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Programmatic Environmental Impact Statement / Environmental Impact Report. Draft. Part 1

CalFed Bay-Delta Program

CALFED
BAY-DELTA
PROGRAM

Programmatic Environmental Impact Statement/ Environmental Impact Report

Draft

June 1999

Draft Environmental Impact Statement/Environmental Impact Report
CALFED Bay-Delta Program

Prepared by the CALFED Bay-Delta Program for the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, Natural Resources Conservation Service, U.S. Army Corps of Engineers, and California Resources Agency

This Draft Programmatic Environmental Impact Statement/Environmental Impact Report (Draft Programmatic EIS/EIR) is prepared in compliance with the National Environmental Policy Act (NEPA), the U.S. Bureau of Reclamation (Reclamation) policy and procedures for implementing NEPA, and the California Environmental Quality Act (CEQA).

The CALFED Bay-Delta Program (Program) is a cooperative effort of 15 state and federal agencies with regulatory and management responsibilities in the San Francisco Bay/San Joaquin River Bay-Delta to develop a long-term plan to restore ecosystem health and improve water management for beneficial uses of the Bay-Delta system. The objective of this collaborative planning process is to identify comprehensive solutions to the problems of ecosystem quality, water supply reliability, water quality, and Delta levee and channel integrity.

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Each of the four alternatives, including the Preferred Program Alternative, includes Ecosystem Restoration, Water Quality, Levee System Integrity, Water Use Efficiency, Water Transfer, Watershed, Storage, and Conveyance elements. Because the problems addressed by the Program and the solutions are closely interrelated, the descriptions of each of the Program elements, except for the Conveyance element, do not vary among alternatives. This is a programmatic-level document to select a long-term plan. The document focuses on the interrelated long-term and cumulative consequences of each of the alternatives. Implementation of the long-term plan will follow the approval of a Final Programmatic EIS/EIR, and subsequent environmental review for project-specific aspects of the Program will be required.

The Program issued a Draft Programmatic EIS/EIR in March 1998. Because a Preferred Program Alternative has been identified since that time, the Program decided to prepare a new Draft Programmatic EIS/EIR. The primary difference between the two documents is the analysis associated with the Preferred Program Alternative and the reduction in the number of alternatives from 12 to 4. The Program also took the opportunity to update its analysis of consequences for all alternatives and to restructure the document into a more reader-friendly format. Comments received on the previous draft document are identified or addressed, as appropriate, in the impact analyses. As this is a new document, you will need to provide specific comments on this document even if you commented on the previous draft.

Preface

The CALFED Bay-Delta Program (Program) includes a series of proposed actions that will take place in stages over time and a decision-making process for moving forward through the next phase of the Program. This preface describes the relationships between:

- The Preferred Program Alternative evaluated in this document and the overall CALFED Program decision.
- This document and the appendices, which together constitute the Draft Programmatic Environmental Impact Statement/Environmental Impact Report (EIS/EIR).
- The programmatic impact analysis in this document and future proposed actions with project-specific impact analysis in subsequent documents.

Preferred Program Alternative

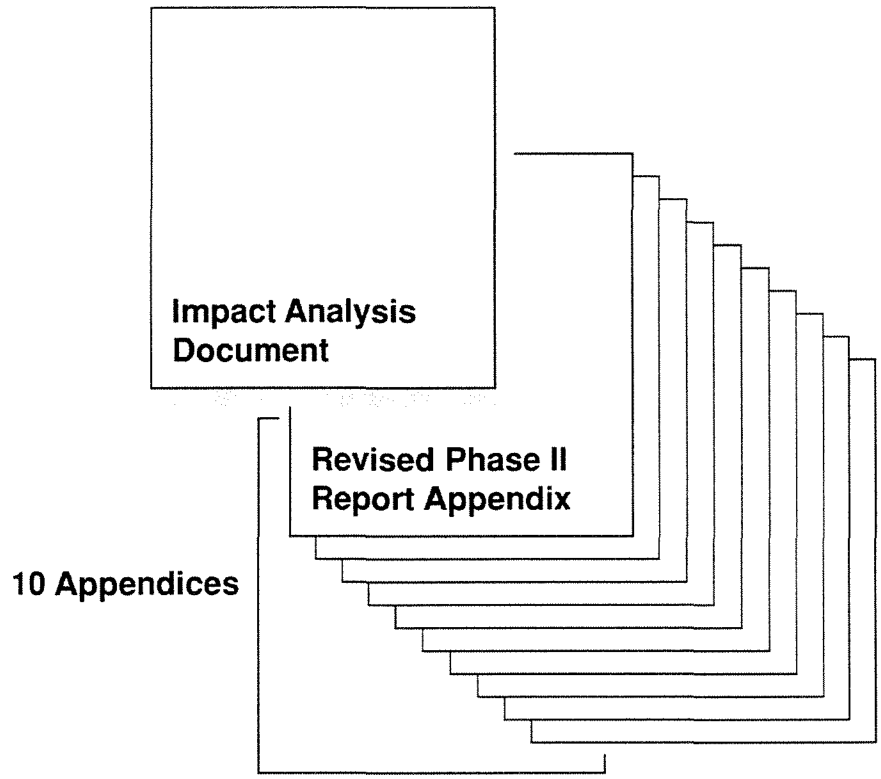
The Preferred Program Alternative consists of a set of broadly described programmatic actions that set the long-term, overall direction of the Program. However, detail at a greater level of specificity than is available in the programmatic description of the Preferred Program Alternative is important to understanding how this large, complex program may be implemented, funded, and governed in the future. Accordingly, the CALFED agencies have described proposed actions for the first years following a Record of Decision/Certification of the final, as well as set out a long-term implementation strategy.

The Preferred Program Alternative consists of a set of broadly described programmatic actions that set the long-term, overall direction of the Program.

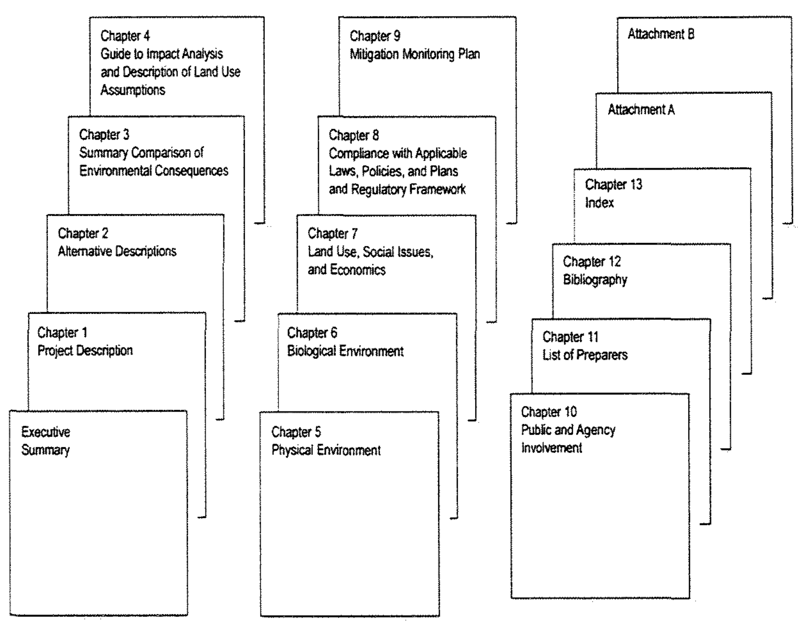
The potential near-term actions and long-term implementation strategy are presented in the Implementation Plan and the Revised Phase II Report Appendices. The near-term actions and the long-term implementation strategy share two characteristics: they are designed to achieve multiple benefits by emphasizing actions that serve several purposes, and they will be implemented in ways that increase our knowledge so that we can adapt subsequent actions to increase their effectiveness. As appropriate, the near- and long-term actions will be subject to subsequent alternative analysis, environmental review, and permitting decisions before these actions are implemented. Together, the description of the Preferred Program Alternative, the near-term actions, and the long-term implementation strategy make up the CALFED Program Decision. The CALFED Program Decision is contained in Attachment B to this document and more broadly covered in the Revised Phase II Report Appendix.

Contents of the Draft Programmatic EIS/EIR

The Draft Programmatic EIS/EIR includes an impact analysis document and 10 appendices. The illustration below shows how these documents fit together.



Impact Analysis Document. The impact analysis document contains the required programmatic environmental document elements, including an Executive Summary. The illustration at the right depicts those elements.



Appendices. The Revised Phase II Report Appendix contains a general summary of the other appendices. More fundamentally, it also describes the Program process, the fundamental Program concepts that have guided their development, and analyses that have revealed the comparative technical advantages of each alternative. Further, this report describes how this large, complex program may be implemented, funded, and governed in the future.

The six program plan appendices are the:

- Ecosystem Restoration Program Plan (3 volumes)
- Water Quality Program Plan
- Water Use Efficiency Program Plan
- Water Transfer Program Plan
- Long-Term Levee Protection Plan
- Watershed Program Plan

The six program plans include a description of programmatic plans and actions that are evaluated in this impact analysis document as well as more specific actions that will be subject, as appropriate, to subsequent environmental review.

The remaining three appendices are:

The Implementation Plan Appendix describes the proposed schedule and process for implementing near-term actions in the context of the overall implementation approach, including financial and assurance strategies.

The Multi-Species Conservation Strategy Appendix describes a comprehensive species and habitat conservation program that builds on the Ecosystem Restoration Program to provide a framework for compliance with endangered species laws.

The Multi-Species Conservation Strategy describes a comprehensive species and habitat conservation program.

The Comprehensive Monitoring, Assessment, and Research Program Appendix describes the information generated from monitoring, assessment, and research will be used to (1) assess the effectiveness of existing actions (2) guide additional research and (3) modify the actions of each of the Program elements in order to improve the Program's ability to meet its goals and objectives.

Programmatic Impact Analysis

The Program currently consists of multiple actions that are diverse, geographically dispersed, and generally described. These actions will be carried out over the course of many years. In addition, there is some uncertainty regarding the eventual outcome of Program actions. Consequently, the Program will be implemented in stages, using the information gained by adaptive management to modify and refine Program actions over time, within the framework of the Preferred Program Alternative. Given the uncertainties, the large scope of the Program area, and the conceptual nature of the proposed actions, the Program elected to prepare a Programmatic EIS/EIR.

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This document provides a broad overview of the potential actions that could be taken by the Program. It describes, in a broad sense, the environmental consequences of proposed actions and enables decisions to be made regarding Program direction and content. Information from this document will be incorporated by reference into subsequent tiered environmental documents for specific projects. This level of analysis is consistent with the guidance for programmatic documents provided by the Council on Environmental Quality's Regulations for implementing the National Environmental Policy Act (NEPA) and by the State California Environmental Quality Act (CEQA) Guidelines.

The Preferred Program Alternative will not, in itself, enact any changes in law, regulation, or policy, or allow project construction. Instead, the Preferred Program Alternative describes programmatic actions that set the long-term, overall direction of the Program. Any subsequent actions or facility construction stemming from the programmatic actions in the Preferred Program Alternative must be developed in compliance with NEPA, CEQA, and other applicable laws and regulatory processes.

The Preferred Program Alternative will not, in itself, enact any changes in law, regulation, or policy, or allow project construction.

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LIST OF ACRONYMS

A

AB	Assembly Bill
AFB	Air Force Base
AFRP	Anadromous Fish Restoration Program
ALS	Action levels
ARWRI	American River Water Resource Investigation
ATSF	Atchison, Topeka and Santa Fe
AWMC	Agricultural Water Management Council

B

BATs	best available technologies
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta estuary
BCDC	San Francisco Bay Conservation and Development Commission
BDAC	Bay-Delta Advisory Council
BMPs	best management practices

C

CAA	Clean Air Act
CalEPA	California Environmental Protection Agency
CALFED Ops Group	California-Federal Operations Group
CART	CALFED Agency Review Team
CCC	Contra Costa Canal
CCCTs	combined cycle combustion turbines
CCFB	Clifton Court Forebay
CCWD	Contra Costa Water District
CDF	California Department of Forestry and Fire Protection
CERT	Certification of the EIS/EIR
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CMARP	Comprehensive Monitoring and Research Program
CO	carbon monoxide
Conservation Strategy	Multi-Species Conservation Strategy
Corps	U.S. Army Corps of Engineers
CTs	combustion turbines
CUWA	California Urban Water Agency
CUWCC	California Urban Water Conservation Council
CVGSM	Central Valley Groundwater and Surface Water Model
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
CZMA	Coastal Zone Management Act

D

D-	Water Right Decision
D/DBPR	Disinfectant/Disinfection By-Products Rule
DBCP	dibromochloropropane
DBEEP	Delta-Bay Enhanced Enforcement Program
DBPs	disinfection by-products
DCC	Delta Cross Channel
DEFT	Diversion Effects on Fisheries Team
DFG	California Department of Fish and Game

DHS	California Department of Health Services
DMC	Delta-Mendota Canal
DOC	Department of Conservation
DPC	Delta Protection Commission
Dupont	El Dupont De Nemours & Co.
DWR	California Department of Water Resources
DWRSIM	DWR system operational model

E

EBMUD	East Bay Municipal Utility District
EC	electrical conductivity
ECCID	East Contra Costa Irrigation District
EDB	ethylene dibromide
EDD	California Economic Development Department
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
EPA	U.S. Environmental Protection Agency
ERAF	Education Reinvestment Augmentation Fund of 1992
ESA	Endangered Species Act
ESWTR	Enhanced Surface Water Treatment Rule
EWA	Environmental Water Account
EWMP	efficient water management practices

F

FCAA	Federal Clean Air Act
FEMA	Federal Emergency Management Act
FIP	Federal Implementation Plan
FPPA	Farmland Protection Policy Act of 1981
fps	feet per second
FWCA	Fish and Wildlife Coordination Act

G

GIS	geographic information system
GWh	gigawatt hours

I

I-5	Interstate-5
I-80	Interstate-80
IIC	Imperial Irrigation District
Interior	U.S. Department of the Interior
IOCs	inorganic chemicals
ISDP	Interim South Delta Program
ISO	California Independent System Operator

J

JPOD	joint point of diversion

K

KCWA	Kern County Water Agency

L

LCPSIM	Least-Cost Planning Simulation Model
Ldn	day-night sound level
LTMS	Long-Term Management Strategy

M

M&I	municipal and industrial
MAD	mosquito abatement district
MAF	million acre-feet
MCLGs	maximum contaminant level goals
MCLs	maximum contaminant levels
mg/L	milligrams per liter
MH	Maas-Hoffman
MOA	Memorandum of Agreement
msl	mean sea level
MTBE	methyl tert-butyl ether
MW	megawatts
MWD	The Metropolitan Water District of Southern California
MWh	megawatt hour
MWQI	Municipal Water Quality Investigation
μg/L	micrograms per liter
μmhos/cm	micromhos per centimeter

N

NBA	North Bay Aqueduct
NAWQA	National Water Quality Assessment
NCCAB	North Central Coast Air Basin
NCFCWCD	Napa County Flood Control and Water Conservation District
NCP	navigation control point
NDDB	National Diversity Data Base
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NMOG	non-methane organic gas
NOD	Notice of Determination
NOI/NOP	Notice of Intent/Notice of Preparation
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source pollution
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSDWR	National Secondary Drinking Water Regulations
NWR	National Wildlife Refuge

O

O_3	ozone
Ops	Operations Coordination

P

PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PG&E	Pacific Gas and Electric Company
PL	Public Law
PM_{10}	particulate matter smaller than 10 microns in diameter
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand

Program	CALFED Bay-Delta Program
Programmatic EIS/EIR	Programmatic Environmental Impact Statement/Environmental Impact Report

Q

QWEST	Measure of net flow in the lower San Joaquin River and other smaller Delta channels

R

RBDD	Red Bluff Diversion Dam
Reclamation	U.S. Bureau of Reclamation
RMP	Regional Monitoring Plan
RO	reverse osmosis
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board

S

SB	Senate Bill
SBA	South Bay Aqueduct
SCFCWCD	Solano County Flood Control and Water Conservation District
SCVWD	Santa Clara Valley Water District
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMPA	Suisun Marsh Preservation Agreement
SO_2	sulfur dioxide
SOC	synthetic organic chemical
SR 99	State Route 99
SRA	State Recreation Area
SRFCP	Sacramento River Flood Control Project
Strategic Plan	Strategic Plan for the Ecosystem Restoration Program
SDCWA	San Diego County Water Authority
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWTR	Surface Water Treatment Rule

T

TAF	thousand acre-feet
TCE	trichloroethylene
TDS	total dissolved solids
THM	trihalomethane
TIE	toxicity identification evaluation
TMDL	total maximum daily load
TOC	total organic carbon
TSS	total suspended solids
TTHMs	total trihalomethanes

U

USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
USTs	underground storage tanks

V

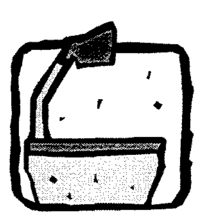
UV	ultra violet
VAMP	Vernalis Adaptive Management Plan
VMS	Visual Management System
VOCs	volatile organic chemicals

W

Western	Western Area Power Administration
WMA	Wildlife Management Area
WQCP	water quality control plan
WSCC	Western Systems Coordinating Council

Chapter 1. Project Description

The Bay-Delta estuary is the largest estuary on the West Coast and is the hub of California's water supply system. For decades, conflicting demands on the system have resulted in threats to Bay-Delta resources, including a declining ecosystem with some species threatened with extinction, degradation of water quality, and reduced levee system stability. The initial steps of how the CALFED Bay-Delta Program hopes to alleviate the problems in the Bay-Delta are outlined in this chapter.



1. Project Description

1.1 PROJECT DESCRIPTION

1.1.1 BACKGROUND

A maze of tributaries, sloughs, and islands, the San Francisco Bay/Sacramento-San Joaquin Delta estuary (Bay-Delta) is the largest estuary on the West Coast of the United States. It is a haven for plants, fish, and wildlife, supporting over 750 plant and animal species. In addition to native species, a number of species have been introduced either purposefully (striped bass) or accidentally (Chinese mitten crab). The Bay-Delta includes over 738,000 acres in five counties. The Bay-Delta is critical to California's economy, supplying drinking water for two-thirds of Californians and irrigation water for over 7 million acres of the most highly productive agricultural land in the world. The location of the Sacramento-San Joaquin Delta is shown in Figure 1-1.

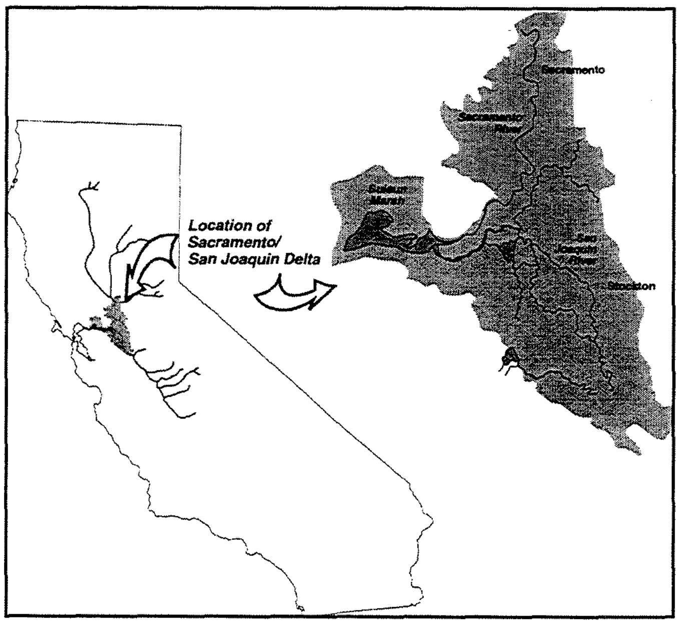


Figure 1-1. Location of the Sacramento/ San Joaquin Delta

For decades, the region has been the focus of competing interests—economic and ecologic, and urban and agricultural. These conflicting demands have resulted in a number of threats to Bay-Delta resources:

- Declining fish and wildlife habitat
- Native plant and animal species becoming threatened with extinction

Some Delta Statistics

- 738,000 acres including 538,000 acres of irrigated agriculture
- 750 plant and animal species
- Source of drinking water for 22 million Californians
- Supplies irrigation water for the 45% of the nation's produce grown in California

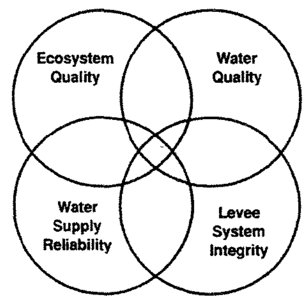
- Degradation of the Delta as a reliable source of high quality water

- A Delta levee system faced with an unacceptably high risk of failure

Even though environmental, urban, and agricultural interests have recognized the Delta as a critical resource, for decades they have been unable to agree on appropriate management of the Delta resources. Consequently, the numerous "traditional" efforts to address the Bay-Delta problems, including government decrees, private remediation efforts, and seemingly endless rounds of litigation, have failed to reverse the steady decline of the Delta as fish and wildlife habitat and as a reliable source of water.

Interrelationships of Bay-Delta Problems and Solutions

What are the problems that face the Bay-Delta and why have they occurred? At the simplest level, problems occur when demands conflict over the use of resources from the Bay-Delta system. As California's population increases, we ask more of the system and there is more conflict. Single-purpose efforts to solve problems often fail to address these conflicts. To the extent that these efforts acquire or protect resources for one interest, they may cause impacts on other resources and increase the level of conflict. In the past, most efforts to improve water supply reliability or water quality, improve ecosystem health, or maintain or improve the Delta levees were single-purpose projects. Single-purpose projects have the potential to solve one problem but create other problems, and thereby engender opposition to future actions.



The CALFED Bay-Delta Program has taken a different approach, recognizing that many of the problems in the Bay-Delta system are interrelated. Problems in one resource problem area cannot be solved effectively without addressing problems in all four problem areas at once. This greatly increases the scope of our efforts but ultimately will enable us to make progress and move forward to a lasting solution.

1.1.2 DEVELOPMENT OF THE CALFED BAY-DELTA PROGRAM

The CALFED Bay-Delta Program (Program) was established in May 1995. CALFED is a consortium of five state and ten federal agencies with management and regulatory responsibilities in the Bay-Delta estuary.

State and federal agencies participating in CALFED are noted in the box on the next page. They are listed according to their respective roles in preparation of the Programmatic Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

Seeking solutions to the resource problems in the Bay-Delta, state and federal agencies signed a "Framework Agreement" in June 1994. As part of the Framework Agreement, the state and federal governments pledged to (1) coordinate their implementation of water quality standards to protect the Bay-Delta estuary; (2) coordinate the operation of the State Water Project (SWP) and the Central Valley Project (CVP), which both involve transporting fresh-water through the Delta to points south; and (3) develop a process to establish a long-term Bay-Delta solution that will address four categories of problems: ecosystem quality, water quality, water supply reliability, and levee system vulnerability.

The impetus to forge this joint effort came at the state level in December 1992 with the formation of the State Water Policy Council and the Bay-Delta Oversight Council, an advisory group to the State Water Policy Council. In September 1993, the Federal Ecosystem Directorate was created to coordinate federal resource protection and management decisions for the Bay-Delta.

Role of CALFED Agencies in Preparation of Programmatic EIS/EIR

Lead Agencies—State and federal agencies who have the principal responsibility for carrying out or approving the project:

- Resources Agency of California
- U.S. Fish and Wildlife Service
- U.S. Bureau of Reclamation
- U.S. National Marine Fisheries Service
- U.S. Environmental Protection Agency
- U.S. Natural Resource Conservation Service
- U.S. Army Corps of Engineers

Responsible Agencies—State agencies, other than the lead agency, with a legal responsibility for carrying out or approving the project:

- California Environmental Protection Agency
- California Department of Fish and Game*
- California Department of Water Resources
- California State Water Resources Control Board

Cooperating Agencies—Federal agencies, other than the lead agencies, with jurisdiction by law or special expertise with respect to any environmental impact:

- U.S. Forest Service
- U.S. Geological Survey
- U.S. Western Area Power Administration
- U.S. Bureau of Land Management

Other agencies, such as the California Department of Food and Agriculture, regularly participate.

* The California Department of Fish and Game is also a trustee agency with jurisdiction over natural resources held in trust for the people of California.

The Framework Agreement laid the foundation for the Bay-Delta Accord and CALFED. The Accord, also called the Principles for Agreement on Bay-Delta Standards between the State of California and the Federal Government, detailed interim measures for both environmental protection and regulatory stability in the Bay-Delta. On December 15, 1994, the Accord was signed by state and federal resource agencies, with the cooperation of local water agencies and environmental organizations. The Accord was set to expire on December 15, 1997. In late 1997, the state and federal signatories to the Accord extended its effect through December 31, 1998. In December 1998, a second 1-year extension was signed, extending the Accord until December 1999.

CALFED oversees the coordination and increased communication between federal agencies, state agencies, and stakeholders in three areas outlined in the Framework Agreement:

- Substantive and procedural aspects of water quality standard setting;
- Improved coordination of water supply operations with endangered species protection and water quality standard compliance; and
- Development of a long-term solution to fish and wildlife, water supply reliability, flood control, and water quality problems in the Bay-Delta.

The Program is charged with responsibility for the third issue identified in the Framework Agreement. This Draft Programmatic EIS/EIR evaluates this long-term program.

1.1.3 STRUCTURE OF THE PROGRAM

In addition to the CALFED agencies, Bay-Delta stakeholders contribute to the Program design and the problem-solving and decision-making process. The public participation and input that have been essential throughout the process have included the Bay-Delta Advisory Council (BDAC) and public participation in workshops, scoping meetings, comment letters, and other public outreach efforts. The BDAC charter is described in the adjacent text box.

Bay-Delta Advisory Council

The Bay-Delta Advisory Council (BDAC) is chartered under the Federal Advisory Committee Act and includes representatives of stakeholders, including water districts and utilities, environmental organizations, the California Farm Bureau, and sport fishing organizations from throughout California, jointly selected by the Governor of California and President Clinton, and appointed by Secretary of the Interior Babbitt. The BDAC meets regularly with CALFED agencies and staff to review the status of work on developing the recommended program. Additionally, BDAC has formed several subcommittees, called "work groups," on various issues to provide more focused attention on particularly complex issues. This group of public advisors helps define problems in the Bay-Delta, helps to assure broad public participation, and offers advice on proposed solutions.

The CALFED agencies appointed an Executive Director to oversee the process of developing a long-term comprehensive plan for the Delta. The Executive Director selected staff from the CALFED agencies to carry out the task. In addition, the CALFED agencies and stakeholders worked with the Program through multi-level technical and policy teams.

The Program was divided into a three-phase cooperative planning process (Figure 1-2). The process is expected to lead to a determination of the most appropriate strategy and actions necessary to reduce conflicts in the Bay-Delta system. Phase I began in May 1995 with a series of public workshops to define the problems of the Bay-Delta and begin work on developing a range of alternatives to solve the Bay-Delta system problems. The Program participants worked to clearly define the fundamental problems in the Bay-Delta system: ecosystem quality, water supply reliability, water quality, and levee system integrity. This effort resulted in the development of a mission statement, solution principles, and objectives (on the following page) for the Program. In addition, an initial group of actions was developed and refined into three preliminary categories of solutions (Section 1.4.1). Phase I was completed in August 1996.

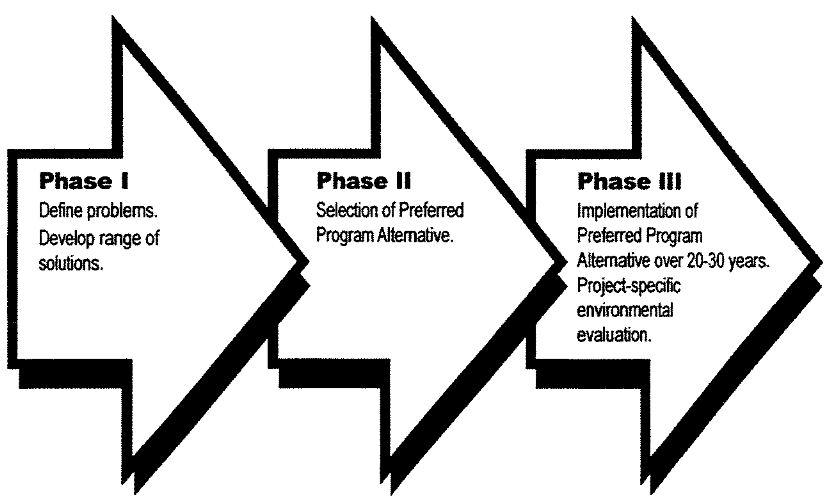


Figure 1-2. Three Phases of the CALFED Process

CALFED Bay-Delta Program Mission Statement

The mission statement does not stand alone as a single statement of Program purpose. Rather, the mission statement is supported by sets of primary objectives and solution principles. The mission statement is important and reflects the basic intent of the Program. However, the full expression of the Program mission is reflected in the mission statement, objectives, and solution principles, read together.

Mission Statement

The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system.

Primary Objectives of the CALFED Program

- *Ecosystem Quality* - Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species.
- *Water Supply* - Reduce the mismatch between Bay-Delta water supplies and the current and projected beneficial uses dependent on the Bay-Delta system.
- *Water Quality* - Provide good water quality for all beneficial uses.
- *Vulnerability of Delta Functions* - Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.

Solution Principles

The solution principles were developed as a means to achieve the Program's objectives in the context of a multi-purpose mission and a history of (competing) contentious environmental, political, and institutional influences on the affected resources. The solution principles provide an overall measure of the acceptability of alternatives and guide the design of the institutional part of each alternative. The solution principles are:

- **Reduce conflicts in the system**. Solutions will reduce major conflicts among beneficial uses of water.
- **Be equitable.** Solutions will focus on solving problems in all problem areas. Improvement for some problems will not be made without corresponding improvements for other problems.
- **Be affordable**. Solutions will be implementable and maintainable within the foreseeable resources of the Program and stakeholders.
- **Be durable**. Solutions will have political and economic staying power and will sustain the resources they were designed to protect and enhance.
- **Be implementable**. Solutions will have broad public acceptance and legal feasibility, and will be timely and relatively simple to implement compared with other alternatives.
- **Pose no significant redirected impacts**. Solutions will not solve problems in the Bay-Delta system by redirecting significant negative impacts, when viewed in their entirety, within the Bay-Delta or to other regions of California.

Phase II is ongoing and will culminate with a Record of Decision (ROD) and certification (CERT) of the EIS/EIR in 2000. Phase II includes development of the Preferred Program Alternative and development of an implementation plan focusing on the first 7 years following the ROD/CERT. Section 1.4.2 presents the Phase II alternative development process.

