The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on vegetation and wildlife:

1. Avoid direct or indirect disturbance to wetland and riparian communities, special-status species habitat, rare natural communities, significant natural areas, and other sensitive habitat.
2. Restore and enhance sufficient in-kind wetland and riparian habitat or rare natural communities and significant natural areas at offsite locations (near project sites) before or at the time that project impacts are incurred. Replace not only acreage lost, but also habitat value loss.
3. Design Program features to permit on-site mitigation or nearby restoration of wetland, riparian habitat, special-status species habitat, rare natural communities, and significant natural areas that have been removed by permanent facilities.
4. Phase the implementation of Ecosystem Restoration Program habitat restoration to offset temporary habitat losses and to restore habitat (including special-status species habitat) before, or at the same time that, project impacts associated with the Ecosystem Restoration Program are incurred.
5. Restore wetland and riparian communities, special-status species habitat, and wildlife use areas temporarily disturbed by on-site construction activities immediately following construction. Example actions include direct planting of native plants, controlling nonnative plants to improve conditions for reestablishing native plants, and enhancing and restoring the original site hydrology to allow for the natural reestablishment of the affected plant community.
6. Avoid creating wetlands in areas with high concentrations of mercury in sediments and anaerobic conditions.
7. Phase the implementation of modifications to levees that would be necessary to meet PL 84-99 standards in order to minimize the effects of fragmentation of riparian habitats and associated wildlife.
8. Implement BMPs such as avoiding disturbance to highly erodible soils and installing siltation barriers and detention basins to reduce the potential for siltation of nearby wetlands.
9. Maintain sufficient outflow downstream of constructed off-stream reservoirs to maintain existing downstream wetland riparian communities.
10. Restore or enhance sufficient waterfowl foraging habitat near existing use areas to offset impacts on the abundance, quality and availability of waterfowl forage. Restoration and enhancement actions include restoring and managing seasonal wetlands for wintering waterfowl, producing crops with high forage value (such as corn and rice), and modifying farming practices to increase forage availability (for example, leaving portions of forage crops unharvested through winter or shallowly flooding fields).
11. Avoid important wildlife habitat areas, such as critical deer winter range and fawning habitat.
12. Restore and enhance important wildlife habitat use areas temporarily disturbed by on-site construction activities by planting and maintaining native species immediately following construction.
13. Restore and enhance upland habitat areas within affected watersheds or in other watershed if sufficient habitat enhancement is unavailable within the affected watershed.

This could include modifying existing land management practices (for example, grazing and fire management practices) to improve conditions for the natural reestablishment and long-term maintenance of affected plant communities and habitats.

14. Avoid direct or indirect disturbance to areas occupied by special-status species.
15. Avoid construction or maintenance activities within or near occupied special-status species habitat areas or important wildlife use areas when species may be sensitive to disturbance, such as during the breeding season.
16. Restore habitat areas occupied by special-status species that are temporarily disturbed by on-site construction activities immediately following construction.
17. Restore and enhance suitable habitat areas that are occupied by, or are near and accessible to, special status species that have been affected by the permanent removal of occupied habitat areas.
18. Phase habitat restoration actions to restore sufficient suitable habitat to minimize the adverse affects of impacts on occupied special-status species habitats before impacts are incurred.
19. For species for which relocation or artificial propagation is feasible, establish additional populations of special-status species adversely affected by the Program in suitable habitat areas elsewhere within their historical range.
20. Provide incentives to alter agricultural practices to improve habitat conditions for affected special-status species that use agricultural lands. This could included planting and managing crops to increase the availability or quantity of forage for affected species.
21. Avoid direct or indirect disturbances to rare natural communities and significant natural areas.
22. Restore or enhance disturbed rare natural communities or significant natural areas at offsite locations before, or when, Program actions that could affect these communities are incurred.
23. Restore rare natural communities or significant natural areas at or near affected locations after Program activities are completed.
24. Manage recreation-related activities on lands managed under the Program to minimize or avoid potential adverse effects of recreation-related activities on sensitive habitats, important wildlife use areas, and special-status species.
25. Phase ERP to initially restore natural waterfowl foraging on agricultural lands with low forage value while restored habitat with high forage value develops.
26. Phase ERP to initially restore wetland habitat with high forage value to offset the loss of agricultural foraging habitat that may result from the ERP.
27. Restore riparian vegetation disturbed by on-site construction activities immediately following construction.
28. Restore or enhance sufficient in-kind riparian habitat at off-site locations, near project sites, in a manner that reduces the degree of existing habitat fragmentation before, or when, project impacts are incurred to offset habitat losses.
29. Restore habitat temporarily disturbed by on-site construction activities immediately following construction.
30. Restore rare natural communities, significant natural areas, and wildlife use areas temporarily disturbed by on-site construction activities immediately following construction. Example actions include direct planting of native plants, controlling

nonnative plants to improve conditions for reestablishing native plants, and enhancing and restoring the original site hydrology to allow for the natural reestablishment of the affected plant community.

