



Alternative 6 - Summary

Extensive Habitat Restoration with New Storage

Emphasis

Increase fish populations through natural production, and reduce entrainment to such an extent that fish take at diversions no longer has a significant effect on fish populations. Improve water supply reliability by reducing the frequency and duration of Endangered Species Act (ESA) constraints on water diversions.

Distinguishing Features

This alternative is intended to provide moderate to high levels of resource improvement and conflict resolution.

Physical/Structural	Operational/Management	Institutional/Policy
<ul style="list-style-type: none"> • Extensive habitat restoration and creation to support fish populations • Screens on all priority diversions and salmon bypass at Old River to lower fish mortality • South Delta island(s) converted to water storage facilities (300 - 400 TAF) to reduce fish entrainment losses • High level of levee improvements incorporating habitat restoration to reduce system vulnerability • Restoration of 4,000 - 6,000 acres of tidal wetlands in Suisun Bay to increase fish production • Maintenance of floodway capacity to increase flood protection • New screened intake at Italian Slough 	<ul style="list-style-type: none"> • Real-time monitoring and modified diversion operations reduce fish loss • About 100,000 AF of San Joaquin River water purchased to improve fish transport through the Delta • Pollutant source controls and increased flows to improve water quality 	<ul style="list-style-type: none"> • Funded levee improvements, emergency management plan, and long-term subsidence program permanently reduce system vulnerability • Increased fish populations permit substantial reduction of ESA constraints on diversions

Benefits

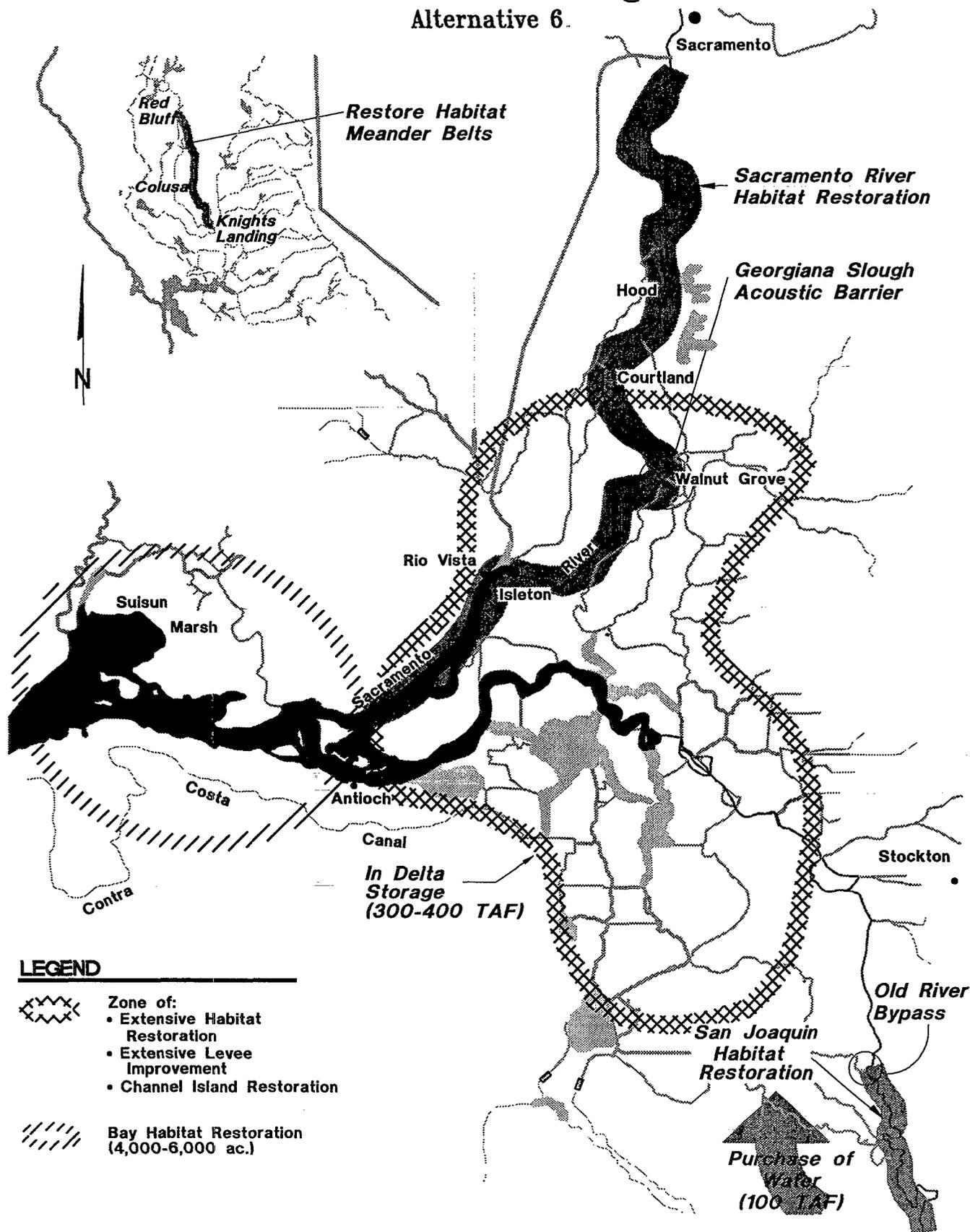
- Substantially improves and enhances habitat to sustain high-interest fish species
- Improves water supply reliability by substantially reducing ESA constraints on diversions
- Substantially reduces vulnerability of Delta functions to catastrophic loss
- Moderately improves Delta water quality

