

# APPENDIX K

---

*CALFED Bay-Delta Program  
Appendices - Phase 1 Summary Report*

**DRAFT** June 21, 1996

## 31 PRELIMINARY ALTERNATIVES

Ninety-six preliminary alternatives were developed using various approaches for combining actions to address the four primary conflicts in the Bay-Delta system. These consist of core actions supplemented by actions targeted at resolving one of the four major conflicts. Because each is targeted at one of the major conflicts, the preliminary alternatives were not likely to be stand-alone alternatives that accomplish all the primary objectives and resolve the four conflicts. Instead, they provided insight about the best ways to combine approaches into alternatives that do meet the objectives of the CALFED Bay-Delta Program.

Based on a preliminary assessment of the 96 preliminary alternatives, 31 were selected as best meeting the program objectives. These 31 were then used in the next step to develop 20 "balanced" alternatives addressing all Program objectives.

The following 31 preliminary alternatives were selected for use in combining into additional alternatives.

## Preliminary Alternative EQ-332

*Group*

*Title*

**ECOSYSTEM QUALITY**

**Enhance Fish Production**

Increase populations of anadromous and Bay-Delta native fish through habitat improvements and hatchery production.

### Key Actions

***Hatcheries improvement***—Expand hatcheries to maximize production of salmon and steelhead in Sacramento and San Joaquin river basins; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch. Also improve hatchery operations to improve genetics and limit effects on wild salmon and steelhead populations to the maximum extent possible.

***Habitat restoration, upstream***—Restore riverine, riparian, wetland, and adjacent terrestrial habitat to restore fish spawning, rearing, feeding habitats, and improve fish survival.

***Channel and floodway habitat improvement***—Expand floodway habitat, channels, and meander belts in the Bay-Delta and in rivers and tributaries upstream of the Delta to restore fish spawning, rearing, feeding habitats, and improve fish survival.

***Habitat management***—Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations.

***Introduced/nuisance species***—Reduce the numbers of nuisance species from key habitat and modify habitat to limit introduced/nuisance species.

***Reservoir operations modification***—Change reservoir operations and Delta inflow patterns to benefit fish habitat and production.

### Supporting Actions

***Fisheries management***—Tag/mark all hatchery fish to assess role of hatchery produced fish and to focus harvest on hatchery fish.

***Fish passage improvements***—Improve passage of anadromous fish at all feasible small dams and other barriers in the Sacramento and San Joaquin rivers and their tributaries.

***Drainage, mine remediation***—Remediate discharges from abandoned mines in tributaries of the upper Sacramento River below Shasta Dam to the maximum extent reasonably possible.

***Instream flow timing***—Provide pulse flows for fish passage and attraction to the maximum extent reasonably possible.

***Diversion, reduction upstream***—Reduce diversions upstream of the Delta during critical periods of fish presence or migration.

## Preliminary Alternative EQ-340

<i>Group</i>	<i>Title</i>
<b>ECOSYSTEM QUALITY</b>	<b>Maximum Fish Populations</b>

Increase populations of anadromous and Bay-Delta native fish through habitat improvements, reduced diversions, isolated diversion facilities, improved water quality, improved water management, improved agricultural practices, and hatchery production.

### Key Actions

***Habitat restoration upstream***—Restore riverine, riparian, wetland, and adjacent terrestrial habitat to restore fish spawning, rearing, feeding, migrating habitats and improve fish survival.

***Channel and floodway habitat improvement***—Expand floodway habitat, channels, and meander belts in the Bay-Delta and in upstream rivers and tributaries to restore fish spawning, rearing, feeding, migrating habitats, and improve fish survival. Modify floodway drainage to reduce fish stranding.

***Conveyance facility, east side***—Develop an isolated Delta conveyance facility around the east side of the Delta to reduce diversion impacts and restore Delta habitat conditions.

***Conveyance facility, Sacramento Valley***—Construct isolated conveyance facilities on the east and west sides of the Sacramento Valley to remove diversions from the Sacramento River and its tributaries.

***Conveyance facility, San Joaquin Valley***—Construct isolated conveyance facilities on the east and west sides of the San Joaquin Valley to remove diversions from the San Joaquin River and its tributaries.

***Storage, Sacramento Valley, upstream***—Expand off-stream storage upstream of the Delta in the Sacramento Valley. Additional storage would increase the yield of the Sacramento Valley and provide additional water for fish protections and protection.

***Storage, in-Delta***—Expand storage within the Delta in the Sacramento Valley. Additional storage would increase the yield from the Delta and provide additional water for fish protections and protection.

***Habitat management***—Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations.

***Introduced/nuisance species***—Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

***Hatcheries improvement***—Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch. Improve hatchery operations to maximize production, improve genetics, and limit effects on wild salmon and steelhead populations to the maximum extent possible.

***Reservoir operations modification***—Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

***Instream flow acquisition***—Acquire flows to improve instream flows.

***Fish screens***—Improve existing screens and install additional screens to reduce the effects of diversions.

## Supporting Actions

***Fisheries management***—Tag/mark all hatchery fish to assess role of hatchery produced fish and to focus harvest on hatchery fish.

***Fish passage improvements***—Improve passage for anadromous fish at all feasible small dams and other barriers in the Sacramento and San Joaquin rivers and their tributaries.

***Instream flows timing***—Provide flows for fish passage and attraction to the maximum extent reasonably possible.

***Levee maintenance and stabilization***—Protect levees from catastrophic failure to preserve Delta habitat conditions and minimize loss of fish and invertebrates to flooded islands.

***Pollutant discharge management***—Reduce pollutant inputs from agricultural and mine drainage, dredging, and urban and wastewater discharges.

*Long-term planning for drought contingencies*—Provide institutional mechanisms for long-term planning and water management for drought contingencies and for developing alternate supplies for drought situations.

## Preliminary Alternative EQ-341

Group

Title

ECOSYSTEM QUALITY

Maximize Native Fish Production

Increase production of native anadromous and Bay-Delta resident fish through maximum reasonable levels of habitat improvements, modification of diversion patterns, improved water quality, improved water management, improved agricultural practices, and supportive hatchery activities.

### Key Actions

*Habitat restoration, upstream*—Restore riverine, riparian, wetland, and adjacent terrestrial habitat to restore fish spawning, rearing, feeding, and migrating habitats and improve fish survival.

*Channel and floodway habitat restoration*—Expand floodway habitat, channels, and meander belts in the Bay-Delta and in upstream rivers and tributaries to restore fish spawning, rearing, feeding, and migrating habitats and improve fish survival. Modify floodway drainage to reduce fish stranding.

*Habitat management*—Establish comprehensive and integrated habitat management programs to maximize benefits to fish populations, and improve floodway drainage to reduce fish stranding.

*Introduced/nuisance specie*—Reduce the numbers of nuisance and predator species from key habitats and export facilities, and modify habitat to limit introduced/nuisance species.

*Hatcheries improvements*—Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin to develop new self-sustaining wild runs; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch to restore stocks to self-sufficient levels. Improve hatchery operations to maximize production, improve genetics, and limit effects on wild salmon and steelhead populations to the maximum extent possible.

*Reservoir operations modifications*—Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

**Diversion capacity increase**—Increase the diversion capacity of the Delta export facilities to increase diversions during less sensitive fish periods and decrease diversions during more sensitive periods.

**Fish screens**—Improve existing fish screens and install additional fish screens to reduce diversion impacts.

**Supporting Actions**

**Fisheries management**—Tag/mark all hatchery fish to assess role of hatchery produced fish and to focus harvest on hatchery fish.

