CEQA Conclusion: The construction and presence of new transmission lines would represent a less-than-significant impact on California least tern as a result of take of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. *AMM20 Greater Sandhill Crane* contains the commitment for all new transmission lines constructed as a result of the project to be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, there would be no take of California least tern from the project per Section 86 of the California Fish and Game Code, and the construction and operation of transmission lines would result in a less-than-significant impact on California least tern.

Greater Sandhill Crane

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on greater sandhill crane. Greater sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes permanent and temporary "roosting and foraging" and "foraging" habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (see Appendix 2.A *Covered Species Accounts*, of the Draft BDCP). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those only used in some years. Factors included in assessing the loss of foraging habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (see Appendix 2.A, *Covered Species Accounts*, of the Draft BDCP).

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-4A-27. Full implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles that would benefit the greater sandhill crane.

- Protect at least 3,892 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Resource Restoration and Performance Principle GSC1).
- Create at least 320 acres of managed wetlands (part of the nontidal wetland restoration acreage) in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated

lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principle GSC2).

- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes River Preserve greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane (Resource Restoration and Performance Principle GSC3).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Resource Restoration and Performance Principle GSC4).

Greater sandhill crane is a fully protected species and "take" of individuals, per Section 86 of the California Fish and Game Code, is prohibited. With the implementation of *AMM20 Greater Sandhill Crane*, construction activities would not result in take of the species, which would avoid take per Section 86 of the California Fish and Game Code[3]. As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the greater sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

[3] Section 86 of the California Fish and Game Code defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The project proponents do not propose to hunt, pursue, catch, or capture greater sandhill cranes. Killing would be avoided through AMM20.

Table 12-4A-27. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting and Foraging–Permanent	0	3
	Roosting and Foraging–Temporary	16	85
	Foraging	1,799	850
Total Impacts Water Conveyance Facilities		1,815	938
Environmental Commitments 4, 6–7, 9–11[a]	Roosting and Foraging–Permanent	0	0
	Roosting and Foraging–Temporary	0	0
	Foraging	1,985	0
Total Impacts Environmental Commitments 4, 6–9–11[a]		1,985	0
Total Roosting/Foraging–Permanent		0	3
Total Roosting/Foraging–Temporary		16	85
Total Foraging		3,784	850
TOTAL IMPACTS		3,800	938

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 4A would result in the combined permanent and temporary loss of up to 104 acres of modeled roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) and 4,634 acres of foraging habitat for greater sandhill crane (3,784 of permanent loss, 850 acres of temporary loss; see Table 12-4A-27). Project measures that would result in these losses are water conveyance facilities and transmission line construction, establishment and use of reuseable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 8 Grassland Natural Communities Restoration*, *Environmental Commitment 10 Nontidal Marsh Natural Community Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to nontidal wetland through Environmental Commitment 10. Habitat enhancement and management activities through Environmental Commitment 11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities as they are currently designed would result in the combined permanent loss of up to 1,815 acres of modeled greater sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,799 acres of foraging habitat (Table 12-4A-27). Foraging habitat that would be permanently impacted by water conveyance facilities would consist of 474 acres of very high-value, 202 acres of high-value, 579 acres of medium-value, and 544 acres of low-value foraging habitat (Table 12-4A-28). In addition, 3 acres of permanent roosting and foraging habitat, 85 acres of temporary roosting and foraging habitat,

and 850 acres of foraging habitat would be temporarily removed (Table 12-4A-27, Table 12-4A-28). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within one year following construction; however, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. Water conveyance facilities activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

The acres of roosting and foraging habitat that would be removed would occur from the construction of a temporary transmission line on Zacharias Island, Bouldin Island, and Venice Island and from the construction of a temporary concrete batch plant and a permanent access road on Bouldin Island; however, the implementation of *AMM20 Greater Sandhill Crane* would require that water conveyance facilities activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site, as described in *AMM20 Greater Sandhill Crane* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. The potential for greater sandhill crane bird strike on electrical transmission facilities is addressed below under Impact BIO-70.