During Phase III, the Preferred Program Alternative will begin to be implemented, and will continue in stages over many years. This phase will include any necessary studies and site-specific environmental review and permitting. Because of the size and complexity of the Program alternatives, implementation is likely to take place over a period of 20–30 years. Part of the challenge for Phase II is designing an implementation strategy that acknowledges this long planning horizon and ensures that all participants remain committed to the successful completion of all phases of implementation.

1.2 PROJECT DESCRIPTION AND PROGRAM PURPOSE AND NEED

The project description is an element of an EIR required by the California Environmental Quality Act (CEQA). For the Program, the project description is the same as the purpose and need statement required by the National Environmental Policy Act (NEPA).

Purpose Statement

The purpose of the CALFED Program is to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system.

The purpose of the Program is to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system. To practicably achieve this program purpose, CALFED will concurrently and comprehensively address problems of the Bay-Delta system within each of four critical resource categories: ecosystem quality, water quality, water supply reliability, and levee system integrity. Important physical, ecological, and socioeconomic linkages exist between the problems and possible solutions in each of these categories. Accordingly, a solution to problems in one resource category cannot be pursued without addressing problems in the other resource categories.

Because of the complexity of the problems and solutions being considered, the following goals and objectives explain how the Program intends to achieve the purpose within each of these four critical resource categories.

Ecosystem Quality. The goal for ecosystem quality is to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta system to support sustainable populations of diverse and valuable plant and animal species. This can be accomplished by addressing the objectives, which collectively improve and increase aquatic and wetland habitats so that they can support the sustainable production and survival of estuarine and anadromous fish and wildlife species, and increase population health and population size to levels that assure sustained survival.

The objectives in summary form are:

1. Increase the amount of shallow riverine, shaded riverine, tidal slough, and estuary entrapment and null zone habitats for aquatic species.

2. Improve the in-Delta, upstream, and downstream movement of larval, juvenile, and adult life stages of aquatic species.

3. Reduce water quality degradation.

4. Increase the amount of brackish tidal marsh, fresh-water marsh, riparian woodland, waterfowl breeding habitat, wintering range for wildlife, managed permanent pasture and floodplains, and associated riparian habitats for wildlife species.

5. Contribute to the recovery of threatened or endangered species and species of special concern.

Water Supply Reliability. The goal for water supply reliability is to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system. This can be accomplished by addressing the objectives, which collectively reduce the conflict among beneficial water users, improve the ability to transport water through the Bay-Delta system, and reduce the uncertainty of supplies from the Bay-Delta system. These objectives in summary form are:

The goal for water supply reliability is to reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system.

1. Maintain an adequate water supply to meet expected in-Delta beneficial use needs.

2. Improve export water supplies to help meet beneficial use needs.

3. Improve the adequacy of Bay-Delta water to meet Delta outflow needs.

4. Reduce the vulnerability of Bay-Delta levees.

5. Improve the predictability of the water supply available from the Bay-Delta system for beneficial use needs.

Water Quality. The goal for water quality in the Bay-Delta system is to provide good-quality water for all beneficial uses, including drinking water, agricultural uses (both in-Delta and exported), industrial uses, recreational in-Delta uses, and Delta aquatic habitats. This can be accomplished by addressing the objectives, which collectively provide for the improvement of water quality for all beneficial uses. The objectives in summary form are:

The goal for water quality in the Bay-Delta system is to provide good-quality water for all beneficial uses, including drinking water, agricultural uses (both in-Delta and exported), industrial uses, recreational in-Delta uses, and Delta aquatic habitats.

1. Improve the reliability and quality of raw water for drinking water needs.

2. Reduce constituents in agricultural water that affect operations and crop productivity.

3. Improve the reliability and quality of water for industrial needs.

4. Improve the quality of raw water for recreational uses including consumption of aquatic resources.

5. Improve the quality of water for environmental needs.

Levee System Integrity. The goal for levee system integrity is to reduce the risk to land uses and associated agricultural and other economic activities, water supply, infrastructure, and the Bay-Delta ecosystem from catastrophic breaching of Delta levees. This can be accomplished by addressing the objectives, which collectively provide management of the risk resulting from gradual deterioration of Delta conveyance and catastrophic breaching of the Delta levees. The objectives in summary form are:

The goal for levee system integrity is to reduce the risk to land uses and associated agricultural and other economic activities, water supply, infrastructure, and the Bay-Delta ecosystem from catastrophic breaching of Delta levees.

1. Reduce the risk to land use from seepage and overtopping of the levees, subsidence of peat soils, and catastrophic inundation of Delta islands.

2. Reduce the risk to in-Delta and export water supply from sudden catastrophic island inundation and the resultant salinity intrusion.

3. Reduce the risk to in-Delta and export water supply facilities from sudden catastrophic island inundation.

4. Reduce the risk to the existing Delta ecosystem from seepage, erosion, and overtopping of levees; from peat soils; and from catastrophic island inundation and the resultant salinity intrusion.

The purpose statement responds to the following needs.

Ecosystem Quality. The health of the Bay-Delta system has declined as a result of a number of factors, including degradation and the loss of habitats that support various life stages of aquatic and terrestrial biota. Further, the decline in health has resulted from activities within and upstream of the Bay-Delta system. One early human-induced event was hydraulic mining in the river drainages along the eastern edge of the Central Valley. The mining degraded habitat in Central Valley streams as channel beds and shallow areas filled with sediment. In addition, the reduced capacity of the sediment-filled channels increased the frequency and extent of periodic flooding, accelerating the need for flood control measures to protect adjacent agricultural, industrial, and urban lands. Levees constructed to protect these lands eliminated fish access to shallow overflow areas, and dredging to construct levees eliminated the tule bed habitat along the river channels.

The health of the Bay-Delta system has declined as a result of a number of factors, including degradation and the loss of habitats that support various life stages of aquatic and terrestrial biota.

Since the 1850s, 700,000 acres of overflow and seasonally inundated lands in the Bay-Delta system have been converted to agricultural, industrial, and urban uses. Many of the remaining stream sections have been dredged or channelized to improve navigation and to increase stream conveyance capacity in order to accommodate flood flows and facilitate water export.

Upstream water development and use, depletion of natural flows by local diverters, and the export of water from the Bay-Delta system have changed seasonal patterns of the inflow, reduced the outflow, and diminished the natural variability of flows into and through the Bay-Delta system. Facilities constructed to support water diversions (upstream, in-Delta, and export facilities) cause straying or direct losses of fish (for example, through unscreened diversions) and can increase exposure of juvenile fish to predation. Entrainment and removal of substantial quantities of food-web organisms, eggs, larvae, and young fish further exacerbate the impacts of overall habitat decline.

Habitat alteration and water diversions are not the only factors that have affected ecosystem health. Water quality degradation caused by pollutants and increased concentrations of substances also may have contributed to the overall decline in the health and productivity of the Bay-Delta system. In addition, undesirable introduced species may compete for available space and food supplies, sometimes to the detriment of native species or economically important introduced species.

Water Supply Reliability. The Bay-Delta system provides the water supply for a wide range of in-stream, riparian, and other beneficial uses—such as drinking water for millions of Californians and irrigation water for agricultural land. While some beneficial water uses depend on the Bay-Delta system for only a portion of their water needs, others are highly or totally dependent on Bay-Delta water supplies. As water use and competition among uses has increased during the past several decades, conflicts have increased among users of Bay-Delta water. Heightened competition for the water during certain seasons or during water-short years has magnified the conflicts.

As water use and competition among uses has increased during the past several decades, conflicts have increased among users of Bay-Delta water.

Water flow and timing requirements have been established for certain fish and wildlife species with critical life stages that depend on fresh-water flows. These requirements have reduced water supplies and flexibility to meet the quantity and timing of water delivered from the Bay-Delta system. Water suppliers and users are concerned that additional restrictions that may be needed to protect species would increase the uncertainty and further reduce the availability of Bay-Delta system water for agricultural, industrial, and urban purposes.

Delta levees and channels may fail. Water users are concerned that such failures could result in an interruption of water supply for both urban and agricultural purposes, and degradation of water quality and aquatic habitats.

Water Quality. Good-quality water is required to sustain the high-quality habitat needed in the Bay-Delta system to support a diversity of fish and wildlife populations. In addition, the Bay-Delta system is a source of drinking water for millions of Californians and is critical to the state's agricultural sector. The potential for increasingly stringent drinking water requirements that require new treatment technologies is spurring water providers to seek higher quality source waters and to address pollution in source waters. Pollutants enter the Bay-Delta system through a variety of sources, including sewage treatment plants, industrial facilities, forests, farm fields, mines, residential landscaping, urban streets, ships, and natural sources. The pollutants, pathogens, natural organics, and salts

Good-quality water is required to sustain the high-quality habitat needed in the Bay-Delta system to support a diversity of fish and wildlife populations. In addition, the Bay-Delta system is a source of drinking water for millions of Californians and is critical to the state's agricultural sector.

in the Bay-Delta system affect, in varying degrees, existing fish and wildlife, as well as human and agricultural uses of these waters. The salts entering the Bay-Delta system from the ocean and from return flows upstream and within the Delta decrease the utility of Bay-Delta system waters for many purposes, including the ecosystem, agriculture, and drinking water. The level of natural organics in the water (resulting primarily from the natural process of plant decay on many of the Delta peat soil islands) is of concern because of by-products formed from natural organics reacting with disinfection chemicals commonly used to meet public health requirements in water treatment.

Levee System Integrity. Levees were first constructed in the Delta during the late 1800s, when settlers began to turn tidal marshes into agricultural land. Over time, both natural settling of the levees and shallow subsidence (oxidation, which lowers the level of the land over time) of the Delta island soils resulted in a need to increase levee heights to maintain protection. There is a growing concern that this increased height, coupled with poor levee construction and inadequate maintenance, make Delta levees vulnerable to failure, especially during earthquakes or floods. Failure of Delta levees can result in flooding of Delta farmland and wildlife habitat. If a flooded island is not repaired and drained, the resulting large body of open water can expose adjacent islands to increased wave action and possible levee erosion. Levee failure on specific islands can affect water supply distribution systems, such as the Mokelumne Aqueduct. Similarly, levee failure on key Delta islands can draw salty water up into the Delta, as water from downstream rushes to fill the breached island. This is of particular concern in low-water years when less fresh water is available to repel the incoming salt water. Such a failure could interrupt the water supply for urban, agricultural, and environmental uses, and degrade water quality and aquatic habitats.

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1.3 PROGRAM GEOGRAPHIC SCOPE

The geographic scope of analysis and actions for the Program that evolved through both technical and public forum discussions focuses on the Bay-Delta system for purposes of problem definition, while allowing solution generation from a much broader area.

1.3.1 CALFED PROBLEM AND SOLUTION AREAS

The Program is addressing problems that have been identified in or closely linked to the Suisun Bay/Suisun Marsh and Delta area (see Figure 1-3). However, the scope of possible solutions to these problems encompass any action that can be implemented by the CALFED agencies, or can be influenced by them, to address the identified problems—regardless of whether implementation takes place in the Delta/Suisun Bay/Suisun Marsh area.

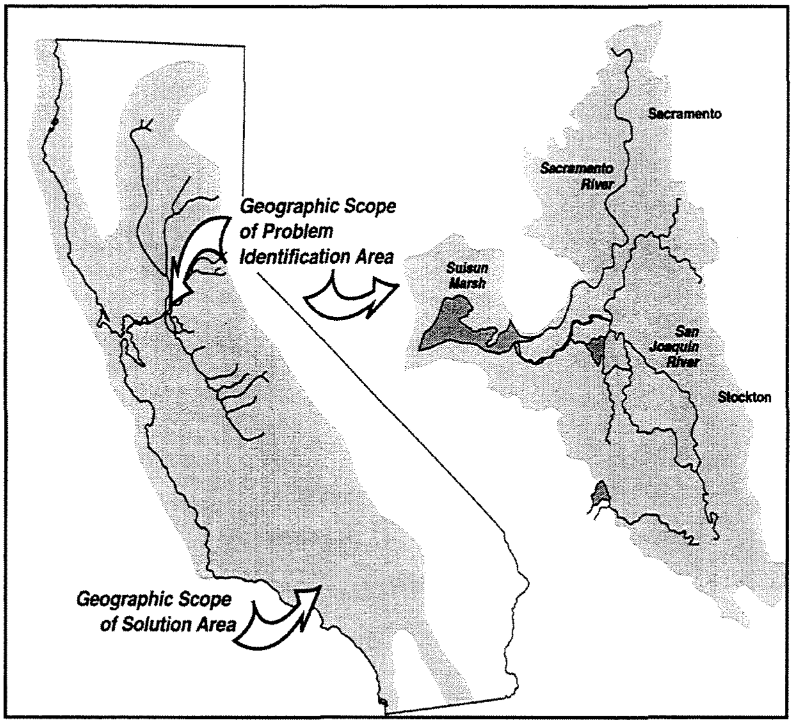

Figure 1-3. Geographic Scope of Program Problem and Solution Areas

Any problem currently associated with (1) the management and control of water in the Bay-Delta, or (2) the beneficial use of water in the Bay-Delta (including both environmental and economic uses) is within the purview of the Program if at least part of the problem is located in the Bay-Delta or is directly associated with conditions in the Bay-Delta.

In contrast to the problem scope, the solution scope is quite broad, potentially including any action that could help solve identified problems in the Bay-Delta. Since a wide range of actions are encompassed by the basic project purposes and solutions, it follows that various actions will affect different geographic areas, depending on the nature and location of the action. Thus, although each action will not affect the entire geographical solution area, certain actions will directly or indirectly affect areas in the Central Valley watershed, Trinity River watershed, southern California water system service area, Suisun Bay, San Pablo Bay, San Francisco Bay, portions of the Pacific Ocean out to the Farallon Islands, and a near-coastal band extending from about Morro Bay to the Oregon border.

An expanded solution scope is necessary because many problems related to the Bay-Delta are caused by factors outside the Bay-Delta. An expanded solution scope is desirable from a planning point of view because more benefits may be generated at lower cost if solutions are not limited to the geographic Bay-Delta.

An expanded solution scope is necessary because many problems related to the Bay-Delta are caused by factors outside the Bay-Delta. Moreover, an expanded solution scope is desirable from a planning point of view because more benefits may be generated at lower cost if solutions are not limited to the geographic Bay-Delta. For example, the problem of declining salmon populations is linked to the Bay-Delta because of high salmon mortality during salmon migrations. However, the broader problem of declining salmon populations extends far beyond the Bay-Delta. One solution action might be to reduce salmon mortality during salmon migration through the Bay-Delta. However, it might be less expensive and more effective to combine that action with an effort to promote greater salmon protection upstream.

1.3.2 DESCRIPTION OF THE STUDY AREA

The Program study area map, included as a pull out inside the back cover of this report, has been broken down into regions: the Delta Region, the Bay Region, the Sacramento River Region, the San Joaquin River Region (including the Tulare Lake Basin), and the Other SWP and CVP Service Areas.

Delta Region

The Delta Region is defined in California Water Code Section 12220 and is comprised roughly of lowlands (lands approximately at or below the 5-foot contour) and uplands (lands above the 5-foot contour that are served water by lowland Delta channels). The Delta Region has been carved out of the Sacramento River and San Joaquin River watersheds because of its legal status and the Program's focus on this region.

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Bay Region

The Bay Region includes Suisun Bay and Marsh, San Pablo Bay, and the San Francisco Bay watershed. In addition, an off-shore band, approximately 25 miles wide that runs from Point Conception to the Oregon border, has been included to cover anadromous fish along the California coast.

The Bay Region includes Suisun Bay and Marsh, San Pablo Bay, and the San Francisco Bay watershed. In addition, an off-shore band, approximately 25 miles wide that runs from Point Conception to the Oregon border, has been included to cover anadromous fish along the California coast.

The upper watershed areas of the Bay Region include the unregulated watersheds that drain directly into San Francisco Bay, and the watershed areas upstream of existing reservoirs and fish migration barriers in the San Francisco Bay Area. These areas include the east-sloping drainages of San Mateo, San Francisco, and Marin Counties; north- and west-sloping drainages of Contra Costa and Alameda Counties; and the east- and north-sloping drainages of Santa Clara County. The major creeks in the Bay Region include Miller, Corte Madera, San Rafael, Novato, San Ramon, Walnut, Pacheco, Wildcat, Alameda, Berryessa, Coyote, Guadalupe, Stevens, and San Francisquito.

Sacramento River Region

The Sacramento River Region essentially is bounded by the ridge tops of the Sacramento River watershed or hydrologic region. The Trinity River is connected by a pipeline to the Sacramento River system and contributes to the CVP water supply. Because of this

The Sacramento River Region essentially is bounded by the ridge tops of the Sacramento River watershed or hydrologic region.

contribution, the watershed area from which Trinity River flows are diverted into the Bay-Delta system is included in the geographic scope of the Program study area. The Goose Lake watershed, in the northeast corner of California, has been left out of the study area because it rarely contributes to the flow of the Pit and Sacramento Rivers.

The upper watershed areas of the Sacramento River Region can be subdivided into three sub-regions on the north, east, and west sides of the Sacramento Valley. The upper watershed areas on the north side of the valley include all or portions of Shasta, Siskiyou, and Trinity Counties. The upper watershed areas on the east side of the valley include all or portions of the following counties: Butte, Lassen, Modoc, Nevada, Placer, Plumas, Sierra, and Yuba. The upper watershed areas on the west side of the valley include all or portions of the following counties: Colusa, Glenn, Lake, Napa, Solano, Tehama, and Yolo.

San Joaquin River Region

The San Joaquin River Region includes both the San Joaquin and Tulare Lake hydrologic basins.

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Upper watershed areas of the San Joaquin River Region encompass the watersheds and major tributaries upstream of the existing reservoirs and fish migration barriers in the San Joaquin River Region. During years of high flood flows, the region may include the areas of the Kings River drainage upstream of Pine Flat Reservoir. The major rivers of the San Joaquin River watershed include the Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, San Joaquin, Chowchilla, and Fresno.

Other SWP and CVP Service Areas

The Other SWP and CVP Service Areas region includes two distinct, noncontiguous areas: in the north are the San Felipe Division's CVP service area and the South Bay SWP service area; to the south are the SWP service areas. The northern section of this region encompasses parts of the central coast counties of Santa Clara, San Benito, Santa Cruz, and Monterey. The southern portion includes parts of Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties.

The Other SWP and CVP Service Areas region includes two distinct, noncontiguous areas: in the north are the San Felipe Division's CVP service area and the South Bay SWP service area; to the south are the SWP service areas.

The upper watersheds in the Other SWP and CVP Service Areas are not described in this report because no specific watershed activities are proposed in these areas.

1.4 PROGRAM ALTERNATIVES DEVELOPMENT PROCESS

1.4.1 CALFED PHASE I PROCESS

Early in Phase I, the Program identified 50 categories of actions to resolve Bay-Delta problems and achieve Program objectives. These action categories were drawn from existing literature and input from CALFED agencies, BDAC, and numerous workshops with interested parties and the general public. The action categories represent the building blocks of the alternatives—that is, each alternative is a combination of action categories reflecting differing approaches to achieving Program objectives and addressing solution principles.

Given the large number of these categories and the range of perspectives on solutions to Bay-Delta problems among stakeholders and CALFED agencies, thousands of potential alternatives could have been identified. A first step for the Program was to devise a methodology that would keep the number of alternatives to a manageable level while still representing the full range of approaches to resolving problems.

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The methodology chosen to accomplish this was to define the critical conflicts that exist between bene-ficial uses and resources in the Bay-Delta and then to define approaches to resolving these conflicts

The methodology chosen to accomplish this was to define the critical conflicts that exist between beneficial uses and resources in the Bay-Delta and then to define approaches to resolving these conflicts. The following conflicts were identified:

- **Fisheries and Diversions.** The conflict between fisheries and diversions results primarily from fish mortality attributable to water diversions. This includes direct loss at pumps, reduced survival when young fish are drawn out of river channels into the Delta, and reduced spawning success of adults when migratory cues are altered. The effects of diversions on species of special concern have resulted in regulations that restrict the quantities and timing of diversions.

- **Habitat and Land Use and Flood Protection.** Habitat to support various life stages of aquatic and terrestrial biota in the Bay-Delta has been lost because of land development and construction of flood control facilities to protect developed land. The need for habitat affects land development planning as well as levee maintenance and planning. Efforts to restore the balance often require that land used for agricultural production be dedicated to habitat.

- **Water Supply Availability and Beneficial Uses.** As water use and competition for water have increased during the past several decades, conflict also has increased among users. A major part of this conflict is between the volume of in-stream water needs and out-of-stream water needs, and the timing of those needs within the hydrologic cycle.

- **Water Quality and Land Use.** Water quality can be negatively affected by land use, and ecosystem water quality needs are not always compatible with urban and agricultural water quality needs.

In assessing these conflicts, alternate approaches to conflict resolution and alternative levels of resolution were defined. Approaches for resolving the fisheries and diversions conflict included: (1) a fish productivity approach, and (2) a diversion modification approach. Approaches for resolving the habitat and land use and flood protection conflict included: (1) an existing land use pattern approach, and (2) a modified land use pattern approach.

In assessing these conflicts, alternate approaches to conflict resolution and alternative levels of resolution were defined.

Approaches for resolving the water supply availability and beneficial uses conflict included: (1) a demand reduction approach, and (2) a supply enhancement approach. Approaches for resolving the water quality and land use conflict included: (1) managing the quality of Delta inflows, and (2) managing in-stream water quality after discharges had occurred. Within each of these approaches, levels of conflict resolution ranging from less intensive to more intensive were identified.

This process produced 32 separate approaches to resolving the four conflicts. At this point, four teams of experts representing a variety of technical disciplines were formed—one team for each conflict area. These teams then were assigned an equal number of the 32 approaches (eight apiece), and directed to develop approximately three preliminary solution alternatives—sets of actions and action categories—for each of the eight approaches.

This procedure identified 100 preliminary solution alternatives that subsequently served as the foundation for the refinement process that defined the short list of three basic alternatives to be included in the Phase II analysis. In the Program's judgment, these 100 solution alternatives were representative of the larger number of possible combinations and bracketed the range of possible solutions to the four conflicts and, therefore, to the key problems facing the Bay-Delta. In addition, six solution principles guide the development of alternatives (see box on page 1-5).

A total of 100 preliminary solution alternatives subsequently served as the foundation for the refinement process that defined the short list of three basic alternatives to be included in the Phase II analysis.

The 100 preliminary alternatives were very broad by design. Moreover, they tended to address the four critical conflicts in varying degrees—that is, they were not necessarily balanced in addressing Program objectives and solution principles.

At this point in the process, leadership responsibility for the four teams was moved from the technical experts to Program staff. This change was made to take advantage of staff's specific expertise on Bay-Delta issues and to more systematically include Program team members in the process, in order to ensure maximum sensitivity to the policies and positions of the CALFED agencies and stakeholder groups. The Program teams were instructed to begin balancing their alternatives, and to refine the initial set to approximately 6-10 per area by combining those alternatives with similar characteristics. This process produced a refined list of 31 alternatives.

Continued consolidation and balancing of the alternatives brought the number to 20. These 20 alternatives were presented to stakeholders, BDAC members, and the public at a workshop. Consolidation and refinement based on input from that workshop produced the 10 alternatives described in the Program's April 1996 Phase I Progress Report. During April and May, the Program conducted 9 public meetings around the state, a workshop in Sacramento, and a meeting of the Bay-Delta Advisory Council to discuss the 10 alternatives.

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The comments received at the meetings and workshop cover a wide range of technical, policy, and financial concerns.

The comments received at the meetings and workshop cover a wide range of technical, policy, and financial concerns. Oral comments were generally consistent with comments contained in the over 160 letters received by the Program. Some of the comments prompted consideration of modifying the structure and presentation of the alternatives, as follows:

- The best possible source water quality is of paramount importance to urban water supplies. Agencies that deliver drinking water are very concerned about the cost of meeting future drinking water quality standards, as well as the technical challenges associated with treating source water of degraded quality. This suggests strong pollutant source control measures in every alternative.

- Delta levees will be needed to protect agriculture, infrastructure, and habitat no matter how water is conveyed in the Delta. Delta levees protect many values, including farms, habitat, infrastructure, and Delta water quality. Even if a new conveyance facility is built that protects water quality for some export users, adequate levee integrity will still be required to protect water quality and many other values in the Delta. This argues for a similar level of Delta levee protection in each alternative.

- Ecosystem actions at the modest and perhaps the moderate level appear inadequate; the Program needs a single coherent vision of ecosystem restoration. The restoration of ecosystem functions and the recovery of Bay-Delta species likely will require diverse actions that will be extensive in scope. There is really no alternative to a single comprehensive plan for restoring ecosystem health. Adaptive management will be vital in guiding efforts to improve ecosystem quality. It is this adaptive management that will provide the needed flexibility in the Ecosystem Restoration Program.

- Water use efficiency must be strongly pursued in all the alternatives. This suggests that water use efficiency measures should be implemented at an increased level among all the alternatives, where previously some alternatives included efficiency at modest or moderate levels.

The above comments led to the conclusion that water use efficiency, water quality, levee system integrity, and ecosystem quality were necessary in each of the alternatives to achieve the Program's purpose and needed to be composed of the same actions in all alternatives. Although the goal is to implement each of these programs at high levels in order to effectively achieve the Program's purpose, they will be implemented incrementally, or in stages, over time. This will provide flexibility for monitoring and adapting actions in response to the results of the initial actions.

The remaining components, conveyance and water storage, include the approaches that could vary by alternative. Distinctly different alternatives that cover the range represented by the 10 draft alternatives could be formed by combining the four programs that are common to all alternatives with the two variable components. This general concept was confirmed by application of solution principles for alternative refinement and evaluation.

Based on this information, the fundamental structure of the alternatives was simplified. Three basic alternative approaches were formed around different configurations of Delta conveyance: existing system conveyance, modified through-Delta conveyance, and dual-Delta conveyance. Each includes the same set of four programs that are common to all alternatives and involve water use efficiency, water quality, levee system integrity, and ecosystem quality. Storage for each alternative could be evaluated to support these programs and the Delta conveyance and to seek a balance between attainment of program objectives and cost effectiveness.

> At the end of Phase I, three basic alternative approaches were formed around different configurations of Delta conveyance: existing system conveyance, modified through-Delta conveyance, and dual-Delta con-veyance. Each includes the same set of four programs that are common to all alternatives and involve water use efficiency, water quality, levee system integrity, and ecosystem quality.

1.4.2 CALFED PHASE II PROCESS

The three basic alternative approaches from Phase I were carried into Phase II. The major tasks undertaken during Phase II to further refine the alternatives were:

- Added two Program elements (Water Transfer and Watershed) to each alternative because of their value in helping the Program meet its multiple objectives.
- Refined the eight Program elements and associated actions.
- Developed strategies for implementing the alternatives.
- Developed 17 variations of the three basic alternative approaches to further explore potential refinements for storage and conveyance. These included three variations for Alternative 1, four variations for Alternative 2, and five variations for Alternative 3.
- Eliminated five variations from further consideration due to technical and other considerations (see Section 2.4).
- Evaluated the impacts of the 12 remaining variations in the March 1998 Draft Programmatic EIS/EIR (State Clearinghouse Number: 96032083).
- Eliminated some of the 12 variations and consolidated others (see Section 2.4).
- Considered public comments on the March 1998 Draft Programmatic EIS/EIR and additional technical analysis to redefine the three basic alternative approaches and develop a Preferred Program Alternative for evaluation in this report.

The 4 action alternatives evaluated in this report are very similar to 3 of the 12 action alternative variations evaluated in the March 1998 Draft Programmatic EIS/EIR.

The 4 action alternatives evaluated in this report are very similar to 3 of the 12 action alternative variations evaluated in the March 1998 Draft Programmatic EIS/EIR.

Alternative 1 is similar to Alternative Variation 1C, with and without storage, from the March 1998 Draft Programmatic EIS/EIR, with the addition of the Suisun Marsh levees and potential channel dredging for channel enlargement.

Alternative 2 is similar to Alternative Variation 2B, with and without storage, from the March 1998 Draft Programmatic EIS/EIR, with the same Suisun Marsh levees and potential channel dredging for channel enlargement.

Alternative 3 is similar to Alternative Variation 3E, with and without storage, from the March 1998 Draft Programmatic EIS/EIR, with the same Suisun Marsh levees and potential channel dredging for channel enlargement. Alternative 3 also includes evaluation of an isolated facility, ranging in size from 5,000 to 15,000 cubic feet per second (cfs).

The **Preferred Program Alternative** incorporates elements similar to some of the elements in Alternatives 1 and 2. While it includes a potential for a new diversion structure near Hood and channel to the Mokelumne River, the size of this facility would be considerably smaller than Alternative 2. If, after additional analysis, this new facility is not constructed, the Preferred Program Alternative would be most similar to Alternative 1.

The three basic Program alternatives and the Preferred Program Alternative are described in detail in Chapter 2. Section 2.4 discusses the alternative variations that were not carried forward for further evaluation in this Draft Programmatic EIS/EIR.

1.5 NEXT STEPS

Between the Draft Programmatic EIS/EIR and the Final Programmatic EIS/EIR—in early 2000, work will continue on refining and evaluating the Preferred Program Alternative. CALFED will work with elected officials, local agencies, interest groups, and the public over the coming months to respond to comments on this draft to finalize the Preferred Program Alternative.

Between the Draft Programmatic EIS/EIR and the Final Programmatic EIS/EIR—in early 2000, work will continue on refining and evaluating the Preferred Program Alternative.

The Record of Decision and certification of the EIS/EIR is expected to take place sometime in summer 2000.

1.5.1 ACTIONS THAT WILL BE TAKEN BASED ON THIS DOCUMENT

It is anticipated that future lead agencies, responsible agencies, and stakeholder local agencies, such as water districts, will rely on the Programmatic EIS/EIR as they consider subsequent actions. As appropriate, subsequent actions will be subject to alternative analysis, environmental review, and permitting decisions before these actions are implemented.

Program EIS/EIR

This environmental document is a Program EIS/EIR that is intended to provide the co-lead agencies and responsible agencies with the information necessary to make an informed decision when they decide whether to approve and adopt the Preferred Program Alternative. The purpose of a Program EIS/EIR is to identify and assess the environmental impacts of a series of actions that comprise an overall program, such as the CALFED Long-Term Program Plan. As described in the State CEQA Guidelines Section 15168, a Program EIR:

> May be prepared on a series of actions that can be characterized as one large project and are related either: (1) geographically; (2) as logical parts in the chain of contemplated actions; (3) in connection with issuance of rules, regulations, plans, or other general criteria to govern the conduct of a continuing program; or (4) as individual activities carried out under the same authorizing statutory or regulatory authority and having generally similar environmental effects which can be mitigated in similar ways.

