	X	X	
Manifold	X									X			

Legend:

BOW = Blue Oak Woodland
GPCW = Gray Pine-Chaparral Woodland
MMC = Mixed- Montane Chaparral
SMCF = Sierran Mixed Confer Forest
JP/FF = Jeffrey Pine/Fir Forest
RI = Riparian
JP = Jeffrey Pine
OG = Open Ground
WM = Wet Meadow
W = Water
RU = Ruderal
D = Developed
OW = Oak Woodland

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FIGURES

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Placeholder for Figures TERR 8-1 and TERR 8-2

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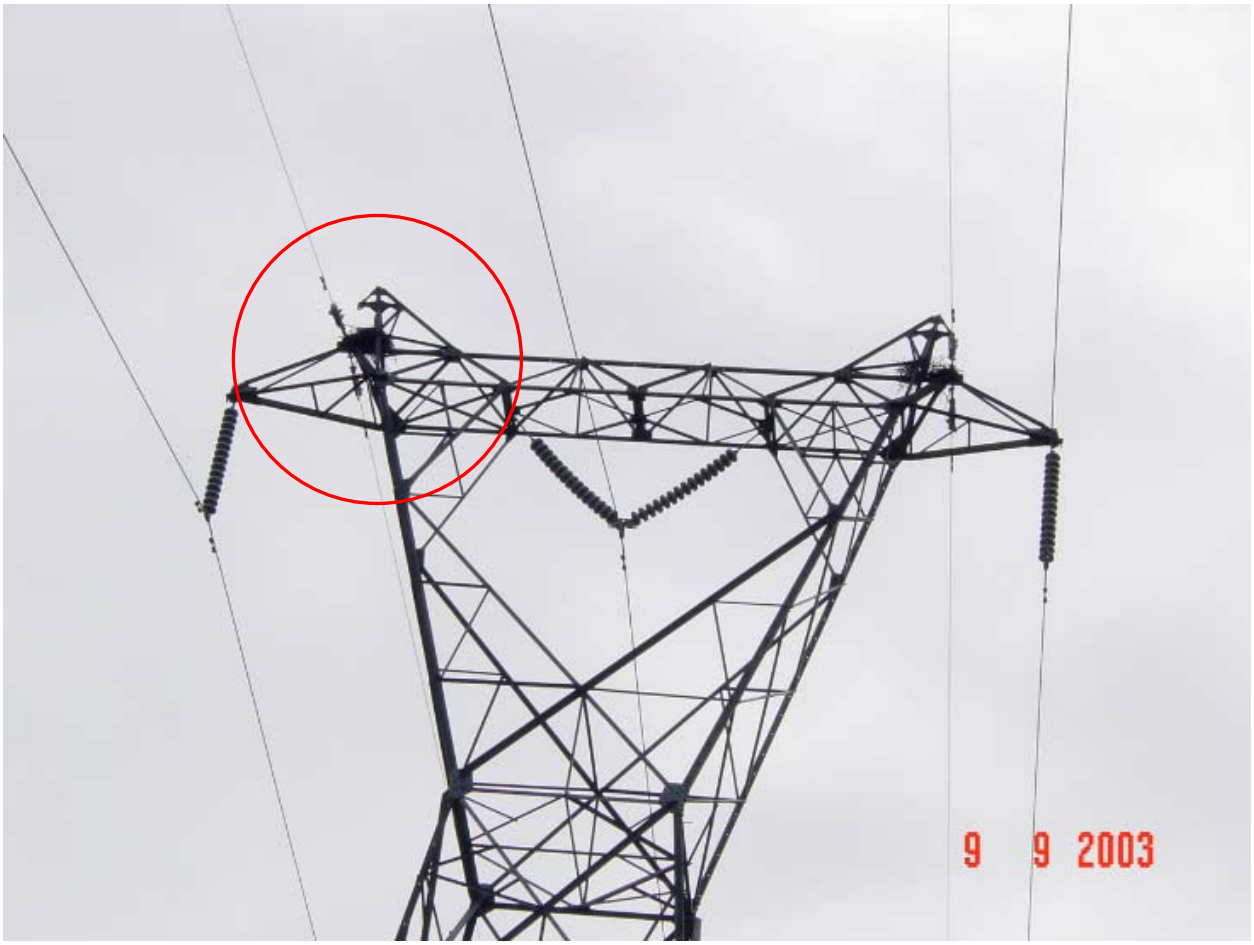

