CEQA Conclusion: Indirect effects resulting from project operations and maintenance as well as construction-related noise and visual disturbances could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 as part of Alternative 4A, the project would avoid the potential for substantial adverse effects on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders. The indirect effects of Alternative 4A would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on California tiger salamander.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Giant Garter Snake

The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic, tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities (primarily grassland and cropland) within 200 feet of modeled aquatic habitat features. The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh/White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 4A would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-4A-21. Alternative 4A would include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit the giant garter snake.

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).

- Protect 1,060 acres and restore 1,070 acres of grassland (Environmental Commitment 3 and Environmental Commitment 8).
- Protect 843 acres of high-value upland giant garter snake habitat adjacent to suitable aquatic habitat (Environmental Commitment 3, Resource Restoration and Performance Principle GGS4).
- Restore 255 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle in CZ 4 and CZ 5 (Environmental Commitment 10).
- Protect 11,870 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species, of which 255 acres of rice land or equivalent-value habitat would be protected for giant garter snake and connected to the restored 255 acres of aquatic habitat in nontidal marsh for giant garter snake in CZ 4 or CZ 5 (Environmental Commitment 3, Resource Restoration and Performance Principles GGS1 and GGS3).
- Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2)
- Target cultivated land conservation to provide connectivity between other conservation lands (Resource Restoration and Performance Principle CL2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Resource Restoration and Performance Principle GGS2).
- Create connections from the Coldani Marsh/White Slough subpopulation to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting 255 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 255 acres may consist of muted tidal freshwater emergent wetland and may overlap with the 160 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria (Resource Restoration and Performance Principle GGS5).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-21. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 4A

Project Component	Habitat Type [b]	Permanent	Temporary
Water Conveyance Facilities	Aquatic (acres)	217	120
	Upland (acres)	455	193
	Aquatic (miles)	13	7
Total Impacts Water Conveyance Facilities (acres)		**672**	**313**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic (acres)	0	0
	Upland (acres)	0	0
	Aquatic (miles)	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a] (acres)		0	0
TOTAL IMPACTS (acres)		**672**	**313**

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

[b] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 4A would result in the permanent and temporary loss combined of up to 337 acres of modeled aquatic habitat (tidal and nontidal combined), up to 648 acres of modeled upland habitat, and up to 20 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-4A-21). Project measures that would result in these losses are water conveyance facilities and transmission line construction, geotechnical investigation, and establishment and use of RTM. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities would degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of approximately 672 acres of modeled giant garter snake habitat, composed of 217 acres of aquatic habitat and 455 acres of upland habitat (Table 12-4A-21). The 455 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 130 acres of high-, 292 acres of moderate-, and 33 acres of low-value habitat. In addition, approximately 13 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of up to 120 acres of giant garter snake aquatic habitat and up to 193 acres of adjacent upland habitat in areas near construction and geotechnical investigation in CZ 5 and CZ 6 (see Table 12-4A-21 and Terrestrial Biology Map Book). In addition, approximately 7 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction. There are three giant garter snake occurrences in the vicinity of the water conveyance facilities construction footprint in Snodgrass Slough and Middle River.

Most of the habitat to be lost is in CZ 6 on Mandeville Island. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 4A construction locations. Water facilities construction and operation is expected to have low to moderate potential for adverse effects on giant garter snake aquatic habitat on Mandeville Island because it is not located near or between populations identified in the draft recovery plan. An estimated 301 of the 672 acres would be lost as storage areas for reusable tunnel material, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored: while this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. Furthermore, the amount of storage area needed for reusable tunnel material is flexible and the footprint used in the effects analysis is based on a worst case scenario: the actual area to be affected by reusable tunnel material storage would likely be less than the estimated acreage.

- *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 protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values. These effects cannot be quantified, but are expected to be minimal because vegetation removal would occur around existing infrastructure and roads where giant garter snake are not as likely to be present. Any of these minor impacts would be avoided and minimized by the AMMs listed below.

  Passive recreation in the reserve system could result in human disturbance of giant garter snakes basking in upland areas and compaction of upland burrow sites used for brumation. However, AMM37, described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS, requires setbacks for trails in giant garter snake habitat. With this measure in place, recreation-related effects on giant garter snake are expected to be minimal.

- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 3, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and environmental commitments as described below.

- Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the Coldani Marsh/White Slough subpopulation [CZ 4]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated construction and restoration could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project

design, as practicable. Construction monitoring and other measures would be implemented to avoid and minimize injury or mortality of this species during construction as described in *AMM16 Giant Garter Snake*.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are approximately 31,281 acres of aquatic and 53,285 acres of upland modeled habitat for giant garter snake in the study area. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 337 acres of aquatic habitat and 648 acres of upland habitat for giant garter snake during the term of the plan (1% of the total aquatic and upland modeled habitat in the study area).

With full implementation of Alternative 4A there would be protection of 1,060 acres and restoration of 1,070 acres of grassland, protection of 11,870 acres of cultivated lands, 119 acres of nontidal wetlands, and restoration of 832 acres of nontidal wetlands in the study area. Lands to be protected and restored specifically for the giant garter snake total 1,353 acres (255 acres nontidal marsh, 843 acres of grassland, 255 acres of cultivated lands (rice or habitat of equivalent value in CZ 4, and CZ 5). In addition to the 1,353 acres of high-value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration and protection of garter snake habitat. An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands.

Protection and management of cultivated lands (Environmental Commitment 11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Giant garter snake habitat would be restored and protected specifically to conserve and expand the Coldani Marsh/White Slough subpopulation of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the study area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the study area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 337 acres of aquatic habitat should be restored, 337 acres of aquatic habitat should be protected, and 1,296 acres of upland habitat should be protected for giant garter snake.

Alternative 4A also includes commitments to implement *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, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural*

Communities, AMM16 Giant Garter Snake, and AMM37 Recreation. All of these AMMs include elements that avoid or minimize the risk of activities affecting habitats and species adjacent to work areas and storage sites. 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 AMM37 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

***NEPA Effects*:** In the absence of actions to restore and protect habitat, the effects on giant garter snake habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles GGS1-GGS5, L2, L3, CL1, and CL2, and guided by AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in place throughout the construction period and operations, the effects of Alternative 4A as a whole on giant garter snake would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on giant garter snake habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles GGS1-GGS5, L2, L3, CL1, and CL2, and guided by AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on giant garter snake would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, the effects of Alternative 4A would have a less-than-significant impact on giant garter snakes.

Impact BIO-50: Indirect Effects of Alternative 4A on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, habitat restoration, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in effect during all project activities.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey.

Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under water conveyance facilities were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see Draft BDCP Appendix 5.D, *Contaminants*).

Marsh (tidal and nontidal) restoration also has the potential to increase exposure to methylmercury. 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. Thus, restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with minimization and mitigation measures and adaptive management and monitoring, *Environmental Commitment 12 Methylmercury Management* is expected to reduce the amount of methylmercury resulting from the restoration of natural communities.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Yolo Basin is where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008); however, there would be no construction or restoration in this area. Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Measures described in *Environmental Commitment 12 Methylmercury Management* include provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, Environmental Commitment 12 is expected to reduce the effects of methylmercury resulting from natural communities and floodplain restoration on giant garter snake.

***NEPA Effects*:** Implementation of the AMMs listed above and *Environmental Commitment 12 Methylmercury Management* as part of implementing Alternative 4A would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. These AMMs and Environmental Commitment would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on giant garter snake.

***CEQA Conclusion*:** Indirect effects from project operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, AMM16, and AMM37 and *Environmental Commitment 12 Methylmercury Management* as part of Alternative 4A construction, operation and maintenance, the project would avoid or minimize the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. Therefore, the indirect effects of Alternative 4A would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Implementation of Alternative 4A would not introduce a substantial barrier to the movement among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

***NEPA Effects*:** Alternative 4A would not adversely affect connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

***CEQA Conclusion*:** Alternative 4A would have a less-than-significant impact on connectivity among giant garter snakes in the study area and therefore no mitigation is required.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on giant garter snake.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in Draft BDCP Appendix 2.A, *Species Accounts*, Section 2A.29, *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Alternative 4A would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-4A-22. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area.

Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles to benefit the western pond turtle.

- Protect 103 acres and restore 251 acres of valley/foothill riparian habitat (Environmental Commitments 3 and 7).
- Protect 119 acres and restore 832 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, which will