The Multi-Species Conservation Strategy (Conservation Strategy) is a part of the Program. The environmental consequences of implementing the Conservation Strategy are described in the Programmatic EIS/EIR in conjunction with the analysis of the Program as a whole. At a programmatic level, the environmental effects of implementing the conservation measures in the Conservation Strategy are within the parameters of the environmental effects described in the Programmatic EIS/EIR for implementing the various Program elements and the associated mitigation strategies. Additional environmental review of individual Program actions will tier from the Programmatic EIS/EIR and provide further detail about the environmental effects of implementing Conservation Strategy conservation measures.

The Safe, Clean, Reliable Water Supply Act calls for the Programmatic EIS/EIR to include a schedule for all elements of the long-term comprehensive plan. The schedule is presented in the Implementation Plan Appendix.

The Safe, Clean, Reliable Water Supply Act calls for the Programmatic EIS/EIR to include a schedule for all elements of the long-term comprehensive plan.

1.6 RELATIONSHIP WITH OTHER ONGOING PROGRAMS

Due to the extent of the Program study area, many activities and studies are currently ongoing or planned for the near future that could be affected by Program actions. Related studies and projects that have been conducted recently or are currently being completed are summarized in the following discussion.

Water Rights Process for CVP and SWP (State Water Resources Control Board). As a followup to adopting the 1995 Water Quality Control Plan for the San Francisco/Sacramento-San

Joaquin Delta Estuary (WQCP), the State Water Resources Control Board (SWRCB) is evaluating alternatives for implementing that plan. This process may increase the amount of water provided by other water rights holders to meet Bay-Delta water quality standards. Consequently, operations of upstream projects may change. Because the outcome is not complete, a conservative assumption was used in modeling for the EIR being prepared by the SWRCB for the project. It was assumed that the Bay-Delta Accord criteria would be the long-term plan for the Delta. If in-stream flows provided by the other water rights holders increases, some portion of the Ecosystem Restoration Program environmental flows could be satisfied by this water rights process, which may reduce the amount of water that the Program needs to acquire from willing sellers. It may also reduce the amount of water that the Program needs to develop or may allow for the developed water to be used more effectively in meeting Program objectives. Any additional demand on water right holders could decrease the amount of water available for transfer.

Central Valley Project Improvement Act (U.S. Bureau of Reclamation). On October 30, 1992, the President signed into law the Reclamation Projects Authorization and Adjustment Act of 1992 (Public Law 102-575) that included Title XXXIV, the Central Valley Project Improvement Act (CVPIA). The CVPIA amends previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation. The impacts associated with the CVPIA have been analyzed in a draft programmatic EIS that was released in November 1997. The final EIS is due in fall 1999. Four provisions of the Act were included in the No Action Alternative for this EIS/EIR for the Program:

The CVPIA amends previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation.

- Dedication of 800 thousand acre-feet (TAF) for fish and wildlife purposes
- Delivery of Level 4 water amounts to state and federal refuges
- Shasta Temperature Control Device
- Restoration Fund and Friant Division Surcharge

The majority of the remaining CVPIA actions are included in the Program alternatives in the Water Use Efficiency, Water Transfer, Water Quality, and Ecosystem Restoration Programs. The Program seeks to improve overall system reliability. The Program's objective of improving water reliability may help to offset any agricultural water impacts due to dedication of the 800 TAF.

Place of Use EIR for CVP Water Supplies (U.S. Bureau of Reclamation/SWRCB). Some areas adjacent to the existing CVP service area have been served with CVP water. This process considered the impacts of expanding the SWRCB designated place of use for CVP water to include these areas. The SWRCB and U.S. Bureau of Reclamation (Reclamation) are preparing the EIR as part of the approval process. The modeling for this draft EIS/EIR assumes that the process will be completed by 2020, to include lands currently receiving CVP water. If it is not completed and approved, water would need to be used within the existing CVP service area. This may marginally increase the reliability of CVP deliveries and thereby marginally increase the overall reliability of the Program. The SWRCB is

Some areas adjacent to the existing CVP service area have been served with CVP water. This process considered the impacts of expanding the SWRCB designated place of use for CVP water to include these areas.

considering expanding the CVP place of use during its water quality plan implementation process.

Trinity River Studies (U.S. Fish and Wildlife Service). In October 1984, the U.S. Fish and Wildlife Service (USFWS) began a 12-year study to describe the effectiveness of increased flows and other habitat restoration activities to restore fishery populations in the Trinity River. An EIS/EIR is being prepared under a concurrent program to evaluate alternatives to restore and maintain natural production of anadromous fish in the Trinity River mainstem downstream of Lewiston Dam. Historically, an average annual quantity of approximately 1.3 million acre feet (MAF) of water has been diverted from the Trinity River to the Sacramento River system (1964-1992). While the Trinity River is outside the Program study area, a change in the Trinity River flow requirements and a corresponding change in the amount of water diverted to the Sacramento River system could affect future flows to the Delta. Changes also could affect overall water supply reliability and carryover storage in Shasta Reservoir, and water quality and temperature in the Sacramento River. A range of possible future Trinity River flow requirements has been considered in this programmatic evaluation (see Attachment A for additional detail).

The USFWS is preparing an EIS/EIR to evaluate alternatives to restore and maintain natural production of anadromous fish in the Trinity River mainstem downstream of Lewiston Dam.

Bulletin 160-98, California Water Plan Update (Department of Water Resources). Bulletin 160, updated every 5 years by the Department of Water Resources (DWR), contains estimates of future water demands in the state. Modeling for the Programmatic EIS/EIR considers a range of possible future demands for the No Action Alternative and the Program alternatives. The high end of this range is bound by the most recent demand estimates prepared for Bulletin 160-98 for 2020.

Bulletin 160, updated every 5 years by DWR, contains estimates of future water demands in the state.

Sacramento and San Joaquin River Basins Comprehensive Study (U.S. Army Corps of Engineers). In January 1997, California experienced one of the most costly and geographically extensive flood disasters in the history of the state. Major storms throughout California caused record flows on many rivers. In the Central Valley, storms stressed the flood management systems for the Sacramento and San Joaquin Rivers to their capacity and beyond. Although reservoir flood storage reduced flood flows by 50% or more, saving lives and significantly reducing property damage, levees failed in some areas. Two major levee breaks occurred on the Sacramento River and its tributaries. Many levees that did not fail were severely damaged and required extensive repairs. On the San Joaquin River, levees failed in more than two dozen places. Damages in both systems exceeded $0.5 billion.

In response to extensive flooding and damages in 1997, the U.S. Congress authorized the U.S. Army Corps of Engineers (Corps) to provide a comprehensive analysis of the Sacramento River and San Joaquin River basin flood management systems, and to partner with the State of California to develop master plans for flood management into the next century. The Corps and the California Reclamation Board are leading a Comprehensive Study to improve flood management by combining traditional flood damage reductions measures with nontraditional measures that include floodplain management concepts. The Comprehensive Study is examining policy issues that affect flood management and is seeking opportunities to integrate environmental restoration with flood damage reduction measures.

In response to extensive flooding and damages in 1997, the U.S. Congress authorized the Corps to provide a comprehensive analysis of the Sacramento River and San Joaquin River basin flood management systems, and to partner with the State of California to develop master plans for flood management into the next century.

The Comprehensive Study will develop and begin to implement master plans within a watershed framework that will increase flood protection and improve the ecosystem or major rivers and tributaries in the Central Valley. Because this study is the first system-wide evaluation of the flood management systems in the Central Valley, it represents a change in how projects are identified, selected, and implemented.

The study will contribute directly toward meeting the goals of the Levee System Integrity Program in the Delta. The Comprehensive Study is part of the No Action Alternative.

Long-Term Management Strategy (U.S. Environmental Protection Agency/Corps/SWRCB/Regional Water Quality Control Board/Bay Conservation and Development Commission). Coastal managers have long expressed concern about environmental threats of disposing large volumes of sediments in ecologically sensitive areas. The long-range goals of the Long-Term Management Strategy (LTMS) are to reduce disposal in the estuary and to find beneficial uses for the dredged material. The LTMS already has resulted in designation of a deep ocean disposal site 50 miles offshore of San Francisco that is an ecologically superior alternative to disposal in the estuary itself. Since use of the ocean disposal site began in late 1995, over 4 million cubic yards of dredged material have been diverted from disposal in the Bay, and overall Bay disposal has dropped from historical averages of about 6 million cubic yards annually, to approximately 2.5 million cubic yards.

The long-range goals of the Long-Term Management Strategy (LTMS) are to reduce disposal in the estuary and to find beneficial uses for the dredged material. Program and LTMS agencies will coordinate during Program implementation on potential joint levee construction and habitat restoration projects.

However, this is the short-term approach until beneficial use projects can be initiated. Dredged material can be reused in a variety of ways, including levee maintenance and stabilization, and restoration of habitat such as tidal wetlands. Using clean sediments from dredging projects, the LTMS agencies have participated in pilot levee maintenance projects and have constructed the Sonoma Baylands wetland restoration project. LTMS is now considering other projects and other ways of beneficially reusing dredged material. A specific policy of the LTMS is to pursue habitat restoration projects that are consistent with habitat goals and plans worked out in other venues, including the Program. Of particular interest are the cost-sharing opportunities of working with the Corps and other dredgers who must pay for the dredging in any event. These parties can provide the clean material to restoration projects much more efficiently than the restoration project could acquire the material.

Program and LTMS agencies will coordinate during Program implementation on potential joint levee construction and habitat restoration projects.

Vernalis Adaptive Management Plan (Reclamation/USFWS). The May 1995 WQCP contained water quality and flow objectives pertaining to the San Joaquin River basin. During 1997, Reclamation acquired water within the San Joaquin River system to help meet the WQCP's flow objectives. In an effort to refine the science for the flow objective, the San Joaquin River interests collaborated to identify feasible actions that would protect the river's fish resources and implement the SWRCB's flow objectives. This collaboration led to a proposed scientifically based adaptive fishery management plan known as the Vernalis Adaptive Management Plan (VAMP). The VAMP will provide protective measures for fall-run chinook salmon and will gather scientific information on survival of salmon

The Vernalis Adaptive Management Plan will be implemented through experimental flows on the San Joaquin River and export pumping rates with a temporary fish barrier on Old River during the 1-month period each year, from approximately April 15 to May 15.

smolts through the Delta. The VAMP will be implemented through experimental flows on the San Joaquin River and export pumping rates with a temporary fish barrier on Old River during the 1-month period each year, from approximately April 15 to May 15. Additional attraction flows are targeted for October.

The VAMP includes proposed water acquisition in the form of a pulse flow at Vernalis during the April and May period, and other flows identified to meet anadromous fish flow objectives. VAMP flows should have beneficial effects for Delta smelt. Water will be acquired from willing sellers by Reclamation on the San Joaquin River and its tributaries.

The San Joaquin River Group Authority, Reclamation, and the USFWS have prepared a final EIS/EIR for the VAMP, released in January 1999. In March 1999, an environmental assessment was released for additional water acquisition for meeting VAMP flow objectives. The VAMP will directly contribute to meeting the restoration goals of the Ecosystem Restoration Program. The VAMP is included in the No Action Alternative.

California 4.4 Plan (Colorado River Board). The rights of seven states (including California) and Mexico to use Colorado River water is governed by a series of agreements, treaties, laws, and court decisions—collectively referred to as the "Law of the River." California is entitled to 4.4 MAF of water in a normal year. Agriculture has first priority to about 90% of California's entitlement; the balance goes to The Metropolitan Water District of Southern California (MWD), which operates the Colorado River Aqueduct to deliver water to urban users.

Historically, California has used more water than its entitlement. California's use above its entitlement has been made possible through a reallocation of unused water from Arizona's and Nevada's entitlements. In 1997, the Colorado River provided about 5.2 MAF of the 8.4 MAF of water used for agriculture and urban uses in southern California. The Secretary of the Interior has directed California to devise a plan to live within its entitlement of 4.4 MAF of water per year.

The Secretary of the Interior has directed California to devise a plan to live within its entitlement of 4.4 MAF of water per year from the Colorado River.

The draft plan focuses on changes in the use, supply, or transfer of Colorado River water.

The Secretary of the Interior has advised California that, absent a plan on how it can live within its entitlement, the Secretary will be less likely beginning in 1999 to make water available to California above its entitlement. If California has an acceptable plan for living within its entitlement, the Secretary could make water available to the state beyond its entitlement through a water surplus declaration.

The Colorado River Board, with assistance from the Director of DWR, is responsible for developing the California plan. The Board's draft plan (dated August 11, 1997) includes the following major components, all of which are focused on changes in the use, supply, or transfer of Colorado River water. The plan relies first on a variety of intrastate measures that either conserve water or increase water supplies. The plan then relies on measures that would make extra water available to California. These measures include purchasing water from other states, interstate storage agreements, and revising the river's reservoir operations. Adoption of these measures is contingent on preapproval or other action by the Secretary of the Interior since other basin states would be affected.

If California was to live within its 4.4 MAF entitlement today, the immediate impact would fall mostly on MWD because almost all of the allocation to California above its entitlement now goes to urban users serviced by MWD. Since the draft California plan focuses on changes in use, supply, or transfer of Colorado River water, the Program has assumed the plan will **not** lead to additional demand on Delta water.

Imperial Irrigation District and San Diego County Water Authority Water Transfer. Depending on local conditions, San Diego County obtains from 75 to 95% of its water from MWD, which imports water from the Colorado River and northern California. The San Diego County Water Authority (SDCWA) has negotiated an agreement for the long-term transfer of conserved water from the Imperial Irrigation District (IID) to the San Diego region. Under the negotiated contract, IID and its agricultural customers would conserve water and sell it to the SDCWA for at least 45 years. Either agency may extend the contract for another 30 years beyond the initial term. Deliveries in the first year of the contract would total 20 TAF and increase annually in 20-TAF increments until they reach a maximum of 200 TAF. The two agencies may agree to transfer an additional 100 TAF per year after year 10. The SDCWA also has been negotiating with MWD for use of the Colorado River Aqueduct to deliver the water that would result from a water transfer agreement with IID.

The San Diego County Water Authority (SDCWA) has negotiated an agreement for the long-term transfer of conserved water from the Imperial Irrigation District (IID) to the San Diego region. Under the negotiated contract, IID and its agricultural customers would conserve water and sell it to the SDCWA for at least years.

These agreements could play a significant role in helping the Colorado River Board develop a plan that allows California to live within its 4.4-MAF water entitlement from the Colorado River. The Program has assumed that these agreements will NOT change demand for Delta water.

Category III. The Bay-Delta Accord included a commitment to develop and fund nonflow-related ecosystem restoration activities to improve the health of the Bay-Delta ecosystem. This funding source and commitment is commonly referred to as "Category III." The Category III Steering Committee was formed to administer previous rounds of Category III funding. In 1996, the administration function for Category III funds was shifted to CALFED's Restoration Coordination Program, which receives input from the Ecosystem Roundtable, the BDAC, and the general public. The Ecosystem Roundtable is a subcommittee of BDAC specifically created to provide input from a broad cross section of stakeholder interests to the Restoration Coordination Program.

The Bay-Delta Accord included a commitment to develop and fund non-flow related ecosystem restoration activities to improve the health of the Bay-Delta ecosystem. This funding source and commitment is commonly referred to as "Category III."

Actions funded under the Restoration Coordination Program are selected for their benefits to the long-term Program regardless of the final configuration of the Preferred Program Alternative. These actions must be consistent with any alternative configuration and provide early implementation benefits. This implementation also provides valuable information that can be used to adaptively manage the system. Actions funded through the Restoration Coordination Program must have appropriate environmental documentation, result in no potentially significant cumulative impacts, and must not limit the choice of a reasonable range of alternatives. As the CALFED long-term program becomes more developed, the priorities and project selection process have been revised to ensure consistency with the Strategic Plan for Ecosystem Restoration (Strategic Plan), the Ecosystem Restoration Program objectives, and the draft Stage 1 action list.

Ecosystem Restoration Program projects may be identified as directed programs or through a public solicitation process. The Ecosystem Restoration Program has the discretion of directing funds toward specific actions (directed programs) that are considered to help achieve the program's long-term ecosystem restoration goals. Projects selected as directed programs are identified through public and technical outreach and the use of the Strategic Plan, the Ecosystem Restoration Program objectives, and the draft Stage 1 action list. Proposals selected through the public solicitation process are evaluated and scored by technical review panels made up of state, federal, and stakeholder technical representatives with the necessary expertise. Once potential projects are identified either as directed programs or through technical scoring of solicited proposals, they are forwarded to the CALFED Integration Panel.

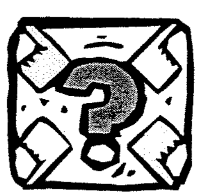
The Integration Panel, comprised of state, federal and stakeholder technical representatives, evaluates potential projects based on the Program's comprehensive goals for ecosystem restoration. The Integration Panel takes into consideration the project's ability to meet the funding priorities and implementation guidelines, the system-wide ecosystem benefits of the project, and its compatibility with non-ecosystem Program objectives. The Integration Panel forwards preliminary recommendations for funding to the Ecosystem Roundtable and CALFED Policy Group. The CALFED member agencies, acting through the CALFED Policy Group, make final funding recommendations to the Secretary for Resources and the Secretary of Interior.

The Integration Panel, comprised of state, federal and stakeholder technical representatives, evaluates potential projects based on the Program's comprehensive goals for ecosystem restoration. The Integration Panel takes into consideration the project's ability to meet the funding priorities and implementation guidelines, the system-wide ecosystem benefits of the project, and its compatibility with non-ecosystem Program objectives.

To date, the Restoration Coordination Program has received more than 800 proposals and has funded 195 projects, for a total of approximately $228 million. Types of projects funded have included fish screens, fish ladders, land acquisition, habitat restoration, and focused research and monitoring that are designed to provide information to improve future restoration efforts. Funding sources include contributions from the California Urban Water Agencies, Proposition 204 state bond funds and funding from the federal Bay-Delta Act, and federal EPA watershed funding. For 1999, the majority of funds available are from the federal Bay-Delta Act, with additional contributions from state Proposition 204. The Restoration Coordination Program also has the responsibility of improving coordination among fish and wildlife restoration programs in the Central Valley to ensure that Category III programs and projects are well integrated with other restoration programs, and are consistent with the long-term Ecosystem Restoration Program and the Strategic Plan.

Chapter 2. Alternative Descriptions

This chapter describes the alternatives considered in this Draft Programmatic EIS/EIR. The four Program alternatives represent approaches to meeting the CALFED Bay-Delta Program objectives.



2. Alternative Descriptions

This section describes the alternatives considered in this document. The CALFED Bay-Delta Program (Program) alternatives are discussed first, beginning with a brief summary of the alternatives that focuses on their differences, followed by an overview of each of the Program alternative elements. The No Action Alternative is then described. Next, the Environmentally Preferred Alternative is described. Finally, the other alternatives that were considered but not carried forward are noted, along with the rationale for eliminating them from further consideration.

The Preferred Program Alternative identified in this chapter consists of a set of broadly described programmatic actions that set the long-term, overall direction of the Program. However, detail at a greater level of specificity than is available in the programmatic description of the Preferred Program Alternative is important in understanding how this large, complex program may be implemented, funded, and governed in the future. Accordingly, the CALFED agencies have described their proposed actions for the first years following a Record of Decision (ROD)/Certification of the final EIS/EIR (CERT), as well as set out a long-term implementation strategy.

The Preferred Program Alternative identified in this chapter consists of a set of broadly described programmatic actions that set the long-term, overall direction of the Program.

The combined descriptions of the Preferred Program Alternative, the near-term actions, and the long-term implementation strategy comprise the CALFED Program Decision. The CALFED Program Decision is contained in Attachment B and is further described in the Phase II Report and Implementation Plan Appendices.

2.1 PROGRAM ALTERNATIVES

2.1.1 SUMMARY

The four Program alternatives represent differing approaches to conveying water through the Delta. Each of the alternatives includes the Ecosystem Restoration, Water Quality, Levee System Integrity, Water Use Efficiency, Water Transfer, Watershed, Storage, and Conveyance elements. Each Program alternative includes an assessment with storage up to 6.0 million acre-feet [MAF]) and without storage. Because the problem being addressed by the Program and the solution are closely interrelated, the descriptions of each of the Program elements, except for the Conveyance element, do not vary among alternatives.

The four Program alternatives represent differing approaches to conveying water through the Delta.

Program Alternatives

Alternative 1 relies primarily on the current configuration of the Delta channels.

Alternative 2 adds significant improvements to north Delta channels that accompany the south Delta improvements contemplated in Alternative 1.

Alternative 3 adds a new canal connecting the Sacramento River in the north Delta to the SWP and CVP export facilities in the south Delta.

The **Preferred Program Alternative** includes the potential for a new screened diversion near Hood and other north Delta improvements, if these features are determined necessary to meet drinking water quality goals and can be operated without adversely affecting fish populations.

Alternative 1 relies primarily on the current configuration of the Delta channels. One significant variation includes selected channel improvements in the south Delta, together with streamflow and stage barriers (or their equivalent) at selected locations. (See Figure 2-1.)

Alternative 2 adds significant improvements to north Delta channels that accompany the south Delta improvements contemplated in Alternative 1. The features include a 10,000-cubic foot per second (cfs) diversion facility in the vicinity of Hood on the Sacramento River. (See Figure 2-2.)

Alternative 3 adds a new canal connecting the Sacramento River in the north Delta to the SWP and CVP export facilities in the south Delta, in addition to the north and south Delta facilities contemplated in Alternatives 1 and 2. (See Figure 2-3.)

The Preferred Program Alternative incorporates elements similar to some of the elements in Alternatives 1 and 2. While it includes a potential for a new diversion structure near Hood and channel to the Mokelumne River, the size of this facility would be considerably smaller than Alternative 2. If after additional analysis this new facility is not constructed, the Preferred Program Alternative would be most similar to Alternative 1. (See Figure 2-4.)

2.1.2 Overview of the Eight Program Elements

The descriptions of the alternatives are programmatic, defining broad approaches to meet Program purposes. The alternatives are not intended to define the site-specific actions that ultimately will be implemented in Phase III of the Program. A more complete description of the programmatic actions on each of these elements can be found in the Revised Phase II Report Appendix as well as specific program appendices. In addition, the various program plans contain descriptions of near-term actions that, as appropriate, will be evaluated in subsequent environmental documents.

The descriptions of the alternatives are programmatic, defining broad approaches to meet Program purposes.