Constraints and Concerns

- Uncertain reduction in diversion constraints
- Uncertain of time required to achieve improvements fish and water supply
- Continue diversions of export supplies and resulting entrainment in south Delta

Extensive Habitat Restoration With New Storage

Alternative 6.



LEGEND

-  Zone of:
 - Extensive Habitat Restoration
 - Extensive Levee Improvement
 - Channel Island Restoration

-  Bay Habitat Restoration (4,000-6,000 ac.)

Alternative 6

Extensive Habitat Restoration with New Storage

Overview

This alternative emphasizes increasing fish populations by making extensive habitat improvements. Substantially increased fish populations can reduce the frequency and duration of Endangered Species Act constraints on water diversions, improving supply flexibility and reliability. In addition, the purchase of San Joaquin basin water and new in-Delta island water storage will improve fish transport through the Delta.

habitat improves fish population

Currently, limitations on fish entrainment (take limits) are set to avoid jeopardizing fish populations. When these limits are approached, diversions are curtailed or stopped, creating a high degree of uncertainty for water users. Fish populations are affected by many factors including diversion effects, flow, and other habitat conditions. As habitat is improved, leading to greater fish populations, the effect of diversions on population should be reduced. This should consequently lessen take limit constraints on diversions, providing improved water supply reliability.

75-125 miles of habitat along Delta levees

4,000 - 6,000 acres of tidal wetlands in Suisun Marsh

Restoration of upstream habitats in the Sacramento and San Joaquin river systems will improve spawning and survival success of fish, while channel features will be restored to provide habitat. In the Delta, restoration of shallow riverine and riparian habitat will provide spawning areas for native fish and increase forage areas and escape cover for juvenile salmon, Delta smelt, splittail, and other species. New habitat will be constructed along Delta channels. Moderate areas of shallow tidal habitat will be developed in the Suisun Bay for wet-year spawning and rearing of Delta smelt and the migratory needs of salmon. Fish screens on all priority diversions and barriers will be installed to reduce entrainment and keep migrating fish in the main river channel.

improve habitats in upper Sacramento and San Joaquin Rivers

about 100 TAF environmental purchased from San Joaquin

This alternative constructs a new water storage facility in the south Delta, storing 300,000 to 400,000 acre-feet for environmental purposes. The facility will be filled through screened diversions when water is available and when fish entrainments can be avoided using real-time monitoring. Water will be released from this facility to improve fish transport conditions in the Delta and to shift the timing of diversions to avoid entrainment effects. Water will be purchased from willing San Joaquin basin water users and released to transport fish through the Delta and improve water quality in the San Joaquin River and south Delta.

300-400 TAF of new Delta storage for the environment

fish screen all priority diversions

This alternative provides a high level of levee improvements, an emergency management plan, and a long-term subsidence program to permanently reduce system vulnerability. Water quality will be improved by controlling pollutant discharges at the source.

