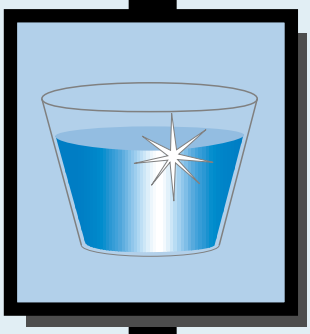

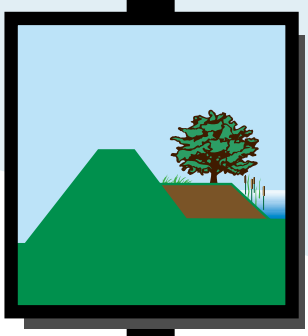

CALFED
BAY-DELTA
PROGRAM

Attachment 6b

Programmatic Endangered Species Act Section 7 Biological Opinions

National Marine Fisheries Service

August 28, 2000

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

August 28, 2000

In Reply Refer to:
SWR-00-SA-0110:MEA

Mr. Lester A. Snow
Regional Director
United States Bureau of Reclamation
2800 Cottage Way
Sacramento, California 95825-1898

Dear Mr. Snow:

This document transmits the National Marine Fisheries Service (NMFS) biological opinion for the implementation phase of the CALFED Bay-Delta Program. This biological opinion is based on NMFS' review of the proposed CALFED Bay-Delta Program, and its effects on the federally endangered Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), and threatened Central Valley spring-run chinook salmon (*O. tshawytscha*) and their designated critical habitat in accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et sq.*). Your August 18, 2000 request for a programmatic consultation, made on behalf of the Bureau of Reclamation (Reclamation) and the other Federal co-lead agencies for the CALFED Bay-Delta Program (Environmental Protection Agency, Army Corps of Engineers, Natural Resources Conservation Service, and Fish and Wildlife Service), was received on August 18, 2000.

This document also transmits NMFS' Essential Fish Habitat (EFH) Conservation Recommendations for Pacific coast salmon, coastal pelagic species, and west coast groundfish which may be effected by the proposed action as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) as amended (16 U.S.C. 1801 et seq.). While EFH designations for salmon have yet to be approved by the Secretary of Commerce, we expect them to be forthcoming and provide these recommendations to facilitate your consultation obligations.

The biological opinion and EFH conservation recommendations are based on information provided in the Programmatic Environmental Impact Statement (PEIS) for the CALFED Bay-Delta Program (Program) and the Multi-Species Conservation Strategy (MSCS), an appendix to the PEIS, which is the biological assessment for the Program. A complete administrative record of this consultation is on file in NMFS' Sacramento Area Office, Sacramento, California.

Based upon the best available scientific and commercial information, this biological opinion concludes that implementation of the CALFED Bay-Delta Program is not likely to jeopardize the continued existence of federally endangered Sacramento River winter-run chinook salmon, threatened Central Valley steelhead, and threatened Central Valley spring-run chinook salmon or result in the destruction or adverse modification of designated critical habitat for these species.

However, implementation of the CALFED Bay-Delta Program addressed in this biological opinion is anticipated to result in incidental take of listed species. Due to the programmatic nature of the PEIS and CALFED's Preferred Program Alternative, the project specific and action specific information necessary to determine the amount and extent of incidental take of endangered Sacramento River winter-run chinook salmon, threatened Central Valley steelhead, and threatened Central Valley spring-run chinook salmon associated with individual CALFED Program activities/actions is lacking. Therefore, incidental take of endangered Sacramento River winter-run chinook salmon, threatened Central Valley steelhead, and threatened Central Valley spring-run chinook salmon is not authorized in this biological opinion. NMFS anticipates that Reclamation and/or other Federal CALFED co-lead action agencies, as appropriate, will initiate project specific or action specific consultations tiered to this programmatic consultation. These future consultations, tiered under this programmatic consultation, will evaluate and estimate the amount of incidental take of listed species associated with action specific implementation plans and, if appropriate, authorize the amount and extent of incidental take.