Figure 2-1

General Features of Alternative 1 with a Focus on Delta Facilities

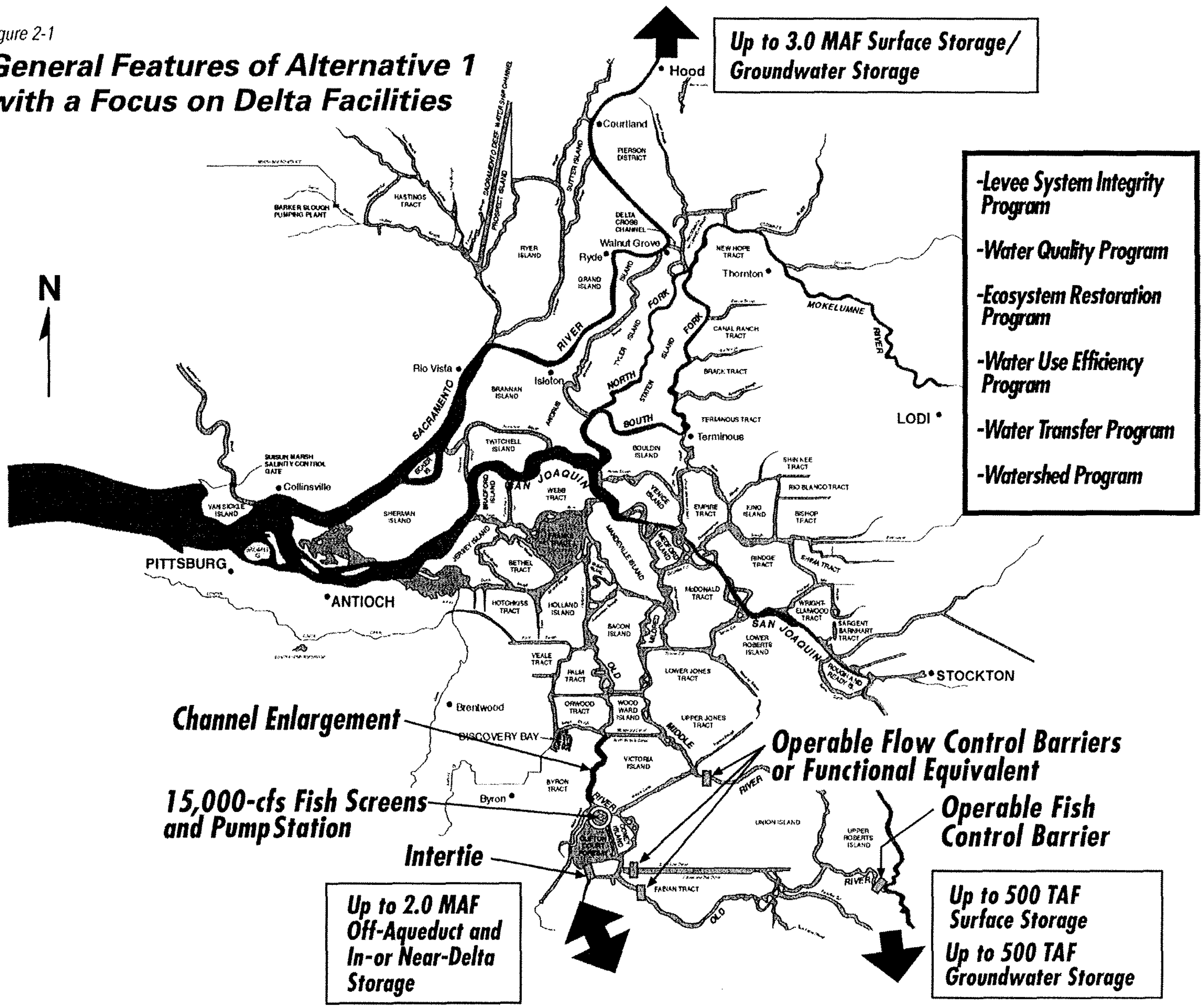


Figure 2-2
General Features of Alternative 2 with a Focus on Delta Facilities

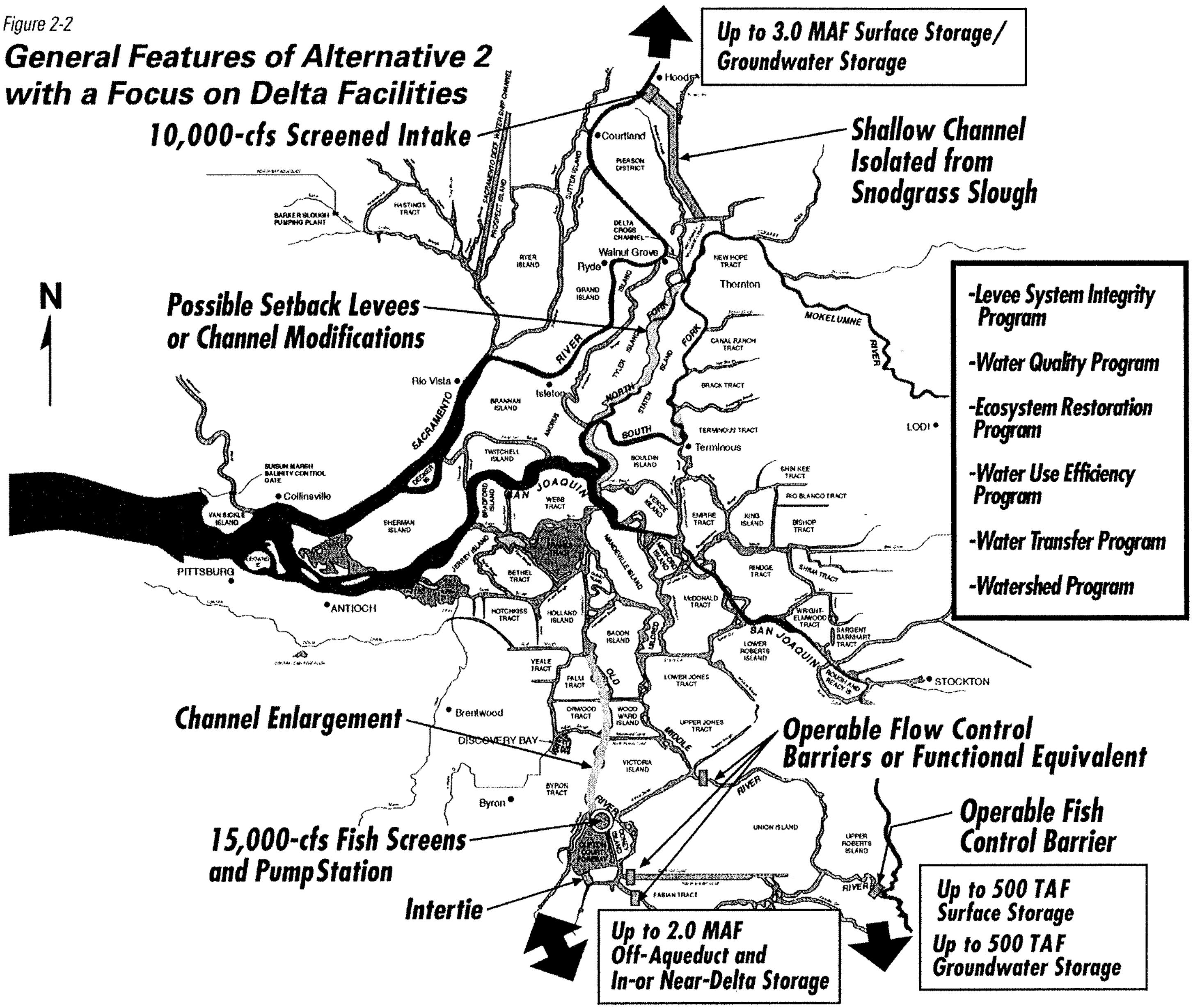


Figure 2-3

General Features of Alternative 3 with a Focus on Delta Facilities

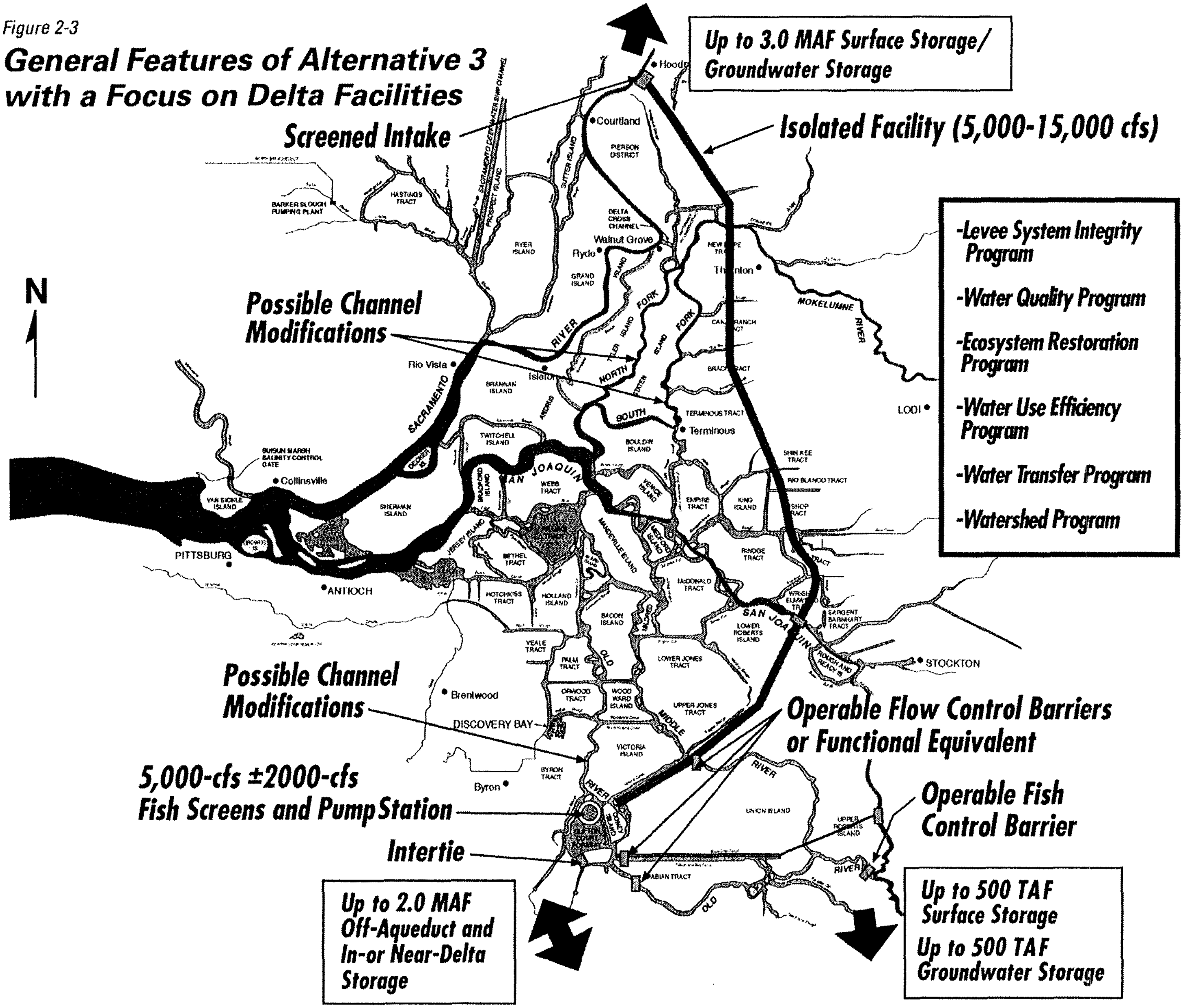
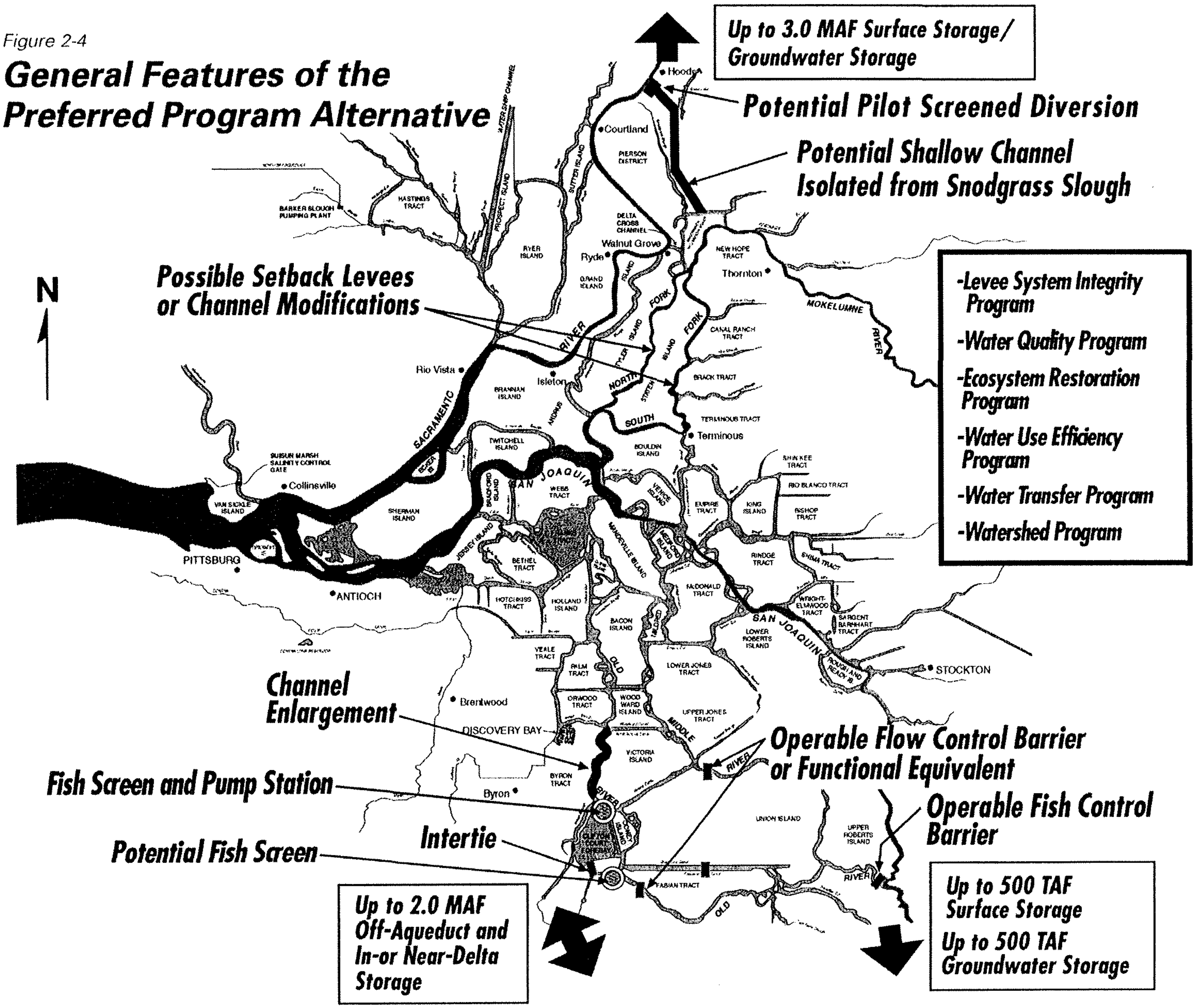
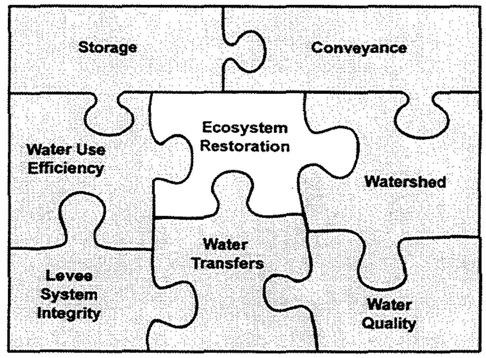


Figure 2-4

General Features of the Preferred Program Alternative



Ecosystem Restoration Program



The goal of the Ecosystem Restoration Program is to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta system to support sustainable populations of diverse and valuable plant and animal species. In addition, the Ecosystem Restoration Program, along with the water management strategy, is designed to achieve or contribute to the recovery of listed species found in the Bay-Delta and thus achieve goals in the Multi-Species Conservation Strategy (Conservation Strategy). Improvements in ecosystem health will reduce the conflict between environmental water use and other beneficial uses, and allow more flexibility in water management decisions.

The goal of the Ecosystem Restoration Program is to improve and increase aquatic and terrestrial habitats, and to improve ecological functions in the Bay-Delta in order to support sustainable populations of diverse and valuable plant and animal species.

The Ecosystem Restoration Program identifies programmatic actions designed to restore, rehabilitate, or maintain important ecological processes, habitats, and species within 14 ecological management zones. Implementation of these programmatic actions will be guided by six goals presented in the Strategic Plan for Ecosystem Restoration (Strategic Plan). Nearly 100 restoration objectives have been developed that are directly linked to one of the six goals. Each objective further defines the restoration approach for each ecological process, habitat, species, or ecosystem stressor. One to several restoration targets have been developed for each objective to set more specific or quantified restoration levels.

Long-term implementation of the Ecosystem Restoration Program will be guided by the adaptive management approach described in the Strategic Plan. This approach to restoration will require review by an Ecosystem Restoration Science Review Panel and will rely on information developed in the Comprehensive Monitoring, Assessment, and Research Program (CMARP).

The Ecosystem Restoration Program includes the following actions:

- Protecting, restoring, and managing diverse habitat types representative of the Bay-Delta and its watershed.
- Acquiring water from sources throughout the Bay-Delta's watershed to provide flows and habitat conditions for fishery protection and recovery.
- Restoring critical in-stream and channel-forming flows in Bay-Delta tributaries.
- Improving Delta outflow during key periods.
- Reconnecting Bay-Delta tributaries with their floodplains through constructing setback levees, acquiring flood easements, and constructing and expanding flood bypasses.

- Developing assessment, prevention, and control programs for invasive species.

- Restoring aspects of the sediment regime by relocating in-stream and floodplain gravel mining, and by artificially introducing gravels to compensate for sediment trapped by dams.

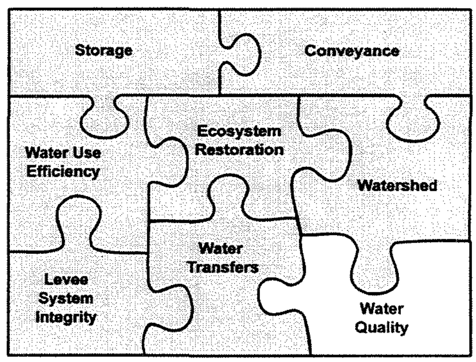
- Modifying or eliminating fish passage barriers, including removing dams, constructing fish ladders, and constructing fish screens that use the best available technology.

- Targeting research to provide information that is needed to define problems sufficiently and to design and prioritize restoration actions.

For more information, see the Ecosystem Restoration Program Plan and Revised Phase II Report Appendices.

Water Quality Program

The Program is committed to achieving continuous improvement in the quality of the waters of the Bay-Delta system—with the goals of minimizing ecological, drinking water, and other water quality problems and of maintaining this quality once achieved. Improvements in water quality will result in improved ecosystem health, with indirect improvements in water supply reliability. Improvements in water quality also increase the utility of water, making it suitable for more uses.



The Program is committed to achieving continuous improvements in the quality of the waters of the Bay-Delta system.

The Water Quality Program includes the following actions:

- Drinking water parameters. Reducing the loads and impacts of bromide, total organic carbon (TOC), pathogens, nutrients, salinity, and turbidity through a combination of measures—including source reduction, alternative sources of water, treatment, storage, and, if necessary, conveyance improvements such as a screened diversion structure (up to 4,000 cfs) on the Sacramento River near Hood. The Conveyance section of this chapter discusses this potential improvement.

- Pesticides. Reducing the impacts of pesticides through (1) development and implementation of best management practices (BMPs) for both urban and agricultural uses; and (2) support of pesticide studies for regulatory agencies, while providing education about and assistance with implementation of control strategies for the regulated pesticide users.

- Organochlorine pesticides. Reducing the load of organochlorine pesticides in the system by reducing runoff and erosion from agricultural lands through BMPs.

- Trace metals. Reducing the impacts of trace metals, such as copper, cadmium, and zinc, in upper watershed areas near abandoned mine sites. Reducing the impacts of copper through urban stormwater programs and agricultural BMPs.

- Mercury. Reducing mercury levels in rivers and the estuary by source control at inactive and abandoned mine sites.

- Selenium. Reducing selenium impacts through reduction of loads at their sources, and appropriate land fallowing and land retirement programs.

- Salinity. Reducing salt sources in urban and industrial wastewater to protect drinking and agricultural water supplies; facilitating development of successful water recycling, source water blending, and groundwater storage programs. Salinity in the Delta would be controlled by limiting salt loadings from its tributaries and through managing seawater intrusion by such means as using storage capability to maintain Delta outflow, and to adjust the timing of outflow and by managing exports.

- Turbidity and sedimentation. Reducing the turbidity and sedimentation that adversely affect several areas in the Bay-Delta and its tributaries.

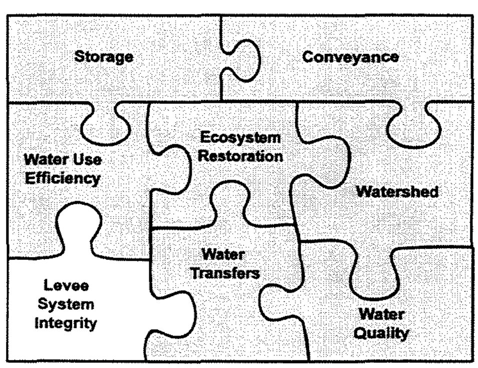
- Low dissolved oxygen. Reducing the impairment of rivers and the estuary from substances that exert excessive demand on dissolved oxygen.

- Toxicity of unknown origin. Through research and monitoring, identifying parameters of concern in the water and sediment, and implementing actions to reduce their impacts on aquatic resources.

For more information, see the Water Quality Program Plan and Revised Phase II Report Appendices.

Levee System Integrity Program

The Levee System Integrity Program focuses on improving levee stability to benefit all users of Delta water and land. Actions described in this program element protect water supply reliability by maintaining levee and channel integrity. Levee actions will be designed to provide simultaneous improvement in habitat quality, which would indirectly improve water supply reliability. Levee actions also would protect water quality, particularly during low-flow conditions when a catastrophic levee breach would draw salty water into the Delta.



The Levee System Integrity Program focuses on improving levee stability.

The Levee System Integrity Program consists of five main components plus the Suisun Marsh levee rehabilitation work:

- Delta Levee Base Level Protection Plan. Improving and maintaining Delta levee system stability to meet the Corps' Public Law (PL) 84-99 standard.

- Delta Levee Special Improvement Projects. Enhancing flood protection for key islands that provide state-wide benefits to the ecosystem, water supply, water quality, economy, and infrastructure.

- Delta Levee Subsidence Control Plan. Implementing current BMPs to correct subsidence adjacent to levees and coordinating research to quantify the effects and extent of inner-island subsidence.

- Delta Levee Emergency Management and Response Plan. Implementing actions that will build on existing state, federal, and local agency emergency management programs.

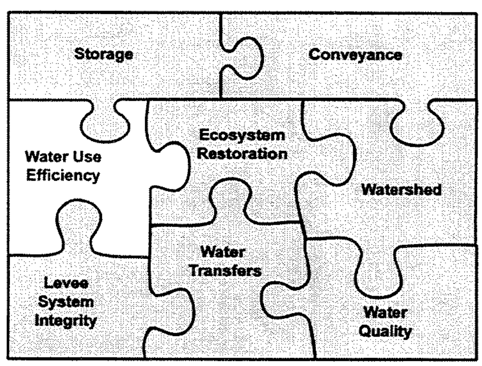
- Delta Levee Risk Assessment. Performing a risk assessment to quantify the major risks to Delta resources from floods, seepage, subsidence, and earthquakes; evaluating the consequences; and developing recommendations to manage the risk.

- Suisun Marsh levees. Rehabilitating Suisun Marsh levees.

For more information, see the Long-Term Levee Protection Plan and Revised Phase II Report Appendices.

Water Use Efficiency Program

The Water Use Efficiency Program includes actions to assure efficient use of existing and any new water supplies developed by the Program. Efficiency actions can alter the pattern of water diversions and reduce the magnitude of diversions, providing ecosystem benefits. Efficiency actions also can result in reduced discharge of effluent or drainage, improving water quality.



The Water Use Efficiency Program includes actions to assure efficient use of existing and any new water supplies developed by the Program.

The Water Use Efficiency Program will build on the work of the existing Agricultural Water Management Council and California Urban Water Conservation Council process, supporting and supplementing those processes through planning and technical assistance, and through targeted financial incentives (both loans and grants). The Water Use Efficiency Program has identified potential recovery of currently irrecoverable water losses of over 1.4 MAF annually by 2020 as a result of Program actions. Before execution of the ROD, the Program will identify measurable goals and objectives for its urban and agricultural water conservation programs, water reclamation programs, and managed wetlands programs.

Actions related to water conservation include:

- Implementing agricultural and urban conservation incentives programs to provide grant funding for water management projects that will provide multiple benefits and are cost effective at the state-wide level, including improved water quality and reduced ecosystem impacts.
- Identifying, in region-specific strategic plans for agricultural areas, measurable objectives to ensure that water management is improved.
- Expanding state and federal programs to provide increased levels of planning and technical assistance to local water suppliers.
- Working with the Agricultural Water Management Council (AWMC) to identify appropriate agricultural water conservation measures, set appropriate levels of effort, and certify or endorse water suppliers that are implementing locally cost-effective feasible measures.
- Working with the California Urban Water Conservation Council (CUWCC) to establish an urban water conservation certification process and set appropriate levels of effort in order to ensure that water suppliers are implementing cost-effective, feasible measures.
- Helping urban water suppliers to comply with the Urban Water Management Planning Act.
- Identifying and implementing practices to improve water management for wildlife areas.
- Gathering better information on water use, identifying opportunities to improve water use efficiency, and measuring the effectiveness of conservation practices.
- Conducting directed studies and research to improve understanding of conservation actions.

Actions related to water recycling include:

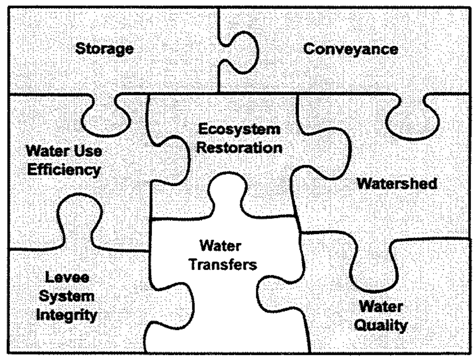
- Helping local and regional agencies to comply with the water recycling provisions in the Urban Water Management Planning Act.
- Expanding state and federal recycling programs to provide increased levels of planning, technical, and financial assistance (both loans and grants) and to develop new ways of providing assistance in the most effective manner.

- Providing regional planning assistance that can increase opportunities for the use of recycled water.

For more information, see the Water Use Efficiency Program Plan and Revised Phase II Report Appendices.

Water Transfer Program

The Water Transfer Program proposes a framework of actions, policies, and processes that, collectively, will facilitate water transfers and the further development of a state-wide water transfer market. The framework also includes mechanisms to provide protection from third-party impacts. A transfers market can improve water availability for all users, including the environment. Transfers also can help to match water demand with water sources of the appropriate quality, thus increasing the utility of water supplies.



The Water Transfer Program proposes a framework of actions, policies, and processes that, collectively, will facilitate water transfers and further development of a state-wide water transfer market.

The Water Transfer Program includes the following actions and recommendations:

- Establishing a California Water Transfer Information Clearinghouse to provide a public informational role. The clearinghouse would (1) ensure that information regarding proposed transfers is publically disclosed, and (2) perform ongoing research and data collection functions to improve the understanding of water transfers and their potential beneficial and adverse effects.

- Requiring water transfer proposals submitted to DWR, Reclamation, or SWRCB to include analysis of potential groundwater, socioeconomic, or cumulative impacts as warranted by individual transfers.

- Streamlining the water transfer approval process currently used by DWR, Reclamation, and the SWRCB. This action includes clarifying and disclosing current approval procedures and underlying policies, as well as improving the communication between transfer proponents, reviewing agencies, and other potentially affected parties.

- Refining quantification guidelines used by agencies when they review proposed water transfers for approval. This action includes resolving issues between stakeholders and approving agencies regarding the application of current agency-based quantification criteria.

- Improving the accessability of state and federal conveyance and storage facilities for the transport of approved water transfers.

A California Water Transfer Information Clearinghouse would (1) ensure that information regarding proposed transfers is publically disclosed, and (2) perform ongoing research and data collection functions to improve the understanding of water transfers and their potential beneficial and adverse effects.

- Clearly defining carriage water requirements and resolve conflicts over reservoir refill criteria so that transfer proponents are informed of the implications of these requirements.

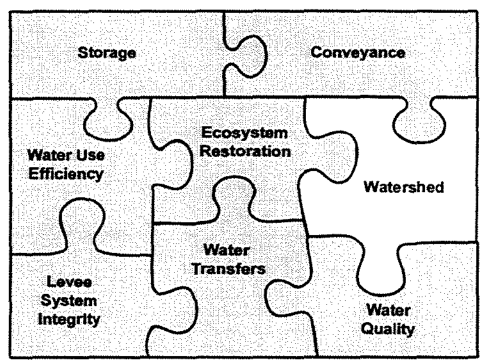
- Identifying appropriate assistance for groundwater protection programs through interaction with CALFED agencies, stakeholders, the State Legislature, and local agencies. This action is intended to assist local agencies in the development and implementation of groundwater management programs that will protect groundwater basins in water transfer source areas.

- Establishing accounting, tracking, and monitoring methods to aid in-stream flow transfers under California Water Code Section 1707.

For more information, see the Water Transfer Program Plan and Revised Phase II Report Appendices.

Watershed Program

The Watershed Program provides financial and technical assistance to local watershed programs that benefit the Bay-Delta system. Watershed actions can improve reliability by shifting the timing of flows, increasing base flows, and reducing peak flows. These actions also help to maintain levee integrity during high-flow periods. Other watershed actions will improve water quality by reducing the discharge of parameters of concern.



The Watershed Program provides financial and technical assistance to local watershed programs that benefit the Bay-Delta system.

The Watershed Program includes the following elements:

- Supporting local watershed activities. Implementing watershed restoration, maintenance, and conservation activities that support the goals and objectives of the Program, including improved river functions.

- Facilitating coordination and assistance. Facilitating and improving coordination and assistance between government agencies, other organizations, and local watershed groups.

- Developing watershed monitoring and assessment protocols. Facilitating monitoring efforts that are consistent with Program protocols and support watershed activities that ensure that adaptive management processes can be applied.

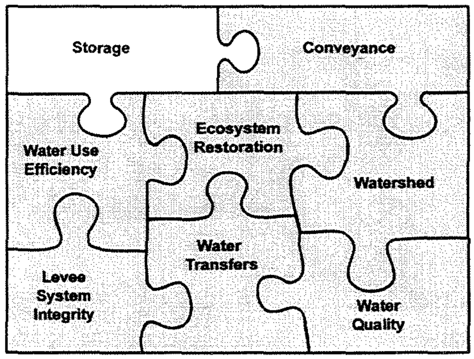
- Supporting education and outreach. Supporting resource conservation education at the local watershed level, and providing organizational and administrative support to watershed programs.

- Defining watershed processes and relationships. Identifying the watershed functions and processes that are relevant to Program goals and objectives, and providing examples of watershed activities that could improve these functions and processes.

More detailed information is provided in the Watershed Program Plan and Revised Phase II Report Appendices.

Storage

Groundwater and/or surface water storage can be used to improve water supply reliability, provide water for the environment at times when it is needed most, provide flows timed to maintain water quality, and protect levees through coordinated operation with existing flood control reservoirs.



Groundwater and/or surface water storage can be used to improve water supply reliability, provide water for the environment at times when it is needed most, provide flows timed to maintain water quality, and protect levees through coordinated operation with existing flood control reservoirs.

Decisions to construct groundwater or surface water storage will be predicated on complying with all Program linkages, including:

- An assessment of groundwater storage, surface storage, reoperation of power facilities, and a fish barrier as part of the Integrated Storage Investigation.

- Demonstrated progress in meeting the Program's water use efficiency, water reclamation, and water transfer program targets under the Water Management Strategy.

- Implementation of groundwater monitoring and modeling programs.

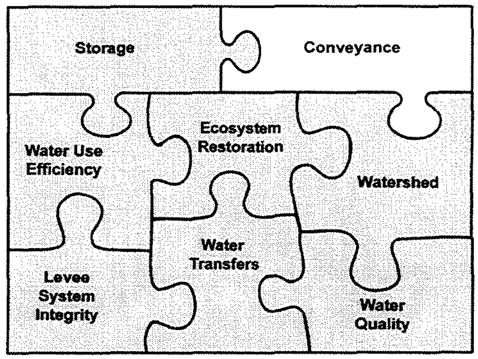
- Compliance with all environmental review and permitting requirements.

Subject to the above conditions, new groundwater and/or surface water storage would be developed and constructed, together with aggressive implementation of water conservation, recycling, and a protective water transfer market, as appropriate to meet Program goals. During Phase I, through the Water Management Strategy (including the Integrated Storage Investigation), the Program will evaluate and determine the appropriate mix of surface water and groundwater storage, identify acceptable projects, and initiate permitting and construction if Program linkages and conditions are satisfied.

The total volume of surface water and groundwater storage being assessed for the Preferred Program Alternative range up to 6.0 MAF. Facility locations being considered are located in the Sacramento and San Joaquin Valleys, and in the Delta. A list of sites for further consideration is included in the Revised Phase II Report appendix. Those surface storage projects that appear most feasible are noted in the Revised Phase II Report Appendix.

Conveyance

The Preferred Program Alternative employs a through-Delta approach to conveyance. Modifications in conveyance would result in improved water supply reliability, protection of and improvement in Delta water quality, improvements in ecosystem health, and reduced risk of supply disruption due to catastrophic breaching of Delta levees.



Modifications in conveyance would result in improved water supply reliability, protection of and improvement in Delta water quality, improvements in ecosystem health, and reduced risk of supply disruption due to catastrophic breaching of Delta levees.

The four alternate conveyance approaches are described below.

Alternative 1 - Existing System Conveyance. Delta channels would be maintained essentially in their existing configuration. Several improvements would be made in the south Delta.

Conveyance Features of Program Alternatives

Alternative 1 - Existing System Conveyance. Delta channels would be maintained essentially in their existing configuration. Several improvements would be made in the south Delta.

Alternative 2 - Modified Through-Delta Conveyance. Significant improvements to north Delta channels would accompany the south Delta improvements contemplated under Alternative 1.

Alternative 3 - Dual-Delta Conveyance. The dual-Delta conveyance alternative is formed around a combination of modified Delta channels and a new canal or pipeline, connecting the Sacramento River in the north Delta to the SWP and CVP export facilities in the south Delta.

Preferred Program Alternative - Through-Delta Conveyance. The Preferred Program Alternative incorporates elements similar to some of the elements in Alternatives 1 and 2. While it includes a potential for a new diversion structure near Hood and channel to the Mokelumne River, the size of this facility would be considerably smaller than Alternative 2. If, after additional analysis, this new facility is not constructed, the Preferred Program Alternative would be most similar to Alternative 1.

South Delta Improvements. Under Alternative 1, south Delta improvements include:

- Old River would be enlarged in the reach north of Clifton Court Forebay (CCFB) to reduce channel velocities and associated scouring. Both dredging and levee setbacks are being considered to increase conveyance capacity.
- A new 15,000-cfs screened intake with low-lift pumps would be constructed at the head of CCFB.
- A new intertie facility would be constructed to connect the SWP and the CVP facilities.
- An operable fish control barrier would be constructed at the head of Old River.
- Operable flow control barriers would be constructed on Middle River, Grant Line Canal, and Old River.

Operating Assumptions. Water management criteria play an important role in defining the Program alternatives. The flow, storage, and diversion of water must be simulated to identify differences among the alternatives that result from varying water management criteria. Many assumptions related to project operations and regulatory requirements needed to be made in order to complete the necessary water simulation modeling. The water management criteria for the Program alternatives include ranges of water demands

Due to their length, the operating assumptions for all Program alternatives are included in Attachment A.

and regulatory requirements. The range of water demands represents uncertainty in the future need for Bay-Delta water supplies due to uncertainty in projections of population, land use, implementation of water use efficiency measures, and the effects of water marketing. The range of regulatory requirements also represents uncertainty related to implementation of the state and federal ESAs and future SWRCB decisions. Due to their length, the operating assumptions for all Program alternatives are included in Attachment A.

Alternative 2 - Modified Through-Delta Conveyance. Significant improvements to north Delta channels would accompany the south Delta improvements contemplated under Alternative 1.

South Delta Improvements. Under Alternative 2, south Delta improvements include:

- As under Alternative 1, Old River would be enlarged in the reach north of CCFB. Also as under Alternative 1, both levee setbacks and dredging are being considered to increase conveyance capacity.
- As under Alternative 1, a new 15,000-cfs capacity screened intake with pumps would be constructed at the head of CCFB, and an interconnection of the CVP and SWP at CCFB would consolidate the project intakes through a single-screen facility.
- As under Alternative 1, operable flow control barriers or their equivalent would be constructed on Middle River, Grant Line Canal, and Old River.

Relationship to the Interim South Delta Program

The Program alternatives include a variety of proposed south Delta and CVP/SWP improvements that are components of DWR's proposed Interim South Delta Program (ISDP). The specific ISDP facilities that are featured in various alternatives include flow control structures (Middle River, Grant Line Canal, and Old River) and a fish control structure at the head of Old River.

Although the proposed location is the same, the component that does vary between the programs is the new Clifton Court Forebay (CCFB) intake structure. The ISDP concept features a 25,000-30,000 cfs gated structure that is operated in conjunction with the tidal cycle. This design would allow for continuous pumping at CCFB of 10,300 cfs from the Banks Pumping Plant. The Program's largest proposed intake facility consists of a fish-screening complex and a 15,000-cfs pump station that can be continuously operated independent from tidal influence. Further studies are required to support the theory of year-round continuous pumping at a rate of 15,000 cfs without adversely affecting stages and water quality in south Delta channels. The results of these studies also may indicate that channel enlargement in Old River might not be required at this export flow rate.

The Program's SWP and CVP improvements also include a channel (intertie) between CCFB and the Tracy intake channel, as well as potential new fish screens for the existing Tracy Fish Screening Facility. These features are not part of the ISDP.

North Delta Improvements. Under Alternative 2, north Delta improvements include:

- A new 10,000-cfs diversion structure from the Sacramento River in the vicinity of Hood to the Mokelumne River. The diversion would include a screened intake and pumping facilities.
- A fish ladder or equivalent would be constructed to convey fish upstream, past the pumps and screens that are associated with the diversion structure, to the Sacramento River.
- The Lower Mokelumne River channel would be widened to improve water conveyance and flood control from Interstate 5 (I-5) to the San Joaquin River.