By linking extensive habitat restoration and levee improvements with additional storage dedicated for environmental purposes, this alternative increases fish populations while reducing system vulnerability. The conditions resulting from increased fish populations provide benefits to water supply reliability, predictability, and flexibility. Delta water quality is also improved.

extensive habitat restoration linked with extensive levee improvements

Physical and Structural Features

Habitat Restoration

Activities	Benefits
<ul style="list-style-type: none"> Restore riparian, shaded riverine, and shallow water habitat along the Sacramento River channel between Sacramento and Collinsville 	<ul style="list-style-type: none"> Provides substantial improvement in aquatic habitat as well as improvements in water supply reliability and water quality Increases survival and spawning success of anadromous and Delta native fish
<ul style="list-style-type: none"> Restore upper Sacramento River habitat and natural channel functions 	<ul style="list-style-type: none"> Increases survival and spawning success of anadromous fish
<ul style="list-style-type: none"> Restore Delta and floodway corridor shallow water, riparian, terrestrial, and tidal wetland habitat Restore approximately 75 to 125 miles of shallow water, riverine, and riparian habitat along Delta levees 	<ul style="list-style-type: none"> Provides spawning areas for Delta native fish and forage areas and escape cover for juvenile salmon, Delta smelt, splittail, and other species. Provides improvements in water supply reliability and water quality
<ul style="list-style-type: none"> Restore and protect channel islands from erosion and enhance habitat 	<ul style="list-style-type: none"> Provides habitat for aquatic and terrestrial plant and animal species Improves water quality
<ul style="list-style-type: none"> Restore about 4,000 to 6,000 acres of tidal wetlands in Suisun Bay 	<ul style="list-style-type: none"> Provides wet-year spawning habitat for Delta smelt, rearing areas for salmon, and wildlife habitat (e.g. canvasback and redhead ducks)
<ul style="list-style-type: none"> Restore riverine channel features in the San Joaquin River above the Delta to lower water temperatures and reduce predation 	<ul style="list-style-type: none"> Improves fish survival

Considerations
<ul style="list-style-type: none"> • Sacramento River Channel – Feasible and cost-effective habitat restoration implemented between Sacramento and Collinsville. • Upper Sacramento River – Create meander belts where feasible (e.g., Red Bluff to Colusa) and riparian sections in other areas (e.g., Colusa to Knights Landing). • Delta – Candidate areas for shallow water habitat restoration include Prospect Island, Liberty Island, Little Holland Tract, Hastings Tract, Yolo Bypass, and the southeast Delta. Candidates for Delta levee habitat restoration include Twitchell Island along Threemile Slough and Sevenmile Slough, Georgiana Slough, and the North and South Forks of the Mokelumne River. • Floodway Corridors – Habitat restoration must not impair capacity of floodways. • Suisun Bay – Convert diked wetlands or create tidal wetlands with dredge spoils between Collinsville and Carquinez Strait. • San Joaquin River – Confine wide, shallow channels and isolate in-channel gravel quarry areas. May not be self-sustaining.

Water Storage

Activities	Benefits
<ul style="list-style-type: none"> • Convert one or more Delta islands to a water storage facility with approximately 300,000 to 400,000 AF capacity • Construct screened diversions to divert flows into storage 	<ul style="list-style-type: none"> • Provides additional diversion flexibility • Improves fish transport through the Delta • Could significantly improve response time (compared to Folsom or Shasta Reservoirs) for releasing water for improved management of X2 • Reduces entrainment of fish • Reduces frequency and duration of export curtailments

Considerations
<ul style="list-style-type: none"> • Locate new environmentally dedicated Delta storage reservoir near export pumps on one or more islands such as Bacon, Mandeville, or Victoria. • Divert water during November, December, and January; release water from March to July as needed. With real-time monitoring, divert when species of concern are not present and release water to move fish or release for diversion. • Environmentally dedicated water storage in the Delta allows reduction in diversions during critical periods. • Creation of a wide riparian and shallow water habitat corridor around the perimeter of Delta island storage would provide additional fish and wildlife benefits.

Fish Protection and Transport

Activities	Benefits
<ul style="list-style-type: none"> • Construct a San Joaquin River bypass at the head of Old River 	<ul style="list-style-type: none"> • Encourages outmigrating fish to stay in the San Joaquin River • Allows for managing flows down Old River



Activities	Benefits
<ul style="list-style-type: none"> • Install fish screens on all priority diversions in the Delta, rivers, and tributaries 	<ul style="list-style-type: none"> • Reduces entrainment of fish
<ul style="list-style-type: none"> • Construct new screened State Water Project intake at Italian Slough 	<ul style="list-style-type: none"> • Avoids fish predation and entrainment in Clifton Court Forebay when diversion rates are low
<ul style="list-style-type: none"> • Improve drainage in floodway corridors 	<ul style="list-style-type: none"> • Reduces fish stranding
Considerations	
<ul style="list-style-type: none"> • Select diversions for screening according to criteria including size of intake, location, peril to fish, and screening feasibility. 	