Figure TERR 8-3. Raptor Nest on Big Creek 1 to Eastwood Powerhouse Transmission Line.

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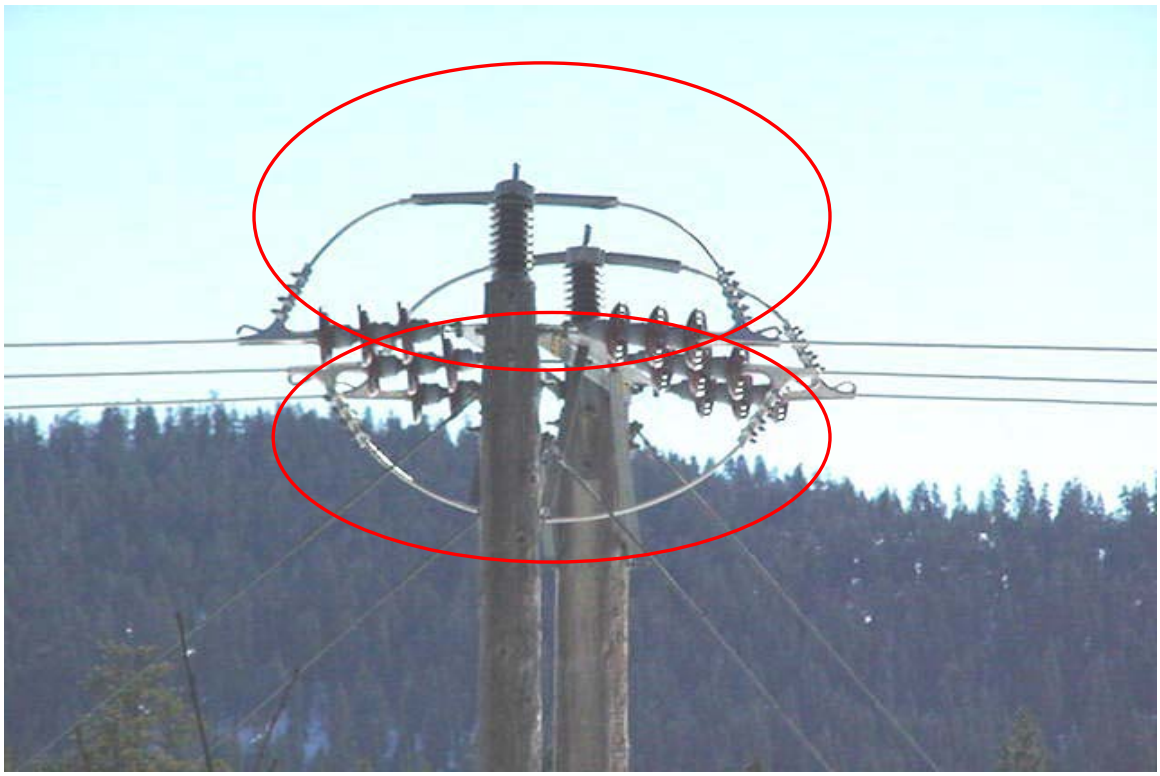
Portal Powerhouse Grid Interconnect sub-transmission line without raptor hoods.