Operating Assumptions. See Attachment A.

Alternative 3 - Dual-Delta Conveyance. The dual-Delta conveyance alternative includes a combination of modified Delta channels and a new canal or pipeline, connecting the Sacramento River in the north Delta to the SWP and CVP export facilities in the south Delta.

The dual-Delta conveyance alternative includes a combination of modified Delta channels and a new canal or pipeline, connecting the Sacramento River in the north Delta to the SWP and CVP export facilities in the south Delta.

South Delta Improvements. Under Alternative 3, south Delta improvements include:

- A new appropriately sized screened intake with pumps at the head of CCFB.
- As under Alternative 1, Old River would be enlarged in the reach north of CCFB. Also as under Alternative 1, both levee setbacks and dredging are being considered to increase conveyance capacity.
- As under Alternative 1, operable flow control barriers or their equivalent would be constructed on Middle River, Grant Line Canal, and Old River.

North Delta Improvements. Under Alternative 3, these improvements generally run from the north to the south Delta and include:

- An open-channel isolated facility ranging in size from 5,000- (±2000) to 15,000-cfs capacity would be constructed. The intake to the isolated facility would be in the Freeport-Hood vicinity and may include dual points of intake. The intake(s) would be screened. The isolated facility would be placed along the eastern side of the Delta and connected to CCFB.
- Connections would be constructed between south Delta islands, the Contra Costa and Tracy Pumping Plants, and portions of San Joaquin County and the new canal.
- As under Alternative 2, the Mokelumne River channel would be widened to improve water conveyance and flood control from I-5 to the San Joaquin River.

Operating Assumptions. See Attachment A.

Preferred Program Alternative - Through-Delta Conveyance. The Preferred Program Alternative incorporates elements similar to some of the elements in Alternatives 1 and 2. While it includes a potential for a new diversion structure near Hood and channel to the Mokelumne River, the size of this facility would be considerably smaller than Alternative 2. If after additional analysis this new facility is not constructed, the Preferred Program Alternative would be most similar to Alternative 1.

Although the Preferred Program Alternative includes a potential for a new diversion structure near Hood and channel to the Mokelumne River, the size of this facility would be considerably smaller than under Alternative 2. If after additional analysis this new facility is not constructed, the Preferred Program Alternative would be most similar to Alternative 1.

South Delta Improvements. Under the Preferred Program Alternative, south Delta improvements include:

- Constructing a new screened intake at CCFB with protective screening criteria.

- Constructing either a new screened diversion at Tracy with protective screening criteria and/or expanding the new diversion at CCFB to meet the Tracy Pumping Plant export capacity.

- Implementing the Joint Point of Diversion (JPOD) for the SWP and CVP, and constructing interties.

- Constructing an operable barrier at the head of Old River to improve conditions for salmon migrating up and down the San Joaquin River.

- Constructing operable barriers, or their equivalent, taking into account fisheries, water quality, and water storage needs in the south Delta.

- Changing the SWP operating rules to allow export pumping up to the current physical capacity of the SWP export facilities.

North Delta Improvements. Under the Preferred Program Alternative, north Delta improvements include:

- Studying and evaluating a screened diversion structure on the Sacramento River (or equivalent water quality actions) as a measure to improve drinking water quality in the event that Water Quality Program measures do not result in adequate improvements toward the Program's drinking water quality goals. This evaluation would consider how to operate the Delta Cross Channel (DCC) in conjunction with the new diversion structure in order to improve drinking water quality, while maintaining fish recovery.

  If the Water Quality Program measures are consistently not achieving drinking water quality goals, and the evaluation demonstrates that a screened diversion of up to 4,000 cfs would help to achieve those goals without adversely affecting fish populations, a pilot diversion facility would be constructed. This pilot structure likely would include a fish screen, pumps, and a channel between the Sacramento and Mokelumne Rivers. The design, size, and operating rules for this pilot facility would include an analysis of impacts on upstream and downstream migrating fish, as well as impacts from habitat shifts resulting from increased flows in the east Delta on Delta species. Following evaluation of the pilot facility operations, a final decision would be made on whether the diversion channel and structure should continue to be used and, if so, what the operational rules and optimum size of the diversion should be.

- Constructing new setback levees or dredging and/or improving existing levees along the channels of the lower Mokelumne River system from I-5 downstream to the San Joaquin River.

Operating Assumptions. See Attachment A.

The Preferred Program Alternative includes a process for determining the conditions under which any future additional conveyance facilities or water management actions would be taken. The process would include:

- An evaluation of whether water supplies can provide a level of public health protection equivalent to 50 parts per billion (ppb) bromide and 3 parts per million (ppm) TOC.

- An evaluation based on two reports from an independent panel of experts—one report on the Program's progress toward these measurable water quality goals, and the second report on the Program's progress toward ecosystem restoration objectives, with particular emphasis on fisheries recovery.

The Preferred Program Alternative includes a process for determining the conditions under which any future additional conveyance facilities or water management actions would be taken.

2.2 NO ACTION ALTERNATIVE

The No Action Alternative is a description of the anticipated physical, project operation, and regulatory features that would be in place in 2020 if the Program is not approved. The No Action Alternative was used as a basis for comparison of the Program alternatives. The purpose of this comparison is to highlight the changes to the environment that would take place as a result of implementing the various alternatives. The Program also is comparing the alternatives to existing conditions, referred to as the "affected environment" in this document.

The No Action Alternative is a description of the anticipated physical, project operation, and regulatory features that would be in place in 2020 if the Program is not approved.

Working with agencies, stakeholders, and interested public, the Program developed and applied criteria in the selection of physical features that would be included in the No Action Alternative. These criteria and the projects selected are presented in Attachment A. Generally, the physical features selected were under construction or recently constructed or approved as of June 1995.

CVPIA Section 3406(b)

The dedication of water for environmental purposes and delivery of water to refuges per Central Valley Project Improvement Act (CVPIA) (Section 3406 [b][2] and [d][1] and [2], respectively) are also part of the No Action Alternative because they were explicitly implemented upon enactment of the CVPIA. The majority of the remaining CVPIA actions are included in Program alternatives in the Water Use Efficiency, Water Transfer, Water Quality, and Ecosystem Restoration Program actions.

Water management criteria also play an important role in defining the No Action Alternative. The flow, storage, and diversion of water must be simulated to identify differences among alternatives that result from varying water management criteria. Many assumptions related to project operations and regulatory requirements needed to be made in order to complete the necessary water simulation modeling. The water management criteria for the No Action Alternative include ranges of water demands and regulatory requirements. The range of water demands represents uncertainty regarding future conditions that will affect demands for Bay-Delta water supplies; these conditions include rates and amounts of future population growth, land use change, implementation of water use efficiency measures, and effects of water marketing. The range of regulatory requirements also represents uncertainty related to implementation of state and federal Endangered Species Acts (ESAs) and future SWRCB decisions. For example, changes in

Water management criteria also play an important role in defining the No Action Alternative. The flow, storage, and diversion of water must be simulated to identify differences among alternatives that result from varying water management criteria.

future operations could require reinitiating ESA consultations with the National Marine Fisheries Service and USFWS. These consultations could result in new biological opinions and changes in regulatory requirements. While specific assumptions were made to complete the water simulation modeling, the Program's intention is to depict a general range of reasonably anticipated regulatory requirements. These assumptions should not be interpreted as specific predictions of future regulatory actions. The "bookend" assumptions used to bracket the water demand and regulatory requirement ranges are detailed in Attachment A.

Ranges also were used to describe possible flow changes in the Trinity and American Rivers due to the Trinity River Flow Analysis Study and implementation of the East Bay Municipal Utility District's (EBMUD's) CVP contract. These activities could result in changes in the availability of water to meet Program objectives. The assumed ranges were included in the No Action Alternative assumptions only to help decision makers better understand the potential consequences of these actions to the Program. No decisions have been made about the proposed Trinity River flows or American River diversions. Both of these efforts currently are undergoing environmental review. The bookend assumptions used to bracket the potential outcome of these processes also are described in Attachment A.

Attachment A also lists the non-project, non-modeling assumptions issues or policies that are part of the No Action Alternative. In addition, Attachment A includes a comments and issues section that addresses a number of items that have been discussed throughout the development of the No Action Alternative.

Attachment A lists the non-project, non-modeling assumptions issues or policies that are part of the No Action Alternative.

2.3 ENVIRONMENTALLY PREFERABLE ALTERNATIVE

The problems and potential solutions facing the Bay-Delta involve a complex set of interrelated biological, chemical, and physical systems. This complexity, coupled with the broad scope and number of actions needed to implement the Program, the 20- to 30-year implementation period, the need to test hypotheses, and resource limitations make it necessary to implement the Program in stages. Consequently, the Preferred Program Alternative provides for implementation of the Program in a staged manner and establishes mechanisms to obtain the necessary additional information to guide the next stage of decision making.

The Preferred Program Alternative consists of a through-Delta conveyance approach, coupled with ecosystem restoration, water quality improvements, levee system improvements, increased water use efficiency, improved water transfer opportunities, watershed restoration, and a Water Management Strategy that includes an integrated storage program. The Preferred Program Alternative meets the Program's multiple purposes, reduces adverse environmental effects, and provides a system of research and monitoring to determine whether modifications or additional actions are needed. It provides multiple benefits, including:

The Preferred Program Alternative meets the Program's multiple purposes, reduces adverse environmental effects, and provides a system of research and monitoring to determine whether modifications or additional actions are needed.

- Modifying the timing and magnitude of flow to restore ecological processes and to improve conditions for fish, wildlife, and plants in the Bay-Delta system.
- Improving and increasing aquatic and terrestrial habitats.
- Modifying and eliminating fish passage barriers.
- Constructing fish screens that use the best available technology.
- Reducing the loads and impacts of bromide, total organic carbon, pathogens, nutrients, salinity, and turbidity.
- Reducing the impacts of pesticides.
- Reducing the impacts of trace metals, mercury, and selenium.
- Improving and maintaining the stability of the Delta and Suisun Marsh levee system.
- Enhancing flood protection for key Delta islands.
- Expanding and implementing agricultural and urban conservation incentive programs.
- Implementing better water management for managed wetlands.
- Facilitating water transfers while protecting from third parties from potentially significant adverse impacts.
- Supporting local watershed restoration, maintenance, and conservation activities.
- Developing appropriate groundwater and surface storage in conjunction with specified water conservation, recycling, and water transfer programs to provide water for the environment at times when it is needed most, and to improve water supply reliability.
- Modifying existing Delta conveyance systems for improved water supply reliability and water quality, improved ecosystem health, and reduced risk of supply disruption due to catastrophic breaching of Delta levees.

Compared to the No Action Alternative, the Preferred Program Alternative provides significant improvements in terms of both its water quality and ecosystem health effects. Under the No Action Alternative, each of the four areas of critical concern—ecosystem quality, water quality, levee system integrity and water supply reliability—would continue to deteriorate, with resultant potentially significant adverse impacts on fisheries, endangered species, and species of concern and their habitats. In addition, the quality of both in-Delta and export water likely would decline under the No Action Alternative. This decline in water quality could result in potentially significant adverse impacts on fisheries, ecosystem health, and drinking water quality. With the continued decline of the ecosystem, interruptions of water deliveries also likely would occur because of constraints on export pumping to protect threatened and endangered species. Finally, under the No Action Alternative, the Delta levees would continue to be vulnerable to failure because of limited maintenance in some locations and the lack of a comprehensive plan for effective emergency response.

There is concern whether a through-Delta conveyance approach can meet future water quality objectives and not adversely affect the recovery of threatened and endangered fish species. Although some scientific and engineering evidence suggests that a dual-Delta conveyance configuration may improve export water quality and achieve fish recovery more effectively, other evidence indicates that such a conveyance configuration can cause in-Delta water quality problems. In addition, during scoping and public meetings, some stakeholders and agencies voiced concern that moving water around the Delta instead of through it may:

There is concern whether a through-Delta conveyance approach can meet future water quality objectives and not adversely affect the recovery of threatened and endangered fish species.

- Cause difficulty in ensuring the appropriate operation of such a facility.
- Create impacts from construction.
- Increase the amount of land needed for the facility.
- Provide an engineered solution when non-structural modifications and reoperation of existing facilities may provide similar benefits.

Although the CALFED agencies did not rule out the possibility of constructing an isolated conveyance facility in the future, they were mindful that, even if approved immediately following the ROD/CERT, such a facility could not be studied, approved, funded, and constructed within the first stage (7 years) of implementation.

In light of the technical and feasibility issues discussed above, the CALFED agencies propose to begin with through-Delta modifications. As part of the Preferred Program Alternative, the Program also would:

- Investigate storage opportunities in the context of the broader Water Management Strategy.
- Implement the first stage of the Ecosystem Restoration, Water Quality, and Levee System Integrity Program Plans.
- Monitor the results of these actions to determine whether an isolated conveyance facility as part of a dual-Delta conveyance configuration is necessary to meet the Program objectives.

If the Program purposes cannot be fully achieved with the actions proposed in the Preferred Program Alternative, additional actions—including an isolated conveyance facility—may need to be added in the future. Until additional information is available to determine whether water quality objectives and fish recovery goals can be met and which, if any, additional actions will be necessary to achieve the Program goals and objectives, the Preferred Program Alternative is the best alternative to achieve overall project purposes and provide significant beneficial improvements over the conditions anticipated under the No Action Alternative, while establishing a process for obtaining this additional information. Moreover, the way the alternatives are structured, going forward with the Preferred Program Alternative does not preclude the Program's ability to undertake additional conveyance actions in the future, subject to appropriate environmental review.

Until additional information is available to determine whether water quality objectives and fish recovery goals can be met and which, if any, additional actions will be necessary to achieve the Program goals and objectives, the Preferred Program Alternative is the best alternative to achieve overall project purposes and provide significant beneficial improvements over the conditions anticipated under the No Action Alternative, while establishing a process for obtaining this additional information.

As described above, the Preferred Program Alternative adopts a set of programmatic actions designed to achieve the objectives for each of the resource areas while evaluating the effectiveness of those actions, and assessing whether modifications may be needed to meet Program goals and objectives. The Preferred Program Alternative accordingly constitutes the "Environmentally Preferable Alternative" as that term is used in NEPA, and the "Environmentally Superior Alternative" as that term is used in CEQA.

2.4 ALTERNATIVES NOT CARRIED FORWARD FOR FURTHER EVALUATION

The three basic alternative approaches developed in Phase I were carried into Phase II. Seventeen alternative configurations of the three basic alternative approaches were developed to further explore potential refinements for storage and conveyance in Phase II. Of the 17 configurations, 5 were eliminated from further evaluation, and 12 were evaluated in the March 1998 Draft Programmatic EIS/EIR. Based on public and agency comments on the March 1998 Draft Programmatic EIS/EIR and additional technical analysis, the Program was able to further refine and narrow the number of alternative solutions to the four evaluated in this document.

The following explains the rationale for the elimination of alternative configurations from further evaluation prior to and after the release of the March 1998 Draft Programmatic EIS/EIR.

Elimination of Alternative Configurations prior to the March 1998 Draft Programmatic EIS/EIR. Five of the alternative configurations were eliminated based on the results of a narrowing process. The narrowing process primarily focused on technical deficiencies and the conveyance options used in each alternative. Additionally, if alternatives provided the same conveyance function with similar impacts, the less expensive alternatives were retained. Alternatives with lower costs but higher adverse impacts were eliminated. The evaluation used the following process and recommendations from technical work groups, operational modeling results, engineering prefeasibility studies, preliminary information from impact analysis, preliminary cost estimates, and other information:

Five of the alternative configurations were eliminated based on the results of a narrowing process that primarily focused on technical deficiencies and the conveyance options used in each alternative.

- Identify and eliminate technical problems not evident when the alternatives were formulated that severely limit an alternative's chances for success.
- Identify alternatives with engineering or technical problems that must be resolved for the alternatives to proceed.
- Modify each alternative, if possible, to remove the technical problems.
- If modifications to the alternative cannot solve the problem, the alternative is not practicable and will be eliminated.
- Reduce the number of alternatives that achieve the same conveyance function with similar impacts.
- Identify alternatives that meet Program objectives to approximately the same degree and achieve the same conveyance function.
- Use engineering or technical and cost evaluations to compare the conveyance features of the alternatives. Consider adverse impacts of each alternative. If one alternative has significantly higher costs for conveyance and/or greater adverse impacts while achieving similar functions, it is not practicable and will be eliminated from further consideration.

Using the above criteria, five alternative configurations (2C, 3C, 3D, 3F, and 3G) were eliminated from further analysis.

Configuration 2C. The Multiple Intakes Conveyance Option in Configuration 2C would use three isolated conveyance channels to convey water to CCFB from two diversion locations on the San Joaquin River and one location on Old River near Franks Tract.

Configuration 2C was eliminated because the alternative would need to be modified to remove technical problems and, even after modification, hydraulically controlling the three water diversion "arms" would have been difficult. In addition, fish screens were needed to prevent fish entrainment at the pumps. Fish screens are costly because they require elaborate flow structures for the intake facilities. Configuration 2C is very expensive, with a total construction cost of $2.281 billion and a monitoring cost of $2.4 million. Configuration 3I includes the same multiple Delta intake option, as well as options that address possible impacts on anadromous fish that are associated with Configuration 2C. Configuration 3I allows for more operational flexibility.

Configuration 3C. Configuration 3C uses a buried pipeline isolated facility to convey 5,000 cfs from a diversion on the Sacramento River at Hood along the east Delta to CCFB. No new storage is included in this alternative.

Configuration 3C was eliminated because Configuration 3A provides the same conveyance function at less cost. The alternatives are identical, except Configuration 3C proposed a pipeline isolated facility while Configuration 3A proposes an open channel.

Configuration 3A would cost $857 million, while Configuration 3C would cost $2.067 billion. The environmental consequences of the pipeline are very similar to those of a channel; therefore, elimination of the pipeline did not result in the loss of an environmentally preferred alternative from the study.

Configuration 3D. As in Configuration 3C, Configuration 3D uses a buried pipeline isolated facility to convey 5,000 cfs from a diversion on the Sacramento River at Hood along the east Delta to CCFB. Configuration 3D differs from Configuration 3C in that it includes new storage.

Configuration 3D was eliminated because Configuration 3B provides the same conveyance function at less cost. The alternatives are identical, except Configuration 3D proposed a pipeline isolated facility while Configuration 3B proposes an open channel. Configuration 3B would cost $857 million, while Configuration 3D would cost $2.067 billion.

Configuration 3F. Configuration 3F, or "Chain-of-Lakes," uses a connected chain of up to eight lakes, created by flooding Delta islands, that would convey water via siphons beneath Delta channels to CCFB.

Configuration 3F was eliminated because of issues related to environmental damage, logistics, and cost. A major drawback of this configuration is the Delta land use conversion it entails. Approximately 37,000 acres of land would be required to create the chain of lakes. Conversion of this land is an environmental concern because some of the land (primarily on the water side of levees) currently provides aquatic habitat. The land currently has valuable agricultural uses, has habitat value for terrestrial wildlife species, and some of this land is intended for habitat restoration under the Ecosystem Restoration Program. In addition to the land use conversion concerns, this configuration creates a logistical concern related to achievement of water quality objectives—the storage of water on Delta peat soils may create TOC problems for urban water users. Finally, this alternative is estimated to cost approximately $2.4 billion compared to a cost of $1.7 billion for Configuration 3E, which provides similar water storage and conveyance functions with fewer associated adverse environmental impacts.

Configuration 3G. Configuration 3G, the Western Delta Isolated Conveyance Facility, uses the Deep Water Ship Channel, and a west Delta conveyance pipeline, tunnel, and channel to convey 5,000 cfs from the intake on the Sacramento River near Sacramento to CCFB.

Configuration 3G was eliminated because its cost is estimated at $2.3 billion, substantially more than the estimated $0.9 billion for Configuration 3B, which provides very similar water conveyance benefits and results in very similar environmental impacts.

The Program considered public comments on the March 1998 Draft Programmatic EIS/EIR and completed additional technical analysis to eliminate some of the configurations and consolidate others.

Elimination of Alternative Configurations after the March 1998 Draft Programmatic EIS/EIR. The March 1998 Draft Programmatic EIS/EIR evaluated the impacts of the remaining 12 alternative configurations. The Program considered public comments on the March 1998 Draft Programmatic EIS/EIR and completed additional technical analysis to eliminate some of the configurations and consolidate others.

Configuration 1A. Configuration 1A used six Program elements (Ecosystem Restoration, Water Quality, Levee System Integrity, Water Use Efficiency, Water Transfer, and Watershed Programs) without new storage and conveyance facilities. The Program has determined that a broad range of water management options, including storage, must be evaluated and implemented to achieve the Program's goals. Each alternative now includes a range of storage from 0 to up to 6.5 MAF. An alternative configuration without storage like Configuration 1A is represented in the analysis for zero storage in each of the four alternatives evaluated in this document. In addition, the Program has determined that the goals cannot be met without some south Delta conveyance improvements, which were not part of Configuration 1A.

Configuration 1B. Configuration 1B is similar to Configuration 1A, except for the addition of select south Delta conveyance improvements. Configuration 1B does not include storage. As discussed for Configuration 1A, the zero storage component is represented in the analysis for each of the four selected alternatives.

Configuration 2A. Configuration 2A includes north and south Delta channel modifications that are designed to improve water conveyance but does not include storage. Like Configurations 1A and 1B, this configuration is represented in the zero storage analysis for each of the four selected alternatives.

Configuration 2D. Configuration 2D includes modifications in the north and south Delta that are designed to improve water conveyance, to integrate habitat restoration with the conveyance improvements, and to provide new aqueduct storage south and downstream of the Delta. The alternative provides for more efficient water conveyance from the Sacramento River through the South Fork Mokelumne River and Old River near CCFB. The Program has determined that environmental concerns require separating the main water conveyance path from major new habitat. Locating major habitat away from the main water conveyance path would provide less chance of fish being carried to the south Delta export pumps. The habitat and its potential impacts in this configuration is still represented in the analysis of the Ecosystem Restoration Program element in each of the four selected alternatives. Separating the conveyance and the major new habitat also is preferable for water quality because it keeps the organic carbon that originates in the wildlife habitat out of the main water conveyance path.

Configuration 2E. Configuration 2E includes modifications in the north and south Delta that are designed to improve water conveyance, to provide significant habitat restoration, and to provide additional surface water and groundwater storage. The conveyance and habitat portions are similar to those in Configuration 2D, except for the addition of conveyance and habitat on Tyler Island and the elimination of the 10,000-cfs intake near Hood. Configuration 2E was eliminated for the same reasons that Configuration 2D was eliminated.

Configuration 3A. Configuration 3A includes north and south Delta channel modifications that are designed to improve water conveyance and a small (5,000-cfs) open-channel isolated facility. The configuration does not include new storage. Like the other no-storage configurations, the zero storage in this configuration is represented in the analysis of the four selected alternatives. Additionally, Configuration 3A is represented in the analysis for Alternative 3 in this document. Alternative 3 is examining a range of volumes (5,000 cfs, 10,000 cfs, and 15,000 cfs) for the isolated facility.

Configuration 3B. Configuration 3B includes north and south Delta channel modifications that are designed for water conveyance, a small (5,000-cfs) isolated facility constructed as an open channel, and surface water and groundwater storage. Configuration 3B is represented in the analysis for Alternative 3 in this document. Alternative 3 is examining a range of volumes(5,000 cfs, 10,000 cfs, and 15,000 cfs) for the isolated facility.

Configuration 3H. Configuration 3H includes modifications in the north and south Delta that are designed for water conveyance and significant habitat restoration, a small (5,000-cfs) isolated facility constructed as an open channel, and surface water and groundwater storage. The conveyance and habitat portions are the similar to those in Configuration 2D. Configuration 3H was eliminated for the same reasons that Configurations 2D and 3B were eliminated.

Configuration 3I. Configuration 3I includes three new diversion locations in the south Delta for Tracy and Banks Pumping Plants, a 15,000-cfs isolated facility, and surface water and groundwater storage. The new south Delta diversions were envisioned for use separately or in combination to provide increased operational flexibility. However, Configuration 3I was eliminated for several environmental and cost reasons. For example, the middle diversion on the San Joaquin River:

- Exposes the Eastside tributary and San Joaquin salmon to a new screen.
- Could adversely affect Delta smelt and striped bass.
- Would present problems in salvaging fish because of its location in a tidal zone.
- Could exacerbate water quality problems in the south Delta.

The western diversion is in an area that is critical for Delta smelt and is also in the tidal zone, requiring salvage of fish. The southern diversion on the San Joaquin River likely could be used for only short periods of time due to lack of San Joaquin River flows. The original concept involved no screen on each of these three diversions at their upstream ends but screens at common facilities for the Banks and Tracy Pumping Plants. Because of concern about predation that could occur in the slow-flowing channels, fish screens at the upstream ends were included in the alternative. Cost estimates are approximately $2 billion higher for Configuration 3I than for Alternative 3, which is evaluated in this document. Because of concerns about potentially damaging conditions to the aquatic environment and the substantially higher cost, Configuration 3I was eliminated from further consideration.

Chapter 3. Summary Comparison of Environmental Consequences

This chapter presents a summary of the programmatic environmental consequences of implementing the CALFED Bay-Delta Program that are discussed in Chapters 5, 6, and 7.

3. Summary Comparison of Environmental Consequences

3.1 ENVIRONMENTAL RESOURCE IMPACTS AND ECONOMIC AND SOCIAL EFFECTS

Section 3.1.1 discusses the environmental consequences of the Preferred Program Alternative and Alternatives 1, 2, and 3 compared to the No Action Alternative and existing conditions. Section 3.1.2 discusses expected benefits of the Preferred Program Alternative compared to the No Action Alternative. Section 3.1.3 discusses potentially significant avoidable and unavoidable adverse impacts of the Preferred Program Alternative compared to the No Action Alternative. Section 3.1.4 lists economic and social effects that may be caused by the Preferred Program Alternative. Some of the sections describe effects of the CALFED Bay-Delta Program (Program) by study regions, which are described in Chapter 2.

3.1.1 SUMMARY COMPARISON OF ENVIRONMENTAL IMPACTS

Table 3-1 (at the end of the chapter) provides a summary comparison of the environmental consequences of the No Action Alternative; Alternatives 1, 2, and 3; and the Preferred Program Alternative.

In general, impacts resulting from the Conveyance element vary by alternative. Impacts resulting from the other Program elements vary minimally among alternatives. The Storage element includes a wide range of storage amounts, as described in Chapter 2. In Table 3-1, therefore, the impacts associated with the Storage and Conveyance elements are described separately for each alternative, while the description of the other Program elements encompasses all the alternatives. For details of how each of the Program

In general, impacts resulting from the Conveyance element vary by alternative. Impacts resulting from the other Program elements vary minimally among alternatives.

elements would be specifically affected by the various alternatives, please see Chapters 5, 6, and 7.

The impacts identified in Table 3-1 for the Preferred Program Alternative include consequences associated with possible changes in project operations of the CVP and SWP. These project changes in operation also could be included in Alternatives 1, 2, and 3. To avoid repetition in the summary table and because, typically, the project changes in operation would cause environmental consequences that are similar among the alternatives, these environmental consequences are not listed under Alternatives 1, 2, and 3. Where analysis found that project changes in operation could cause different environmental consequences under different alternatives, the information is presented in the table.

The impacts identified in Table 3-1 for the Preferred Program Alternative include consequences associated with possible changes in project operations of the CVP and SWP.

3.1.2 SUMMARY OF BENEFICIAL IMPACTS

Table 3-2 (at the end of the chapter) summarizes the benefits to resources that are expected from implementing the Preferred Program Alternative. The benefits are estimates of effects resulting from implementing all of the proposed Program elements that make up the Preferred Program Alternative.

3.1.3 SUMMARY OF POTENTIALLY SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACTS

Table 3-3 (at the end of the chapter) identifies the potentially significant avoidable and unavoidable impacts on resources resulting from implementation of the Preferred Program Alternative. For potentially significant avoidable impacts, measures are available to reduce the impacts to less-than-significant levels. For potentially significant unavoidable impacts, no feasible means have been identified to mitigate impacts to less-than-significant levels. Specific analysis of environmental impacts, their significance, and the availability and choice of specific mitigation measures will be developed and presented in future second-tier environmental documents prepared, as necessary, prior to implementation of specific Program projects and actions.

Specific analysis of environmental impacts, their significance, and the availability and choice of specific mitigation measures will be presented in future second-tier environmental documents prepared, as necessary, prior to implementation of specific Program projects and actions.

Under CEQA, economic or social effects are not treated as a significant impact on the environment unless they will lead to physical changes in the environment. This information therefore is presented in Section 3.1.4 below.

3.1.4 SUMMARY OF ECONOMIC AND SOCIAL EFFECTS

Table 3-4 below lists the economic and social effects that may result from implementation of the Preferred Program Alternative.

Table 3-4. Summary of Economic and Social Effects of the Preferred Program Alternative

Agricultural economics	Generally enhances or maintains agricultural revenues but may reduce agricultural income in local areas, especially in the Delta Region, due to conversion of agricultural lands to other uses.
Agricultural social issues	Generally benefits the agricultural community but may cause localized adverse social effects.
Urban water supply economics	May lower regulatory and water treatment costs and increase water supply, but may add costs through payment for Program elements. Many economic effects cannot be determined until more specific information is available.
Regional economics	Generally benefits regional economies but may cause adverse effects in the Delta Region. The amount and allocation of costs and benefits are currently uncertain.
Environmental justice	Beneficial or adverse effects to minority or low-income populations are possible. Project-specific evaluation is required to determine effects.
Indian trust assets	Adverse effects are not anticipated, but effects cannot be determined at the programmatic level of analysis. Project-specific evaluation is required to determine effects.

Qualitative methods and professional judgment were used in the evaluation of economic and social effects summarized in Table 3-4. These effects are presented in greater detail in Sections 7.2, 7.3, 7.5, 7.10, 7.14, and 7.15. Quantitative information for determining costs and economic benefits is not available. This information will be developed in future planning studies and project-specific analysis.

Quantitative information for determining costs and economic benefits is not available. This information will be developed in future planning studies and project-specific analysis.

3.2 SUMMARY OF GROWTH-INDUCING IMPACTS

Potential growth-inducing impacts are summarized in Table 3-5 (at the end of the chapter). Growth-inducing impacts are the ways in which the Program could foster (directly or indirectly) economic or population growth, or the construction of additional housing in the surrounding environment—with subsequent impacts on a variety of resources.

For this document, it was assumed that any increased water supplies or improved water supply reliability associated with the Program would stimulate growth and remove barriers to growth in the water service area. At this time, growth-inducing impacts on resources are described only broadly. Growth-inducing impacts will be analyzed in greater detail in future project-specific NEPA/CEQA documents that are tiered from this document.

