FINAL ENVIRONMENTAL IMPACT REPORT FOR IMPLEMENTATION OF THE 1995 BAY/DELTA WATER QUALITY CONTROL PLAN

State Clearinghouse Number 97-122056

VOLUME 1

November 1999

STATE WATER RESOURCES CONTROL BOARD
California Environmental Protection Agency

STATE OF CALIFORNIA
Gray Davis, Governor

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
Winston H. Hickox, Secretary

STATE WATER RESOURCES CONTROL BOARD
P.O. Box 2000
Sacramento, CA 95812-2000
(916) 657-2170
http://www.waterrights.ca.gov/baydelta/

James Stubchaer, Chair
Mary Jane Forster, Vice Chair
John Brown, Member
Arthur Baggett, Jr., Member

Walt Pettit, Executive Director
Dale Claypoole, Deputy Director

PREFACE

On May 22, 1995, the State Water Resources Control Board (SWRCB) adopted the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 Bay/Delta Plan or Bay/Delta Plan) which establishes objectives for the protection of municipal, agricultural, and fish and wildlife beneficial uses in the Bay/Delta Estuary. The 1995 Bay/Delta Plan includes objectives in the Bay/Delta Estuary for Delta outflow, Sacramento and San Joaquin river flows, salinity, dissolved oxygen, and State Water Project (SWP) and Central Valley Project (CVP) operations.

On July 27, 1995, the SWRCB filed a Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the development of a water right decision to implement requirements for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. The project is defined as a water right decision that (1) identifies the responsibility of water right holders in the Bay/Delta Estuary watershed to achieve the flow, operational, and water quality requirements in the 1995 Bay/Delta Plan and allocates responsibility according to established principles of water law; (2) may authorize the combined use of the CVP and the SWP points of diversion in the Delta; (3) requires actions to improve habitat conditions in the central valley; and (4) requires measures to improve water supply reliability for users of water within and from the Bay/Delta Estuary watershed. The NOP requested input from all interested parties on the scope and content of the EIR.

Public workshops were held on four days in August, September, and November 1995. Based on comments received at these workshops indicating that the NOP did not provide sufficient project detail, a revised NOP was issued in December 1995. During 1996, nine additional days of workshops were held to discuss issues arising from the revised NOP. The SWRCB staff convened a technical workshop on March 18, 1997, to review the analytical methods being used to calculate water availability when water right priorities are used to implement the 1995 Bay/Delta Plan flow objectives (Flow Alternatives 3 and 4).

The Draft EIR for Implementation of the 1995 Bay/Delta Water Quality Control Plan, Volume I (Chapters I through XII) was issued in November 1997. Volumes II (Chapter XIII - Alternatives for Implementing the Joint Points of Diversion) and III (Appendices) were issued on December 15, 1997. The Draft EIR was circulated to interested parties with a 45-day review commencing with the release of Volumes II and III, with comments to be received by January 30, 1998. Because interested parties requested additional review time, the comment period on the Draft EIR was extended to April 1, 1998.

A Notice of Public Hearing, dated December 2, 1997, was issued for the consideration of (1) alternatives to implement water quality objectives for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, (2) a petition to change points of diversion of the CVP and the SWP in the southern Delta, and (3) a petition to change places of use and purpose of use of the CVP. The petition to change places of use and purpose of use of the CVP is the subject of a separate EIR.

Volume IV of the Draft EIR, was issued on May 26, 1998. Volume IV contains revisions to Chapters V, VI, and XIII to include the provisions of the San Joaquin River Agreement (1) as an alternative for implementing the flow objectives in the 1995 Bay/Delta Plan (Flow Alternative 8) and (2) as an alternative for implementing the petition for joint use of the SWP and CVP points of diversion in the Delta (Joint POD Alternative 9). Chapters V and VI were also revised to correct errors in the original modeling of Flow Alternative 5. Volume IV was circulated for a 45-day review with comments due by July 13, 1998.

The SWRCB received 104 letters on the Draft EIR, representing the comments of 125 parties. The letters are available for review in their entirety on the SWRCB website (*http://www.waterrights.ca.gov/baydelta*). The comments and response-to-comments are included as Volume III of the Final EIR.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF FIGURES (cont.)

LIST OF TABLES

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF TABLES (cont.)