Approximately 1,480 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites.

Construction-related activities would not be expected to result in take of greater sandhill crane if they were present in the study area, because cranes would be expected to avoid contact with construction and other equipment. The potential for greater sandhill crane bird strike on electrical transmission lines is discussed below under Impact BIO-70.

The effects of noise and visual disturbance from water conveyance facilities construction activities are discussed under Impact BIO-71. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-28. Value of Greater Sandhill Crane Foraging Habitat affected by Alternative 4A

Foraging Habitat Value Class	Land Cover Type	Amount Affected by Water Conveyance Facilities permanent [temporary] (acres)	Amount Affected by Environmental Commitments (permanent acres)
Very high	Corn, rice	474 [224]	524
High	Wheat, managed wetlands,	202 [95]	222
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	579 [273]	638
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	544 [257]	601
Total		1,799 [850]	1,985

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 59 acres of greater sandhill crane foraging habitat in the north Delta. Loss of foraging habitat from Environmental Commitment 4 would consist of 16 acres of very high-value, 7 acres of high-value, 19 acres of medium-value, and 18 acres of low-value foraging habitat.
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: This activity would result in the permanent loss of approximately 251 acres of greater sandhill crane foraging habitat. Loss of foraging habitat from Environmental Commitment 4 would consist of 66 acres of very high-value, 28 acres of high-value, 81 acres of medium-value, and 76 acres of low-value foraging habitat.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 843 acres of cultivated lands that comprise greater sandhill crane foraging habitat. Loss of foraging habitat from Environmental Commitment 4 would consist of 222 acres of very high-value, 94 acres of high-value, 271 acres of medium-value, and 255 acres of low-value foraging habitat.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 832 acres of modeled foraging habitat for the greater sandhill crane. Impacts would consist of approximately 219 acres of very high-value, 93 acres of high-value, 268 acres of medium-value, and 252 acres of low-value foraging habitat (Table 12-4A-28). A portion of the restored nontidal marsh would be expected to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this

restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. The potential for these activities to result in take of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Chapter 4, *Covered Activities and Associated Federal Actions*, of the Draft BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.
- *Water Facilities Operations and Maintenance:* Post construction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by the AMMs listed below. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2, AMM6 and AMM20 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The following paragraphs summarize the combined effects discussed above and describe Alternative 4A environmental commitments that offset or avoid these effects. NEPA effects and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 104 acres roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) from the construction of the water conveyance facilities. In addition, 4,634 acres of foraging habitat would be removed or converted (Water Conveyance Facilities—2,649 acres; *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration,* and *Environmental Commitment 10 Nontidal Marsh Restoration*—1,985 acres). Of these acres of foraging habitat impact, 2,598 acres would be medium- to very high-value habitat (Table 12-4A-28).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of foraging habitat. Using these ratios would indicate that 104 acres of greater sandhill crane roosting habitat should be restored/created and 104 acres should be protected to compensate for the losses of greater sandhill crane roosting and foraging habitat. In addition, 4,634 acres of high- to very high-value foraging habitat should be protected to mitigate the water conveyance facilities losses of greater sandhill crane foraging habitat.

The implementation of *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would require that no greater sandhill crane roost sites were directly impacted

by water conveyance facilities covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the water conveyance facilities impact on 104 acres of roosting and foraging habitat. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

Under Alternative 4A, project proponents would commit to creating up to 95 acres of roosting habitat within 2 miles of existing permanent roost sites Resource Restoration and Performance Principle GSC4). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. In addition, 320 acres of roosting habitat would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Resource Restoration and Performance Principle GSC2). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The creation of 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see Figure 3.3-7 in the Draft BDCP) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Resource Restoration and Performance Principle GSC3). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 4,811 acres of cultivated lands that provide high- to very high-value foraging habitat would be protected. This habitat would occur within 2 miles of known roost sites and at least 80% would be maintained in very high-value habitat types in any given year (see Table 12-4-28 for greater sandhill crane foraging habitat values).