For this document, it was assumed that any increased water supplies or improved water supply reliability associated with the Program would stimulate growth and remove barriers to growth in the water service area.

It is unlikely that any of the Program alternatives would result in substantial population or economic growth in the Delta, Bay, or Sacramento River Regions. Water supply, reliability, and quality would be enhanced by implementation of the Program in these regions, but other water resources are available in these regions that could be used for growth. In the San Joaquin River Region and the Other SWP and CVP Service Areas, however, fewer alternative water supply sources are available. In the San Joaquin River Region, improvements in water quality, supply, and reliability could allow additional agricultural land to be developed and could allow a shift to higher value crops. Further, it is possible that these improvements could result in urban population and economic growth. In the Other SWP and CVP Service Areas, improvements in water supply, reliability, and quality could induce urban growth.

It is unlikely that any of the Program alternatives would result in substantial population or economic growth in the Delta, Bay, or Sacramento River Regions.

Summarized in Table 3-5 are resources that could be adversely affected if growth was to take place as a result of the Program. For example, if additional growth was to take place, existing soils or air quality could be affected.

3.3 SUMMARY OF SHORT- AND LONG-TERM RELATIONSHIPS

This section provides a resource-specific summary of the balance between the short-term uses of the environment and the maintenance and enhancement of long-term productivity for the Preferred Program Alternative. Short-term uses versus long-term productivity for each resource category considered are summarized in Table 3-6 (at the end of the chapter).

Overall benefits to long-term productivity related to biological resources, water quality, water management, and flood control outweigh the short-term adverse impacts. Adverse short-term impacts caused by changes in land use are associated with geology and soils, agricultural resources, recreation, and cultural resources. However, long-term benefits to these resources also were identified.

Overall benefits to long-term productivity related to biological resources, water quality, water management, and flood control outweigh the short-term adverse impacts.

Adverse short-term impacts, primarily related to construction activities, were identified for most resources. The short-term construction-related impacts would be minor and would cease when construction was complete. Where possible, avoidance and mitigation measures would be implemented as a standard course of action to lessen impacts on these resources.

3.4 SUMMARY OF IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS

Table 3-7 (at the end of the chapter) lists the irreversible and irretrievable commitments of resources that are attributable to the Preferred Program Alternative. Irreversible and irretrievable commitments of resources result from the direct or indirect use or consumption of resources in such a way that they cannot be restored or returned to their original condition despite mitigation efforts. An irretrievable impact or commitment of resources occurs when a resource is removed or consumed. These types of impacts are evaluated to ensure that consumption is justified.

Irreversible commitments of resources could result from Program actions that involve construction and land conversion. Committed resources could include construction materials, labor, and energy needed for construction, operation, and maintenance. Land conversion due to Program use would commit agricultural, open space, and natural environments to other uses.

Irreversible commitments of resources could result from Program actions that involve construction and land conversion.

Specific resources that could be irreversibly and irretrievably committed as a result of the Program could include geology and soils, vegetation and wildlife, regional economics, agricultural resources, cultural resources, power production and energy, and visual resources. Where possible, avoidance and mitigation measures would be implemented as a standard course of action to lessen impacts on these resources. For additional discussion, refer to the resource-specific impact analyses in Chapters 5, 6, and 7.

3.5 SUMMARY OF CUMULATIVE IMPACTS

Under NEPA and CEQA, cumulative impacts must be analyzed and discussed. A cumulative impact is created as a result of the combination of the project or program being evaluated together with other projects that may cause related impacts. Table 3-7 (at the end of the chapter) presents, by resource category and region, the potentially significant cumulative impacts of the Preferred Program Alternative and the projects and activities listed in Attachment A. The table identifies the environmental resource categories that potentially could experience cumulative impacts because of implementing the projects listed in Attachment A, in addition to the Program. If implementing the Program would not result in a potentially significant impact on a resource, potentially significant adverse cumulative effects for that resource are not noted in the Table 3-8—even if other actions would result in a potentially significant impact. A narrative discussion of the cumulative effects is provided below. The cumulative impact analysis is qualitative. Impact analysis was based on information from available environmental documents and studies, and based on knowledge of the generally expected kinds

Because of the preliminary phase of most of the projects (environmental reviews have not been initiated, drafted, or finalized), comparable environmental information for identifying cumulative impacts was not available.

of effects of similar projects in the study area. Because of the preliminary phase of most of the projects (environmental reviews have not been initiated, drafted, or finalized), comparable environmental information for identifying cumulative impacts was not available.

3.5.1 DELTA REGION

In the Delta Region, potentially significant adverse cumulative impacts could occur in all resource categories that are addressed in this document from the development of water management projects, environmental restoration projects, and urbanization listed in Attachment A, in concert with implementation of the Program.

Potentially significant adverse cumulative impacts could occur in all resource categories in the Delta Region.

3.5.2 BAY REGION

In the Bay Region, potentially significant adverse cumulative impacts could occur due to the development of water management projects, environmental restoration projects, and urbanization listed in Attachment A, in concert with implementation of the Program. These projects could potentially cause adverse impacts on all resource categories, except transportation, agricultural land and water uses, utilities and public resources, and flood control resources.

In the Bay Region, potentially significant adverse cumulative impacts related to Bay-Delta hydrodynamics, water quality, water supply and management, groundwater, geology and soils, and power production and energy could occur.

3.5.3 SACRAMENTO RIVER AND SAN JOAQUIN RIVER REGIONS

In the Sacramento River Region, potentially significant adverse cumulative impacts could occur due to the development of water management projects, environmental restoration projects, and urbanization listed in Attachment A, in concert with implementation of the Program. These projects could potentially cause adverse impacts on all environmental resource categories except urban land use resources.

Potentially significant adverse cumulative impacts could occur in all resource categories except urban land use resources in the Sacramento River and San Joaquin River Regions.

3.5.4 OTHER SWP AND CVP SERVICE AREAS

In the Other SWP and CVP Service Areas, potentially significant adverse cumulative impacts are expected from the development of water management projects, environmental restoration projects, and urbanization listed in Attachment A, in concert with the Program. Resources potentially affected include water quality, water supply and water management, groundwater, and power and energy.

Potentially significant adverse cumulative impacts could occur in the water quality, water supply and water management, groundwater, and power and energy resource categories in the Other SWP and CVP Service Areas.

3.6 MITIGATION STRATEGIES FOR CUMULATIVE IMPACTS

Mitigation strategies are available to reduce the severity of cumulative impacts. The mitigation strategies generally consist of safeguards by law, regulations, and water rights standards; contracts; physical measures; and water management programs.

A number of water management programs are in place to address potential conflicts between agricultural and urban water use and ecosystem restoration activities. Many of the specific impacts will be identified in these studies, and potential mitigation will be incorporated into the design and project-specific environmental review conducted for each project. Any action-specific mitigation will be identified in subsequent tiered, site- and action-specific analyses. Some of the studies and management programs in place include:

A number of water management programs are in place to address potential conflicts between agricultural and urban water use and ecosystem restoration activities.

- Formation of the federal/state Bay-Delta Advisory Council
- SWRCB Water Quality Control Plan
- Formation of the Delta Protection Commission
- San Joaquin River Management Plan
- Sacramento River 1086 Plan
- EPA's Comprehensive Conservation Management Plan for the Bay-Delta Estuary
- Striped Bass Recovery Plan
- Native Fisheries Recovery Plan
- Anadromous Fish Restoration Program
- Interagency Ecological Program
- Regional Water Quality Control Board Basin Plans

State and federal laws that provide safeguards for cumulative impacts include the:

Several state and federal laws provide safeguards for cumulative impacts.

- Area of Origin Law
- Delta Protection Act
- California Environmental Quality Act
- National Environmental Policy Act
- National Fish and Wildlife Coordination Act
- Clean Water Act
- Central Valley Project Improvement Act
- National Historic Preservation Act
- Archeological and Historical Preservation Act
- Federal Endangered Species Act
- California Endangered Species Act
- Provisions in congressional authorization of federal water projects

General physical mitigation strategies are presented in Chapters 5, 6, and 7 for each resource category.

Table 3-1. Summary Comparison of Environmental Consequences

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
WATER SUPPLY AND WATER MANAGEMENT					
Annual Delta exports could decrease by as much as 570 TAF or could increase by as much as 370 TAF over the long-term period. Reductions in annual Delta exports would result from more protective Delta water management criteria; increases in annual Delta exports would result from higher demands on the Bay-Delta system. During dry and critical years, annual Delta exports could decrease by as much as 610 TAF or could increase by as much as 130 TAF. Higher Bay-Delta system demands have a relatively small impact on Delta exports during dry and critical years because the system is generally supply-limited during droughts. For most parameters of interest, existing conditions fall within the range of uncertainty associated with the alternative.	Some improvements would be realized from improved export pumping capacity. Greater benefits may be obtained if additional storage facilities are constructed. Without additional storage, annual long-term period Delta exports would increase 270-390 TAF (dry and critical year exports would increase up to 190 TAF) over the No Action Alternative. With additional storage, annual Delta exports would increase 690-800 TAF (dry and critical year exports would increase 240-640 TAF) over the No Action Alternative.	Some improvements would be realized from improved export pumping capacity. Greater benefits may be obtained if additional storage facilities are constructed. Without additional storage, annual long-term period Delta exports would increase 230-410 TAF (dry and critical year exports would increase up to 200 TAF) over the No Action Alternative. With additional storage, annual Delta exports would increase 460-800 TAF (dry and critical year exports would increase 130-650 TAF) over the No Action Alternative.	Some improvements would be realized from improved export pumping capacity. Greater benefits may be obtained if additional storage facilities are constructed. The alternative was evaluated with both a 5,000- and 15,000-cfs isolated facility. Without additional storage, annual long-term period Delta exports would increase 140-590 TAF (dry and critical year exports could decrease 90 TAF or increase 440 TAF) over the No Action Alternative. With additional storage, annual Delta exports would increase 410-1,300 TAF (dry and critical year exports would increase 90-1,200 TAF) over the No Action Alternative.	Actions under the Water Use Efficiency and Water Transfer Programs would lead to more efficient allocation of existing supplies. The degree to which beneficial redistribution of water resources would occur is uncertain. Ecosystem Restoration Program actions could use more water than current agricultural land uses. The Levee System Integrity, Water Use Efficiency, and Water Transfer Programs would contribute to improved supply reliability. Actions under the Water Quality Program could increase the amount of water available for some beneficial uses and provide improved operational flexibility.	Some improvements would be realized from improved export pumping capacity. Greater benefits may be obtained if additional storage facilities are constructed. The alternative was evaluated with and without a new screened diversion (2,000-4,000 cfs) from the Sacramento River near Hood to the Mokelumne River system. Without a new diversion, consequences are similar to those under Alternative 1. With a new diversion and no additional storage, annual long-term period Delta exports would increase 250-380 TAF (dry and critical year exports would increase 50-180 TAF) over the No Action Alternative. With a new diversion and additional storage, annual Delta exports would increase 490-900 TAF (dry and critical year exports would increase 180-670 TAF) over the No Action Alternative. Changes in operations could affect water supply and management.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
BAY-DELTA HYDRODYNAMICS AND RIVERINE HYDRAULICS					
Changes in Bay-Delta hydrodynamics and riverine hydraulics could result either from more protective Delta water management criteria or higher demands on the Bay-Delta system. For most parameters of interest, existing conditions fall within the range of uncertainty associated with the alternative.	Small increases in reverse QWEST flow would occur with or without new storage. Circulation patterns and water levels would improve in south Delta channels through the operation of flow control structures. Bay-Delta X2 position may increase or decrease. Minor changes to riverine flows and existing reservoir operations would occur through implementation of new storage.	Substantial decreases in reverse QWEST flow would occur with or without new storage through the operation of a Hood diversion. Circulation patterns and water levels would improve in south Delta channels through the operation of flow control structures. Bay-Delta X2 position may increase or decrease. Minor changes to riverine flows and existing reservoir operations would occur through implementation of new storage.	The alternative was evaluated with both a 5,000- and 15,000-cfs isolated facility. Substantial decreases in Sacramento River flow at Rio Vista and reverse QWEST flow would occur with or without new storage through the operation of an isolated facility. Circulation patterns and water levels would improve in south Delta channels through the operation of flow control structures. Bay-Delta X2 position may increase or decrease. Minor changes to riverine flows and existing reservoir operations would occur through implementation of new storage.	The Ecosystem Restoration Program pulse flows and Delta outflow targets result in potentially substantial short-term increases in Sacramento River and San Joaquin River flows during selected periods from March to May. The Levee System Integrity Program could alter channel geometry and slightly increase channel depth, which could alter flow patterns. The Water Use Efficiency Program could reduce or eliminate the need for increased diversions as populations increase or demand grows. These changes would benefit streamflows overall, but detrimental in-stream flow reductions could occur in cases where streams are partially or entirely fed by return flows. Water Transfer Program actions could modify the timing and magnitude of streamflows. Effects of the Watershed Program could range from very limited changes in flows in localized stream reaches to large-scale changes in flow regimes. Program actions may increase retention of surface water in the watershed, resulting in less variable runoff patterns.	The alternative was evaluated with and without a new screened diversion (2,000-4,000 cfs) from the Sacramento River near Hood to the Mokelumne River system. Without a new diversion, consequences are similar to those under Alternative 1. With a new diversion, substantial decreases in reverse QWEST flow would occur with or without new storage. Circulation patterns and water levels would improve in south Delta channels through the operation of flow control structures. Bay-Delta X2 position may increase or decrease. Minor changes to riverine flows and existing reservoir operations would occur through implementation of new storage. Changes in operations could cause changes in Bay-Delta circulation patterns and reservoir releases.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
WATER QUALITY					
Delta water quality would gradually deteriorate.	Shift in timing of Delta inflow results in some improvements in Delta water quality in alternative with storage, but is offset by increased south Delta pumping. Salinity would increase in Delta in alternative without storage. With or without storage, average monthly salinities would be increased in parts of central and west Delta, Old River, CCFB, and San Joaquin River. Bromide concentrations would increase in Old and Middle Rivers.	Reduction in salinity and bromide concentrations due to improved circulation pattern and shift in timing of Delta inflow in alternative with storage. Salinity in lower Sacramento and San Joaquin Rivers in west Delta would increase due to diversion of water into central and south Delta. With and without storage there are reductions in peak salinity levels in the central Delta, Old River, Middle River, DMC, and CCFB. Corresponding decreases in bromide levels are expected with lower salinity. Moderate increases in salinity in the west Delta under high water use with storage scenarios.	Quality of water exported to South-of-Delta SWP and CVP Service Areas improves substantially with isolated facility because water is taken from Sacramento River instead of Delta. Salinity increases at Rock Slough, and in south and central Delta. With and without storage very good reductions in salinity are projected in CCFB and good reductions during peak salinity periods are projected for Old River and the DMC. Mixed changes in the interior Delta are expected. West Delta areas would experience some salinity increases during high water use scenarios.	All regions would experience substantial potential benefits from source control measures of the Water Quality Program. The Ecosystem Restoration and Levee System Integrity Programs increase sediment loading and turbidity during construction and initial operation. Western Suisun Marsh levee rehabilitation could protect water quality. Ecosystem Restoration Program would reestablish more natural flows, lowering water temperature and salinity, and increase dissolved oxygen at certain times of the year.	Similar impacts as Aternative 1 without a Hood area diversion and similar impacts on Alternative 2, but less water quality impacts with a Hood area diversion facility. Changes in operations may significantly affect water quality in the Delta Region and quality dependent beneficial uses. Reductions in export pumping rates could temporarily reduce the intrusion of ocean-derived salinity and bromides into the vicinity of the export pumps. Water quality benefits could result from beneficial increases in net Delta outflows, and overall improvements in circulation patterns. Increases in reverse flows in Old River, during selected periods, could temporarily degrade central and south Delta water quality. Operational changes could cause increases in fresh-water inflows to the Bay and significant changes to the salinity gradient. Changes in pumping operations could move the position of X2 upstream or downstream by as much as 2 km, and about 1 km further upstream during selected periods. Significant improvements are expected in water quality exported to the San Joaquin River Region and the Other SWP and CVP Service Areas.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
GROUNDWATER RESOURCES					
Increased groundwater use with potential adverse impacts related to overdraft, subsidence, and water quality.	Alternative with surface water and groundwater storage could potentially reduce the potentially significant adverse impacts on groundwater resources throughout all regions.	Impacts similar to Alternative 1.	Impacts similar to Alternative 1.	The Ecosystem Restoration, Water Quality, and Levee System Integrity Programs would increase groundwater recharge. The Water Use Efficiency and Water Transfer Programs can result in greater reliance on groundwater resources during dry periods and potential reductions in groundwater recharge. These changes can adversely affect groundwater resources for third-party users.	Impacts similar to Alternative 1. Changes in operations could significantly affect groundwater resources, depending on the change of recharge rates and pumping due to the changes in operation in export water in the San Joaquin River Region and service areas. Changes in groundwater use could change subsidence rates, which could affect land use and water demands in the San Joaquin River Region and the Other SWP and CVP Service Areas.
GEOLOGY AND SOILS					
Conditions similar in type, but of greater magnitude than, existing conditions due to continued soil erosion, sediment contamination, subsidence, and channel degradation.	Reduced potential for erosion of channel, levee, and interior island soils through levee setbacks. Applied salt loads would be reduced in the Delta, Sacramento River, and San Joaquin River Regions. With new storage, increased ground disturbance, inundation, and shoreline wind and wave erosion.	Impacts similar to Alternative 1, but a larger area of land would be affected by additional conveyance facilities.	Impacts similar to Alternative 1, but a larger area of land would be affected by the isolated facility.	The Ecosystem Restoration Program would result in beneficial long-term effects in all geographic regions except the Other SWP and CVP Service Areas with respect to soil erosion, geomorphology, and sediment transport. The Water Use Efficiency Program would reduce erosion from agricultural lands. Watershed efforts could result in adverse short-term impacts on surface soil and channel erosion in the Sacramento River and San Joaquin River watersheds, but would result in beneficial long-term impacts on stream geomorphology by reducing sediment inputs from hillslope, bank, and channel erosion. The Levee System Integrity component could cause sediment loading and increased channel	Impacts similar to Alternative 1 without a Hood area diversion. Impacts similar to Alternative 2 with a Hood area diversion.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE: ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
GEOLOGY AND SOILS (continued)					
				depth. Beneficial impacts of the Suisun Marsh levee component include decreased soil salinity and increased protection of managed wetlands and tidally influenced lands due to increased flood protection.	
NOISE					
Conditions similar to existing conditions.	Construction of facilities would cause noise impacts that can be mitigated.	Impacts similar to Alternative 1.	Impacts similar to Alternative 1.	Impacts similar to Alternative 1.	Impacts similar to Alternative 1.
TRANSPORTATION					
Conditions similar to existing conditions, but traffic demands and traffic volume on existing roadways are expected to increase.	Potentially significant short- and long-term impacts where construction of levee, storage, and conveyance improvements may cause rerouting or temporary closure of traffic routes.	Impacts similar to Alternative 1. Additional short-term impacts would occur from construction of conveyance facilities.	Impacts similar to Alternative 2.	Construction activities associated with the Ecosystem Restoration and Levee System Integrity Program improvements may cause potentially significant short-term impacts on roadways and traffic routes if detours or road closures occur.	Impacts similar to Alternative 1 without a Hood area diversion. Impacts similar to Alternative 2 with a Hood area diversion.
AIR QUALITY					
Conditions similar to existing conditions.	Short-term construction air quality impacts that can be mitigated would occur in the Delta, Sacramento River, and San Joaquin River Regions.	Impacts similar to Alternative 1. Additional short-term impacts would occur from construction of conveyance facilities.	Impacts similar to Alternative 2. Some additional impacts would be related to construction of an isolated facility.	Direct, short-term air quality impacts during construction. Increased emissions associated with fugitive dust; prescribed burning; equipment use and cultivation, agricultural chemical use, and crop shifting; and land use changes leading to higher residential, commercial, or recreational uses. Increased use of fossil fuels or other energy resources.	Impacts similar to Alternative 1 without a Hood area diversion. Impacts similar to Alternative 2 with a Hood area diversion.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
FISHERIES AND AQUATIC ECOSYSTEMS					
Conditions similar to existing conditions, although increased input of contaminants and increased Delta exports would adversely affect some aquatic organisms and potentially limit opportunities for recovery of special-status species.	Adverse impacts, including increased entrainment loss, reduced productivity, and delayed migration of fish species would result from diversion to new storage and increased exports in alternative with storage. Without storage, change in flow conditions would be less, and impacts described above would be less.	Impacts related to increased diversion and subsequent effects on flow conditions would be similar to those under Alternative 1. Additional impacts on Delta channel flows would result from the Hood diversion, including increased entrainment, reduced Delta productivity, negative impacts on upstream migration of adult anadromous fish, reduced survival of aquatic outmigrants, and habitat loss or degradation. Beneficial impacts could result from Delta flow conditions in the Lower San Joaquin River that improve fish migration to the Bay. Impacts from dredging operations and disposal of spoils could cause temporary degradation of water quality, structural characteristics, water flow variations, and habitat for fish and aquatic ecosystems, as well as the delayed migration of fish species.	Impacts related to diversion and subsequent effects on flow conditions would be improved compared to those under Alternative 1. Impacts associated with a Hood diversion would be reduced compared to Alternative 2. An isolated facility could result in beneficial impacts in the east, central, and south Delta due to restored ecological processes related to Delta hydraulics, reduced entrainment losses, increased productivity, and improved aquatic outmigration. Dredging impacts would be less than those described for Alternative 2. If the isolated facility is sized adequately, the south Delta barriers may not be needed, and the impacts associated with those barriers avoided.	The Ecosystem Restoration and Water Quality Program actions would improve and increase aquatic habitats and increase species abundance under all alternatives in all regions except the Other SWP and CVP Service Areas. The Water Use Efficiency Program is expected to create ecosystem benefits through reduced diversion entrainment impacts, modifications in flow timing, and improved instream water quality. The Water Transfer Program may provide water for ecosystem purposes. The Levee System Integrity Program, including the Suisun Marsh levee component, could adversely affect fish and aquatic ecosystems through decreased water quality for fish and aquatic ecosystems, and loss of seasonal wetlands during levee rehabilitation; beneficial impacts could include decreased soil salinity and increased protection of managed wetlands and tidally influenced lands due to increased flood protection.	Impacts similar to Alternative 1 with or without a Hood area diversion. The Hood area diversion would not be constructed until it is determined that it would not significantly affect fishery resources. Changes in operation could benefit fish and aquatic resources by reducing entrainment at the pumps and providing improved flow conditions in Delta channels. Make-up pumping could adversely affect fish and aquatic species through increased entrainment and flow changes in Delta channels. Changes in operations could reduce entrainment at the pumping facilities in the south Delta. Reoperation of reservoirs could potentially degrade water temperature conditions, and increase spawning and rearing mortality. Reduced flow could adversely affect transport of eggs and larvae.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
VEGETATION AND WILDLIFE					
Conditions similar to existing conditions.	Construction of alternative with storage would affect vegetation and wildlife communities by disruption and reduction of habitats, fragmentation and loss of habitat, and permanent loss of wetland and riparian habitat. Similar but reduced impacts in alternative without storage.	Greater adverse impacts on vegetation and wildlife than under Alternative 1, and benefits to some species from the creation of aquatic habitats. Dredging for increased conveyance could reduce the amount of terrestrial habitat that setback levees would affect but would not provide opportunities for the habitat creation that setback levees may offer.	Greater adverse impacts than Alternative 2 resulting from extensive facility construction.	The Ecosystem Restoration and Water Quality Programs would lead to improved habitats under all alternatives. The Water Use Efficiency Program may result in adverse impacts on some habitats by reducing or eliminating surface water runoff. Changes in crop mix as a result of increased efficiencies and water transfers may reduce the amount of wildlife-friendly crops. Beneficial impacts of the Levee System Integrity Suisun Marsh levee component include decreased soil salinity, and increased protection of managed wetlands, tidally influenced lands, and critical waterfowl and terrestrial species habitats from increased flood protection. The Suisun Marsh levee component may result in temporary loss of habitat and displacement of wildlife during levee rehabilitation.	Impacts similar to Alternative 1 without a Hood area diversion. Impacts similar to Alternative 2 with a Hood area diversion.
AGRICULTURAL LAND AND WATER USE					
Shifts in production from field crops and grains to fruits and vegetables are expected.	Agricultural lands, including up to approximately 15,000 acres of prime, statewide important and unique farmlands, would be converted; and potential conflicts between proposed actions and regional land use plans and policies could occur. Some of these effects cannot be avoided. Storage facilities could increase the amount of water available for agricultural production.	Agricultural lands, including up to approximately 19,500 acres of prime, statewide important and unique farmlands would be converted, and potential conflicts between proposed actions and regional land use plans and policies could occur. Some of these effects cannot be avoided. Storage facilities could increase the amount of	Agricultural lands, including up to approximately 21,000 acres of prime, statewide important and unique farmlands, would be converted, and potential conflicts between proposed actions and regional land use plans and policies could occur. Some of these effects cannot be avoided. Storage facilities could increase the amount of	The Ecosystem Restoration Program would convert up to approximately 152,000 acres of prime, statewide important and unique agricultural lands to other uses in the Delta, Sacramento River, and San Joaquin River Regions. These impacts cannot be fully mitigated. Habitat could use additional water supplies. The Water Quality Program would result in improved water quality of irrigation water, higher crop yields, and greater crop selection flexibility. Retirement of lands in the San	Agricultural lands, including prime, statewide important and unique farmlands, ranging from up to approximately 15,000 acres without a Hood area diversion facility to up to 19,500 with a facility, would be converted by storage and conveyance facilities. Storage facilities could increase the amount of water available for agricultural production. Changes in operations may affect agricultural land and water use in the San Joaquin River Region and Other SWP and CVP Service Areas.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE: ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
AGRICULTURAL LAND AND WATER USE (continued)					
		water available for agricultural production. Dredging to increase conveyance reduces the amount of land that setback levees require. Dredging spoil disposal could occur on agricultural lands.	water available for agricultural production. Dredging to increase conveyance reduces the amount of land that setback levees require. Dredging spoil disposal could occur on agricultural lands.	Joaquin River Region could affect up to approximately 37,000 acres of agricultural land. The Levee System Integrity Pro-gram would convert up to approximately 35,000 acres of Delta Region farmland but provide great-er protection to farmland from flooding and salinity intrusion.	
AGRICULTURAL ECONOMICS					
The cost of water is expected to continue to increase.	Conversion of farmland may result in adverse economic effects.	Effects similar but more pronounced than Alternative 1. Dredging to increase conveyance could reduce the amount of agricultural land setback levees require and reduce effects on agricultural production.	Effects similar but more pronounced than Alternatives 1 or 2.	The Ecosystem Restoration and Watershed Programs would convert agricultural lands from production, resulting in adverse economic effects on revenue generation, employment, and local spending, but could increase spending related to other activities like hunting and fishing. The Water Quality Program would reduce long-term production costs and generate higher crop yields. Jobs and economic income would be lost in the San Joaquin River Region as lands are retired. Levee System Integrity Program would potentially convert agricultural land from production but would provide increased protection to farmlands, resulting in short-term adverse effects but creating long-term benefits. Water transfers may result in changes to local economies as a result of the sale of water. The type of effect would depend on how revenues from the sale are spent and how local economies are affected because of the transfer of water into	Effects similar to Alternative 1 without a Hood area diversion and effects similar to Alternative 2 with a Hood area diversion. Changes in operations may affect agricultural economics in the San Joaquin River Region and Other SWP and CVP Service Areas. Reductions in water supply could reduce agricultural production and industry, and adversely affect local rural economies. Increases in water supply could benefit the agricultural economy. The Watershed Program would alter land use practices in the upper watershed, which may result in foregone economic opportunities.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
AGRICULTURAL ECONOMICS (continued)					
				or away from a region. The Watershed Program would alter land use practices in the upper watershed, which may result in foregone economic opportunities.	
AGRICULTURAL SOCIAL ISSUES					
Conditions similar to existing conditions.	Job losses could occur as agricultural land is converted to other uses.	Job losses similar to, but more pronounced than, Alternative 1.	Job losses similar to, but more pronounced than, Alternative 1.	The Ecosystem Restoration Program would result in a significant loss of jobs due to the conversion of agricultural lands for habitat restoration. The Water Quality Program could result in a loss of jobs in the San Joaquin River Region as lands are retired. The Water Use Efficiency Program would result in increased yield for farmers but may reduce on-farm jobs associated with irrigation activities. Water transfers may result in the loss of farm worker jobs and other job-related effects in the selling region. The loss of farm worker jobs in the receiving region, if the water is purchased for agricultural use, may be avoided by a transfer.	Effects similar to Alternative 1 without a Hood area diversion and effects similar to Alternative 2 with a Hood area diversion. Changes in operations may affect agricultural social issues in the San Joaquin River Region and Other SWP and CVP Service Areas. Reductions in water supply could reduce agricultural production and industry, and adversely affect local rural economies. Increases in water supply could benefit the agricultural economy by increasing jobs.
URBAN LAND USE					
Continued development trends would cause displacement of some residents, disruption of some existing communities, and local and regional land use plan inconsistencies.	Urban effects could include displaced residents, disruption of existing communities, and inconsistencies with local and regional land use plans.	Effects similar to Alternative 1 but potentially more pronounced.	Effects similar to Alternative 1 but potentially more pronounced than Alternative 1 or 2.	Other programs are expected to result in only negligible effects on urban land uses but could require relocation of major infrastructures.	Effects similar to Alternative 1 without a Hood area diversion. Effects similar to Alternative 2 with a Hood diversion.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
URBAN WATER SUPPLY ECONOMICS					
Water supply reliability would continue to decline, and supply costs would increase.	Water supply costs could increase.	Effects similar to Alternative 1.	Effects similar to Alternative 1.	Other programs are not expected to significantly affect urban economics.	Effects similar to Alternative 1. Changes in operations may affect urban water supply economics in the San Joaquin River Region and Other SWP and CVP Service Areas. Reductions in water supply could result in an adverse effect, depending on the magnitude of reduction
UTILITIES AND PUBLIC SERVICES					
Demand for utilities and public services is expected to increase significantly.	Alternative 1 could increase demand for utilities and public services, and require the relocation of some utility infrastructure components.	Alternative 2 causes effects that are similar to, but more pronounced than, Alternative 1.	Alternative 3 causes effects that are similar to, but more pronounced than, Alternative 2.	The Ecosystem Restoration Program may require the relocation of utility infrastructure components.	Effects similar to Alternative 1 without a Hood area diversion. Effects similar to Alternative 2 with a Hood area diversion.
RECREATION RESOURCES					
Increased demand for recreational opportunities.	Alternative 1 with storage facilities would create new recreational opportunities while displacing some existing opportunities. Barriers in the Delta for fish and flow control would restrict boat travel, and affect marina access and use. These impacts cannot be fully mitigated.	Impacts similar to, but more pronounced than, Alternative 1. Dredging for increased conveyance would not cause the degree of long-term impacts on recreational resources or offer the opportunities for habitat enhancement that setback levee construction may provide.	Impacts similar to Alternative 2. Isolated facility may affect additional recreational facilities.	The Ecosystem Restoration Program could convert existing open space uses in the Delta, Sacramento River, and San Joaquin River Regions. The Levee System Integrity Program improvements may result in beneficial impacts by creating beach slopes associated with new levees and reduced exposure to flooding for existing recreational facilities. Some facilities could be closed or relocated, depending on the location of the levee improvements. Some public fishing areas may be temporarily disrupted during levee rehabilitation for the Suisun Marsh levee component.	Impacts similar to Alternative 1 without a Hood area diversion. Impacts similar to Alternative 2 with a Hood area diversion.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE: ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
FLOOD CONTROL					
Property values in the Delta Region would continue to increase, but flood protection levels would slightly decline.	Small potential benefits or costs to flood control would be experienced in the Sacramento River and San Joaquin River Regions. Alternative with storage may provide additional flood control benefits.	Similar to Alternative 1, but greater benefits to flood control in the Delta, Sacramento River, and San Joaquin River Regions from channel improvements, setback levees, and dredging. Dredging for increased conveyance could provide flood control benefits by increasing channel capacity. Dredged spoil disposal over peat soils could prevent oxidation and continued subsidence.	Similar to Alternative 2.	The Ecosystem Restoration, Water Quality, and Levee System Integrity Programs are expected to substantially benefit flood control. The levee system component could protect water quality, structures, and resources in the Delta. The Suisun Marsh levee component could increase channel depth slightly as levees are standardized.	Impacts similar to Alternative 1 without a Hood area diversion. Impacts similar to Alternative 2 with a Hood area diversion.
POWER PRODUCTION AND ENERGY					
The No Action Alternative would affect power and energy resources due to changes in water demand, conveyance, and pumping strategies.	Alternative 1 with storage would increase project energy use as operations change, would decrease the amount of CVP energy available for sale, and would increase the SWP's net energy requirement.	Effects similar to Alternative 1.	Effects similar to Alternative 1.	Other Program elements may affect power production and energy, but would not significantly affect CVP and SWP hydroelectric generating capacity, power production economics, or energy generation.	Effects similar to Alternative 1. Changes in operations may affect power production and energy resources in all regions. Changes in the amount of water exported from the pumping plants in the Delta and changes in operations of storage reservoirs could reduce or increase power production and energy use.
REGIONAL ECONOMICS					
Conditions similar to existing conditions adjusted for population growth.	Adverse effects are expected from loss of agricultural production, and beneficial effects would result from increased recreation and water supply.	Effects similar to those of Alternative 1 but would provide more beneficial recreational effects and water supply.	Effects similar to Alternative 2. In addition, this alternative would provide greater water supply reliability as a result of additional conveyance flexibility.	The Ecosystem Restoration and Levee System Integrity Programs would remove agricultural lands from production, resulting in adverse economic effects.	Effects similar to Alternative 1 without a Hood area diversion, and effects similar to Alternative 2 with a Hood area diversion but with less export water quality improvement.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
CULTURAL RESOURCES					
Additional development could result in impacts on cultural resources.	Disturbance of some cultural resources in all regions is expected except in the Other SWP and CVP Service Areas.	Impacts similar to Alternative 1. Dredging to increase conveyance could reduce the amount of land that setback levees require. Disposal of dredged spoils could affect buried archeological sites.	Impacts similar to Alternative 2 but greater due to construction of isolated facility.	The Ecosystem Restoration Program could adversely affect cultural resources in all regions except the Other SWP and CVP Service Areas. The Levee System Integrity Program could adversely affect cultural resources in the Delta.	Effects similar to Alternative 1 without a Hood area diversion. Effects similar to Alternative 2 with a Hood area diversion.
PUBLIC HEALTH AND ENVIRONMENTAL HAZARDS					
Some adverse impacts on public health and beneficial impacts on environmental hazards are expected.	Construction activities may expose people to hazardous materials and waste. Alternative 1 with storage could benefit firefighting.	Impacts similar to Alternative 1.	Impacts similar to Alternative 1.	The Ecosystem Restoration, Water Quality, and Levee System Integrity Programs may increase the amount of mosquito breeding habitat. Reduced surface water pollution would reduce health risks and may discourage mosquitoes.	Effects similar to Alternative 1.
VISUAL RESOURCES					
Continued development could result in some visual impacts. Flooding caused by levee failure could be considered an adverse visual impact.	Adverse visual impacts in the Delta from flow control structures. Facilities may obstruct views or be visually obtrusive. Alternative 1 with storage would cause shoreline "ring" effects.	Impacts similar to Alternative 1, additional adverse impacts could occur in the Delta from new conveyance facilities and channel enlargement.	Impacts similar to Alternative 2, with additional impacts caused by the isolated facility.	The Ecosystem Restoration Program would cause short-term construction impacts; but long-term benefits in the Delta; and beneficial and adverse impacts in the Bay, Sacramento River, and San Joaquin River Regions. The Levee System Integrity Program, including the Suisun Marsh levee component, could result in temporary construction and long-term visual impacts in the Delta.	Effects similar to Alternative 1 without a Hood area diversion. Effects similar to Alternative 2 with a Hood area diversion.