LIST OF ABBREVIATIONS AND ACRONYMS

General Terms

1978 Delta Plan	1978 Water Quality Control Plan for the Saramento-San Joaquin Delta and Suisun Marsh
1991 Bay/Delta Plan	1991 Water Quality Control Plan for Salinity for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
1995 Bay/Delta Plan	Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
Bay/Delta Estuary	The San Francisco Bay/Sacramento-San Joaquin Delta Estuary
Framework Agreement	Framework Agreement between the Governor's Water Policy Council of the State of California and the Federal Ecosystem Directorate
Principles Agreement	Principles for Agreement on Bay/Delta Standards between the State of California and the Federal Government

Abbreviations

BOD	Biochemical Oxygen Demand
^{o}C	degrees Celsius
CBOD	Carbonaceous Biochemical Oxygen Demand
Cfs	cubic feet per second
Cx	carbon emissions
D-1275	Water Right Decision 1275, May 31, 1967 (State Water Project Decision)
D-1422	Water Right Decision 1422, April 4, 1973 (New Melones Decision)
D-1485	Water Right Decision 1485, dated August 16, 1978 (1978 Delta Plan)
D-1630	Draft Water Right Decision 1630, April 1993
DBCP	Dibromochloropropane
DDT	the insecticide Dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DS/m	deci-siemens per meter
EC	electrical conductivity

^{o}F	degrees Fahrenheit
Ft/s	feet per second
Gpcd	gallons per capita per day
JTU	Jackson turbidity units
M	meters
MAF	million acre-feet
mgd	million gallons per day
Mg/l	milligrams per liter
mm	Millimeters
mmhos/cm	micromhos per centimeter at 25 degrees centigrade (EC)
mmhos/cm	millimhos per centimeter at 25 degrees centigrade (EC); equivalent to mS/cm (millesiemens) or dS/m
msl	mean sea level
M&I	municipal and industrial
NOx	oxides of nitrogen
NTU	nephelometric turbidity units
PM10	particulate matter of less than 10 microns in diameter
POC	Particulate Organic Carbon
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
qwest	San Joaquin River downstream flow at DWRSIM node 528
ROG	reactive organic gases
RV	recreational vehicle
SNA	significant natural area
SOx	oxides of sulfur
TAF	thousand acre-feet
TCD	temperature control device
TDS	total dissolved solids
THM	trihalomethane
vpd	vehicles per day
WC	California Water Code
WQ 81-1	Water Quality Order 81-1
WR 95-6	Water Right Order WR95-6, dated June 8, 1995

Acronyms

ACID	Anderson-Cottonwood Irrigation District
ACWD	Alameda County Water District
AFB	Air Force Base
AWSC	American Water Suppliers in California
BCDC	San Francisco Bay Conservation and Development Commission
BLM	U.S Bureau of Land Management
BMP	Best Management Practice
CALFED	CALFED Bay Delta Program established under the Framework Agreement
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
COA	Coordinated Operations Agreement
CRA	California Resources Agency
CUAW	Consumptive Use of Applied Water
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CVPM	Central Valley Production Model
CVRWQCB	Central Valley Regional Water Quality Control Board
DD	Direct Diversion
DEIR	Draft Environmental Impact Report for Implementation of the 1995 Bay/Delta Water Quality Control Plan
DFG	California Department of Fish and Game
DHS	Department of Health Services
DMC	Delta-Mendota Canal
DPR	California Department of Parks and Recreation
DSA	DWR Depletion Study Area
DWR	California Department of Water Resources
DWRDSM	DWR Delta Simulation Model
DWRSIM	DWR Planning Simulation Model
EBMUD	East Bay Municipal Utility District
EBMUDSIM	EBMUD Planning Model
EIR	Environmental Impact Report (pursuant to CEQA)
EIR/EIS	an EIR and an EIS as a combined document

EIS	Environmental Impact Statement (pursuant to NEPA)
ER	Environmental Report, Appendix I of the 1995 Bay/Delta Plan
ESA	Federal Endangered Species Act
ETAW	Evapotranspiration of applied water
EWMP	Efficient Water Management Practices
FED	Federal Ecosystem Directorate
FEIR	Final Environmental Impact Report for Implementation of the 1995 Bay/Delta Water Quality Control Plan
FERC	Federal Energy Regulatory Commission
FO	Friant Obligation
FSSD	Fairfield-Suisun Sewer District
FWUA	Friant Water Users Association
GCID	Glenn-Colusa Irrigation District
GRCD	Grassland Resource Conservation District
GWD	Grasslands Water District
HEC	Hydrologic Engineering Center
ID	Irrigation District
IO	Inbasin Obligation
ISDP	Interim South Delta Program
LAA	Los Angeles Aqueduct
LACFCD	Los Angeles County Flood Control District
LADWP	City of Los Angeles, Department of Water and Power
LORP	Lower Owens River Project
MCWRA	Monterey County Water Resources Agency
MID	Modesto Irrigation District
MMWD	Marin Municipal Water District
MOU	Memorandum of Understanding
MWD	Metropolitan Water District of Southern California
NBA	North Bay Aqueduct
NEPA	National Environmental Policy Act
NID	Nevada Irrigation District
NMFS	National Marine Fisheries Service
NMR	New Melones Reservoir
NMWD	North Marin Water District
NPDES	National Pollution Discharge Elimination System
NRA	National Recreation Area
NWR	National Wildlife Refuge
OHV	Off-Highway Vechicle