**Fish passage improvements**—Improve passage of anadromous fish at all feasible small dams and other barriers in the Sacramento and San Joaquin rivers and their tributaries.

**Instream flow timing**—Provide flows for fish passage and attraction to the maximum extent reasonably possible.

**Levee maintenance and stabilization**—Protect levees from catastrophic failure to preserve Delta habitat conditions and minimize loss of fish and invertebrates to flooded islands.

**Pollutant discharge reduction**—Reduce pollutant inputs from agricultural and mine drainage, dredging, and urban and wastewater discharges.

**Instream flow acquisition**—Improve water supply for fish by acquiring water supply for fish.

**Long-term planning for drought contingencies**—Institute mechanisms for long-term water management for drought contingencies and for developing alternate drought supplies.

**Alternative EQ-342**

*Group*

*Title*

**ECOSYSTEM QUALITY**

**Maximize Bay-Delta Fish Populations**

Increase populations of Bay-Delta native fish through habitat improvements, reduced diversions, isolated diversion facilities, improved water quality, improved water management, improved agricultural practices, and hatchery production.

**Key Actions**

**Upstream habitat restoration**—Restore riverine, riparian, wetland, and adjacent terrestrial habitat to restore fish spawning, rearing, feeding, migrating habitats and improve fish survival.

**Improve floodway habitat**—Expand floodway habitat, channels, and meander belts in the Bay-Delta to restore fish spawning, rearing, feeding, migrating habitats and improve fish survival.

**Constructed isolated conveyance facility**—Construct an isolated conveyance facility through the Delta to restore Delta habitat conditions and reduce effects of diversions.

**Integrated habitat management**—Establish comprehensive and integrated habitat management programs to maximize benefits of key and supporting actions in this alternative to protect and enhance fish populations.

**Control introduced/nuisance species**—Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

**Hatchery management**—Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch.

**Modify reservoir operations**—Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

**Increase diversions capacity**—Increase diversion capacity to allow less diversion during key periods.

**Acquire instream flows**—Acquire water supplies for fish to improve instream flows.

**Fish Screens**—Improve existing screens, install new screens, and enforce screening requirements to reduce the effects of diversions on fish populations.

## Supporting Actions

**Fisheries management**—Tag/mark all hatchery fish to assess role of hatchery produced fish and to focus harvest on hatchery fish.

**Pulses flows**—Provide flows for fish passage and attraction to the maximum extent reasonably possible.

**Levee maintenance and stabilization**—Protect levees from catastrophic failure to preserve Delta habitat conditions and minimize loss of fish and invertebrates to flooded islands.

**Reduce pollutant discharges**—Reduce pollutant inputs from agricultural and mine drainage, dredging, and urban and wastewater discharges.

**Additional storage upstream of the Delta**—Acquire additional water supply for fish by acquiring water supply for fish through development of new off-stream storage upstream of the Delta.

**Through-Delta conveyance and storage facility**—Provide in-Delta storage on Delta islands combined with a cross-Delta conveyance system to improve water supply reliability.

**Long-term management for drought contingencies**—Provide institutional mechanisms for long-term water management and development of alternative supplies for drought situations.

## Alternative EQ-343

<i>Group</i>	<i>Title</i>
<b>ECOSYSTEM QUALITY</b>	<b>Modest Enhancement of Native Fish Populations</b>

Increase populations of native anadromous and Bay-Delta resident fish through modest levels of habitat improvements, reduced diversions, isolated diversion facilities, improved water quality, improved water management, improved agricultural practices, and supportive hatchery activities.

## Key Actions

**Upstream habitat restoration**—Restore riverine, riparian, wetland, and adjacent terrestrial habitat to restore fish spawning, rearing, feeding, migrating habitats, and fish survival.

**Improve floodway habitat**—Expand floodway habitat, channels, and meander belts in the Bay-Delta and upstream in rivers and tributaries to improve fish spawning, rearing, feeding, migrating habitats, and fish survival. Also improve floodway drainage to reduce fish stranding.

**Consolidate diversions**—Construct isolated diversion facilities in the Delta and Sacramento and San Joaquin Valleys isolate diversions and restore Delta habitat conditions.

**Integrated habitat management**—Establish comprehensive and integrated habitat management programs to maximize benefits of key and supporting actions in this alternative to protect and enhance fish populations.

**Control introduced/nuisance species**—Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

**Hatcheries management**—Expand hatchery production of salmon and steelhead in Sacramento and San Joaquin river basin; construct hatchery facilities for delta smelt, sturgeon, and perhaps Sacramento perch.

**Modify reservoir operations**—Change reservoir operations and Delta inflow and export patterns to benefit fish habitat and production.

**Increase diversion capacity**—Increase diversion capacity to allow less diversion during key periods.

**Acquire instream flows**—Acquire water supplies for fish to improve instream flows.

**Fish screens**—Improve existing screens, install new screens, and enforce screening requirements to reduce the effects of diversions on fish populations.

## Supporting Actions

**Fisheries management**—Tag/mark all hatchery fish to assess role of hatchery produced fish and to focus harvest on hatchery fish.

**Improve hatcheries**—Improve hatchery operations to maximize production, improve genetics, and limit effects on wild salmon and steelhead populations to the maximum extent possible.

**Improve fish passage**—Improve passage for anadromous fish at all feasible small dams and other barriers in the Sacramento and San Joaquin rivers and their tributaries.

**Pulse flows**—Provide flows for fish passage and attraction to the maximum extent reasonably possible.

**Levee maintenance and stabilization**—Protect levees from catastrophic failure to preserve Delta habitat conditions and minimize loss of fish and invertebrates to flooded islands.

**Reduce pollutant discharges**—Reduce pollutant inputs from agricultural and mine drainage, dredging, and urban and wastewater discharges.

**Additional storage upstream of the Delta**—Improve water supply for fish acquiring additional water supply by constructing new off-stream storage upstream of the Delta.

**Through-Delta conveyance and storage facility**—Provide in-Delta storage on Delta islands combined with a cross-Delta conveyance system to improve water supply reliability.

**Long-term management for drought contingencies**—Provide institutional mechanisms for long-term water management and development of alternate supplies for drought situations,

### Alternative EQ-344

Group

Title

**ECOSYSTEM QUALITY**

**Maximum Diversion Impacts Reduction**

Reduce direct and indirect impacts of upstream and in-Delta diversions using operations and management strategies, fish screens, barriers, diversion consolidations, and water quality improvements while maintaining or augmenting water supply delivery capacity.

#### Key Actions

**Modify reservoir operations**—Operate Sacramento and San Joaquin reservoirs to provide increased instream flows, reduced stranding, and reduced temperatures.

**Delta inflow management**—Create a Delta watermaster's office to manage inflows, central channel operations, and outflow and export operations.

**Consolidate diversions and modify timing**—Consolidate and relocate all diversions to less sensitive environmental areas, with improved designs to reduce potential entrainment. Adjust the timing for in-Delta and Montezuma Salinity Control Gates diversions, and relocate Delta pumping plants away from key habitat.

**Fish screens**—Improve fish screen mesh sizes and protection performance, and install more fish screens.

**Install barriers to guide fish movement**—Install barriers to keep upstream migrants in the Sacramento River, and to block fish movement into Old River. Construct barriers diverting out migrants from the Sacramento River directly into western Delta channels to minimize their vulnerability to either existing or relocated export pumps.

*Install barriers to control salinity*—Install salinity control barriers to improve water quality in the Delta.

*Increase rates of diversion capacity*—Obtain approvals to enlarge and fully utilize export and conveyance capacities during less environmentally sensitive times.