31. Restore and enhance suitable habitat areas that are occupied by, or are near and accessible to, special-status species that have been adversely affected by the permanent removal of occupied habitat areas.

7.1 Agricultural Land and Water Use. Implementation of the Preferred Program Alternative may have potentially significant effects on agricultural land and water use. These effects may include: (1) Conversion of prime, statewide important, and unique farmlands to project uses; (2) Conflicts with local government plans and policies; and (3) Conflicts with adjacent land uses.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on agricultural land and water use:

1. Site and align Program features to avoid or minimize effects on agriculture.
2. Examine structural and nonstructural alternatives to achieve project goals in order to avoid effects on agricultural land.
3. Implement features that are consistent with local and regional land use plans.
4. Involve all affected parties, especially landowners and local communities, in developing appropriate configurations to achieve the optimal balance between resource effects and benefits.
5. Retain water allocations from retired drainage-impaired lands within the existing water districts.
6. Support the testing and application of alternative crops to idled farmland (for example, agroforestry or energy crops).
7. Provide water supply reliability benefits to agricultural water users.
8. Support the California Farmland Conservancy Program in acquiring easements on agricultural land in order to prevent its conversion to urbanized uses and increase farm viability. Focus on lands in proximity to where any conversion effect takes place.
9. Restore existing degraded habitat as a priority before converting agricultural land.
10. Focus habitat restoration efforts on developing new habitat on public lands before converting agricultural land.
11. If public lands are not available for restoration efforts, focus restoration efforts on acquiring lands that can meet ecosystem restoration goals from willing sellers where at least part of the reason to sell is an economic hardship (for example, lands that flood frequently or where levees are too expensive to maintain).
12. Use farmer-initiated and developed restoration and conservation projects as a means of reaching Program goals.
13. Where small parcels of land need to be acquired for waterside habitat, seek out points of land on islands where the ratio of levee miles to acres farmed is high.
14. Obtain easements on existing agricultural land for minor changes in agricultural practices (such as flooding rice fields after harvest) that would increase the value of the agricultural crop(s) to wildlife.
15. Include provisions in floodplain restoration efforts for compatible agricultural practices.

16. Purchase water for habitat purposes so that the same locality is not affected over the long term.
17. Use a planned or phased habitat development approach in concert with adaptive management.
18. Minimize the amount of water supply required to sustain habitat restoration acreage.
19. Develop buffers and other tangible support for remaining agricultural lands. Vegetation planted on these buffers should be compatible with farming and habitat objectives.
20. In implementing levee reconstruction measures, work with landowners to establish levee reconstruction methods that avoid or minimize the use of agricultural land.
21. Work with landowners to establish levee subsidence BMPs that avoid effects on land use practices. Through adaptive management, further modify BMPs to reduce effects on agricultural land.
22. Implement erosion control measures to the extent possible during and after project construction activities. These erosion control measures can include grading the site to avoid acceleration and concentration of overland flows, using silt fences or hay bales to trap sediment, and revegetation areas with native riparian plants and wet meadow grasses.
23. Protect exposed soils with mulches, geotextiles, and vegetative ground covers to the extent possible during and after project construction activities in order to minimize soil loss.
24. Use rotational fallowing to reduce selenium drainage.
25. When it appears that land within an agricultural preserve may be acquired from a willing seller by a State CALFED agency for a public improvement as used in Government Code Section 51920, advise the Director of Conservation and the local governing body responsible for the administration of the preserve of the proposal.
26. Limit the number of acres that can be fallowed (in order to produce transferrable water) in a given area (district or county) or the amount of water that can be transferred from a given area.
27. Support assistance programs to aid local entities in developing and implementing groundwater management programs in water transfer source areas.
28. Dredged materials will be analyzed, dredged and handled in accordance with permit requirements. Permits will incorporate mitigation strategies identified in Section 5.3 to prevent release of contaminants of concern.
29. Utilize the criteria and objectives in the Water Transfer Program, in conjunction with existing legal constraints on water transfers, to protect against adverse effects due to water transfers. The criteria for future water transfer proposals include:
    - Water transfers must be voluntary.
    - Water market transactions must result in the transfer or exchange of water that truly increases the utility of the supply, not water that a transferor has never used or water that would have been legally available for downstream use in the absence of a transfer.
    - Water rights of all legal water users must not be impaired.
    - Transfers must not cause overdraft or degradation of groundwater basins, or impair correlative rights of overlying users.
    - Entities receiving transferred water should be required to show that they are making efficient use of existing water supplies.