OWID	Oroville-Wyandotte Irrigation District
PCWA	Placer County Water Agency
PEIS	Programmatic Environmental Impact Statement
PG&E	Pacific Gas and Electric Company
POD	Point of Diversion
PSA	DWR planning subarea
RWQCB	Regional Water Quality Control Board
SANJASM	USBR San Joaquin Operations Model
SCE	Southern California Edison
SCVWD	Santa Clara Valley Water District
SCWA	Solano County Water Agency
SDWA	South Delta Water Agency
SDWMP	South Delta Water Management Program
SEW	Suisun Ecological Workgroup
SFEP	San Francisco Estuary Project
SFWD	San Francisco Water District
SID	Solano Irrigation District
SJR	San Joaquin River
SJRIO	San Joaquin River Input/Output Model
SJRIO	San Joaquin River Input/Output Model
SJRMP	San Joaquin River Management Plan
SJVDP	San Joaquin Valley Drainage Program
SMPA	Suisun Marsh Preservation Agreement
SMSCG	Suisun Marsh Salinity Control Gate
SMUD	Sacramento Municipal Utility District
SR	Storage Releases
SRA	State Recreation Area
SRCD	Suisun Resource Conservation District
SRDWA	Sacramento River and Delta Water User's Association
SSWD	South Sutter Water District
SW	Supplemental Water
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWTR	Surface Water Treatment Rule
TBP	South Delta Temporary Barriers Project
TCP	Traditional Cultural Property
TID	Turlock Irrigation District

UC	University of California
USBR	United States Bureau of Reclamation
USCOE	United States Army Corps of Engineers
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VA	Veterans Administration
WCWD	Western Canal Water District
WD	Water District
WFP	Water Forum Proposal
WMA	Wildlife Management Area
WSCT	Western Suisun Marsh Salinity Control Test
WWTP	Stockton Wastewater Treatment Plant
YCFC&WCD	Yolo County Flood Control and Water Conservation District
YCWA	Yuba County Water Agency
YOY	Young of Year

EXECUTIVE SUMMARY

In 1995, the State Water Resources Control Board (SWRCB) adopted a water quality control plan (Bay/Delta Plan or Plan) for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay/Delta or Estuary). The Plan identifies municipal and industrial, agricultural, and fish and wildlife beneficial uses for waters of the estuary, and specifies objectives to protect these uses. The objectives consist of numeric objectives for flow; numeric objectives for water quality constituents (salinity and dissolved oxygen); numeric operational constraints for the State Water Project (SWP) and the Central Valley Project (CVP); a narrative objective for the protection of salmon; and a narrative objective for the protection of brackish tidal marshes in Suisun Marsh.

Most of the objectives in the 1995 Bay/Delta Plan are currently implemented through biological opinions issued by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for protection of delta smelt and winter-run chinook salmon, respectively, and through SWRCB Water Right Decision 1485 (D-1485) and SWRCB Order WR 98-9. Order WR 98-9 is an interim order expiring on December 31, 1999. Under the biological opinions, D-1485, and the interim order, responsibility for meeting most of the objectives is assigned to the SWP, operated by the California Department of Water Resources (DWR), and the CVP, operated by the U.S. Bureau of Reclamation (USBR). The DWR and the USBR have agreed to implement the objectives until the SWRCB adopts a water right decision that allocates responsibility to meet the Plan objectives. The proposed project is an administrative action to implement the Plan by allocating responsibility for achieving the Plan objectives to water right holders whose diversions affect the beneficial uses of water in the estuary. The proposed project also includes consideration of whether and under what conditions combined use of the SWP and CVP points of diversion should be authorized.

As required by the California Environmental Quality Act (CEQA), the SWRCB prepared environmental documentation on the impact of adopting the Plan. The Environmental Report (ER) is a programmatic document that provides a foundation for this final Environmental Impact Report (FEIR).