Table 3-1. Summary Comparison of Environmental Consequences (continued)

NO ACTION ALTERNATIVE	STORAGE AND CONVEYANCE ALTERNATIVE 1	STORAGE AND CONVEYANCE ALTERNATIVE 2	STORAGE AND CONVEYANCE ALTERNATIVE 3	OTHER PROGRAMS	PREFERRED PROGRAM ALTERNATIVE AND CHANGES IN OPERATION
ENVIRONMENTAL JUSTICE					
Conditions similar to existing conditions.	Some actions could dispro-portionately affect minority and low-income populations, including migrant workers, as agricultural land is converted to other uses.	Effects similar to Alternative 1.	Effects similar to Alternative 1.	The Ecosystem Restoration Program could disproportionately affect minority and low-income populations, including migrant workers, as agricultural land is converted to other uses. The Levee System Integrity Suisun Marsh levee component could displace some low-income houses on or near the levees during levee rehabilitation.	Effects similar to Alternative 1. Changes in operations may result in environmental justice effects in all regions. Reductions in water supply caused by changes in export water to the San Joaquin River Region or the Other SWP and CVP Service Areas could affect employment of minority and low-income popula-tions. Increases in water supply caused by changes in export water to these regions could result in a beneficial impact.
INDIAN TRUST ASSETS					
Conditions similar to existing conditions.	Some programs could ad-versely affect the Sacramento River and San Joaquin River Regions.	Effects similar to Alternative 1	Effects similar to Alternative 1.	The Ecosystem Restoration Pro-gram could benefit from water or fishing rights.	Effects similar to Alternative 1.

Notes:
CCFB = Clifton Court Forebay.
DMC = Delta-Mendota Canal.
km = Kilometer.
TAF = Thousand acre-feet.

Table 3-2. Summary of Beneficial Impacts Associated with the Preferred Program Alternative

RESOURCE CATEGORY	BENEFICIAL IMPACTS
Water supply and water management	Improvements in water supply are expected through coordinated implementation of Water Use Efficiency, Water Transfer, Water Quality, and Watershed Programs; facilities reoperation and integration; and, if appropriate, additional groundwater and/or surface water storage. Without storage, implementation of water use efficiency measures and transfers would lead to more efficient allocation of existing supplies, addressing some beneficial use needs. The adequacy of these non-storage measures in meeting beneficial use needs is uncertain.
Bay-Delta hydrodynamics and riverine hydraulics	Environmental implications of changes in Bay-Delta hydrodynamics and riverine hydraulics are discussed in other sections of the report in the context of each of the resources affected by the changes.
Water quality	Improved water quality for environmental and urban or agricultural uses from reduced concentrations of many contaminants, including heavy metals, pesticide residues, salts, selenium, pathogens, suspended sediments, total organic carbon, and bromides.
Groundwater resources	In areas undertaking managed conjunctive use programs, long-term increased groundwater levels, reduced pumping-induced subsidence, improved groundwater recharge, locally reduced potential for salt-water intrusion or pumping-induced migration of existing contaminants, and reduced groundwater extraction and reduced long-term lift costs.
Geology and soils	Reduced soil and wind erosion; reduced soil salinity, selenium concentrations, and sediment contamination; decreased soil subsidence; decreased loadings of toxic metals and organic compounds; reduced sediment transport; and reduced potential for seismically induced catastrophic failure of levees.
Noise	Reduced traffic or farm machinery noise associated with land use changes and reduced noise from modifying existing filtration plants, well fields, and pump stations.
Transportation	Roadway improvements, improved traffic flow, and accessibility to newly created wildlife or recreation areas.
Air quality	Decreased emissions from preparing agricultural land, burning fossil fuels, and applying herbicides and pesticides; reduction in fugitive dust production; and reduced crop burning due to crop shifting.
Fisheries and aquatic ecosystems	Reactivated and maintained ecological processes and structures that sustain healthy fish, wildlife, and plant populations; increased abundance and distribution of desired aquatic species; improved streamflow, sediment supply, floodplain connectivity, stream temperature, and biological productivity; and reduced entrainment losses.
Vegetation and wildlife	Net increases in target habitat types, increased protection for natural habitats, reduced toxic organic and inorganic constituents in the food web; increased quality and quantity of wetland and riparian habitats; increased habitat diversity; improved vigor of target populations (including special-status species); and long-term flood protection for existing and restored wetland, riparian, upland, and agricultural habitats.
Agricultural land and water use	Increased certainty in availability of irrigation water, potential for higher value crops and higher grazing productivity because of better water quality, increased property protection and reduction of salt-water intrusion, updated aging and inefficient irrigation systems, and opportunities for water transfers that could make irrigation water available where it may not have been otherwise.

Table 3-2. Summary of Beneficial Impacts Associated with the Preferred Program Alternative (continued)

RESOURCE CATEGORY	BENEFICIAL IMPACTS
Agricultural economics	Protection, long-term savings, increased revenues, and certainty for the agricultural economy.
Agricultural social issues	Some localized increases in agriculture-related employment, protection of agricultural jobs and income from catastrophic loss due to levee failure, and reduced future social dislocations due to water reliability.
Urban land and water use	Greater flood protection for urban centers.
Urban water supply economics	Lower treatment and regulatory costs, improved water quality, relocated water supply intakes, reduced risk of export interruptions caused by levee failure, and increased water supply availability.
Utilities and public services	Reduced risk to electrical or natural gas transmission lines, utility facilities, communication infrastructure, and emergency service centers due to levee failure.
Recreation resources	Increased open space; enhanced or restored wetland or wildlife habitat; improved water quality; increased fishing, hunting, and wildlife viewing opportunities; more recreation-related jobs; increased quality of recreational experience; increased flood protection for camping facilities and boat launches; and increased or improved access to public recreation areas.
Flood control	Easier inspection, maintenance, and repair of the flood control system; improved flood flow conveyance capacities; and reduced incidences of instability and overtopping failures. Additional system-wide flood control benefits from levees improved to the Public Law 84-99 standards and restored floodplains.
Power production and energy	Some increase in hydropower generation if new storage is constructed.
Regional economics	Increases in recreation-related or construction-based economies, increased land values due to flood protection, reduced cost to some water supplies due to increased storage, and some increases in regional revenues and jobs associated with the Storage element.
Cultural resources	Protection of cultural resources that are present on a site purchased and placed under federal ownership.
Public health and environmental hazards	Better water quality, which could reduce opportunities for disease transmission and mosquito breeding habitat; reduced sediment loading in streams and rivers; reduced surface water pollution from agricultural field drainage; improved human safety from flood control and fire management capabilities; and reduced exposure to hazardous materials.
Visual resources	Restored woodland, riparian, and wetland habitats; increases in visual variety to the landscape and possible upgrade of variety class; and improvement or preservation of natural watershed landscape character.
Environmental justice	Short-term restoration-related employment, restored fishing and hunting opportunities for populations that rely on fishing or hunting for subsistence, and reduced threat of death and economic devastation from flooding.
Indian trust assets	Possible improvements in water and fishing rights.

Table 3-3. Summary of Potentially Significant Adverse Avoidable and Unavoidable Impacts Associated with the Preferred Program Alternative

RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT ADVERSE IMPACTS
Water supply and water management	Temporary local water supply interruptions due to turbidity of water during construction of facilities and habitat restoration activities.
Bay-Delta hydrodynamics and riverine hydraulics	None identified; changes in this category may cause effects in other resource categories.
Water quality	Increases in concentrations of bromide, salinity, total dissolved solids, and total organic carbon in the Delta. Increased diversion of water from the Delta, reducing outflow to the Bay and changing Bay salinity. Releases of inorganic or organic suspended solids, or toxic substances into the water column in the Delta. Increased water temperatures and decreased dissolved oxygen concentrations in the Delta. Potential decreased in-stream water quality from reduced in-stream flows associated with new storage facilities.
Groundwater resources	Increased groundwater extractions in the Sacramento Valley, and, to a lesser extent, the San Joaquin Valley, resulting in land subsidence, lower groundwater levels, and higher pumping costs; degradation of groundwater quality; or losses of existing wells.
Geology and soils	Increases in agricultural land soil conversion, local subsidence, soil erosion and soil salinity, construction-related short-term soil erosion, and sediment deposition or soil compaction from heavy equipment. Changes to geomorphology downstream of surface water storage facilities. Ground disturbance, inundation, and shoreline wind and wave erosion.
Noise	Increased noise from heavy construction equipment operation, traffic along major access and haul routes, and vehicle traffic associated with the construction labor force; facility operation of spillways, pumping generating plants, and switchyards; and additional automobile or boat traffic associated with recreational use.
Transportation	Changed traffic flows around construction sites, detoured traffic as new roadways and railroad bridges are constructed, and added construction vehicles to existing traffic levels. Relocated or permanently closed roads. Impeded or blocked patrol or rescue boats in Delta sloughs where fish barriers and flow control structures are installed.
Air quality	Direct, short-term air pollutant emissions during construction activities. Increased emissions associated with fugitive dust, prescribed burning programs, equipment use and cultivation, agricultural chemical use, and crop shifting; and land use changes leading to higher residential, commercial, or recreational uses. Increased use of fossil fuels or other energy resources.
Fisheries and aquatic ecosystems	**Increased non-native species abundance distribution**; blocked access to habitat and potentially altered water quality and flow conditions from placement of barriers in the south Delta. Altered natural ecosystem structure, removal of benthic communities, and creation of conditions that may damage habitat for desired species from dredging activities. Short-term disturbance of existing biological communities and species habitat, mobilized sediments, and input contaminants from construction activities. Reduced streamflow and Delta outflow, changed seasonal flow, water temperature variability, and changes in salinity potentially resulting in reduced habitat abundance, impaired species movement, and increased loss of fish to diversions. Increased entrainment loss of chinook salmon and other species from diversions to new off-stream storage. Reduced frequency and magnitude of net natural flow conditions in the south and central Delta from Delta Cross Channel operations and south Delta barriers. With a Hood area diversion facility, impacts on individual organisms of special-status species from reduced net flow conditions in the Sacramento River downstream of Hood; increased mortality through abrasion, increased predation, and other factors from a new fish screen facility; and delayed migration and reduced spawning success for adult fish.

Bold indicates a potentially significant unavoidable impact.

Table 3-3. Summary of Potentially Significant Adverse Avoidable and Unavoidable Adverse Impacts Associated with the Preferred Program Alternative (continued)

RESOURCE CATEGORY	POTENTIALLY SIGNIFICANT ADVERSE IMPACTS
Vegetation and wildlife	**Fragmentation of existing habitat corridors on small or ephemeral tributaries as a result of inundation by storage reservoirs, potentially blocking the movement and interchange of populations of some wildlife species from upper to lower watershed locations. Loss of habitat and direct impacts on special-status species.** Loss of incidental wetlands and riparian habitats that depend on agricultural water use inefficiencies. Temporary or permanent loss or distur-bance of wetland and riparian communities, wintering waterfowl habitat, portions of rare natural communities and significant natural areas, and quantity or quality of forage for species of concern.
Agricultural land and water use	**Conversion of prime, state-wide important, and unique farmland; and conflicts with local government plans and policies; conflicts with adjacent land uses.**
Urban land and water use	Displacement of existing urban residences, physical disruption or division of established communities, and potential conflicts with local general plans.
Utilities and public services	Relocation or modification of major infrastructure components; increased risk of gas line ruptures during construction.
Recreation resources	Temporary or permanent closure of some recreation areas or facilities; reduced access to recreation facilities and decreased recreation opportunities from changes in reservoir levels. **Loss of terrestrial and on-stream recreation by inundation from reservoirs. Temporary and permanent changes to motorized boating in the Delta from speed limits, channel closures, and installation of flow and fish control barriers.** Decrease in flooded lands suitable for wildlife viewing, hunting, and fishing. Reduced water-contact recreation quality from releases of reservoir cold water.
Flood control	Reduced levee stability and reductions in a channel's flood flow conveyance from barriers in the channel. Increases in seepage, wind-fetch, and wave erosion on landside levee slopes; level of flooding downstream of diversions after removal of Sacramento River tributary diversion structures and other flow obstructions; flood stages along streams. Localized subsidence, resulting in levee slumping or cracking if occurring near levees. Adverse impacts on water quality from use of dredged materials.
Power production and energy	Decrease in amount of energy available for non-project uses, possible air quality and land use impacts from new power plants to replace lost power.
Cultural resources	Impacts on cultural resources from ground-disturbing activities; new construction, excavation, or fill; inundation; altering existing facilities; altering the historic setting of a cultural resource; and introducing elements out of character with a cultural resource site.
Public health and environmental hazards	Increases in mosquito breeding habitat. Increases in risk of groundwater contamination from naturally occurring or spilled hazardous materials and from improper handling of hazardous materials; exposure to hazardous materials and waste from construction; and water quality degradation, resuspension of contaminants, and exposure to hazardous materials from placement of contaminated dredged spoils.
Visual resources	Visual impacts from construction activities, such as vegetation removal, construction of staging areas, night-time glare from construction lights, haul routes, and dust. Presence of constructed linear and obtrusive features (such as dams and spillways), view obstructions, and a bathtub ring effect caused by fluctuating reservoir water levels; new levees and embankments that could visually dominate the surrounding flat, open landscape; and new facilities. Degraded views in visually sensitive areas from Program actions, such as creating borrow pits for gravel replacement, installing fish screens in areas with high visual sensitivity, and altered timber harvesting practices.

Bold indicates a potentially significant unavoidable impact.

Table 3-5. Summary of Potential Program-Induced Growth Impacts Associated with the Preferred Program Alternative

RESOURCE CATEGORY	RESOURCE CATEGORIES THAT MIGHT BE ADVERSELY AFFECTED BY PROGRAM-INDUCED GROWTH
Water supply and water management	Yes
Bay-Delta hydrodynamics and riverine hydraulics	No
Water quality	Yes
Groundwater resources	Yes
Geology and soils	Yes
Noise	Yes
Transportation	Yes
Air quality	Yes
Fisheries and aquatic ecosystems	Yes
Vegetation and wildlife	Yes
Agricultural land and water use	Yes
Agricultural economics	No
Agricultural social issues	No
Urban land and water use	No
Urban water supply economics	No
Utilities and public services	Yes
Recreation resources	Yes
Flood control	Yes
Power production and energy	No
Regional economics	No
Cultural resources	Yes
Public health and environmental hazards	Yes
Visual resources	Yes
Environmental justice	No
Indian trust assets	No

Table 3-6. Summary of Short- and Long-Term Associated Relationships with the Preferred Program Alternative

RESOURCE CATEGORY	RELATIONSHIPS
Water supply and water management	Short-term construction-related impacts may disrupt deliveries. Long-term improvements in supply and reliability.
Bay-Delta hydrodynamics and riverine hydraulics	No relationships identified. Changes in this category may cause impacts on other resources and are addressed in other resource categories.
Water quality	Short-term construction-related impacts. Long-term improvements in water quality.
Groundwater resources	No relationships identified.
Geology and soils	Short-term construction-related and long-term impacts, including ground disturbance, inundation, and changes to geomorphology. Long-term benefits resulting from reduced erosion, salinity, and soil subsidence.
Noise	Short-term noise from construction activities. No long-term increase in noise levels.
Transportation	Short-term construction-related impacts. Long-term adverse impacts, such as relocating or closing roads. Long-term benefits due to road improvements.
Air quality	Short-term construction-related impacts. No long-term effects.
Fisheries and aquatic ecosystems	Short-term construction-related impacts. Flow conveyance facilities and operations could result in short-term impacts. Long-term benefits to fish and aquatic ecosystems.
Vegetation and wildlife	Short-term construction-related impacts. Long-term benefits to vegetation and wildlife resources.
Agricultural land and water use	Long-term benefits from increased irrigation water quality and supply reliability, and from levee protection. Long-term loss of agricultural land used for Program purposes.
Agricultural economics	No relationships identified.
Agricultural social issues	No relationships identified.
Urban land and water use	Short-term construction-related impacts. Long-term benefits from improved water quality and supply reliability.
Urban water supply economics	No relationships identified.
Utilities and public services	Short-term construction-related impacts. Long-term effects associated with increased demand for utilities and public services.
Recreation resources	Short-term construction-related impacts. Long-term benefits from improvements in other environmental resources. Long-term impacts on motorized boating in the Delta Region and possible stream inundation.
Flood control	Short- and long-term benefits from improved flood protection.
Power production and energy	Short-term construction-related impacts. Long-term decrease in power available to other users, requiring replacement power.
Regional economics	Short-term construction-related impacts. No long-term effects.
Cultural resources	Short-term construction-related impacts. Long-term benefits if lands with cultural resources are obtained and receive federal protection.
Public health and environmental hazards	Short-term construction-related impacts. Long-term benefits from improved water quality, flood control, water use efficiency, and fire management. Long-term adverse impacts due to increased mosquito breeding habitat.
Visual resources	Short-term construction-related impacts. Long-term improvements due to improvements in other environmental resources. Long-term adverse effects from constructed linear and obtrusive features and view obstructions.
Environmental justice	Short-term impact from reduction in agricultural lands and fewer opportunities for hunting and fishing. Long-term benefits from increases in agricultural- and recreation-related employment, and from fish and hunting opportunities.
Indian trust assets	Effects appear unlikely but must be determined at a project-specific level.

Table 3-7. Summary of Irreversible and Irretrievable Commitments of Resources Associated with the Preferred Program Alternative

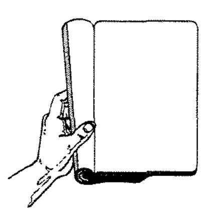
RESOURCE CATEGORY	IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS
Water supply and water management	Displacement of water supplies from one region or use to another region or use.
Bay-Delta hydrodynamics and riverine hydraulics	No commitments identified. Changes in this category may cause impacts to other resources as noted below.
Water quality	No commitments identified.
Groundwater resources	Long-term degradation from overdraft, subsidence, and contamination.
Geology and soils	Ground disturbance, inundation, and changes to downstream geomorphology. Commitments of construction material and land conversion.
Noise	No commitments identified.
Transportation	Displacement of roads.
Air quality	No commitments identified.
Fisheries and aquatic ecosystems	Habitat losses from construction activities, changes in aquatic habitat types.
Vegetation and wildlife	Habitat losses from construction activities, changes in habitat types.
Agricultural land and water use	Conversion of agricultural land to other uses.
Agricultural economics	No commitments identified.
Agricultural social issues	No commitments identified.
Urban land and water use	Commitments of resources, such as construction material, labor, and energy for facilities. Conversion of small amounts of land currently in urban uses to other uses.
Urban water supply economics	Costs and resources committed to a fixed water supply structure are not easily reversed.
Utilities and public services	Increased demand on energy, utility infrastructure, and transmission line capacity.
Recreation resources	Increased recreation access and facilities, changes in boating access and circulation patterns in the Delta Region, and inundation of flowing streams and rivers from enlarging existing storage reservoirs.
Flood control	Improvements in levees, channel conveyance capacity, and other flood control features.
Power production and energy	Commitments of the nonrenewable energy resources needed to construct, implement, and maintain project structures and programs. Increase in project energy use at pumping plants would cause commitments of resources if nonrenewable resources are used to generate electricity for the pumping plants.
Regional economics	No commitments identified.
Cultural resources	Loss of cultural resources. Data recovery techniques ameliorate this loss, but cultural resources cannot be replaced or reproduced once they are lost, regardless of mitigation activities.
Public health and environmental hazards	Changes in amount of mosquito breeding habitat, levels of fuels that contribute to forest fires, and water supply to help fight forest fires.
Visual resources	Changes to visual settings caused by Program actions.
Environmental justice	No commitments identified.
Indian trust assets	No commitments identified.

Table 3-8. Summary of Potentially Significant Adverse Cumulative Impacts

	PROGRAM REGION				
RESOURCE	DELTA	BAY	SACRAMENTO RIVER	SAN JOAQUIN RIVER	OTHER SWP AND CVP SERVICE AREAS
Water supply and water management	✓	✓	✓	✓	✓
Bay-Delta hydrodynamics and riverine hydraulics	✓	✓	✓	✓	
Water quality	✓	✓	✓	✓	✓
Groundwater resources	✓	✓	✓	✓	✓
Geology and soils	✓	✓	✓	✓	
Noise	✓	✓	✓	✓	
Transportation	✓		✓	✓	
Air quality	✓	✓	✓	✓	
Fisheries and aquatic ecosystems	✓	✓	✓	✓	
Vegetation and wildlife	✓	✓	✓	✓	
Agricultural land and water use	✓		✓	✓	
Urban land and water use	✓	✓			
Utilities and public services	✓		✓	✓	
Recreation resources	✓	✓	✓	✓	
Flood control	✓		✓	✓	
Power production and energy	✓	✓	✓	✓	✓
Cultural resources	✓	✓	✓	✓	
Public health and environmental hazards	✓	✓	✓	✓	
Visual resources	✓	✓	✓	✓	

Chapter 4. Guide to Impact Analyses and Description of Land Use Assumptions

This chapter provides a road map for the impact analyses. It also explains some of the approaches used in assembling the range of land use changes that may occur as a result of CALFED Bay-Delta Program implementation.



4. Guide to Impact Analyses and Description of Land Use Assumptions

4.1 GUIDE TO IMPACT ANALYSES

This chapter is included to help readers understand how the impact analyses are presented in Chapters 5, 6, and 7. Information on the environmental consequences of the alternatives presented in this document was derived primarily from technical reports. These technical reports were prepared for many of the resource categories and form the basis for the affected environment and environmental consequences descriptions in the March 1998 Draft Programmatic EIS/EIR and Chapters 5, 6, and 7 of this report. Since the CALFED Bay-Delta Program (Program) alternatives described in this report incorporate elements of the alternatives presented in the March 1998 Draft Programmatic EIS/EIR and the impacts are similar, information in the technical reports was verified and used in these analyses, along with additional modeling runs for the operations and water supply.

This chapter is included to help readers understand how the impact analyses are presented in Chapters 5, 6, and 7.

Because a Preferred Program Alternative has been identified since the March 1998 Draft Programmatic EIS/EIR, the Program decided to rewrite the draft Programmatic EIS/EIR rather than update or supplement the March 1998 version. Comments received on the March 1998 Draft Programmatic EIS/EIR were catalogued, and many of the issues noted in those comments were incorporated into the revised program plans. Where possible, they are also identified and addressed in the impact analyses.

Resources evaluated in this Draft Programmatic EIS/EIR have been grouped into three main categories, as illustrated in Table 4-1.

- Physical environment
- Biological environment
- Land use, social issues, and economics

To provide a quick visual reference for the reader, a topic illustration is included in the footer for each resource. For example, the reference illustration for the air quality resource impact analysis is a hot air balloon.

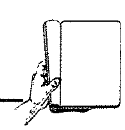


Table 4-1. Resource Categories Evaluated in the Draft Programmatic EIS/EIR

CHAPTER 5
PHYSICAL ENVIRONMENT

- Water Supply and Water Management
- Bay-Delta Hydrodynamics and Riverine Hydraulics
- Water Quality
- Groundwater Resources
- Geology and Soils
- Noise
- Transportation
- Air Quality

CHAPTER 6
BIOLOGICAL ENVIRONMENT

- Fisheries and Aquatic Ecosystems
- Vegetation and Wildlife

CHAPTER 7
LAND USE, SOCIAL ISSUES, AND ECONOMICS

- Agricultural Land and Water Use
- Agricultural Economics
- Agricultural Social Issues
- Urban Land Use
- Urban Water Supply Economics
- Utilities and Public Services
- Recreation Resources
- Flood Control
- Power Production and Energy
- Regional Economics
- Cultural Resources
- Public Health and Environmental Hazards
- Visual Resources
- Environmental Justice
- Indian Trust Assets

The organization of a typical resource discussion is depicted in Figure 4-1. The impact analysis for most resource categories is divided into several parts, including a summary, a description of the affected environment/existing conditions, and discussions of environmental consequences—including such topics as cumulative and growth-inducing impacts. Each of these divisions is explained more fully below.

The impact analysis for most resource categories is divided into several parts, including a summary, a description of the affected environment/ existing conditions, and discussions of environmental consequences—including such topics as cumulative and growth-inducing impacts.

Summary. The summary provides the conclusions of the detailed impact analysis. It gives an overview of the benefits and potentially significant adverse impacts that could result from implementing the Program, and lists possible mitigation strategies to lessen potentially significant impacts. Information presented in the summary for reach resource is the basis for the summary comparison of impacts presented in Chapter 3.

Areas of Controversy. Under CEQA, areas of controversy include differences of opinion among technical experts or areas of uncertainty for which information is not available and cannot be readily obtained. Areas of controversy were identified by comments from CALFED agencies, public comments, and new information developed since the March 1998 Draft Programmatic EIS/EIR. For some resources, issues that do not meet the CEQA definition for areas of controversy have been raised by a number of people. For recreation resources, for example, the effects on motorized boating in the Delta or of flooding free-flowing rivers by enlarging existing reservoirs are areas of concern that do not meet the CEQA definition for areas of controversy. These types of issues also are noted in the "Areas of Controversy" section. Although listing areas of concerns is not required by NEPA or CEQA, the Program decided to acknowledge concerns mentioned in the public review process. In most cases, the concerns are addressed in the impact

Under CEQA, areas of controversy include differences of opinion among technical experts or areas of uncertainty for which information is not available and cannot be readily obtained.

analyses. In some cases, however, the concerns cannot be addressed at the programmatic level and will need to be addressed in second-tier documents.