**Supporting Actions**

*Control predators*—Harvest predators at Delta and upstream diversions, holding areas, or other environmentally sensitive areas in the Sacramento and San Joaquin systems.

*Manage agricultural drainage*—Impose in-Delta and upstream cropping and irrigation practices to increase the effectiveness of chemical applications to reduce non-point source leaching volumes and concentrations. Improve drainage timing for dilution during high flow periods to reduce instream impacts. Treat point source drainage to remove pollutants, and set pollutant load limits in the San Joaquin and Sacramento Rivers. Toxic discharges from industrial plants would be prevented using stronger enforcement, especially during environmentally sensitive periods.

*Restore shallow habitat*—Shallow water habitat would be reconstructed to compensate for historic losses that have reduced accessible spawning and rearing habitat for Delta native species.

**Preliminary Alternative EQ-345**

<i>Group</i>	<i>Title</i>
<b>ECOSYSTEM QUALITY</b>	<b>Optimize Ecosystem Health</b>

Optimize ecosystem health through improvements in water quality, habitat, water conservation, and flows throughout the basin.

**Key Actions**

*Upstream habitat restoration*—Improve riverine, riparian, wetland, and adjacent terrestrial habitats to restore and enhance fish spawning, rearing, and migratory habitats on mainstem and tributary waterways upstream of the Delta.

*Delta habitat restoration*—Improve riverine, riparian, wetland, and adjacent terrestrial habitats to restore and enhance aquatic and terrestrial ecosystems within the Delta.

*Improve floodway habitat*—Improve floodway drainage to reduce fish stranding.

**Improve instream flow timing**—Modify instream flows to emulate the natural flows of the system.

**Isolated Delta conveyance facility**—Construct a small isolated export diversion facility to reduce diversion impacts.

**Comprehensive and integrated habitat management**—Develop comprehensive and integrated habitat management programs to maximize benefits to fish populations.

**Control introduced/nuisance/predator species**—Reduce the numbers of nuisance and predator species from key habitat and modify habitat to limit introduced/nuisance species.

**Manage agricultural drainage**—Reduce pollutant discharges from agricultural sources.

**Remediate mine drainage**—Reduce mine discharges into the Bay-Delta system.

**Manage urban drainage**—Reduce the quantity of or improve the quality of urban and industrial wastewater discharges.

**Conservation**—Reduce demands for water in and out of basin by promoting water conservation, land retirement and fallowing, water pricing reforms, groundwater banking and conjunctive use, and institutional changes in water management.

**Modify reservoir operations**—Modify the reservoir operations of upstream reservoirs and Delta inflow and export patterns to benefit fish habitat and production and water quality.

**Modify diversion timing**—Modify export diversion patterns to reduce the diversions during key fish migration periods.

**Increase diversion capacity**—Increase diversion capacity of the SWP and CVP export facilities to increase the volumes of diversions during periods of reduced fish presence.

**Acquire instream flows**—Acquire water to improve instream flows for fish production and habitat, as well as to improve water quality.

## Supporting Actions

**Fisheries management**—Tag/mark all hatchery fish to assess role of hatchery produced fish and to focus harvest on hatchery fish.

**Fish passage improvement**—Improve passage of anadromous fish at all feasible small dams and other barriers in the Sacramento and San Joaquin rivers and their tributaries.

*Flow pulses*—Provide flows for fish passage and attraction.

*Long-term planning for drought contingencies*—Develop alternate supplies for drought situations and provide institutional mechanisms for long-term water management; promote water conservation and reclamation to insure water supplies for environmental uses during drought conditions.

## Preliminary Alternative EQ-346

<i>Group</i>	<i>Title</i>
<b>ECOSYSTEM QUALITY</b>	<b>Isolate/Reduce Diversion Impacts</b>

Construct an isolated Delta facility and coordinate with strategic releases and barrier operations to increase Delta fisheries without reducing export supply capacity.

### Key Actions

*Construct an isolated conveyance facility*—Construct an east side isolated conveyance facility to avoid diversion impacts to fish. Dedicate capacity as feasible to consolidate in-Delta agriculture diversions to further reduce impacts.

*Fish screens*—Install fish screens or barriers at environmentally sensitive small diversions and at all larger diversions. Emphasize screening locations posing the greatest hazards to candidate and listed species, either in-Delta or upstream of the Delta. Improve fish screen mesh sizes and protection performance to increase the effectiveness of screening.

*Increase rates of diversion capacity*—Obtain approvals to enlarge and fully utilize existing export capacity during less environmentally sensitive times.

*Manage delta inflow*—Coordinate water temperature and pulse flow releases to encourage the movement of various species to target locations. Schedule enhanced pulse flow releases and modified export operations using extensive adaptive management. Assure positive flow with appropriate salinity gradients for improved ecosystem health.

### Supporting Actions

*Restore instream flow timing*—Manage instream flows and temperatures in upstream habitats using both timed releases (above) and restored channel configurations and shoreline habitat to provide enhanced velocity relationships and shading.

*Improve riparian habitat*—Restrict livestock grazing in riparian corridors, and revegetate degraded riparian habitats.

*Changes in locations of diversions*—Relocate upstream diversions from key rearing habitats.

## Preliminary Alternative EQ-347

<i>Group</i>	<i>Title</i>
<b>ECOSYSTEM QUALITY</b>	<b>Improved Flows, Habitat, Quality, and Stability</b>

Maximize Delta inflows and in-Delta and upstream aquatic, riparian, and wetland habitat improvements, water quality, and levee stability to benefit fish populations without new in-water construction, conveyance, or other major infrastructure modifications.

### Key Actions

*Modify reservoir operations*—Reoperate Sacramento and San Joaquin reservoirs to provide increased instream flows, reduced stranding, and reduced temperatures.

*Manage in-Delta diversions*—Adjust the timing of in-Delta and Montezuma Salinity Control Gates diversions to optimize control of the 2ppt isohaline and low-salinity habitat zone.

*Delta inflow management*—Create a Delta water master's office to manage inflows, central channel operations, and outflow and export operations.

*Improve flooding and seismic protections*—Reconstruct levees to higher design and seismic standards, and relocate unstable levees to more stable sites to provide a high degree of system reliability.

### Supporting Actions

*Delta habitat restoration*—Restore tidal action to existing diked wetlands and reconstruct levees to include shallow water habitat. Fill deep water to produce shallow habitat, reconstruct river banks and shallow areas, restore natural channel configurations, and convert agricultural lands to wetlands.

*Integrated resource planning*—Aggressively implement integrated habitat management programs to ensure coordinated implementation of the key and supporting actions of this alternative.

**Improve floodway habitat**—Establish floodways and meander belts, relocate levees to widen floodways, allow river channels to meander, acquire Delta islands as overflow areas, floodways as habitat corridors, and improve floodway drainage to reduce fish stranding.

**Control introduced/nuisance species**—Control introduced species by removing or reducing nuisance species in key habitats, increased regulation of ballast-water releases, improved border inspection practices, and habitat modifications to encourage native species populations.

**Upstream habitat restoration**—Restore and replenish spawning gravels and restore channel configurations and shoreline habitat condition to improve aquatic habitat conditions. Modify gravel mining practices to minimize disruption to benthic populations and reduce sedimentation.

**Improve fish passage**—Improve passage conditions at upstream dams/other barriers, including natural barrier removal.

**Improve riparian habitat**—Restore upstream riparian habitat by restricting livestock grazing in riparian corridors and revegetating degraded riparian habitats. Protect riparian lands through purchase/easements, and restore flows to dewatered riparian habitats.

**Improve wetland habitat**—Restore upstream wetland habitat by modifying floodways to support wetland habitats, reusing agricultural drainage and wastewater effluent to create wetlands, and managing groundwater recharge for wetland habitat.