Raptor Hoods installed on the Big Creek Portal Transmission Line

Figure TERR 8-4. Big Creek Transmission Line Without Raptor Hoods and With Raptor Hoods

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APPENDIX A

SCE Raptor Protection Program Brochure

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RAPTOR PROTECTION PROGRAM

Raptor Protection Program Goals

Raptors, or birds of prey, are meat-eating birds that include the hawks, eagles, and owls. Most species of raptors are protected under one or more laws and/or regulations.

Edison's Raptor Protection Program is designed to:

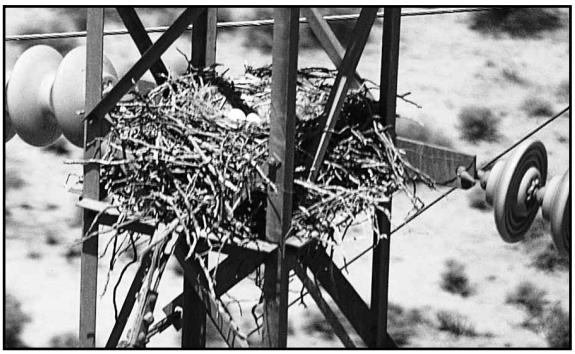
1. Reduce impacts to raptors.
2. Ensure compliance with state and federal laws and rules and regulations protecting these species.
3. Gather and provide information from operating divisions within Edison to Environmental Affairs on facility-caused electrocutions. This information will assist Environmental Affairs in responding to regulatory agency inquiries and provide informed responses to concerns expressed by the public.
4. Assist Company biologists in identifying problem areas where raptor protection may be required. Selectively identify and install cost-effective raptor protection devices to ensure Company compliance with existing laws and regulations.
5. Help identify and isolate where bird-caused outages occur so that these can be minimized, providing higher levels of quality service to our customers.

Raptor Protection

Electrocutions

Raptors often perch or nest on transmission or distribution towers or poles. Occasionally, the birds will make accidental contact between phases or phase and ground, causing harm to or electrocuting the bird. These electrocutions are most common on distribution or subtransmission facilities where energized conductors are close together.

The number of electrocutions can be decreased by either designing the line to minimize contact between phases, or by retrofitting existing lines where necessary with a protective device that prevents this contact. Studies have demonstrated that raptors prefer certain poles for nesting and perching. By identifying these preferred poles, we can modify them, and thus greatly diminish the potential for raptor electrocutions in a cost-effective manner.



Nest Protection

In the absence of other suitable nest sites, raptors often use transmission towers and distribution poles for nesting. State and federal laws and regulations protect these nests from removal at certain times of the year without necessary permits. It is important that nests not be disturbed when eggs or young birds are in them.

Raptor Protection Program Procedures

1. All incidents of facility-related raptor mortality should be reported to your supervisor. You should then fill out the raptor mortality report form available in all district offices or from your supervisor. The completed form should be sent to Environmental Affairs in the General Office.
2. From February through June, nests should not be removed or disturbed. Under no circumstances should known eagle nests be disturbed at any time of the year.
3. If a nest is discovered during this February–June period that presents a hazardous situation for the continued safe operation of the line, try to trim the nest rather than remove it. If a nest must be removed, call Environmental Affairs. Environmental Affairs possesses or will obtain the necessary permits for removing nests.
4. If at any time you have questions regarding these procedures, please discuss them with your supervisor or call Environmental Affairs, Dan Pearson at PAX 29562, or Janet Baas at PAX 29541.

APPENDIX B

SCE Animal/Bird Mortality Report Form

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APPENDIX B

Raptor Mortality Procedures

When a dead or injured raptor is found near or on SCE equipment and facilities (e.g., poles, towers, substations) an internal report must be filed with Environmental Affairs (EA). EA will make the determination if a report to government agencies must also be filed. This is a step-by-step guide to help in the process of completing the raptor mortality report.

Both bald and golden eagles occur within SCE's service territory. Though rare, eagle electrocutions do occur on our lines, especially golden eagles. When an eagle is electrocuted, EA must be contacted immediately and special arrangements must be made for transport of the bird. It is illegal to transport eagles in the U.S. **DO NOT transport any eagle unless authorized by EA**.