This FEIR analyzes alternative actions for implementing the 1995 Plan and the environmental impacts of those alternatives. Most of the potential actions will implement one group of objectives independently of actions to implement other groups of objectives. As a result, many combinations of actions could be taken to implement the Plan. The FEIR does not identify a preferred alternative, but rather categorizes the objectives into groups and identifies various "sets" of alternatives that could be taken to implement each group of objectives. Any decision of the SWRCB to implement the 1995 Bay/Delta Plan will fall within the range of alternatives described and analyzed within this document.

The FEIR analyzes the following sets of alternatives: (1) alternatives for implementing the flow objectives, (2) alternatives for implementing Suisun Marsh salinity objectives, (3) alternatives for implementing salinity control measures in the San Joaquin River Basin, (4) alternatives for implementing southern Delta salinity alternatives (other than Vernalis), (5) alternatives for

implementing the dissolved oxygen objective, and (6) alternatives for implementing combined use of points of diversion. Tables ES-1 through ES-6 summarize the important aspects of each of the alternatives in the different sets. The FEIR also analyzes the cumulative impacts of implementing the flow objectives in concert with other closely related past, present, and reasonably foreseeable future projects.

The environmental impacts associated with the different sets of alternatives are analyzed at the project level for the flow and combined use of points of diversion alternatives, and at the programmatic level for the other sets of alternatives. The base case, or "no project alternative" for this FEIR is necessarily the same as the base case for the ER because this project is a continuation of the project that resulted in the adoption of the Plan. The base case is characterized by the flow conditions that would have occurred with historical hydrology at the present level of development under regulatory requirements that most likely would be in effect if the SWRCB does not approve the project. The applicable regulatory requirements are specified in D-1485, D-1422, and the upstream biological opinion for winter run chinook salmon.

This FEIR identifies significant adverse impacts associated with the alternatives and mitigation measures to reduce impacts to less than significant levels, where possible. The alternatives to implement the dissolved oxygen objectives are not expected to have significant adverse environmental impacts; therefore, the dissolved oxygen objective is not discussed further in this summary.

A. FLOW OBJECTIVES ALTERNATIVES

Implementation of the flow objectives alternatives (Table ES-1) affects water supplies which may, in turn, cause associated environmental impacts. However, because the DWR and the USBR have voluntarily complied with the flow objectives in the Bay/Delta Plan since 1995, many of the environmental effects of implementing the flow objectives have already been experienced. In most instances, the impacts identified in the FEIR are similar to impacts already experienced.

1. Water Supply Impacts

The Bay/Delta Plan increases the quantity of water dedicated to protection of aquatic resources in the estuary. Consequently, water deliveries for municipal and agricultural uses decline. The identity of the parties subject to delivery reductions will depend on the allocation method selected by the SWRCB in its water rights decision implementing the Plan. Over the long term, annual average delivery reductions will be approximately 350,000 acre feet while in critically dry periods the annual average delivery reductions will be approximately 800,000 acre feet.

Table ES-1
Flow Objectives Alternatives

Alternative	Regulatory Requirements	Responsible Parties	Details
1	D-1485 & D-1422; Upstream BO for winter-run chinook salmon	DWR and USBR	Base Case or "No Project" Alternative. These regulatory requirements would be in effect if the SWRCB does not approve the project.
2	1995 Bay/Delta Plan	DWR and USBR	The DWR and the USBR are mutually responsible for meeting the objectives except for the Vernalis flow objectives that are the exclusive responsibility of the USBR.
3	1995 Bay/Delta Plan	Major Post-1914 Appropriative Water Right Holders in the Delta Watershed	Holders of water rights with a cumulative face value in excess of 5,000 acre-feet per year share responsibility for meeting the flow objectives based on the watershed protection statutes and water right priorities. The Friant Project is assumed to be inbasin with respect to the Delta.
4	1995 Bay/Delta Plan	Major Post-1914 Appropriative Water Right Holders in the Delta Watershed	Same as Alternative 3 except most of the deliveries through the Friant-Kern Canal are assumed to be CVP exports subject to watershed protection statutes.
5	1995 Bay/Delta Plan	Reservoir Water Right Holders identified in Tables II-7 and II-8	Monthly average flow requirements are established for each of the major watersheds tributary to the Delta. Responsibility is assigned to water right holders with storage in foothill reservoirs that control downstream flow and upstream reservoirs with capacity of at least 100 TAF where use is consumptive.
6	1995 Bay/Delta Plan	DWR and USBR	Same as Alternative 2 except the USBR meets Vernalis flow objectives by releases from the Delta-Mendota Canal into the San Joaquin River. Water is also released to meet the consumptive use requirement of the South Delta Water Agency.
7	1995 Bay/Delta Plan as modified by the Letter of Intent (LOI)	DWR and USBR; Parties to the Letter of Intent	Same as Alternative 2 except the Vernalis pulse flow objective is replaced by the target flows in the LOI. Some water users in the San Joaquin Basin provide a share of flows in the San Joaquin River as specified in the LOI.
8	1995 Bay/Delta Plan as modified by the San Joaquin River Agreement (SJRA)	DWR and USBR; Parties to the San Joaquin River Agreement	Same as Alternative 2 except the Vernalis pulse flow objective is replaced by the target flows in the SJRA. Export limits during the pulse flow period are replaced by target limits in the SJRA. Members of the San Joaquin River Group provide a share of the flows to meet the Vernalis target flows.