**Acquire water for fish and wildlife**—Acquire water for refuge habitat use, and obtain shifts in diversion timing patterns to maximize benefits to aquatic and riparian terrestrial habitat.

**Water Supply Enhancement**—Manage Sacramento and San Joaquin Valley system tributary watersheds vegetation cover to increase yield, and modify water law to establish instream rights.

## Preliminary Alternative EQ-348

<i>Group</i>	<i>Title</i>
<b>ECOSYSTEM QUALITY</b>	<b>Improved Operations, Conveyance, and Storage</b>

Improve fish populations by emphasizing operational releases, construction of a small east-side transfer facility, and expanded off-stream storage to increase flexibility in providing water for Delta and anadromous species.

### Key Actions

**Modify reservoir operations**—Operate upstream reservoirs for increased instream flows, and reduced temperatures to improve habitat conditions.

**Delta inflow management**—Create a Delta watermaster's office to manage Delta inflows, central channel operations, and outflows and export operations.

**Delta conveyance facility**—Construct small east-side isolated transfer facility for balanced inflow and conveyance benefits.

**Expand off-stream storage**—Develop additional off-stream storage to increase the reliability of supplies for fish protection.

**Increase east side channel capacity**—Increase flows from the Sacramento River to the central Delta by increasing the capacities of existing east-side Delta channels and modifying Delta levees to increase flow cross-sections for more effective movement of water.

**Improve flooding and seismic protections**—Reconstruct levees to higher design and seismic standards to protect water quality for Delta and migratory species.

## Supporting Actions

**Delta and upstream habitat restoration**—Protect riparian lands using purchases and easements, and convert agricultural lands to wetlands where feasible. Reuse agricultural drainage and wastewater effluent to create new wetlands. Clean up sites containing toxic substances and implement pollutant-load limits in the San Joaquin River.

**Establish conjunctive use programs**—Establish conjunctive use programs, and provide incentives for users to shift reliance from surface water to ground water to reduce competition for surface water supplies which could be used for fish protection and habitat enhancement purposes.

**Water marketing and transfers**—Modify California Water Code to ease the implementation and permitting procedures for water transfers, and establish a brokerage for transfers.

**Long-term planning for drought contingencies**—Develop long-term drought contingency plans by increasing water storage capacities at user locations.

## Preliminary Alternative WQ-118

*Group*

*Title*

**WATER QUALITY/LAND USE**

**Diluting Pollutants and  
Creating New Habitat**

Improve water quality by diluting pollutants with stored water and water from reduced diversions and create habitat by converting existing land uses into habitat areas.

### Key Actions

***Restore shallow water habitat***—Create new areas of shallow water habitat in the Delta by subjecting existing leveed lands to tidal action and restoring tidal action to existing diked wetlands.

***Restore upstream habitat***—Create a mosaic of habitat types upstream of the Delta at the minimum level of implementation.

***Increase dilution flows***—Use a variety of actions, including land fallowing and retirement, acquisition of water for instream flows, timing of water transfers, and expand use of desalination in San Joaquin Valley and southern California to reallocate water supplies to be used for dilution.

***Improve levee maintenance and stability***—Improve levees to protect land uses and restored freshwater habitats.

### Supporting Actions

***Reduce water demand***—Reduce demand for Delta water by increasing agricultural, municipal, and industrial water conservation; expanding desalination in the San Joaquin Valley and southern California; reclaiming agricultural, municipal, and industrial wastewater; providing incentives to implement pricing structures to reduce demand; and fallowing and retiring farmland. The water saved by these actions would be used for dilution flows.

***Water transfers***—Facilitate water transfers to be timed to coincide with needs for dilution flows.

***Improve natural flood protection***—Enhance levee flood protection and create new habitat by allowing rivers to meander, relocating levees to create flood ways, and modifying flood ways to support wetland habitats.

## Preliminary Alternative WQ-119

*Group*

**WATER QUALITY/LAND USE**

*Title*

**Diluting Pollutants,  
Restoring Existing and Creating New Habitat**

Improve water quality by diluting pollutants with stored water and water from reduced diversions and create habitat by balancing the preservation and enhancement of existing habitats with the creation of new habitats by converting existing land uses into habitat areas.

### Key Actions

***Restore Delta shallow water habitat***—Create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing riverbanks and shallow areas, restoring/preserving channel islands, and subjecting existing leveed lands to tidal action.

***Restore Delta and upstream habitat***—Create a variety of habitat types upstream of and in the Delta, by protecting, enhancing, and creating new instream, wetland, riparian, and terrestrial habitats.

***Increase dilution flows***—Use a variety of actions, including land fallowing and retirement, acquisition of water for instream flows, timing of water transfers, and expand use of desalination in San Joaquin Valley and southern California, to reallocate water supplies to be used for dilution.

***Improve levee maintenance and stability***—Improve levees to protect land uses and restored freshwater habitats.

### Supporting Actions

***Increase instream flows***—Habitat restoration is complemented with the acquisition of water for instream flows, the management of reservoirs for flows and temperature, and the restoration of flows to dewatered riparian areas. The restoration and replenishment of spawning gravel also contributes to habitat enhancement. The timing of flows would be balanced to provide instream habitat and water quality benefits.

***Restore Riparian and wetland habitat***—Restoration of upstream and Delta riparian and wetland habitat would be undertaken to provide better water quality and greater ecosystem benefits.

**Conservation and reclamation**—Increasing water conservation and reclamation would allow water to be reallocated from use in agricultural, municipal, and industrial purposes to use instream for water quality purposes.

**Remediate mine drainage**—Give urban areas flexibility to fund high-priority mine cleanup.

## Preliminary Alternative WQ-120

Group

**WATER QUALITY/LAND USE**

Title

**Construct Delta Water Quality  
Facilities and Restore Existing Habitat**

Improve Delta water quality primarily by modifying or constructing Delta physical facilities, and create habitat by restoring and enhancing existing habitat areas.

### Key Actions

**Restore Delta shallow water habitat**—Create new shallow water habitat by adding submerged berms to existing levees, filling selected deep areas, and reconstructing riverbanks to resemble their natural cross-sections.

**Restore Delta and upstream habitat**—Restore wetlands and other habitat elements in flood ways to form ecological corridors. Protect and improve existing riparian lands for habitat and water quality, utilizing easements and purchase options.

**Relocate Delta diversions**—Reduce effects of diversions on Bay-Delta aquatic habitat quantity and quality by relocating in-Delta diversions.

**Consolidate diversions and modify timing**—Reduce the number of diversions and alter their timing to increase the quantities of instream flow available for habitat and dilution of contaminants, and improve fish screens. This affords flexibility to manage Delta inflows and exports to improve water quality for ecosystem and export needs.

**Install barriers**—South Delta water quality is improved by the installation of tide gates, barriers, and salinity control structures (e.g., sills or weirs).

**Construct through-Delta conveyance facility**—In-Delta and export water quality is improved by the construction of a through-Delta conveyance system.

**Manage agricultural drainage**—Selected agricultural water quality management measures, such as those directed at drainage volume control, can reduce agricultural demands and increase in-

Delta flows. Exporting agricultural drainage from the San Joaquin Valley to the least sensitive locations in the ocean or salt sinks will greatly reduce water quality problems in the San Joaquin River and southern Delta while minimizing impairment of agricultural lands and resultant losses in production.

## Supporting Actions

**Encourage groundwater banking and conjunctive use**—Expanding conjunctive use programs will increase water supplies and increase flexibility in the timing of diversions and exports.