1. Identify the species of raptor.
Identify the species if possible, especially to determine whether the raptor is an eagle or other raptor. Adult bald and golden eagles range anywhere from 30" to 40" in length and have a 72" to 84" wingspan while other raptors, such as red-tailed hawks are considerably smaller at about 19" in length and a 48" to 56" wingspan. See the attached guide. Whenever there is a doubt, contact Environmental Affairs (EA) for guidance. Take pictures (digital preferred) and send to EA so we can identify the bird.

If the bird is an eagle, follow the instructions directly below. For all other species, go directly to Step Number 2.

Eagle electrocutions:
Call or page EA immediately. You will be given guidance on the next course of action to take. It is illegal to transport eagles in the U.S. Do NOT transport an eagle unless authorized by EA. If the incident occurs after business hours, have the Edison operator connect you with EA staff.

All structures where an eagle electrocution has occurred must be corrected right away. Please contact EA for assistance in making these corrections to the structures.

After contacting EA and following the instructions given, continue to number 2.

2. Fill out a Raptor Mortality Report.
This form is available through EA or can be found on the Environmental Affairs website on SCE's Intranet. Fill out the report as completely as possible. Include maps of the area and, if possible, pictures of the structure, the bird, and the surrounding area (so we have an idea of the habitat in the vicinity of the pole.) Submit this report to EA as soon as possible after the incident.

Whenever multiple electrocutions occur within a few span lengths or on the same structure, these structures should be made raptor safe as soon as possible. Please contact EA for assistance in making these corrections to the structures.

Species other than eagles can be buried on site (away from the pole). You should have a current copy of SCE's U.S. Fish & Wildlife Permit in your vehicle in order to do this legally. This

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permit requires us to maintain records of electrocutions. If you do not have a copy of this document, please contact EA.

3. Send the completed form and attachments to EA.
Send the completed form and any pictures to:
Tracey Alsobrook, Environmental Affairs, G.O. 1

Remember, ordinary people and agencies are watching our activities. We must comply with the laws that protect almost all birds in the U.S. Report all known mortalities to EA. We need your assistance to keep the Company in compliance with the laws and in protecting these natural resources.

Call us when you need help with raptor mortality procedures or raptor protection.

	PAX		PAX
Daniel C. Pearson	29562	Janet Baas	29541
Tracey Alsobrook	27547	Jill Fariss	28545

Golden Eagle

Eagles:
(e.g., golden & bald eagles)
Length: 30-40”
Wingspan: 6½ to 7 feet

Red-Tailed Hawk

Hawks:
(e.g., red-tailed & red-shouldered hawks)
Length: 15-23”
Wingspan: 4 to 4½ feet

Great-horned Owl

Owls:
(e.g., great-horned, barn & great gray owls)
Length: 16-27”
Wingspan: 3½ to 4 ½ feet

Golden Eagle Silhouette

General Hawk Silhouette

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Animal/Bird Mortality Report

To: Tracey Alsobrook
Environmental Affairs (EA)
GO1, Quad 1A

Date: _____

From: Name _____
Work Location_____ PAX _____

Describe the species of the Animal or Bird that was mortally injured by SCE facilities (electrocuted/hit by a SCE vehicle, etc.).

_____
_____

If any bands or tags please return to EA or write number and agency here

_____
_____

Describe how the Animal or Bird was mortally injured by SCE facilities (bird contacted transformer bushings, etc.).

_____
_____
_____
_____

Weather Conditions (e.g. rainy and cold, sunny and warm, etc.)

_____
_____
_____

Circuit Name & Voltage_____

Specific Problem Location (e.g. Pole #/Address/Cross Streets, etc.)

_____
_____
_____

Description of Terrain and Vegetation in Area (e.g. near agriculture area, dense city area, residential housing, etc.)

_____
_____
_____

Please attach picture of the Bird or Animal if possible.

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