- Water rights holders (whether districts or individuals) must play a strong role in determining whether water to which they have a right is transferred.
- The beneficial and adverse impacts on fiscal integrity of the districts and on the economy of agricultural communities in source and receiving areas cannot be ignored.

30. Implement seepage control measures.
31. Support local groundwater management that reduces overdraft and third-party effects, including reduction or discontinuation of groundwater pumping.

7.4 Urban Land Use. Implementation of the Preferred Program Alternative may have potentially significant effects on urban land use. These effects may include: (1) Displacement of some existing commercial uses and residents from Program actions located in urban land use areas; (2) Physical disruption or division of established communities; and (3) Potential conflicts of habitat development and storage and conveyance facilities with general plan land use designations or zoning if located in urban use areas.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on urban land use:

1. Select and design program actions that minimize the displacement of existing residents.
2. Select and design Program actions that do not physically disrupt or divide established communities.
3. Select Program actions that are consistent with local and regional land use plans. This could include consulting and working with local jurisdictions affected by Program actions early in the planning and environmental review process.
4. Notify all affected persons (for example, residents, property owners, school officials, and business owners) in the project area of the construction plans and schedules. This could include arranging schedules for road detours with residents and businesses to maintain access to homes, schools, and businesses; as well as providing protection, relocation, or temporary disconnection of utility services.
5. Select and design Program actions that do not physically disrupt or divide established communities.
6. Minimize the amount of permanent easement required for construction of facilities and consult with property owners to select easement locations that would lessen property disruption and fragmentation.
7. Relocate roads and utilities prior to project construction to ensure continued access and utility service through the project area.
8. Prepare a detailed engineering and construction plan as part of the project design plans and specifications, and include procedures for rerouting and excavating, supporting, and filling areas around utility cables and pipes in this plan.
9. Verify utility locations through consultation with appropriate entities and field surveys (such as probing and pot-holing).
10. Reconnect disconnected cables and lines promptly.

7.6 Utilities and Public Services. Implementation of the Preferred Program Alternative may have potentially significant effects on utilities and public services. These effects may include: (1) Need for relocation or modification of major infrastructure components; and (2) Increased risk of gas line rupture during construction.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on utilities and public services:

1. Site project facilities and transmission infrastructure to avoid existing infrastructure.
2. Construct overpasses, small bridges, or other structures to accommodate existing infrastructure.
3. Coordinate construction activities with utility providers.
4. Design and operate facilities to minimize the amount of energy required and to maximize the amount of energy created.
5. Design project facilities to avoid or minimize their effect on existing infrastructure.

7.7 Recreation. Implementation of the Preferred Program Alternative may have potentially significant effects on recreation. These effects may include: (1) Temporary closure of recreation areas during construction; (2) Decrease in recreation opportunities and increases in boat traffic in some areas due to speed zone restrictions or prohibition of motorized boating in some areas; (3) More stringent enforcement of boat discharges; (4) Temporary or permanent changes in boating access and navigation; (5) Permanent closure of recreation facilities; (6) Potential decrease in flooded lands suitable for wildlife, hunting, and fishing as a result of water use efficiency actions; (7) Reduced water-contact recreation quality from cold water reservoir releases; (8) Displacement of fish and wildlife and loss of terrestrial and loss of on-stream recreation from new off-stream or expanded on-stream reservoirs; (9) Potential for reduced access to recreation facilities and decreased recreation opportunities from changes in reservoir levels; and (10) Potential short-term construction effects of dredging, such as obstructing or closing channels and creating noise and visual effects.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on recreation:

1. Incorporate project-level recreation improvements and enhancements.
2. Work with recreational interests to protect and enhance recreation resources.
3. Conduct an analysis of boating circulation to ensure that appropriate alternative routes are identified and clearly marked if boating circulation in the Delta is to be modified due to temporary, seasonal, or permanent channel closures or to speed restrictions.
4. Identify and mark alternate boating routes.
5. Restoring and designing existing and new levees to accommodate vehicular access and parking for shoreline fishing, boat launching, swimming, hiking, bicycling, and wildlife viewing where feasible.
6. Maintain boating access to prime areas.
7. Construct portage facilities.
8. Construct boat locks.
9. Provide public information regarding alternate access.