As provided in 50 CFR § 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the action is subsequently modified in a way that causes an effect on listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. Since this programmatic consultation does not provide incidental take authorization, Reclamation and/or Federal CALFED co-lead action agencies shall initiate consultations with the NMFS for action specific implementation plans, which may effect listed anadromous salmonids and are to be tiered under this programmatic biological opinion.

Reclamation and the Federal CALFED co-lead agencies have a statutory requirement under section 305(b)(4)(B) of the MSFCMA to submit a detailed response in writing to NMFS that includes a description of measures proposed for avoiding, mitigating, or offsetting the impact of the activity on EFH, as required by section 305(b)(4)(B) of the MSFCMA and 50 CFR 600.920(j) within 30 days. If unable to complete a final response within this time limit, an interim written response should be provided to NMFS within 30 days. A detailed response should follow.

If you have any questions concerning the biological opinion or the attached EFH conservation recommendations please contact Mr. Michael Aceituno in our Sacramento Area Office, 650 Capitol Mall, Suite 6070, Sacramento, CA 95814. Mr. Aceituno may be reached by telephone at (916) 498-6498.

Sincerely,

Rebecca Lent, Ph.D.
Regional Administrator

Enclosure

CALFED BAY-DELTA PROGRAM

PROGRAMMATIC BIOLOGICAL OPINION
(**Endangered Species Act - Section 7 Consultation**)

and

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS
(**Magnuson-Stevens Fishery Conservation and Management Act - EFH Consultation**)

Prepared by
National Marine Fisheries Service
Southwest Region

August 28, 2000

Endangered Species Act -Section 7 Consultation

BIOLOGICAL OPINION

Agency: CALFED - Federal Co-Lead Agencies (Bureau of Reclamation, Fish and Wildlife Service, Army Corps of Engineers, Environmental Protection Agency, National Marine Fisheries Service, and Natural Resources Conservation Service)

Activity: CALFED Bay-Delta Program Final Programmatic Environmental Impact Statement/Environmental Impact Report - Preferred Program Alternative

Consultation Conducted By: National Marine Fisheries Service, Southwest Region.

Date Issued: August 28, 2000

INTRODUCTION

This document transmits the National Marine Fisheries Service' (NMFS) biological opinion on the effects of the Preferred Program Alternative described in the CALFED Bay-Delta Program (CALFED Program) Final Programmatic Environmental Impact Statement/Environmental Impact Report (PEIS/EIR), dated July 2000, on federally listed endangered Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run chinook salmon (*O. tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), and threatened Central California Coast steelhead (*O. mykiss*) in accordance with section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.).

This consultation is intended to address in a comprehensive manner the numerous and widely varied actions related to the implementation of the CALFED Program. While CALFED Program actions are clearly interrelated and interdependent, many actions implemented by the various CALFED Agencies are not and could not be considered as stand alone actions. Nevertheless, the U.S. Fish and Wildlife Service (USFWS) and NMFS have agreed with the other CALFED Agencies that to facilitate ESA compliance, the activities that are listed in the Project Description would be evaluated as a suite of actions all related in one form or another to the CALFED Program. Therefore, this biological opinion addresses the effects upon listed species resulting from the implementation of this suite of actions as a whole and also provides a strategy, or process, for ESA compliance on the individual activities that cumulatively make up the CALFED Program.

CALFED Program implementation , in conjunction with the Multi-Species Conservation Strategy and programmatic biological opinions, will provide benefits in subsequent site specific consultations. Specifically, individual projects that qualify for consultation will be evaluated within the context of the program as a whole, including the major elements designed to improve the environmental baseline and lead to recovery of targeted species. These major elements will be

subject to on-going monitoring, evaluation, and the application of adaptive management. Site specific biological opinions will take into account the environmental benefits that accrue from the CALFED Program. As a result, the NMFS and the USFWS anticipate the implementation of the overall CALFED Program will streamline the ESA compliance process and, as actions to benefit listed species are implemented, will reduce the need for additional provisions to satisfy legal requirements.