Table ES-2
Suisun Marsh Salinity Objectives Alternatives

Alternative	Regulatory Requirements	New Facilities	Green Valley Creek Flow Augmentation	Other Actions
1	D-1485	None	None	None
2	D-1485	Cordelia-Goodyear Ditch and Goodyear Slough Tide Gate. Minor construction on N. Bay Aqueduct.	Up to 80 cfs as needed from N. Bay Aqueduct to meet western marsh objectives.	None
3	1995 Bay/Delta Plan	None	None	None
4	1995 Bay/Delta Plan	Cordelia-Goodyear Ditch and Goodyear Slough Tide Gate. Minor construction on N. Bay Aqueduct.	Up to 80 cfs as needed from N. Bay Aqueduct to meet western Marsh objectives.	None
5	1995 Bay/Delta Plan	None	None	SMPA Amend. III management actions plus September SMSCG operations as needed
6	1995 Bay/Delta Plan	Minor construction on Putah-South Canal and N. Bay Aqueduct	As needed from all sources until objectives are met in western marsh.	None

Table ES-3
Salinity Control Alternatives in the San Joaquin Basin

Alternative	Action
1	No Water Quality Action Taken.
2	All Grasslands Water District wetland releases made during March and April are shifted to February when March Vernalis salinity objectives may be exceeded.
3	Discharge of subsurface agricultural drainage is not authorized for up to three months when assimilative capacity is not available in the San Joaquin River.
4	Combination of Salinity Control Alternatives 2 and 3.

Table ES-4
Southern Delta Salinity Objectives Alternatives

Alternative	Regulatory Requirements	Barrier Locations
1	D-1485	Temporary Barriers at Middle River, Head of Old River, and Old River at Tracy Road Bridge.
2	1995 Bay/Delta Plan	Temporary Barriers at Middle River, Head of Old River, and Old River at Tracy Road Bridge.
3	1995 Bay/Delta Plan	Permanent Barriers at Middle River, Grantline Canal, Head of Old River and Old River at Tracy Road Bridge.

Table ES-5
Dissolved Oxygen Objectives Alternatives

Alternative	Regulatory Requirements	Quantity of Stockton WWTP Discharge	Barrier Operations
1	D-1485	1996 Levels	Temporary Barrier at Head of Old River
2	1995 Bay/Delta Plan	1996 Levels	Temporary Barrier at Head of Old River
3	1995 Bay/Delta Plan	1996 Levels	Permanent Barrier at Head of Old River
4	1995 Bay/Delta Plan	1996 Discharge Quantity, CBOD & Ammonia Effluent Limits as Specified by CVRWQCB	Permanent Barrier at Head of Old River

2. Aquatic Resources

The principal purpose of implementing the flow objectives is to improve conditions for aquatic resources in the Delta. The analysis in the FEIR indicates that this purpose is achieved. The flow alternatives generally result in reduced entrainment and the adverse effects of reverse flows in the critical period for spawning, rearing, and outmigration of many aquatic species in the Delta. The abundance of many Delta species shows a significant positive relationship with Delta outflow in the spring months. In the spring months, Delta outflow under the flow alternatives is greater than in the base case which improves conditions for spawning and survival of aquatic resources. Due to changes in Delta exports and outflow, implementation of the flow alternatives is predicted to have beneficial effects on through-Delta survival of juvenile chinook salmon and steelhead, and on abundance of longfin smelt, Sacramento splittail, starry flounder, *Crangon franciscorum*, and *Neomysis mercedis*, compared to the base case.