The Plan also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on greater sandhill crane: *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM30 Transmission Line Design and Alignment Guidelines*. All of these AMMs include elements that would avoid or minimize the risk of affecting greater sandhill crane habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of greater sandhill crane habitat under Alternative 4A would not be adverse under NEPA because Alternative 4A has committed the project proponents to avoiding and minimizing effects and to restoring and protecting acreages that are greater than the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles GSC1–GSC4, and by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and AMM30 *Transmission Line Design and Alignment Guidelines,* which would be in place during all project activities. Construction activities

would not be expected to result in greater sandhill crane take because foraging and roosting individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas. Considering these commitments, the implementation of Alternative 4A would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: The effects on greater sandhill crane habitat under Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of other environmental commitments, Resource Restoration and Performance Principles GSC1–GSC4, and AMMs. However, the project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 10 that are greater than the mitigation ratios described above. These conservation actions would be guided by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and *AMM30 Transmission Line Design and Alignment Guidelines*, which would be in place during all project activities. Construction activities would not be expected to result in greater sandhill crane take because foraging and roosting individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications. Therefore, Alternative 4A would have a less-than-significant impact on greater sandhill cranes under CEQA.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4A facilities, as described below. The potential take of greater sandhill crane in the area of the proposed transmission lines was estimated for the Draft BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (See Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that risk of take could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Alternative 4A substantially reduced the length of permanent and temporary transmission lines as compared to the Draft BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4A, no permanent transmission lines would be constructed within the greater sandhill

crane winter use area. In addition, no new transmission lines (permanent or temporary) would be constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4A transmission line alignment within the greater sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by greater sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4A as compared to the Draft BDCP.

In addition, after the BDCP Draft EIR/EIS was issued in December of 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4A meets the performance standard of no take of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: (1) siting new transmission lines in lower bird strike risk zones; (2) removing, relocating or undergrounding existing lines where feasible; (3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area (4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area, (5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the crane winter use area; and/or (6) for areas outside of the Stone Lakes National Wildlife Refuge project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would not result in "take" of greater sandhill crane per Section 86 of the California Fish and Game Code. Potential measures include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. Diverters would be installed on existing lines at a rate of one foot of existing transmission line for every one foot of new project transmission line constructed, in an area with equal or higher greater sandhill crane bird strike risk. Placing diverters on existing lines would be expected to reduce existing take in the Plan Area and therefore result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity. Considering that the temporary lines would be removed within the first 10–14 years of Alternative 4A implementation, and with the implementation of one or a combination of the measures described under *AMM20 Greater Sandhill Crane*, there would be no take of greater sandhill crane from the project per Section 86 of the California Fish and Game Code.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the greater sandhill crane winter use area. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the greater sandhill crane winter use area. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, there would be no take of greater sandhill crane from the project per Section 86 of the California Fish and Game Code, and the construction and operation of transmission lines under Alternative 4A would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of the Project on Greater Sandhill Crane

Indirect construction-and operation-related effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other environmental commitments could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The Draft BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4A-29). This would include 1,008

acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-4A-29. Greater Sandhill Crane Habitat Affected by General Construction and Pile Driving Noise Under Alternative 4A (acres)

	General Construction	
Habitat Type	Above 60 dBA	Above 50 dBA
Permanent Roosting	196	1,008
Temporary Roosting	810	1,909
Foraging	7,676	17,327
Total Habitat	8,681	20,243

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (see Chapter 5, *Effects Analysis*, of the Draft BDCP). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (see Chapter 5, *Effects Analysis*, of the Draft BDCP). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (see Chapter 5, *Effects Analysis*, of the Draft BDCP).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from

construction activities are not expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. The implementation of AMM1–AMM6 (Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP; updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Changes in water operations from the construction of the water conveyance facilities and the implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) have the potential to exacerbate bioaccumulation of mercury in greater sandhill crane. Largemouth bass was used as a surrogate species for analysis of impacts from changes in operations from the construction of the water conveyance facilities (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species overestimate the effects on greater sandhill crane because of their position in the food web. Organisms feeding within pelagic-based (algal) food webs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic food webs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Potential indirect effects of increased mercury exposure are likely low for greater sandhill crane because they primarily forage on waste grains and, to a lesser extent, invertebrates associated with cultivated crops. The modeled effects of mercury concentrations from changes in water operations with water conveyance facilities on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of water conveyance facilities construction.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with Environmental Commitment 10 (Nontidal Marsh Restoration) may indirectly affect greater sandhill crane via uptake in lower tropic levels (see Appendix 5.D, *Contaminants*, of the Draft BDCP). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability

- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Environmental Commitment 10 (Nontidal Marsh Restoration) has the potential to mobilize selenium, and therefore increase greater sandhill crane exposure from ingestion of prey items (waste grain and associated invertebrates) with elevated selenium levels. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 10) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists with respect to the location of nontidal restoration activities, there could be an effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal and nontidal habitats (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the restoration design.

NEPA Effects: Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to compensate for affected habitat.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of greater sandhill crane to methylmercury and selenium. The potential indirect effect of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation on greater sandhill crane would not be adverse under NEPA.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would not result in an adverse effect on greater sandhill crane under NEPA.

CEQA Conclusion: Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate for affected habitat.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of greater sandhill crane to methylmercury and selenium. This would be a significant impact. The potential indirect effect of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27*

Selenium Management, which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on greater sandhill crane under CEQA.

Lesser Sandhill Crane

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on lesser sandhill crane. Lesser sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane includes "roosting and foraging" and "foraging" habitat. Suitable roosting and foraging habitat in the study area includes certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and that also provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in the BDCP (see Appendix 2.A, *Covered Species Accounts*, of the Draft BDCP). Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.) The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane.

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-4A-30. Full implementation of Alternative 4A would include the following Resource Restoration and Performance Principles for greater sandhill crane that would similarly benefit the lesser sandhill crane.

- Protect at least 3,892 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Resource Restoration and Performance Principles GSC1).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principles GSC2).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane (Resource Restoration and Performance Principles GSC3).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Resource Restoration and Performance Principles GSC4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the lesser sandhill crane would be less than significant for CEQA purposes, and would not be adverse for NEPA purposes.

Table 12-4A-30. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting and Foraging–Permanent	0	3
	Roosting and Foraging–Temporary	16	85
	Foraging	1,838	988
Total Impacts Water Conveyance Facilities		1,854	1,076
Environmental Commitments 4, 6––11[a]	Roosting and Foraging–Permanent	0	0
	Roosting and Foraging–Temporary	0	0
	Foraging	1,985	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		1,985	0
Total Roosting/Foraging–Permanent		0	3
Total Roosting/Foraging–Temporary		16	85
Total Foraging		3,823	988
TOTAL IMPACTS		3,839	1,076

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 4A would result in the combined permanent and temporary loss of up to 104 acres of modeled roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) and 4,811 acres of foraging habitat (3,823 acres of permanent loss, 988 acres of temporary loss, Table 12-4A-30). Project measures that would result in these losses are water conveyance facilities and transmission line construction, establishment and use of reusable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration*, *Environmental Commitment 8 Grassland Natural Communities Restoration*, *Environmental Commitment 10 Nontidal Marsh Natural Community Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from water conveyance facility construction and conversion of foraging habitat to nontidal natural communities through Environmental Commitment 10. Habitat enhancement and management activities through Environmental Commitment 11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent loss of up to 2,930 acres of modeled lesser sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,838 acres of foraging habitat. Foraging habitat that would be permanently impacted by water conveyance facilities would consist of 1,049 acres of very high-value, 144 acres of high-value, and 325 acres of medium-value foraging habitat (Table 12-4A-31). In addition, 3 acres of permanent roosting and foraging habitat, 85 acres of temporary roosting

and foraging habitat, and 988 acres of foraging habitat would be temporarily removed (Table 12-4A-30). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands. Water conveyance facilities activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