A number of key program actions related to the implementation of a variety of activities, especially those related to addressing the needs of listed species, are considered in developing this biological opinion at the programmatic level. These key program actions are critical to the overall determination of how implementation of this suite of actions may, or may not jeopardize listed species because the effects of the actions are evaluated in the aggregate. If key program actions are not implemented at this programmatic level, or new information becomes available, consultation would be reinitiated at the programmatic level to ascertain how the lack of implementation of any action(s), or new information, affects the evaluation of effects upon listed species associated with the overall implementation of the suite of actions being considered and the subsequent conclusions made in this biological opinion.

The project-specific or tiered consultations that will follow this programmatic consultation will rely on implementation of the key program actions to direct the development and implementation of the project-specific actions. If the CALFED Program fails to implement conservation measures or if new information becomes available then reinitiation on the programmatic level may be necessary.

BACKGROUND

The CALFED Program was initiated in May 1995 by then Governor Pete Wilson and the Clinton Administration to address environmental and water management problems associated with the Bay-Delta. In June 1995, State and Federal agencies launched a partnership to develop and implement a comprehensive, long-term management plan for the Bay-Delta. The management plan is intended to address problems of the Bay-Delta system within four critical, often competing, resource categories: ecosystem quality, water quality, levee system integrity, and water supply reliability. The CALFED Program officially involves the18 CALFED Agencies with management or regulatory responsibilities in the Bay-Delta. Stakeholder input is facilitated through the Bay-Delta Advisory Committee (BDAC).

At its inception, the CALFED Program was divided into two planning phases (Phase I and II) and an implementation phase (Phase III). During Phase I, the CALFED Program concentrated on identifying and defining the problems confronting the Bay-Delta system. A mission statement and guiding principles were developed, along with CALFED Program objectives and an array of potential actions to meet them. Phase I was completed in September 1996.

During Phase II the CALFED Program developed a preferred program alternative (Preferred Program Alternative) and conducted a comprehensive programmatic environmental review process. Because the CALFED solution area is so large, and because it is approaching its task in an integrated, comprehensive way, environmental review must be conducted on a very broad level. Phase II ends following the signing of a Federal Record of Decision (ROD) and State Certification of the Final PEIS/PEIR. Phase III will begin with implementation of the CALFED Program. The CALFED Program solution plan is expected to take 30 years or more to complete.

CONSULTATION HISTORY

Early in Phase I, from July 1995 to July 1996, the co-lead Federal CALFED Agencies held more than 30 public meetings and workshops around the State to involve Californians in developing a Bay-Delta solution. The participating Federal agencies included NMFS, Natural Resources Conservation Service (NRCS), Army Corps of Engineers (Corps), Bureau of Reclamation (Reclamation), Environmental Protection Agency (EPA), and the USFWS. The problems of the Bay-Delta were defined and a range of alternative solutions was developed. Additionally, three preliminary alternatives for Delta water conveyance were identified for further analysis during Phase II. The first conveyance configuration relied primarily on the existing conveyance system, with some minor changes in the south Delta. The second configuration relied on enlarging channels within the Delta. The third configuration included in-channel modifications and a conveyance channel that would move some water around the Delta. Each of these alternatives also included new ground and surface water storage options. Proposed management actions were grouped into six CALFED Program elements (i.e., levee system integrity, water quality improvements, ecosystem restoration, water use efficiency measures, water transfers, and watershed management). In February 1996, the CALFED Program released 20 draft alternative solutions, each including hundreds of actions to help solve the Bay-Delta problems.