10. Avoid construction during peak-use seasons and times.
11. Post warning signs and buoys in channels.
12. Provide in-kind recreation facilities.
13. Maintain reservoir levels as high as feasible during the recreation season, given regulatory and other operational constraints.
14. Minimize water level fluctuation and establish minimum pool levels.
15. Coordinate operation of all reservoir facilities to minimize adverse reservoir fluctuations in any particular facility consistent with regulatory and other operational constraints.
16. Purchase trail rights-of-way or recreational easements.
17. Provide or improve vehicle access and parking for recreation areas.
18. Provide access to waterfront areas and island edges.
19. Create new day-use boating and camping areas.
20. Relocate or construct new recreation facilities and infrastructure.

7.8 Flood Control. Implementation of the Preferred Program Alternative may have potentially significant effects on flood control. These effects may include: (1) Effects on levee stability from levee and berm vegetation management practices for habitat purposes; (2) Reduced levee stability from habitat restoration using conservation easements along riparian corridors; (3) Increased seepage on adjacent islands, possibly leading to flooding from seepage-induced failure from shallow flooding of Delta islands susceptible to subsidence; (4) Increases in wind-fetched and wave erosion on landside levee slopes from island flooding; (5) Increased levels of flooding downstream of diversions after removal of diversion structures and other obstructions to flow in the Sacramento River tributaries; (6) Increased flood stages along small streams due to increases in the roughness of the stream channel from vegetation on stream banks; (7) Levee slumping and cracking caused by groundwater overdraft and subsidence; and (8) Increased stage upstream of and possible decreased stage downstream from gate structures located in channels that reduce the channel's flood flow conveyance.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on flood control:

1. Allow reasonable clearing of deep-rooted trees and shrubs from levee side slopes to support inspection, maintenance, repair, and emergency response, while preserving habitat values.
2. Permit clearing of deep-rooted shrubs and trees on levee side slopes. Trees and shrubs should be allowed to grow only on adjacent berms. If roots penetrate levees, fill materials should be added to levee landside slopes in order to construct a partial setback levee and increase stability.
3. Widen streams downstream of removed water diversion structure to increase conveyance capacity.
4. Incorporate flood control criteria into the design of stream bank revegetation projects. For example, by increasing the width of vegetated sections to maintain conveyance capacity, the net effect of vegetation on flood control would be negligible.
5. Identify locations susceptible to seepage-induced failure on Delta islands that may be intentionally flooded for habitat.

6. Implement a seepage monitoring program on nonflooded islands adjacent to potential shallow-flooded islands.
7. Develop seepage control performance standards to be used during island flooding and storage periods to determine net seepage caused by shallow flooding.
8. Improve levees to withstand expected hydraulic stresses and seepage.
9. Design erosion protection measures to minimize or eliminate wave splash and run-up erosion.
10. Use rip rap or another suitable means of slope protection to dissipate wave force.
11. Construct large wind/wave breaks in the flooded islands to reduce wind-fetch and erosion potential.
12. Identify existing or planned wells that could affect groundwater and substrate conditions underlying nearby levees or flood control devices.
13. Provide incentives to terminate use of wells that can adversely affect levee stability, reduce their pumping volume to safe withdrawal levels as they affect substrate stability, or otherwise replace them with sources that could not affect levee stability.
14. Design structures to minimize the loss of channel conveyance at gate structures located in channels.
15. Install relief wells near the toes of existing levees on neighboring lands.
16. Construct toe berms with an internal drainage system on neighboring lands.
17. Lower the pool elevation on the storage islands.
18. Develop wetland easements adjacent to levees on neighboring islands.
19. Construct a combination of seep and interior ditches and increase pumping rates, install clay blankets, and install impervious cutoff walls through storage island levees.
20. Control boat traffic in order to reduce boat wakes to levels that will not cause levee or bank erosion.
21. Coordinate erosion protection measures and wave force dissipation measures with the Ecosystem Restoration Program to minimize adverse effects to revegetation efforts.
22. Implement flood management measures including dredging, levee maintenance, and snag removal.
23. Support local groundwater management that reduces overdraft and third-party effects, including reduction or discontinuation of groundwater pumping..
24. Support local agencies in distributing groundwater pumping over a wide region rather than to a concentrated area to minimize drawdown of the aquifer.

7.11 Cultural Resources. Implementation of the Preferred Program Alternative may have potentially significant effects on cultural resources. These effects may include: (1) Effects on cultural resources from construction, excavation, fill and flooding; and (2) Alteration of the historic setting of a cultural resource.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on cultural resources:

1. Conduct cultural resource inventories.
2. Avoid sites through project redesign.
3. Map sites prior to undertaking actions that affect cultural resources.