- The acres of roosting and foraging habitat that would be permanently removed is located on Bouldin Island, from the construction of a permanent access road. Temporary impacts on roosting and foraging habitat would occur on Bouldin Island from the construction of a temporary concrete batch plant and a fuel station. Temporary losses would also occur from the construction of temporary transmission lines between the Lambert Road vent shaft and the intermediate forebay, and on Venice Island. However, the implementation of *AMM20 Greater Sandhill Crane* would require that water conveyance facilities activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site, as described in *AMM20 Greater Sandhill Crane* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.
- Approximately 1,480 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would be stored on Bouldin Island, Zacharias Island and parcels south of Lambert Road and north of the Cosumnes River. The reusable tunnel material would likely be moved to other sites for use in levee build-up and restoration, and the affected areas would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS), would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites.

Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because cranes would be expected to avoid contact with construction and other equipment. The potential for lesser sandhill crane bird strike on electrical transmission lines is discussed below under Impact BIO-73.

The effects of noise and visual disturbance from water conveyance facilities construction activities are discussed under Impact BIO-74. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-31. Value of Lesser Sandhill Crane Foraging Habitat Affected By Alternative 4A Water Conveyance Facilities

Foraging Habitat Value Class	Land Cover Type	Water Conveyance Facilities Permanent [Temporary] (acres)
Very high	Corn, alfalfa and alfalfa mixtures	1,049 [448]
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	144 [43]
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, unirrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	325 [245]
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	292 [244]
None	Vineyards, orchards	28 [8]

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 59 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 251 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 843 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 832 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be restored to provide roosting and foraging habitat value for sandhill cranes. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *Environmental Commitment 11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. The potential for these activities to result in direct mortality of lesser sandhill crane would be

minimized with the implementation of *AMM20 Greater Sandhill Crane*. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.

- *Water Facilities Operations and Maintenance*: Post construction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by the AMMs listed below. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of *AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material,* and *AMM20 Greater Sandhill Crane* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The following paragraphs summarize the combined effects discussed above and describe Alternative 4A environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA effects and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 104 acres roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) from the construction of the water conveyance facilities. In addition, 4,811 acres of foraging habitat would be removed or converted (Water Conveyance Facilities—2,826 acres; *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration* and *Environmental Commitment 10 Nontidal Marsh Restoration*—1,985 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 104 acres of sandhill crane roosting habitat should be restored/created and 104 acres should be protected to compensate for the losses of lesser sandhill crane roosting and foraging habitat. In addition, 4,811 acres of high- to very high-value foraging habitat should be protected to mitigate the water conveyance facilities losses of lesser sandhill crane foraging habitat.

The implementation of *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would require that no sandhill crane roost sites were directly impacted by water conveyance facilities covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the water conveyance facilities impact on 104 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

Alternative 4A also includes the following performance standards for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Project proponents would commit to creating up to 95 acres of roosting habitat within 2 miles of existing permanent roost sites (Resource Restoration and Performance Principle GSC4). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. In addition, 320 acres of roosting habitat would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Resource Restoration and Performance Principle GSC2). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that would protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The creation of 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see Figure 3.3-7 in the Draft BDCP) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Resource Restoration and Performance Principle GSC3). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of sandhill crane wintering habitat.

At least 4,811 acres of cultivated lands that provide high- to very high-value foraging habitat would be protected. This habitat would occur within 2 miles of known roost sites and at least 80% would be maintained in very high-value habitat types for greater sandhill crane in any given year (which would be high- to very high-value crop types for the lesser sandhill crane; see Table 12-4-28 and Table 12-4-32 for sandhill crane foraging habitat values).The Plan also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on lesser sandhill crane: *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM30 Transmission Line Design and Alignment Guidelines*. All of these AMMs include elements that would avoid or minimize the risk of affecting lesser sandhill crane habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of lesser sandhill crane habitat under Alternative 4A would not be adverse under NEPA because Alternative 4A has committed the project proponents to avoiding and minimizing effects and to restoring and protecting acreages that meet the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles GSC1–GSC4, and by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and AMM30 *Transmission Line Design and Alignment Guidelines,* which would be in place during all project activities. Considering these commitments, the implementation of Alternative 4A would not result in an adverse effect on lesser sandhill crane.