**Increase reservoir storage**—Expanding existing reservoir storage will increase water supplies and increase flexibility in the timing of diversions and exports.

**Improve island and levee maintenance and stabilization**—Islands are stabilized primarily by large-scale filling of the lowest areas with a suitable blend of inorganic soil and compost or clean dredged materials to restore interior elevations to near mean sea level. The protection of Delta levees will be oriented toward protecting the through-Delta conveyance system.

## Preliminary Alternative WQ-121

<i>Group</i>	<i>Title</i>
<b>WATER QUALITY/LAND USE</b>	<b>Construct Delta Water Quality Facilities, Create New Habitat</b>

Enhance water quality, primarily by modifying or constructing Delta physical facilities, and create new habitat by converting land currently used for economic purposes to habitat areas.

## Key Actions

**Restore shallow water habitat**—Create new shallow water habitat by converting western Delta islands and diked wetlands into tidal wetlands (while improving or protecting existing levees). Aquatic habitat would also be constructed as part of the Delta water conveyance facilities.

**Restore wetland and riparian habitat**—Restore Delta wetlands and riparian habitats by acquiring lands or easements, ensuring adequate water availability (including treated wastewater), and replanting native species.

**Construct a through-Delta conveyance facility**—Delta islands would be converted to a storage and conveyance system extending from the northern diversion to the export pumps. The flooded islands would be connected by a series of inverted siphons with pump stations added where additional hydraulic head is needed.

**Relocate diversion facilities**—Reduce effects on Bay-Delta aquatic habitat quantity and quality by relocating in-Delta diversions. The major benefit is achieved by relocating the export diversion from the current south-Delta site, which is subject to reversal of flows directly toward

the pumps, to the north Delta or Sacramento River. Here diversions can be better timed to avoid fish migration periods, and bypass flows can be maintained past optimally designed fish screens.

**Consolidate diversions and modify timing**—Reduce effects on Bay-Delta aquatic habitat quantity and quality by reducing the number of diversions and altering their timing.

**Fish screens**—Improve or construct fish screens.

**Increase flows for water quality**—Improve export and in-Delta water quality by diverting higher quality Sacramento River water and making releases back into channels at selected Delta locations. Limited releases could be made to rapidly respond to water quality degradation in the Delta (e.g., from saltwater intrusion) at times when there would be no interference with anadromous fish migration.

**Install barriers**—South-Delta water quality would be improved by releases and by constructing tide gates, barriers, and salinity control structures (e.g., sills or weirs).

**Improve island and levee maintenance and stabilization**—Reconstruct selected high-value levees and those protecting the island transfer system to protect against erosion, seepage, overtopping, and seismic failures. Use levee setbacks wherever needed and feasible. Stabilize other islands with smaller scale levee improvements or large scale filling of the lowest areas with suitable blends of inorganic soil and compost or clean dredged materials to restore interior elevations to near mean sea level.

## Supporting Actions

**Restore Delta and upstream habitat**—Implement core actions at the maximum level to support key habitat restoration actions include protecting existing shallow water habitat, managing flows and temperatures, restoring channel configurations and spawning gravel, improving existing degraded riparian habitats, improving fish passage at upstream barriers, restoring riverine habitat on channel islands, and implementing measures to curb further introductions of potentially harmful exotic species.

**Increase reservoir storage and encourage groundwater banking and conjunctive use**—Expand existing reservoir storage and conjunctive use to increase water supplies and maximize flexibility of diversion and export timing.

## Preliminary Alternative WQ-122

Group

**WATER QUALITY/LAND USE**

Title

**Constructing Delta Water Quality Facilities,**

## Restoring Existing and Creating New Habitat

Enhance water quality primarily by modifying or constructing Delta physical facilities, and create habitat by balancing the preservation and enhancement of existing habitats with the creation of new habitats by converting land currently used for economic purposes into habitat areas.

### Key Actions

***Restore shallow water habitat***—Create new shallow water habitat by returning one or two of the most vulnerable western Delta islands to tidal wetlands. Add submerged berms to existing levees, fill selected deep areas, and reconstruct riverbanks to restore their natural cross-sectional profiles. Aquatic habitat would also be constructed as part of the Delta water conveyance facilities.

***Restore wetland and riparian habitat***—Restore wetlands and riparian habitats in floodways to form ecological corridors. Restore Delta wetlands and riparian habitats by acquiring lands or easements, ensuring adequate water availability (including treated wastewaters), and replanting native species.

***Construct an east-side conveyance facility***—Construct an isolated conveyance facility on stable mineral soils around the eastern and southeastern edges of the Delta to serve the State Water Project or combined State Water Project/Central Valley Project. Canal releases to Delta channels would require a large intake size and channel capacity. The canal segments would be connected by a series of inverted siphons beneath points of significant Delta inflows with pump stations located where additional hydraulic head is needed.

***Relocate diversion facilities***—The major benefit is achieved by relocating the project export diversions from the current south-Delta site, which is subject to reversal of flows directly toward the pumps, to the north Delta or Sacramento River, where diversions can be better timed to avoid fish migration periods and bypass flows can be maintained past optimally designed fish screens. Modify facilities and/or operations to vary remaining Delta channel flows, particularly the flow split between the Sacramento and Mokelumne systems, flows toward the pumps, and inflows into the San Joaquin River tributaries, for the purposes of avoiding entrainment, improving aquatic habitat, diluting contaminants, and displacing waters of poor quality.

***Consolidate diversions and modify timing***—Reduce effects on Bay-Delta aquatic habitat quantity and quality by reducing in-Delta diversions and altering their timing. Modify Delta and export diversions and increase export capacities to improve capabilities to maintain higher instream flows where and when needed for aquatic biota and to meet water quality requirements. Allow higher export rates when the flows are not needed for dilution.

***Fish Screens***—Improve and construct fish screens.

***Increase flows for water quality***—Improve export and in-Delta water quality by diverting higher quality Sacramento River water and making releases back into channels at selected Delta locations. Releases could be made to rapidly respond to water quality degradation in the Delta (e.g., from saltwater intrusion) at times and locations when and where there would be no interference with anadromous fish migrations.

***Install barriers***—South Delta water quality is improved by releases from the conveyance facility, tide gates, barriers, and salinity control structures (e.g., sills or weirs).

***Encourage groundwater banking and conjunctive use***—Use expanded groundwater storage actions and conjunctive use to increase water supplies and maximize flexibility of diversion and export timing.

***Develop additional storage***—Expand existing reservoir storage to accommodate additional Delta diversions and provide additional water supplies for use during dry and critical periods.

## Supporting Actions

***Restore Delta habitat***—Core actions implemented at the maximum level include protecting existing shallow water habitat, restoring riverine habitat on channel islands, and implementing measures to curb further introductions of potentially harmful exotic species.

***Restore upstream habitat***—All complementary habitat-related core actions will be implemented at maximum levels in targeted areas of potentially high value to Delta species. Examples include managing flows and temperatures, restoring channel configurations and spawning gravel, improving existing degraded riparian habitats, and improving fish passage at upstream barriers.

***Improve island and levee maintenance and stabilization***—Construct levees built to U.S. Army Corps of Engineers standards to protect the isolated facility. Reconstruct selected high-value levees and those protecting the western Delta wetlands to protect against erosion, seepage, overtopping, and seismic failures. Minimize use of levee setbacks to avoid preemption of existing land uses. Stabilize other islands with smaller scale levee improvements or large scale filling of the lowest areas with suitable blends of inorganic soil and compost, or clean dredged materials, to restore interior elevations to near mean sea level.