Flood Protection and Levee Stabilization

Activities	Benefits
<ul style="list-style-type: none"> • Provide a high level of protection and stabilization of Delta levees 	<ul style="list-style-type: none"> • Manages vulnerability of Delta land use and infrastructure • Manages vulnerability of Delta water supply to salinity intrusion • Manages vulnerability of Delta ecosystem functions • Provides opportunities for habitat restoration
<ul style="list-style-type: none"> • Increase flood conveyance capacity of Delta channels through channel maintenance, improvements, and enlargements 	<ul style="list-style-type: none"> • Manages vulnerability of levees to failure • Increases flood conveyance • Provides opportunities for habitat restoration
Considerations	
<ul style="list-style-type: none"> • Provide flood protection equivalent to Army Corps of Engineers PL 99 standard for these islands: <ul style="list-style-type: none"> All critical western islands such as Bethel Island. All islands with important regional infrastructure (e.g., Mokelumne Aqueduct) such as Woodward Island. All islands with valuable habitat such as Mandeville Island. • Upgrade all other Delta levees to meet at least the Hazard Mitigation Plan (HMP) standards. • Integrate protection and stabilization of levees with Delta habitat restoration activities. • Provide stable funding mechanism for ongoing levee and habitat monitoring, maintenance, and management. • Improvements and enlargements to channels include setback levees in channels with restricted flood capacity. 	

Operational and Management Features

Water Diversion Management

Activities	Benefits
<ul style="list-style-type: none"> Acquire about 100,000 AF of water from users in the San Joaquin basin Use water for pulse flows to transport fish or for diluting poor quality flows Coordinate with the operation of new south Delta storage to improve timing of diversions 	<ul style="list-style-type: none"> Transports fish through the San Joaquin River and Delta Improves water quality Improves management flexibility for diversions to reduce fish loss
<ul style="list-style-type: none"> Improve CVP and SWP operations through predation control, coordinating operations, and improving fish salvaging and handling 	<ul style="list-style-type: none"> Reduces fish losses
<ul style="list-style-type: none"> Improve real-time monitoring of locations of special-concern fish species and modify water diversions to avoid entrainment 	<ul style="list-style-type: none"> Provides an additional tool to help reduce entrainment of special-concern species Improves flexibility to divert water during critical fish migration periods
<ul style="list-style-type: none"> Evaluate, improve, and install behavioral barriers for anadromous fish 	<ul style="list-style-type: none"> Diverts anadromous fish from areas of potential entrainment and predation Allows for continued water diversions at current locations
Considerations	
<ul style="list-style-type: none"> Evaluate continued use of an acoustic barrier at the mouth of Georgiana Slough. Evaluate behavioral barriers for Delta Cross Channel and Threemile Slough. 	

Fisheries Management

Activities	Benefits
<ul style="list-style-type: none"> Mark salmon produced in hatcheries 	<ul style="list-style-type: none"> Facilitates selective catch of hatchery salmon by commercial and recreational fisheries
<ul style="list-style-type: none"> Conduct net-pen rearing of striped bass to supplant natural production 	<ul style="list-style-type: none"> Maintains recreational fishery Reduces operational constraints on water diversions
Considerations	
<ul style="list-style-type: none"> Actions are intended to maintain recreational and commercial fisheries as well as enhance native salmon stocks. Need to assess impact of incidental mortality on native (unmarked) fish. 	