Table ES-6
Joint Point of Diversion Alternatives

Alternative	Regulatory Requirements	Actions
1	D-1485, D-1422, and Upstream BO for winter-run chinook salmon	JPOD authorized to make up export deficiencies occurring under D-1485 in May and June. Identical to Flow Alternative Base Case.
2	1995 Bay/Delta Plan	JPOD not authorized and all water quality objectives are met.
3	1995 Bay/Delta Plan	JPOD authorized for CVP deliveries to the Cross Valley Canal, Musco Olive, Tracy Golf Course, and the Veterans' Administration cemetery. JPOD use limited by terms and conditions in SWP and CVP water right permits. SWP restrictions imposed by USCOE PN 5820-A in effect.
4	1995 Bay/Delta Plan	JPOD authorized as described in Alt. 3 and to provide a net benefit to fish and wildlife. Exports lost by either project as a result of diversion reductions to benefit fish may be made up within twelve months using either or both PODs. Modeling assumes exports are reduced during the April/May pulse flow period. Reductions made up through use of JPOD in other months.
5	1995 Bay/Delta Plan	JPOD authorized for deliveries to any SWP or CVP export area. JPOD use limited by terms and conditions in SWP and CVP water right permits. SWP restrictions imposed by PN 5820-A in effect.
6	1995 Bay/Delta Plan as modified by the Letter of Intent	JPOD authorized as described in Alt. 5 except that San Joaquin River flows at Vernalis are as specified in the Letter of Intent.
7	1995 Bay/Delta Plan	JPOD authorized as described in Alt. 5 except that restrictions imposed by PN 5820-A are not in effect. The ISDP barriers are installed and operated.
8	1995 Bay/Delta Plan	JPOD authorized as described in Alt. 7 except the SWP and CVP diversions are limited only by the combined physical capabilities of the pumping plants and by each project's annual authorized diversion. 1995 demand level modeled for the SWP and 2020 demand level modeled for the CVP.
9	1995 Bay/Delta Plan as modified by the San Joaquin River Agreement	JPOD authorized as described in Alt. 5 except the Vernalis pulse flows and export limits are replaced by the target values in the San Joaquin River Agreement.

Despite the generally positive impact of the implementation of the flow alternatives, there may be negative effects on some life stages of aquatic resources. In some months, the flow alternatives result in higher Delta exports and greater reverse flows than in the base case. Flow Alternative 5 could result in higher exports in some spring months, which may negatively affect young-of-the-year striped bass abundance. Flow Alternative 6 would increase the percentage of Sacramento River water that enters the San Joaquin River. This could adversely affect the imprinting of juvenile

chinook salmon emigrating from the San Joaquin Basin in April and May. The significance of this potential impact is not known.

Implementation of the flow alternatives may result in significant impacts to reservoir fisheries at one or more upstream reservoirs, due to reduction or fluctuation in storage levels during critical time periods for warmwater fish reproduction.

Potential impacts on striped bass under Alternative 5 could be mitigated through additional stocking. If significant effects on reservoir fisheries are observed, mitigation could include additional fish planting, habitat improvement through planting of shoreline vegetation, addition of habitat structures, or improved management of shoreline grazing practices.

3. Groundwater

The decrease in surface water deliveries associated with implementation of the flow objectives will increase groundwater use. Increased groundwater use can cause land subsidence, groundwater overdraft, groundwater quality degradation, and declines in agricultural productivity.

Impacts to groundwater can be mitigated through conservation and water transfers. In addition, land subsidence impacts can be mitigated by limiting groundwater pumping and by land retirement. Overdraft and groundwater quality deterioration impacts can be mitigated by adopting groundwater management plans, establishing a groundwater management agency by statute, cropping pattern changes requiring lower consumptive water use, and conjuctive use programs. The potential for decreased agricultural productivity can be mitigated by blending groundwater supplies with surface water supplies, and shifting to different or more salt tolerant crops.

4. Energy

Implementation of the flow alternatives results in higher net hydropower generation by the SWP and the CVP because exports are reduced. The increased groundwater pumping to replace surface water supplies (described in the previous section) could lead to increased pumping lifts and increases in energy consumption. The alteration of hydroelectric power generation and consumption patterns along with increased groundwater pumping may result in the increased use of fossil-fuel generation, thereby increasing air pollution. This impact may not be entirely mitigable; however, other sources of energy generation are available including nuclear, geothermal, biomass, solar thermal, solar photovoltaic, and wind generation. Additionally, this impact can be partially mitigated through off-peak pumping operations.