## Preliminary Alternative WQ-124

Group

**WATER QUALITY/LAND USE**

Title

**Managing Watersheds and**

**Creating New Habitat**

Improve water quality by managing upstream watersheds and create habitat by converting lands currently used for economic purposes into habitat areas.

**Key Actions**

*Restore Delta shallow water habitat*—Create new areas of shallow water habitat in the Delta by subjecting existing leveed lands to tidal action and restoring tidal action to existing diked wetlands.

*Restore upstream habitat*—Create a mosaic of habitat types upstream of the Delta at the minimum level of implementation.

*Watershed management*—Protect water quality by managing mine drainage and managing land uses within upstream watersheds.

*Improve levee maintenance and stabilization*—Improve levees around important economic land uses and restored freshwater habitats.

**Supporting Actions**

*Restore Delta habitat*—Create a mosaic of habitat types, including shallow water, riverine, riparian, wetland, and terrestrial, in the Delta at the minimum level of implementation.

*Improve natural flood protection*—Enhance levee flood protection and create new habitat by allowing rivers to meander, relocating levees to create flood ways, and modifying flood ways to support wetland habitats.

*Remediate mine drainage*—Give urban areas flexibility to fund high-priority mine cleanup.

**Preliminary Alternative WQ125**

*Group*

**WATER QUALITY/LAND USE**

*Title*

**Managing Watersheds and Restoring Existing and Creating New Habitat**

Improve water quality by managing upstream watersheds and create habitat by balancing the preservation and enhancement of existing habitats with the creation of new habitats through the conversion of existing land uses into habitat areas.

**Key Actions**

*Restore Delta shallow water habitat*—Create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing riverbanks and shallow areas, restoring and preserving channel islands, and subjecting existing leveed lands to tidal action.

*Restore Delta and upstream habitat*—Create a variety of habitat types upstream of and in the Delta by protecting, enhancing, and creating new instream, wetland, riparian, and terrestrial habitats.

*Watershed management*—Protect water quality by managing mine drainage and land uses within upstream watersheds.

*Improve levee maintenance and stabilization*—Improve levees around important economic land uses and restored freshwater habitats.

**Supporting Actions**

*Improve natural flood protection*—Enhance levee flood protection and create new habitat by allowing rivers to meander, relocating levees to create flood ways, and modifying flood ways to support wetland habitats.

*Remediate mine drainage*—Give urban areas flexibility to fund high-priority mine cleanup.

**Preliminary Alternative WQ-126**

<i>Group</i>	<i>Title</i>
<b>WATER QUALITY/LAND USE</b>	<b>Managing Discharges and Restoring Existing Habitat</b>

Improve water quality through the management of agricultural, municipal, industrial, and mine discharges and create habitat by restoring and enhancing existing habitat areas.

**Key Actions**

*Restore Delta shallow water habitat*—Create new areas of shallow water habitat in the Delta by reconstructing levees, riverbanks, and shallow water habitat areas and by restoring/preserving channel islands.

**Restore Delta and upstream habitat**—Restore a variety of Delta and upstream habitats by protecting and enhancing existing aquatic, wetland, and riparian areas.

**Reclamation**—Reclaim agricultural, municipal, and industrial wastewater to be used for a variety of applications and improve water quality by reducing wastewater discharges.

**Improve levee maintenance and stabilization**—Improve levees around important economic land uses and restored freshwater habitats.

**Supporting Actions**

**Increase instream flows**—Complement habitat restoration with the acquisition of water for instream flows, the management of reservoirs for flows and temperature, and the restoration of flows to dewatered riparian areas. The restoration and replenishment of spawning gravel also contributes to habitat enhancement.

**Improve floodway habitat**—Enhance flood ways to restore wetland habitat and to reduce stranding of fish.

**Drainage treatment with wetlands**—Manage agricultural, municipal, and industrial wastewater by treating it through wetlands.

**Remediate mine drainage**—Give urban areas flexibility to fund high-priority mine cleanup.

**Preliminary Alternative WQ127**

*Group*

**WATER QUALITY/LAND USE**

*Title*

**Managing Discharges and  
Creating New Habitat**

Improve water quality by managing discharges and create habitat by converting land used for economic purposes into habitat areas .

**Key Actions**

**Restore shallow water habitat**—Create new areas of shallow water habitat in the Delta by subjecting existing leveed lands to tidal action and restoring tidal action to existing diked wetlands.

**Restore upstream habitat**—Create a mosaic of habitat types upstream of the Delta.

**Reclamation**—Reclaim agricultural, municipal, and industrial wastewater to be used for a variety of applications and improve water quality by reducing wastewater discharges.

**Improve levee maintenance and stabilization**—Improve levees around important economic land uses and restored freshwater habitats.

**Supporting Actions**

**Restore Delta habitat**—Create a mosaic of habitat types in the Delta, including shallow water, riverine, riparian, wetland, and terrestrial, at the minimum level of implementation.

**Improve natural flood protection**—Enhance levee flood protection and create new habitat by allowing rivers to meander, relocating levees to create flood ways, and modifying flood ways to support wetland habitats.

**Drainage treatment with wetlands**—Manage agricultural, municipal, and industrial wastewater by treating it through wetlands.

**Remediate mine drainage**—Give urban areas flexibility to fund high-priority mine cleanup.

**Preliminary Alternative WQ-128**

*Group*  
**WATER QUALITY/LAND USE**

*Title*  
**Managing Discharges, Restoring Existing and Creating New Habitat**

Improve water quality by managing discharges and create habitat by balancing the preservation and enhancement of existing habitats with the creation of new habitats by converting land used for economic purposes.

**Key Actions**

**Restore Delta shallow water habitat**—Create new areas of shallow water habitat in the Delta by reconstructing levees, reconstructing riverbanks and shallow water habitat areas, restoring/preserving channel islands, and subjecting existing leveed lands to tidal action.

**Restore Delta and upstream habitat**—Create a variety of habitat types upstream of and in the Delta by protecting, enhancing, and creating new instream, wetland, riparian, and terrestrial habitats.

**Reclamation**—Reclaim agricultural, municipal, and industrial wastewater to be used for a variety of applications and improve water quality by reducing wastewater discharges.

**Improve levee maintenance and stabilization**—Improve levees around important economic land uses and restored freshwater habitats.

## Supporting Actions

**Increase instream flows**—Complement habitat restoration with the acquisition of water for instream flows, the management of reservoirs for flows and temperature, and the restoration of flows to dewatered riparian areas.

**Improve natural flood protection**—Enhance levee flood protection and create new habitat by allowing rivers to meander, relocating levees to create flood ways, and modifying flood ways to support wetlands and reduce stranding of fish.

**Drainage treatment with wetlands**—Manage agricultural, municipal, and industrial wastewater by treating it through wetlands.

**Remediate mine drainage**—Give urban areas flexibility to fund high-priority mine cleanup.

## Preliminary Alternative WS-1

<i>Group</i>	<i>Title</i>
<b>WATER SUPPLY</b>	<b>Delta and Export Area Demand Reduction</b>

Reduce demand in export areas and in the Delta and upstream of the Delta to better balance water supply availability and demands, improve water quality, and reduce diversion impacts.

### Key Actions

***Conservation***—Implement maximum achievable residential, industrial, and agricultural demand reduction in and upstream of Delta and in export areas.

***Reclamation***—Support maximum efforts to implement municipal wastewater and agricultural drainage reclamation.

***Water marketing***—Increase the efficient utilization of existing water supplies by facilitating water marketing and water-driven pricing.

***Land retirement and fallowing***—Maximize land retirement of marginal agricultural lands and lands of willing sellers. Maximize land fallowing during drought periods.