Water Quality Management

Activities	Benefits
<ul style="list-style-type: none"> Control agricultural, urban, and industrial discharges through retention and timed release 	<ul style="list-style-type: none"> Improves Delta water quality
<ul style="list-style-type: none"> Increase enforcement of source control regulations for agricultural drainage and implement farming best management practices for water quality 	<ul style="list-style-type: none"> Improves Delta water quality
<ul style="list-style-type: none"> Increase enforcement of source control regulations for urban and industrial runoff and implement best management practices for water quality 	<ul style="list-style-type: none"> Improves Delta water quality
<ul style="list-style-type: none"> Integrate existing land retirement and fallowing programs for agricultural lands with drainage problems 	<ul style="list-style-type: none"> Improves Delta water quality
<ul style="list-style-type: none"> Integrate existing and support appropriate on-site mine drainage remediation measures to the maximum extent feasible 	<ul style="list-style-type: none"> Improves Delta water quality
Considerations	
<ul style="list-style-type: none"> Implement discharge retention through cost-effective actions such as constructed wetlands, underground pipe storage, temporary storage ponds, or reuse. Time agricultural and industrial releases to coincide with higher instream flows. Identify priority pollutant sources such as Iron Mountain Mine and west-side San Joaquin agricultural lands. Provide regulatory and institutional incentives for implementation of remediation measures. 	

Institutional and Policy Features

Habitat Programs

Activities	Benefits
<ul style="list-style-type: none"> Integrate recommended habitat restoration actions from other programs, including CVPIA and the Anadromous Fish Restoration Program 	<ul style="list-style-type: none"> Provides additional habitat restoration
<ul style="list-style-type: none"> Establish programs to preserve agricultural land uses that provide valuable habitat functions 	<ul style="list-style-type: none"> Protects existing habitats
<ul style="list-style-type: none"> Establish and CALFED team to coordinate and expedite habitat restoration permits 	<ul style="list-style-type: none"> Accelerates acquiring permits for environmental restoration projects and other CALFED projects
<ul style="list-style-type: none"> Establish and fund a management program and rapid response team to manage introduced species 	<ul style="list-style-type: none"> Protects existing valuable species and habitat
<ul style="list-style-type: none"> Establish a program to identify and use clean dredge materials from the Delta for habitat restoration and levee maintenance in the Delta 	<ul style="list-style-type: none"> Provides materials for habitat and levee improvements

Activities	Benefits
<ul style="list-style-type: none"> Encourage farmers and levee maintenance districts to leave habitat areas undisturbed by working with resource agencies 	<ul style="list-style-type: none"> Protects existing habitats Increases flexibility in maintenance programs
<ul style="list-style-type: none"> Implement a subsidence management program to reverse decline in levels of Delta islands 	<ul style="list-style-type: none"> Provides a long-term increase in stability of Delta levees and reliability of Delta functions Provides wetlands that benefit wildlife
Considerations	
<ul style="list-style-type: none"> Coordinate activities to avoid duplication. Successful program for reversal of subsidence would include converting agricultural use of appropriate deep Delta islands to wetlands. Management of less deeply subsided areas could include rotation of seasonal wetland with wildlife-friendly agricultural practices. 	

Water Quality Standards

Activities	Benefits
<ul style="list-style-type: none"> Reevaluate Delta export/inflow ratios during triennial reviews as habitat effectiveness is realized 	<ul style="list-style-type: none"> Allows for higher level of water transfer based on actual fish population improvements
Considerations	
<ul style="list-style-type: none"> Monitor to verify effectiveness of habitat and entrainment reduction programs. Develop an adaptive management program and modify habitat restoration and export/inflow ratios in response to improved sustainability of important species. 	

Management of System Vulnerability

Activities	Benefits
<ul style="list-style-type: none"> Establish and fund an emergency levee management plan to respond to levee failures 	<ul style="list-style-type: none"> Provides resources to protect Delta functions through proactive and preventative measures
<ul style="list-style-type: none"> Establish landside buffer zones adjacent to levees on islands with deep peat soils 	<ul style="list-style-type: none"> Provides increase in stability of Delta levees and reliability of Delta functions by reducing subsidence adjacent to levees Could be used to provide habitat benefit
Considerations	
<ul style="list-style-type: none"> Determine extent and cost effectiveness of levee management programs and buffer zones. Buffer strip approximately 150 to 200 yards wide dedicated to shallow wetlands. Buffer strip could be used as part of subsidence management program. 	

Preliminary Assessment

Benefits

- Substantially improves and enhances habitat to support sustainability of high-interest fish species
- Improves water supply reliability by substantially reducing ESA constraints on diversions
- Substantially reduces vulnerability of Delta functions to catastrophic loss
- Moderately improves Delta water quality

Constraints and Constraints

- Uncertain of the degree to which habitat improvements will reduce diversion constraints
- Uncertain of the length of time required to achieve intended improvements in fish population and water supply reliability
- Continued diversions of export supplies and resulting entrainment in south Delta