CEQA Conclusion: The effects on lesser sandhill crane habitat under Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of environmental commitments, Resource Restoration and Performance Principles GSC1-GSC4 for greater sandhill crane (which would also benefit lesser sandhill crane), and AMMs. However, the project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 10 that are greater than the mitigation ratios described above. These conservation actions would be guided by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and *AMM30 Transmission Line Design and Alignment Guidelines*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, Alternative 4A would have a less-than-significant impact on lesser sandhill cranes under CEQA.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4A facilities, as described below. The potential mortality of greater sandhill crane in the area of the proposed transmission lines was estimated for the Draft BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (See Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

The transmission line footprint for Alternative 4A was changed substantially from the Draft BDCP to reduce potential risk of greater sandhill crane collisions. The following changes also reduce potential risk of lesser sandhill crane collisions:

Alternative 4A substantially reduced the length of permanent and temporary transmission lines as compared to the Draft BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4A, no permanent transmission lines would be constructed within the greater sandhill crane winter use area. In addition, no new transmission lines (permanent or temporary) would be

constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4A transmission line alignment within the greater sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by both greater and lesser sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4A as compared to the Draft BDCP.

In addition, after the BDCP Draft EIR/EIS was issued in December of 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4A meets the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: (1) siting new transmission lines in lower bird strike risk zones; (2) removing, relocating or undergrounding existing lines where feasible; (3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area (4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area, (5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the crane winter use area; and/or (6) for areas outside of the Stone Lakes National Wildlife Refuge project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would substantially reduce potential collisions of lesser sandhill cranes with transmission lines. Potential measures include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. Diverters would be installed on existing lines at a rate of one foot of existing transmission line for every one foot of new project transmission line constructed, in an area with equal or higher greater sandhill crane bird strike risk. Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and therefore result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of

the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on lesser sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of the Project on Lesser Sandhill Crane

Indirect construction-and operation-related effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other environmental commitments could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4A-29). This would include 1,008 acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise

transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (see Chapter 5, *Effects Analysis*, of the Draft BDCP). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts, and be more vulnerable to predators. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding." (see Chapter 5 of the Draft BDCP). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (see Chapter 5 of the Draft BDCP).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. The implementation of AMM1–AMM6 (Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP; updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Changes in water operations from the construction of the water conveyance facilities and the implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis of impacts from changes in operations

from the construction of the water conveyance facilities (see Appendix D, *Substantive BDCP Revisions*, in this RDEIR/SDEIS). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species overestimate the effects on lesser sandhill crane because of their position in the food web. Organisms feeding within pelagic-based (algal) food webs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic food webs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Potential indirect effects of increased mercury exposure are likely low for lesser sandhill crane because they primarily forage on waste grains, other cultivated crops, and associated invertebrates. The modeled effects of mercury concentrations from changes in water conveyance facilities operations on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of water conveyance facilities construction.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with Environmental Commitment 10 (Nontidal Marsh Restoration) may indirectly affect lesser sandhill crane via uptake in lower tropic levels (see Appendix 5.D, *Contaminants, of the Draft BDCP*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At

Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. Environmental Commitment 10 (Nontidal Marsh Restoration) has the potential to mobilize selenium, and therefore increase lesser sandhill crane exposure from ingestion of prey items with elevated selenium levels. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 10) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists with respect to the location of nontidal restoration activities, there could be an effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) which would provide specific habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal and nontidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the restoration design.

NEPA Effects: Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane*, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to compensate for affected habitat.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of lesser sandhill crane to methylmercury and selenium. methylmercury and selenium. The potential indirect effect of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on waste grains, other cultivated crops, and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of lesser sandhill crane. Therefore, the indirect effects of Alternative 4A implementation on lesser sandhill crane would not be adverse under NEPA.

CEQA Conclusion: Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate for affected habitat, there would not be an adverse effect on lesser sandhill crane.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of lesser sandhill crane to methylmercury and selenium. This would be a significant impact. The potential indirect effect of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on least Bell's vireo and yellow