5. Recreation, Scenic Quality and Cultural Resources

Implementation of the flow objectives will improve conditions for aquatic resources that live in or

migrate through the Delta, increasing their populations. Such improvements may result in increased commercial and sport fishing opportunities as well as nonconsumptive recreational opportunities. The Plan requires closure of the Delta Cross Channel gates to improve migratory conditions for salmon smolts. Closure of the gates, however, impedes navigation between the Sacramento and Mokelumne rivers impacting Delta recreation. This impact is unmitigable.

Modeling results indicate that the flow alternatives could have the effect of lowering water levels in reservoirs earlier in the season, for longer periods, or below the levels than would otherwise occur at certain reservoirs compared to the base case. Consequently, recreation, scenic quality and cultural resources could be impacted at some upstream reservoirs. The significance of these modeling results is difficult to quantify because the natural hydrology already results in substantial reservoir level fluctuations. Modeled reservoir operations may not coincide with real-time operations by reservoir owners.

Recreation impacts at reservoirs can be mitigated by modification or relocation of facilities (such as boat ramps and marinas) to accommodate lower water levels. Impacts to cultural resources can be mitigated by inventorying and evaluating cultural resources at affected reservoirs, preserving and protecting the resources in place where possible, or excavating and documenting the historic values and information of the resources. Impacts to scenic quality are potentially unmitigable.

B. SUISUN MARSH SALINITY OBJECTIVES ALTERNATIVES

The 1995 Bay/Delta Plan contains salinity objectives for Suisun Marsh channels to protect the beneficial uses of the managed marsh. Suisun Marsh Alternative 5 is identified in the FEIR as the environmentally superior alternative, and its implementation is not expected to have significant adverse effects within the marsh.

Some of the Suisun Marsh alternatives (Table ES-2) include flow augmentation in the western marsh to achieve the western Marsh objectives. Such flow increases could adversely affect both terrestrial and aquatic species in the Marsh. Four terrestrial endangered species present in the marsh require brackish conditions for survival and could be affected by additional freshwater inflow. Flow augmentation with water diverted from the Sacramento River could attract salmon and delta smelt into areas of unsuitable habitat, or result in increased entrainment at the point of diversion, thus having an impact on these species.

C. SOUTHERN DELTA SALINITY OBJECTIVES

The Bay/Delta Plan contains salinity objectives for the southern Delta to protect the quality of the water available for irrigated agriculture. Southern Delta salinity concentrations can be improved by construction and operation of permanent barriers in the southern Delta (Table ES-4). Permanent barriers are a component of the Interim South Delta Program (currently part of the South Delta

Improvements Program) now under review by the DWR. Operation of permanent barriers improves water levels and water circulation in the southern Delta.

Notwithstanding the benefits, construction and operation of the barriers have the potential to cause significant impacts to water levels and salinity, aquatic resources, terrestrial biological resources, recreation, navigation and transportation. The relative magnitude of impacts to various aquatic species and habitat as a consequence of the barriers cannot be quantified. Many southern Delta locations see significant improvements in minimum water levels at certain times of the year as a result of barrier operations; however, under some circumstances, construction of permanent barriers reduces water levels.

Mitigation measures are proposed by the DWR in the Interim South Delta Program DEIR to mitigate or reduce impacts to aquatic resources, terrestrial biological resources, recreation, navigation and transportation.

D. JOINT POINTS OF DIVERSION ALTERNATIVES

The FEIR analyzes the impact of implementing the use of combined or "joint" points of diversion (JPOD) by the DWR and USBR in the southern Delta. Approval of the petition would authorize the DWR to divert water from the Delta at the CVP's Tracy Pumping Plant and would authorize the USBR to divert water from the Delta at the SWP's Banks Pumping Plant.

Implementation of the JPOD will help reduce the water supply impacts of implementing the Bay/Delta Plan and thus, lessen the environmental effects. For example, the JPOD could reduce the water supply impacts to water users in the San Joaquin Basin, thereby reducing the groundwater overdraft and subsidence impacts of implementing the Plan. Modeling studies show that the use of the JPOD can increase average annual CVP deliveries to export areas by up to 247,000 acre feet, depending on the JPOD alternative selected.

The FEIR analyzes seven alternatives to implement the JPOD and two base cases (Table ES-6). One base case assumes that the 1995 Bay/Delta Plan is not implemented and the regulatory requirements are specified in D-1485, D-1422 and the upstream biological opinion for winter-run chinook salmon. The second base case assumes Bay/Delta Plan implementation. The second base case was evaluated because the DWR and the USBR have been voluntarily complying with the Plan since 1995. Unless indicated otherwise, the impacts discussed below are in comparison to the 1995 Bay/Delta Plan base case.