4. Conduct surface collections.
5. Perform test excavations.
6. Probe for potentially buried sites.
7. Prepare reports to document mitigation work.
8. Conduct full-scale excavation of sites slated for destruction as a result of projects.
9. Prepare public interpretive documents.
10. Document historic structures by preparing Historic Engineering Records or Historic American Building Surveys.
11. Conduct ethnographic studies for traditional cultural properties.

7.12 Public Health and Environmental Hazards. Implementation of the Preferred Program Alternative may have potentially significant effects on public health and environmental hazards. These effects may include: (1) Short- and long-term increases in mosquito breeding habitat from wetland restoration activities and fluctuating water levels; (2) Increased risk of groundwater and surface water contamination from naturally occurring or spilled hazardous materials and from improper handling of hazardous materials; (3) Increased exposure to hazardous materials and waste from construction activities related to storage and conveyance projects and other Program elements; (4) Increases in water quality degradation, resuspension of contaminants, and exposure to hazardous materials from dredging activities; and (5) Increases in levels of methyl mercury released into the Bay-Delta ecosystem from wetland restoration, levee rehabilitation activities and conveyance actions.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on public health and environmental hazards:

1. Use various mosquito control methods, such as biological agents, chemical agents, and ecological manipulation of mosquito breeding habitat.
2. Support actions to establish or find funding for mosquito abatement activities.
3. Remove or disturb water that remains stagnant for more than 3 days at a construction site.
4. Limit construction to cool weather, when mosquito production is lowest.
5. Limit construction to periods of low precipitation to avoid pools of standing water.
6. Follow established and proper procedures and regulations for identifying, removing and disposing of contaminated materials.
7. Increase monitoring activities to ensure that groundwater pumping equipment is operating to existing standards.
8. Limit or coordinate construction activities to favorable weather conditions to forestall dispersing hazardous materials.
9. Conduct core sampling and analysis of proposed dredge areas and engineer solutions to avoid or prevent environmental exposure to toxic substances after dredging.
10. Modify engineering plans to minimize mercury related problems.
11. Cap exposed toxic sediments with clean clay/silt and protective gravel.
12. Locate constructed shallow-water habitat away from sources of mercury until methods for reducing mercury in water and sediment are implemented.
13. Use cofferdams to construct levees and channel modifications in isolation from existing waterways.

14. Use sediment curtains to contain turbidity plumes during dredging.

7.13 Visual Resources. Implementation of the Preferred Program Alternative may have potentially significant effects on visual resources. These effects may include: (1) Long-term visual effects of new facilities or modified existing facilities; (2) Effects in visually sensitive areas from restoration actions; (3) Degraded watershed views from such actions as erosion control and fire management practices; (4) Creation of borrow pits or spoils material disposal sites associated with storage, conveyance, levee projects, and other Program actions; and (5) Long-term visual effects from construction activities extending more than 5 years.

The following mitigation measures will reduce potential effects of implementation of the Preferred Program Alternative on visual resources:

1. Time changes in flow regimes to minimize "bathtub ring" effects during times of peak recreation use.
2. Minimize construction activities during the peak-use recreation season.
3. Avoid unnecessary ground disturbance outside the necessary construction area.
4. Water areas where dust is generated, particularly along unpaved haul routes and during earth-moving activities, to reduce visual effects caused by dust.
5. Locate and direct exterior lighting for construction activities so that it is concealed to the extent practicable when viewed from local roads, nearby communities, and any recreation areas.
6. Site proposed reservoir(s), if possible, to minimize required cut and fill and locate the reservoir on the flattest topographic section of the site to minimize its visibility.
7. Construct facilities with earth-tone building materials or other visually aesthetic design materials.
8. Revegetate disturbed areas as soon as possible after construction.
9. Locate visually obtrusive features, such as burrow pits and dredged material disposal sites, outside visually sensitive areas and observation sites.
10. Select vegetation type, placement, and density to be compatible with patterns of existing vegetation where revegetation occurs in natural areas. Vegetation such as emergent marsh grasses that can tolerate periodic flooding and drying may be useful.
11. Install landscape screening, such as grouped plantings of trees and tall shrubs, to screen proposed facilities from nearby sensitive viewers.
12. Use native trees, bushes, shrubs, and ground-cover for landscaping, when appropriate, at facilities such as dams and pumping-generating plants, and along new and expanded canals and conveyance channels, in a manner that does not compromise facility safety and access.
13. Create view opportunities of outstanding features through selective vegetation reduction or constructing roadside viewing areas.
14. Recontour and add vegetation to areas rated as "poor" in variety class.