### Supporting Actions

***Improve coordination of land use planning and water supply planning***—Provide incentives for local and regional coordination of land use and water supply planning and support long-term institutional efforts to encourage coordination.

***Improve long-term planning for drought contingencies***—Improve planning to respond to future drought conditions.

***Develop alternative supplies in export areas***—Develop alternative water supplies (e.g., desalination, reclamation) for export areas.

***Encourage groundwater banking and conjunctive use***—To more effectively utilize the potential for groundwater reclamation and land application of treated wastewater, this alternative would maximize groundwater banking and conjunctive use in the export areas.

## Preliminary Alternative WS-2

Group

Title

**WATER SUPPLY****Export Area and Delta Demand Reduction and Storage**

Reduce demand in export area and in and upstream of Delta and provide storage to facilitate transfers and better accommodate water needs during critical periods.

**Key Actions**

**Conservation**—Implement maximum achievable residential, industrial, and agricultural demand reduction in and upstream of Delta and in export areas.

**Reclamation**—Support maximum efforts to implement municipal wastewater and agricultural drainage reclamation.

**Water marketing**—Increase the efficient utilization of existing water supplies by facilitating water marketing and market-driven pricing.

**Develop storage in the Delta**—Develop storage in the Delta and in the export area to facilitate water transfers, capture unregulated flows, minimize storage constraints on exports, and provide critical-period supply.

**Develop storage in export areas**—Develop storage in export areas to facilitate water transfers, capture unregulated flows, minimize storage constraints on exports, and provide critical period supply.

**Encourage groundwater banking and conjunctive use**—In order to maximize the opportunity for groundwater reclamation and recharge, encourage groundwater banking and conjunctive use in the export areas.

**Supporting Actions**

**Land retirement and fallowing**—Maximize land retirement of marginal agricultural lands and lands of willing sellers. Maximize land fallowing during drought periods.

**Improve coordination of land use planning and water supply planning**—Provide incentives for local and regional coordination of land use and water supply planning and support long-term institutional efforts to encourage coordination.

**Improve long-term planning for drought contingencies**—Improve planning to respond to future drought conditions.

*Develop export area alternative supplies*—Develop alternative water supplies (e.g., desalination, reclamation) for export areas.

### Preliminary Alternative WS-3

<i>Group</i>	<i>Title</i>
<b>WATER SUPPLY</b>	<b>East-side Conveyance Facility with Export Area Storage</b>

Provide a large east-side through-Delta conveyance facility with a large increment of additional off-stream storage along the west side of the San Joaquin Valley to increase the reliability and quality of export water while reducing diversion impacts in the Delta.

#### Key Actions

*Construct an east-side conveyance facility* matching the capacity of the export facilities (DMC and California Aqueduct) to convey export water around the Delta to the export facilities. A through-Delta conveyance facility would improve the efficiency of water movement to the export facilities, reducing requirements for environmental carriage water.

*Relocate export diversion facilities* to the Sacramento River to improve the quality of export water and reduce diversion impacts on fish populations.

*Develop a large increment of additional off-stream storage* along the west side of the San Joaquin Valley to improve the reliability of Delta exports. Increased storage capacity would increase diversion opportunities during periods of excess winter or flood flows in the Delta and provide opportunities for management of export diversion timing to increase the yield from the Delta and the Sacramento River.

#### Supporting Actions

*Modify operations of upstream reservoirs* to coordinate supply releases with export diversion timing, available conveyance capacities, and available export area storage capacity.

*Modify export operation criteria* to allow for greater volumes of Delta inflows to be diverted to export area storage during periods of excess winter and flood flows in the Delta. Greater diversions during periods of excess will increase the yield available for export supplies.

*Store groundwater south of the Delta* to increase the reliability of drought year supplies. Stored groundwater would provide long-term storage to increase the level of supply reliability during prolonged drought periods.

## Preliminary Alternative WS-4

<i>Group</i>	<i>Title</i>
WATER SUPPLY	<b>Large East-Side Conveyance Facility with Export Area and Upstream Storage</b>

Provide a large east-side through Delta conveyance facility in conjunction with additional off-stream storage along the west side of the San Joaquin Valley and along the east side of the Sacramento Valley to increase reliability, predictability, and quality of export water while reducing diversion impacts in the Delta.

### Key Actions

*Construct an east-side conveyance facility* matching the capacity of export facilities (DMC and California Aqueduct) to convey export water around the Delta. A large through-Delta conveyance facility would improve the efficiency of water movement to the export facilities, reducing requirements for environmental carriage water.

*Relocate export diversion facilities* to the Sacramento River to improve the quality of export water and reduce diversion impacts on fish populations.

*Develop additional off-stream storage* along the west side of the San Joaquin Valley to improve the reliability of Delta exports. Increased storage capacity would increase diversion opportunities during periods of excess winter or flood flows in the Delta and opportunities to manage export diversion timing to increase the yield from the Delta and the Sacramento River.

*Develop additional storage in the Sacramento Valley* to increase yield. Additional storage capacity, either as expansion of existing reservoirs or construction of new reservoirs, would increase the yield from the Sacramento Valley to improve reliability and predictability of water supplies and provide additional flood protection (system vulnerability).

## Supporting Actions

*Modify reservoir operations* to coordinate supply releases with export diversion timing, available conveyance capacities, and available export area storage capacity.

*Modify export operation criteria* to allow diversion of a greater volume of Delta inflows during periods of excess winter and flood flows in the Delta. Greater diversions during periods of excess will increase the yield available for export supplies.

*Modify California Water Code* to improve procedures and ease implementation of water transfers through the Delta to maximize the use of additional yield from upstream reservoirs.

*Store groundwater south of the Delta* to increase the reliability of drought year supplies. Stored groundwater would provide long-term capacity to increase the level of supply reliability during prolonged drought periods.

## Preliminary Alternative WS-5

Group

**WATER SUPPLY**

Title

**East-Side Conveyance Facility  
with Export Area and Delta Storage**

Provide a large east-side through Delta conveyance facility in conjunction with additional off-stream storage along the west side of the San Joaquin Valley and an in-Delta storage facility to increase reliability, predictability and quality of export water while reducing diversion impacts in the Delta.

## Key Actions

*Construct an east-side conveyance facility* matching the capacity of export facilities (DMC and California Aqueduct) to convey export water around the Delta. A large through-Delta conveyance facility would improve the efficiency of water movement to the export facilities, reducing requirements for environmental carriage water.

*Relocate export diversion facilities* to the Sacramento River to improve the quality of export water and reduce diversion impacts on fish populations.

*Develop additional off-stream storage* along the west side of the San Joaquin Valley to improve the reliability of Delta exports. Increased storage capacity would increase diversion opportunities during periods of excess winter or flood flows in the Delta and opportunities to manage export diversion timing to increase the yield from the Delta and the Sacramento River.

*Develop an in-Delta storage facility* to increase management opportunities for Delta environmental flows and export. An in-Delta storage facility would capture excess winter and flood flows in the Delta and release stored water for either export or environmental needs.

## Supporting Actions

*Modify operations of upstream reservoirs* to coordinate supply releases with export diversion timing, available conveyance capacities, and available export area storage capacity.

*Modify export operation criteria* to allow diversion of a greater volume of Delta inflows during periods of excess winter and flood flows in the Delta. Greater diversions during periods of excess flows will increase the yield available for export supplies.

*Store groundwater south of the Delta* to increase the reliability of drought supplies. Stored groundwater would provide long-term capacity to increase the level of supply reliability during prolonged drought periods.