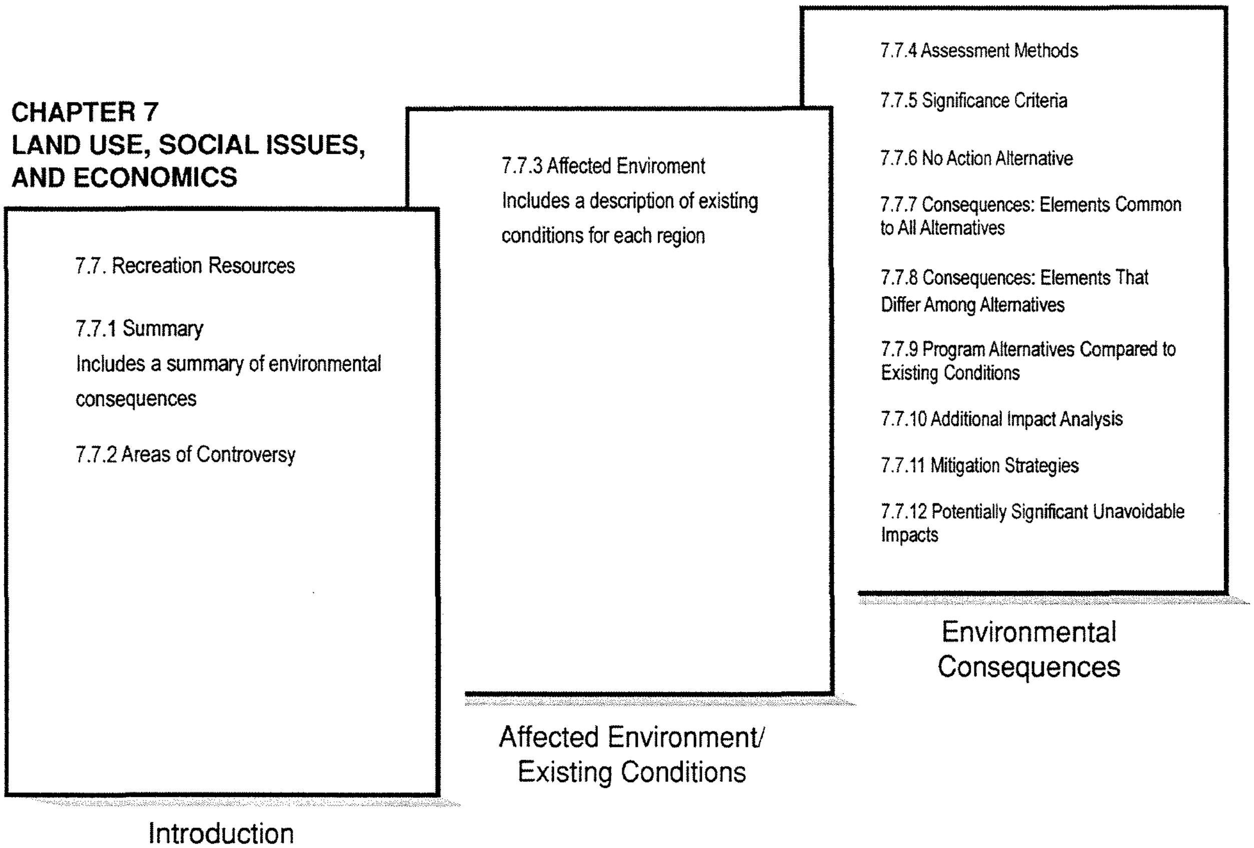


Figure 4-1. Organization of a Resource Discussion Using Recreation as the Example

Affected Environment/Existing Conditions. The "Affected Environment/Existing Conditions" section provides a historical perspective and an overview of the current conditions for each resource. The description of current conditions uses the most recent information available. The discussions are organized by region, in the following order:

- Delta Region
- Bay Region
- Sacramento River Region
- San Joaquin River Region
- Other SWP and CVP Service Areas

The regulatory framework that is part of the existing conditions can be found in Section 3 of Chapter 8, "Compliance with Applicable Laws, Policies, and Plans and Regulatory Framework."

Program regions are combined into a single discussion when their existing conditions/affected environment discussions are similar. Upper watershed descriptions for each resource are discussed, where appropriate, under the various regions.

Assessment Methods. Descriptions of assessment methods are resource specific, and provide the approach used to identify and assess the environmental consequences for the resource category. Analytical models used in the evaluation also are identified.

Significance Criteria. Because of the general nature of the planning process and the broad range of programmatic actions being considered, qualitative thresholds of significance generally are used.

These qualitative and general criteria provide the basis for establishing more specific or quantitative thresholds to be used in the project-specific, second-tier environmental documents. When specific actions are identified in Phase III, significance criteria will be expressed in quantitative terms or measurable performance criteria based on site-specific data.

The Program has not selected a specific conveyance alignment or the location of any other structure or action mentioned in any discussions in this document. These selections will not occur until Phase III and would involve extensive study and interaction with all interested parties.

No Action Alternative. This section presents the environmental consequences of the No Action Alternative compared to existing conditions. The No Action Alternative makes predictions about the future condition of environmental resources, taking into consideration recently constructed projects and projects under construction. For the No Action Alternative, assumptions are made about existing trends that may continue into the future and about water project operations. For example, urbanization that is expected to continue would require additional land and water resources, with consequences on a variety of environmental resources. A list of projects included in the No Action Alternative impact analysis and water operation modeling assumptions are provided in Attachment A.

The impacts of each of the four Program alternatives are compared to both the No Action Alternative and the existing conditions/affected environment in Chapters 6, 7, and 8 of the impact analysis section of this Programmatic EIS/EIR. Under the No Action Alternative, it is assumed that certain changes in the environment will occur regardless of whether any of the alternatives are implemented. For example, it is anticipated that trends in population growth and urbanization will continue, but the rate at which these trends will continue and the locations where they will occur cannot be projected except very generally. The same is true for any environmental impacts caused by growth and urbanization. It is likely that these changes would result in potentially significant impacts on the resources evaluated (land use, air quality, water quality, vegetation and wildlife, fisheries, and others), but there is no accurate way to predict how severe those impacts may be or where they will occur.

Because of the broad programmatic nature of the project, the 20- to 30-year planning horizon, and the imprecise understanding of future conditions, it is difficult to distinguish in any meaningful way the differences between the conditions under the No Action Alternative and existing conditions. Consequently, the environmental impacts of the actions included in the Program alternatives when compared to existing conditions are described as being very similar to the impacts of those alternatives when compared to what is expected to happen under a future no-action scenario.

Program Alternatives. This section presents the consequences of the four Program alternatives, the reasons why social and economic effects are not considered a significant impact on the environment, and deviations from the format outlined in this chapter.

Under CEQA, an economic or social change by itself is not considered a significant impact on the environment. If the analysis can trace a chain of cause and effect from a proposed project through anticipated economic or social changes resulting from the project to physical changes caused in turn by the economic or social changes, it may be considered a significant impact. The focus of the analysis is on the physical changes to the environment, and economic or social changes do not have to analyzed in any detail greater than necessary to trace a chain of cause and effect. However, economic or social effects of a project can be used to determine the significance of physical changes caused by a project, and should be considered (together with technological and environmental factors) in deciding whether changes in a project are feasible to reduce or avoid the significant effects on the environment identified in the EIR. In the interest of full disclosure, the Program presents an overview of the social and economic potential effects of Program implementation.

Under CEQA, an economic or social change by itself is not considered a significant impact on the environment.

For most resources, Levee System Integrity Program actions would affect only the Delta and Bay Regions, and the program is not discussed for other Program regions. The Levee System Integrity Program impacts on Suisun Marsh are discussed under the "Bay Region."

For most resources, Levee System Integrity Program actions would affect only the Delta and Bay Regions, and the program is not discussed for other Program regions. The Levee System Integrity Program impacts on Suisun Marsh are discussed under the "Bay Region."

Because of the system-wide nature of the resource, the power and energy section is presented in a system-wide format. The water supply and Bay-Delta hydrodynamics and riverine hydraulics sections modify the definition of the San Joaquin River Region and the Other SWP and CVP Service Areas to better describe consequences affecting water supplies in those regions.

Program Elements with Consequences Common to All Alternatives. This section presents the environmental consequences of the Program elements that are similar to all alternatives. Generally, the environmental consequences of all Program elements are the same for each alternative. This description of environmental consequences also is presented by Program region. For brevity, regions are combined when environmental consequences are similar.

Program Elements with Consequences That Differ Among Alternatives. The consequences of Program elements that differ among the alternatives primarily are associated with conveyance in the Delta Region; therefore, this section is presented by alternative rather than by region. Other regions are included as subsections, where applicable. For brevity, Program regions are combined where environmental consequences are similar.

Program Alternatives Compared to Existing Conditions. Under CEQA, the Program is required to analyze the effects of the Program alternatives compared to existing conditions and compared to the No Action Alternative. The effect of using the existing conditions as the baseline for determining environmental consequences is presented in this section. This discussion ensures that all potentially significant impacts are identified. In most cases, because of the programmatic nature of the environmental assessment and long planning horizon, the conditions present under the existing conditions baseline are similar to those under the No Action Alternative. In these situations, differences between existing conditions and No Action Alternative cannot be distinguished at the programmatic level, and the results of comparison of each alternative to the No Action Alternative and to existing conditions are the same. Where potential meaningful differences exist between the comparison to existing conditions and the No Action Alternative, the differences are identified and discussed in the this section.

Additional Impact Analysis. Four other topics are included in the impact analysis: cumulative impacts, growth-inducing impacts, the relationship between short-term uses of the environment and maintaining and enhancing long-term productivity, and irreversible and irretrievable commitments of resources. A summary of each of these topics is included in Chapter 3, and they are described below.

Cumulative Impacts. Cumulative impacts are defined as impacts on the environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions undertaken by the same or other agencies or persons. Program actions may be implemented in an interactive manner with other concurrent and subsequent projects. The non-Program actions implemented concurrently with the Program may affect the results of implementing the Program and may result in impacts different than those associated with implementing only Program actions. A description of the programs and projects considered in the cumulative impact analysis is provided in Attachment A.

In general, the analysis of cumulative impacts is qualitative. Impacts were identified based on: (1) information extracted from available environmental documents or studies for the resource categories potentially affected by each project, and (2) knowledge of expected effects of similar projects in the study area. Because of the preliminary phase of most of the projects considered (environmental reviews have not been initiated, drafted, or finalized), comparable environmental information for identifying cumulative impacts was sparse.

In general, the cumulative impact analysis is qualitative. Cumulative impacts were based on resources potentially affected by each project in concert with Program actions.

Growth-inducing Impacts. This section describes actions associated with the Program that could foster economic or population growth; result in construction of additional housing, either directly or indirectly; or remove obstacles to population growth. How population growth could affect existing community services also is considered in this section. Further, this section addresses how growth could lead to disturbances of resources. For example, water supply reliability could lead to growth, and that additional growth could affect geology and soil.

For the following resources, the cumulative impacts and growth-inducing impacts are referred to as Cumulative Effects and Growth-Inducing Effects, and are not treated as significant direct environmental impacts: agricultural economics, agricultural social issues, urban water supply economics, regional economics, and environmental justice (see second paragraph under "Program Alternatives" on page 4-5).

Relationship Between Short-Term Uses and Long-Term Productivity. This section discusses the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. Resource-specific summaries of the short-term uses in the project areas and the maintenance and enhancement of long-term productivity in those areas are provided.

Irreversible and Irretrievable Commitments. This section fulfills the requirement to address irreversible and irretrievable commitments of resources. Irreversible impacts are those that cause, through direct or indirect effects, use or consumption of resources in such a way that they cannot be restored or returned to their original condition despite mitigation. If unavoidable, potentially irreversible impacts are documented in this report. An irretrievable impact or commitment of resources occurs when a resource is removed or consumed. These types of impacts are evaluated to ensure that consumption is justified.

Mitigation Strategies. Because this Draft Programmatic EIS/EIR does not evaluate site-specific actions, no specific mitigation measures or monitoring plans are presented. Instead, general mitigation strategies are identified as ways to avoid, minimize, restore, or compensate for potentially significant adverse impacts. For some resources, specific mitigation measures are provided to display the array of techniques available in order to carry out the strategy. For example, construction activities can cause erosion of soils that leads to adverse impacts on water quality. A mitigation strategy would be to avoid and minimize the impact. Mitigation measures available to carry out this strategy include conducting work during dry periods and using erosion-control fencing or straw bales, water detention basins, and so forth.

Because this draft Programmatic EIS/EIR does not evaluate site-specific actions, no specific mitigation measures or monitoring plans are presented. Instead, general mitigation strategies are identified.

The economic and social information analyses (agricultural economics, agricultural social issues, urban water supply economics, regional economics, and environmental justice) do not contain a mitigation strategies section. However, the Program has presented possible methods to alleviate potential adverse effects on these resources in the discussion of potential effects.

Potentially Significant Unavoidable Impacts. The final section is a discussion of potentially significant unavoidable impacts for each resource category. This section identifies potentially significant adverse impacts that remain significant even after implementing mitigation strategies and measures. For the economic and social information analyses, this section is titled Adverse Effects.

4.2 CEQA DOCUMENT REQUIREMENTS

CEQA requires that certain subjects be documented in an environmental impact analysis. The following explanation is provided to assist the reader in locating these subjects. The locations of discussions about the subjects are noted following each subject.

- Affected environment. Descriptions of the affected environment are in Chapters 5, 6, and 7. This section includes discussions about historical and existing conditions.

- The potentially significant environmental effects of the proposed project. Chapter 3 provides a table of all potentially significant environmental effects of the Preferred Program Alternative. The potentially significant environmental effects of each of the alternatives are discussed by resource category in Chapters 5, 6, and 7.

- Any potentially significant environmental effects that cannot be avoided if the proposal is implemented. Each resource category begins with a summary. Potentially significant environmental effects that cannot be avoided are noted in these summaries.

- Cumulative impacts. Cumulative impacts are addressed in each resource category in Chapters 5, 6, and 7. Chapter 3 contains a table of all potentially significant environmental effects, including significant and unavoidable impacts. Similarly, the potentially significant environmental effects that cannot be avoided are discussed by resource category in Chapters 5, 6, and 7.

- Mitigation measures proposed to minimize the potentially significant effects. Since this is a programmatic EIS/EIR, site-specific actions are not evaluated. Accordingly, no specific mitigation measures or monitoring plans are presented, but general mitigation strategies and a general mitigation monitoring plan are provided. Mitigation strategies can be found in the summaries and text for each resource in Chapters 5, 6, and 7. The draft programmatic mitigation monitoring plan is included in Chapter 9.

- Alternatives to the proposed action including the No Action (or "No Project") Alternative and the environmentally superior (or "environmentally preferable") alternative. Chapter 2 describes alternatives, and Section 2.3 discusses the environmentally superior alternative.

- Growth-inducing impacts of the proposed action. These impacts are discussed in Chapter 3 and addressed in the environmental consequences sections of Chapters 5, 6, and 7.

- The relationship between local short-term uses of mankind's environment and the maintenance and enhancement of long-term productivity. This relationship is summarized in Chapter 3 and addressed in the environmental consequences sections of Chapters 5, 6, and 7.

- Any significant irreversible environmental changes that would be involved in the proposed action should it be implemented. These changes are discussed in Chapter 3 and addressed in the environmental consequences sections of Chapters 5, 6, and 7.

- Summary (with major conclusions, areas of controversy, and issues to be resolved). A summary is included in each impact analysis for all resource categories.

- Project description. The project description is found in Chapter 1. This discussion includes the Program purpose and need, Program goals and objectives, Program solution principles, Program study area and geographic scope, and the next steps in the process.

4.3 ESTIMATED LAND USE CHANGES DUE TO THE PROGRAM

Because of the general and programmatic nature of this document, it is impossible to specifically define the land use changes that will result from implementing the Program. The extent and specific locations of the Program actions have yet to be decided. To evaluate the environmental consequences of Program actions at a programmatic level, it is necessary to estimate the amount of land that could be disturbed by Program actions. The Program identified the maximum ranges of acreage that could be affected by the various Program elements to give decision makers and the public a sense of the "worst-case" land use impact.

> The Program identified the maximum ranges of acreage that could be affected by the various program elements to give decision makers and the public a sense of the "worst-case" land use impact. Although these acreage estimates are possible, the affected acreage likely would be considerably less, depending on measures to avoid, minimize, or mitigate these actions.

Although impacts in the range of these acreage estimates are possible, the affected acreage likely would be considerably less because these estimates do not include reductions in the land use changes that could take place based on measures that may be implemented in Phase III to avoid, minimize, or mitigate these changes.

Because the Ecosystem Restoration Program actions could affect the largest amount of land, particularly agricultural lands, information is offered to illustrate actions that could be taken during Phase III to minimize the extent of lands, particularly in the Delta, adversely affected by the Program. The environmental, economic, and social consequences of these proposed land use changes and other adverse and beneficial impacts associated with the Program can be found in Chapters 5, 6, and 7.

Estimated land use changes are presented here as well as in the various environmental consequences discussions to provide a system-wide perspective regarding potential land use conversions and to reduce repetition in the document.

Other Program elements most likely to influence land use changes are water quality, levee system integrity, storage, and conveyance. The Water Transfer Program may influence land use changes if transfers from agriculture to urban or environmental uses are facilitated by the program. The extent of these potential changes are not known at the present time. Water Use Efficiency and Watershed Program measures are not expected to directly affect current land uses; therefore, no estimates of land changes relating to these programs are presented.

4.3.1 ECOSYSTEM RESTORATION PROGRAM

Table 4-2 summarizes the actions currently contemplated, along with estimates of the acreage that could be affected by each action.

Table 4-2. Estimate of Land Area Affected by the Ecosystem Restoration Program (in acres)

HABITAT TYPE	BAY REGION	DELTA REGION	SACRAMENTO RIVER REGION	SAN JOAQUIN RIVER REGION
Tidal perennial aquatic	1,500	7,000	0	0
Tidal perennial aquatic (shoals)	0	500	0	0
Nontidal perennial aquatic	1,600	2,600	0	1,000
Tidal sloughs	280-420	600-1,200	0	0
Midchannel islands	0	200-800	0	0
Fresh emergent wetland (tidal)	0	30,000-45,000	0	0
Fresh emergent wetland (nontidal)	0	14,500-17,000	0	0
Seasonal wetland	0	30,000	0	0
Riparian	160-360	1,000-1,500	6,500-7,000	700-1,300
Saline emergent wetland (tidal)	7,500-12,000	0	0	0
Stream meander corridor	0	0	19,000-27,000	1,500-2,000
Perennial grassland	4,000	4,000-6,000	0	0
Total acres	**15,040-19,880**	**90,400-111,600**	**25,500-34,000**	**3,200-4,300**

The Ecosystem Restoration Program would coordinate and assist in restoration activities currently under way and future activities that could lead to the habitat restoration goals identified in the program.

The Ecosystem Restoration Program would coordinate and assist in restoration activities currently under way and future activities that could lead to the habitat restoration goals identified in the program. For example, actions under the Central Valley Project Improvement Act and the Central Valley Habitat Joint Venture are designed to protect and restore significant areas of land in the Central Valley. To the extent that these activities and programs establish habitat that is proposed in the Ecosystem Restoration Program, the amount of land needed to achieve the Ecosystem Restoration Program goals would be reduced.

The Program would take a variety of steps to reduce effects on farmland, including:

- Implementation of the Ecosystem Restoration Program would occur over many years. The implementation process would include extensive local community, landowner, and stakeholder involvement.
- Habitat restoration efforts would focus first on developing habitat on public land where appropriate.
- If no public land is available, restoration efforts would focus next on land acquired from willing sellers and that provides substantial benefits for ecological processes, habitat, or species.
- Where small parcels of land are needed for waterside habitat, acquisition efforts would seek out points of land on islands where the ratio of levee miles to acres farmed is high.
- The Program would obtain easements on existing farmland that would allow for minor changes in agricultural practices, thus increasing the value of the crops to wildlife.
- Where possible, floodplain restoration efforts would include provisions for continued agricultural practices, which would be renewed on an annual basis.

4.3.2 WATER QUALITY PROGRAM

Facilities to control and treat various discharge effluents would directly affect current land uses. The extent and locations of these facilities are unknown at this time; consequently, the acreage that could be affected cannot be forecast in a meaningful way. These facilities will need to be evaluated for environmental impacts when the facilities are being planned.

Facilities to control and treat various discharge effluents would directly affect current land uses. The extent and locations of these facilities are unknown at this time; consequently, the acreage that could be affected cannot be forecast in a meaningful way.

The drainage management problem areas on the west side of the San Joaquin Valley are included in the No Action Alternative. This document assumes that land retirement in the area will take place even if the Program does not proceed. The Water Quality Program also has identified this drainage management problem as a water quality issue and intends to facilitate the retirement effort as part of the Water Quality Program element. This action could affect a maximum of 37,000 acres and be carried out in accordance with the September 1990 "A Management Plan for Agricultural Subsurface Drainage and Related Problems on the West Side San Joaquin Valley."

4.3.3 LEVEE SYSTEM INTEGRITY PROGRAM

Levee restoration would cause both temporary and permanent land disturbance near existing levees. Land disturbed temporarily during construction would be restored through revegetation and likely would return to preconstruction conditions. These temporary losses are estimated at between 1,000 and 1,500 acres. Other land would be permanently affected by the larger footprint of the new levees. Levee reconstruction could require approximately 15,000 acres. About 625 of the 1,100 miles of Delta levees would be upgraded, and a 200-foot-wide piece of land is needed for each levee mile. The Program also projected that 100 miles of setback levees could be constructed, affecting an area 500 feet wide per levee mile. Subsidence control could affect about 14,000 acres. In total, an estimated range of 34,000-35,000 acres could be permanently affected by the Levee System Integrity Program. These estimates are the upper range of the possible acreage that could be affected. The Program will refine these estimates as the process continues.

Suisun Marsh levee restoration also would result in land disturbance. Assuming a similar footprint as the Delta levees, restoration of the Suisun Marsh levees could affect from 5,000 to 5,600 acres. Affected land uses are primarily wildlife habitat.

4.3.4 STORAGE

Acreage permanently affected by constructing or modifying storage facilities would be determined by the number, size, and location of sites eventually selected for those facilities. A range of additional groundwater storage also is included in the alternatives. Table 4-3 shows preliminary calculations of land that could be affected by the footprint of new storage facilities. Several representative storage sites were examined to provide a better perspective on the potential magnitude of land use changes, as well as other storage-related consequences. It is likely that land use impacts would extend beyond the reservoir site itself. The actual areas and land uses that would be affected depend on the siting, design, and operation of the reservoir. This information will be developed in subsequent project-specific environmental documents.

Several representative storage sites were examined to provide a better perspective on the potential magnitude of land use changes, as well as other storage-related consequences.

The following sites were investigated as examples for preliminary land use change analysis in this document:

- Sites/Colusa and Thomes-Newville Reservoir sites were selected to represent surface water storage on Sacramento River tributaries. Assuming a storage capacity of 3 MAF, the potential land affected by a new reservoir could range from 16,700 acres (Thomes-Newville) to 29,600 acres (Sites/Colusa). This range is included in the Sacramento River Region in Table 4-3.

- The Montgomery Reservoir site was the representative example for surface water storage on San Joaquin River tributaries. Assuming a storage capacity of 500 thousand acre-feet (TAF), the land that would be affected by a new reservoir at this site was estimated at 8,050 acres. This value is included in the San Joaquin River Region in Table 4-3.

- Groundwater storage was estimated at 1,500 acres in both the Sacramento River and San Joaquin River Regions. These values are included in the respective regional areas in Table 4-3.

- The Los Vaqueros Reservoir site was the example for the surface water storage off-aqueduct option. Assuming a storage capacity of 1 MAF, the potential land affected by enlarging the existing reservoir was estimated at 7,000 acres. This value is included in the San Joaquin River Region in Table 4-3.

- Victoria, Bacon, Holland, and Woodward Islands were the example sites for the in-Delta storage. The sites occupy an area of 18,000-19,500 acres. These values are included in the Delta Region in Table 4-3.

4.3.5 CONVEYANCE

The estimated amounts of land area (for example, agriculture, and fish and wildlife habitat) that would be affected by conveyance features are shown in Table 4-3.

Table 4-3. Estimates of Land Area Affected by Storage and Conveyance (in acres)

	DELTA REGION		SACRAMENTO RIVER REGION	SAN JOAQUIN RIVER REGION	ALL REGIONS
ALTERNATIVE	**STORAGE[1]**	**CONVEYANCE**	**STORAGE[1]**	**STORAGE[1]**	**TOTAL**
PPA[2]	0-15,000	100-4,500	0-32,000	0 to16,600	100-68,100
1	0-15,000	100-400	0-32,000	0 to16,600	100-64,000
2	0-15,000	4,000-4,500	0-32,000	0 to16,600	4,000-68,100
3	0-15,000	4,500-6,000	0-32,000	0 to16,600	4,500-69,600

Note:
PPA = Preferred Program Alternative.

* Estimates assume that channel capacity is enlarged by using setback levees; if dredging is used to enlarge channel capacity, less land would be required. For each configuration, the estimate of land area associated with conveyance changes is based on the following: operable Old River barrier—100 acres; channel enlargement along Old River—300 acres; screened intake near Hood and north Delta channel modifications—3,500-4,000 acres; and isolated open channel (45 miles long and 1,000 feet wide)—4,000-5,000 acres. Range of storage is the same for all alternatives. The upper end of the range reflects the variation possible, depending on which size reservoir is eventually selected.

[1] Average does not include lands that might be affected outside of the reservoir site.
[2] Preferred Program Alternative conveyance estimate ranges from without a pilot diversion facility to including a facility.

Program activities could affect lands designated as prime farmland, unique farmland, and farmland of state-wide importance. Table 4-4 summarizes the acreages by farmland type that could be affected by the Program. Except as noted, the acreage estimates assume that all Program activities would occur on these three types of farmland.

In addition to the long-term land use changes, the Program expects that construction activities will result in temporary conversion of additional agricultural land. Mitigation necessary to offset impacts on wildlife as a result of implementing the levee system integrity, water quality, conveyance, and storage elements may affect additional agricultural lands.

Table 4-4. Estimates of Area of Important Farmland Affected by Program Elements (in acres)

		ECOSYSTEM RESTORATION PROGRAM[2]			LEVEE SYSTEM INTEGRITY PROGRAM[2,5]			STORAGE[3]			CONVEYANCE[2,5,6]			WATER QUALITY PROGRAM[1,2,4]	
ALTERNATIVE/REGION		P	S	U	P	S	U	P	S	U	P	S	U	0	TOTAL
PPA	Delta	85,800-101,600	3,200-6,500	1,400-3,500	31,000	2,500-3,000	500-1,000	0-14,000[2]	0-1,000[2]	0	100-3,800	0-200	0-500	0	124,500-166,100
	Sacramento River	21,700-28,800	3,300-3,900	600-1,300	0	0	0	0	0	0	0	0	0	0	25,600-34,000
	San Joaquin River	3,500-5,000	400-500	100-300	0	0	0	0	0	0	0	0	0	37,000	41,000-42,800
	Total	111,000-135,400	6,900-10,900	2,100-5,100	31,000	2,500-3,000	500-1,000	0-14,000	0-1,000	0	100-3,800	0-200	0-500	37,000	191,100-242,900
1	Delta	85,800-101,600	3,200-6,500	1,400-3,500	31,000	2,500-3,000	500-1,000	0-14,000[2]	0-1,000[2]	0	100-300	0-100	0	0	124,500-162,000
	Sacramento River	21,700-28,800	3,200-3,900	600-1,300	0	0	0	0	0	0	0	0	0	0	25,500-34,000
	San Joaquin River	3,500-5,000	400-500	100-300	0	0	0	0	0	0	0	0	0	37,000	41,000-42,800
	Total	111,000-135,400	6,900-10,900	2,100-5,100	31,000	2,500-3,000	500-1,000	0-14,000	0-1,000	0	100-300	0-100	0	37,000	191,100-238,800
2	Delta	85,800-101,600	3,200-6,500	1,400-3,500	31,000	2,500-3,000	500-1,000	0-14,000[2]	0-1,000[2]	0	3,500-3,800	100-200	400-500	0	128,400-166,100
	Sacramento River	21,700-28,800	3,200-3,900	600-1,300	0	0	0	0	0	0	0	0	0	0	25,500-34,000
	San Joaquin River	3,500-5,000	400-500	100-300	0	0	0	0	0	0	0	0	0	37,000	41,000-42,800
	Total	111,000-135,400	6,900-10,900	2,100-5,100	31,000	2,500-3,000	500-1,000	0-14,000	0-1,000	0	3,500-3,800	100-200	400-500	37,000	195,000-242,900
3	Delta	85,800-101,600	3,200-6,500	1,400-3,500	31,000	2,500-3,000	500-1,000	0-14,000[2]	0-1,000[2]	0	4,000-4,800	300-900	200-300	0	128,900-167,600
	Sacramento River	21,700-28,800	3,200-3,900	600-1,300	0	0	0	0	0	0	0	0	0	0	25,500-34,000
	San Joaquin River	3,500-5,000	400-500	100-300	0	0	0	0	0	0	0	0	0	37,000	41,000-42,800
	Total	111,000-135,400	6,900-10,900	2,100-5,100	31,000	2,500-3,000	500-1,000	0-14,000	0-1,000	0	4,000-4,800	300-900	200-300	37,000	195,400-244,400

Notes:

Types of Farmland

- Prime (P) - Land with the best combination of physical and chemical features for the production of agricultural crops.
- State-wide importance (S) - Land with a good combination of physical and chemical features for the production of agricultural crops.
- Unique (U) - Land of lesser quality soils used for the production of the state's leading agricultural cash crops.

PPA = Preferred Program Alternative.

1 Acreages of farmland of state-wide importance cannot be accurately estimated at this time because mapping has not been completed in the San Joaquin River Region. It is possible that farmland of state-wide importance would be affected by the Water Quality Program in the Grasslands area of the San Joaquin River Region.
2 Estimates assume that all land conversion occurs on lands currently in use for agricultural purposes.
3 Outside the Delta, estimates assume that potential storage reservoirs sites are typically foothill grasslands and do not contain significant amounts of important farmland; small amounts of important farmland could be affected if reservoirs are sited in valleys containing alluvial deposits that support important agricultural farmland.
4 Total includes maximum acreage potentially affected by the Water Quality Program.
5 Estimates assume that all Delta channel capacity is enlarged by constructing setback levees; if dredging is used to enlarge channel capacity, less land would be required.
6 Preferred Program Alternative estimate ranges from without a pilot diversion facility to including a facility.