1. Aquatic Resources

The JPOD can be used to improve conditions for fish by increasing operational flexibility of the projects. Project pumping can be foregone at times that are harmful to fish and the lost yield

recovered at a later time when conditions for fish are more favorable. JPOD Alternative 4 will provide greater protection for aquatic resources than Alternatives 3 and 5-9 because the combined use of points of diversion is used primarily for the benefit of aquatic resources. Modeling analysis shows that exports would be reduced in the spring months under the JPOD alternatives compared to base cases, potentially reducing entrainment in the critical period for spawning, rearing, and outmigration of many aquatic species in the Delta.

Most of the JPOD alternatives will increase exports on an annual average basis. Therefore, the JPOD alternatives could result in increased entrainment and other export-related effects in the Delta in the July to January period (except September) due to increased Delta exports. Survival of yearling spring-run chinook salmon emigrating through the Delta could be reduced because their emigration period (fall and winter) coincides with the period of increased exports.

The abundance of many Delta species shows a significant positive relationship with Delta outflow in the spring months. Delta outflow is expected to change with the implementation of the JPOD alternatives but the effects are not expected to be as significant as entrainment effects. Delta outflow generally decreases compared to the Bay/Delta Plan base case between July and January and increases during February and March because of pumping shifts.

In general, the use of the JPOD is not predicted to adversely impact the through-Delta survival of juvenile chinook salmon and steelhead, or the abundance of delta smelt, Sacramento splittail, starry flounder, longfin smelt, and *Crangon franciscorum,* compared to the Bay/Delta Plan condition. However, JPOD Alternative 6 is predicted to have a slight adverse impact on survival of San Joaquin River fall-run chinook salmon smolts through the Delta compared to the Bay/Delta Plan condition. Alternatives 7 and 8 are predicted to have adverse impacts on young-of-the-year striped bass abundance compared to the Bay/Delta Plan condition.

Modeling studies indicate that implementation of the JPOD alternatives could result in significant impacts to reservoir fisheries in certain CVP reservoirs, due to reduction or fluctuation in storage levels during critical time periods. The magnitude of this adverse effect will depend on operational decisions made by the CVP.

If operations under the JPOD alternatives result in increased entrainment, the entrainment could be mitigated through regulatory constraints applied to operations on a real-time basis. Measures that could be used during critical time periods to reduce or avoid entrainment include switching diversions between SWP and CVP facilities if entrainment is high at one of the facilities, re-operation of the Delta Cross Channel gates, or reduction or termination of increased exports resulting from joint use of the SWP and CVP points of diversion. Potential impacts on striped bass under Joint POD Alternatives 7 and 8 could be mitigated through additional stocking. If significant effects on reservoir fisheries are observed, mitigation could include additional fish planting, habitat

improvement through planting of shoreline vegetation, addition of habitat structures, or improved management of shoreline grazing practices.

2. Energy

The JPOD could cause a reduction in groundwater pumping and an associated increase in net energy generation. However this potential benefit could be offset by a decrease in net hydropower generation resulting from increased export pumping. Thus, the possibility exists that fossil fuel consumption could increase. If this occurs, the effect is not entirely mitigable. Off-peak pumping and other energy sources are available to partially mitigate this impact as listed in section A.4 of this summary.

3. Recreation and Cultural Resources

Modeling results indicate that the JPOD could cause lower water levels in some SWP and CVP reservoirs in the off-season during critically dry periods, which could affect recreation and cultural resources. If there are impacts, modification or relocation of facilities (such as boat ramps and marinas) to accommodate lower water levels would help to mitigate the impact to recreation at affected reservoirs. Impacts to cultural resources can be mitigated by inventorying and evaluating cultural resources at affected reservoirs, preserving and protecting the resources in place where possible, or excavating and documenting the historic values and information of the resources.

E. CUMULATIVE IMPACTS ASSESSMENT

Implementation of the flow objectives in concert with other closely related past, present and reasonably forseeable future projects was assessed for cumulative impacts. Cumulative impacts were assessed at the 2020 level of development. Under the regulatory requirements of the Plan, increased future water demands will result in higher exports and reduced Delta outflow compared to the present level of development. Consequently, aquatic resources sensitive to these parameters could be negatively affected in comparison to current demand levels.