## Preliminary Alternative WS-6

*Group*

*Title*

**WATER SUPPLY**

**Increase Upstream Reservoir Capacity**

Reduce competition for Delta supplies by increasing upstream storage and reoperating existing reservoirs to increase yield.

## Key Actions

*Develop additional upstream storage*—Raise upstream reservoirs (e.g., Shasta) to increase the amount of storage available for upstream, in Delta, and export needs.

*Increase floodway capacity*—Increase downstream channel capacity by widening channels, building setback levees, expanding existing floodways, and/or constructing new floodways to reduce reservoir flood reserve requirements.

*Modify reservoir operations*—Utilize additional storage capacity and downstream floodway capacity to increase carryover storage for water supply.

## Supporting Actions

*Provide instream flows*—Manage releases above core-levels to improve habitat and fish passage.

## Preliminary Alternative WS-7

<i>Group</i>	<i>Title</i>
<b>WATER SUPPLY</b>	<b>Manage Delta Outflow with Delta Storage</b>

Increase effectiveness of Delta outflow utilizing in-Delta storage, adaptive management, and estuarine habitat restoration; thereby reducing total outflow requirements.

### Key Actions

*Delta habitat restoration*—Convert existing leveed lands to tidal action in western Delta (e.g., Sherman Island) and convert existing non-tidal wetlands (e.g., Suisun Marsh) to tidal wetlands to provide additional estuarine habitat upstream of Chipps Island.

*Construct in-Delta storage*—Convert existing leveed lands to storage reservoirs to capture water during high flow periods to provide water supply for Delta outflow management.

*Real-time monitoring*—Intensive sampling of fish distribution and abundance to support adaptive management of the in-Delta storage and release for outflows to control salinity within the expanded estuary habitat.

### Supporting Actions

*Consolidate and modify in-Delta diversions*—Reduce diversion effects in the Delta.

*Improve levee maintenance and stabilization*—Islands are stabilized primarily by large-scale filling of the lowest areas with a suitable blend of inorganic soil and compost or clean dredged materials to restore interior elevations to near mean sea level. The protection of Delta levees will be oriented toward protecting the through-Delta conveyance system.

## Preliminary Alternative WS-8

<i>Group</i>	<i>Title</i>
<b>WATER SUPPLY</b>	<b>Manage Delta Outflow with Delta Storage and Isolated Transfer Facility</b>

Increase effectiveness of Delta outflow utilizing in-Delta storage, adaptive management, and estuarine habitat restoration; thereby reducing total outflow requirements. Isolated transfer facility would be used to reduce entrainment impacts and increase diversion opportunities.

**Key Actions**

*Delta habitat restoration*—Convert existing leveed lands to tidal action in western Delta (e.g., Sherman Island) and convert existing non-tidal wetlands (e.g., Suisun Marsh) to tidal wetlands to provide additional estuarine habitat upstream of Chipps Island.

*Construct in-Delta storage*—Convert existing leveed lands to storage reservoirs to capture water during high flow periods to provide water supply for Delta outflow management.

*Construct isolated transfer facility*—Relocate export intakes and install best available screen and barrier technology on Sacramento River and provide conveyance for full CVP and SWP pumping capacity (15,000 cfs).

*Real time monitoring*—Intensive sampling of fish distribution and abundance to support adaptive management of the in-Delta storage and release for outflows to control salinity within the expanded estuary habitat. Intensive river sampling to support adaptive management of isolated transfer facility when vulnerable life stages are present (e.g., striped bass larvae).

**Supporting Actions**

*Consolidate and modify in-Delta diversions*—Reduce diversion effects in the Delta.

*Modify reservoir operations*—Reoperate reservoirs to provide instream flows and export releases that take into account availability of in-Delta storage and reduced export restrictions.

*Improve channel habitat*—Restore channel habitat as part of levee maintenance in central Delta to increase rearing habitat for resident species to take advantage of relocated diversion facilities.

**Preliminary Alternative WS-9**

*Group*  
**WATER SUPPLY**

*Title*  
**East-side San Joaquin Conveyance  
and Storage Facility**

Develop storage and isolated conveyance facilities on east side of San Joaquin Valley to store excess flows and provide agricultural and urban water supplies to the San Joaquin Valley.

## Key Actions

***Storage, San Joaquin Valley, upstream***—Develop additional off-stream storage facilities (more than one) on the east side of the San Joaquin Valley to capture excess winter and flood flows from San Joaquin River tributaries. Captured water will increase the yield from the San Joaquin Valley and provide additional supplies for urban and agricultural needs as well as San Joaquin River environmental flow needs.

***Conveyance facility, San Joaquin Valley***—Develop an isolated conveyance facility along the east side of the San Joaquin Valley to convey excess winter and flood flows to off-stream storage facilities. The conveyance facility will begin at the American River, Folsom South Canal, and continue the San Joaquin River at Friant Dam.

## Supporting Actions

***Modify reservoir operations***—Reoperate Millerton Lake/Friant Dam and Friant Kern Canal as part of the southern extension of east-side storage/conveyance system to maximize water supply and environmental benefits. Other reservoirs on tributary stream to the San Joaquin River will also be reoperated to maximize the benefit to supply and instream flow management.

***Management of tributary inflows***—Maximize core action to manage instream flows and temperature of east side tributaries for habitat improvement.

## Preliminary Alternative WS-10

<i>Group</i>	<i>Title</i>
<b>WATER SUPPLY</b>	<b>West-side Sacramento Storage and Conveyance Facility</b>

Develop offstream storage and conveyance facilities on west side of Sacramento Valley to divert and store excess water from Shasta, provide west-side agricultural irrigation water, and provide additional water supplies to the Delta during critical periods.

## Key Actions

***Develop additional off-stream storage***—Develop off-stream storage on west side of Sacramento Valley.

***Relocate diversion facility***—Construct new diversion facility below Shasta with capacity to take advantage of significant wet year inflows which otherwise must be released. Eliminate Red Bluff diversion.

*Develop conveyance facilities*—Develop conveyance facilities to connect west-side storage facilities with Shasta, Tehama-Colusa Canal, GCID, and Sacramento River.

## Supporting Actions

*Modify reservoir operations*—Reoperate Shasta Reservoir to provide high flow diversion to westside storage facilities.

## Preliminary Alternative WS-11

<i>Group</i>	<i>Title</i>
WATER SUPPLY	Isolated Delta Conveyance and Storage Facility with Export Area Storage

Provide a combination isolated conveyance and storage facility in the Delta and develop a large off-stream storage facility in the export area to improve reliability and predictability of water supplies.

## Key Actions

*Construct an isolated conveyance and storage facility in the Delta* by linking islands flooded for storage with siphons, existing channels, and new channels constructed across islands. The conveyance capacity of this facility would match the physical pumping and conveyance capacity of the CVP and SWP export facilities, and the storage capacity would be determined by which islands were chosen for flooding.

*Relocate export diversion facilities* to the Sacramento River to reduce diversion impacts on fish populations associated with current export practices.

*Develop additional off-stream storage* along the west side of the San Joaquin Valley to improve the reliability of Delta exports. Additional storage in the export area would improve diversion management flexibility to increase the yield from the Delta and increase the long-term reliability of Delta supplies.

## Supporting Actions

*Modify export operations criteria* to increase the export diversion rate to the physical capacity of the SWP and CVP export facilities and to allow a greater portion of Delta winter and flood flows to be diverted to storage.

*Modify California Water Code* to improve procedures for and implementation of water transfers through the Delta.

*Store groundwater south of the Delta* to increase the reliability of drought supplies. Stored groundwater would provide long-term capacity to increase the level of supply reliability during prolonged drought periods.