CALFED Agencies participated on management and technical teams (e.g., the Water Management Strategy [WMS] and Multi-Species Conservation Strategy [MSCS] teams, and the Ecosystem Restoration Program [ERP] Focus Group) and contributed to several planning documents developed during Phase II, including the Draft (March 1998) and Final (July 2000) PEIS/PEIR; and Administrative Draft (March 31, 2000), Draft (April 17, 2000) and Final (July 2000) MSCS, which serves as the biological assessment for the CALFED Program section 7 consultation.

In June 1996, the list of alternatives was refined to three conceptual comprehensive approaches. In September 1996, the CALFED Agencies released the Phase I Final Report and launched a two-year environmental review of the conceptual alternative solutions. This action concluded Phase I of the CALFED Program and moved it into Phase II.

From June 1996 to December 1997, the CALFED Agencies held hundreds of public meetings to continue to involve the public in the process. Technical staff from various agencies worked with stakeholders to further refine the list of alternatives.

From March 1997 to November 1997, the CALFED Agencies released draft reports for four programs that were common to all of the alternatives. These draft reports included: the Ecosystem Restoration Program Plan, the Water Quality Component Report, the Water Use Efficiency Report, and the Delta Levee System Integrity Program Report.

In December 1997, more than $60 million in ecosystem restoration program projects were funded. This led to an additional $24 million in ecosystem restoration projects being funded in February 1998.

On March 16, 1998, the CALFED Agencies released a draft PEIS/PEIR containing the refined draft alternatives. The release was followed by a 105-day public comment period, which ended on July 1, 1998. Additionally, during the March 16, 1998 to July 1, 1998 time frame, the CALFED Agencies conducted further technical analyses to develop the draft Preferred Program Alternative, while also hosting public meetings, hearings, and workshops to continue to get public input.

In September 1998, another $25.5 million in ecosystem restoration projects were funded. In December 1998, the CALFED Agencies issued the Revised Phase II Report and draft framework plan for a Preferred Program Alternative.

On June 25, 1999, the CALFED Agencies released a revised draft PEIS/PEIR, which was followed by a 90-day comment period.

In July 2000, the CALFED Agencies released the final PEIS/PEIR which was followed by a 30-day comment period.

On August 18, 2000, NMFS received a request for initiation from Reclamation, which is serving as the lead agency for this consultation.

BIOLOGICAL OPINION

Description of the Proposed Action

A. Geographic Scope and Action Area

The geographic scope of CALFED includes two distinct areas, the “Problem Area” and the “Solution Area”. The Problem Area is defined as the legal Delta and Suisun Bay and Marsh. The Solution Area is much broader in extent than the Problem Area; encompassing the Central Valley watershed, the upper Trinity River watershed, the southern California water system service area, San Pablo Bay, San Francisco Bay, portions of the Pacific Ocean out to the Farallon Islands, and a near-shore coastal zone that extends from about Morro Bay to the Oregon border (CALFED MSCS, July 2000). The primary focus area of CALFED’s MSCS includes the legally defined Delta, Suisun Bay and Marsh, the Sacramento and San Joaquin Rivers and their tributaries

downstream of major dams, and the potential locations of reservoirs. This is the area defined as the "Action Area" for purposes of the following Biological Opinion.

Areas outside the MSCS Focus Area but within the CALFED Solution Area such as watersheds above major dams, including a portion of the upper Trinity River watershed, and included within CALFED's Watershed Program Area, other Central Valley Project (CVP) and State Water Project (SWP) service areas that are located outside the MSCS Focus Area, the outer bay region including near-shore coastal areas are not included within the action area for the following biological opinion. This is because potential CALFED actions either do not extend into these areas or potential effects cannot be determined until individual CALFED actions or groups of actions are identified and defined. Since these actions outside the MSCS Focus Area are not evaluated in this opinion, they will not be subject to application under this programmatic biological opinion and will be evaluated, if necessary, under separate consultations.

B. CALFED Bay-Delta Program

The CALFED Program is a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The CALFED Program addresses issues in four general problem areas: ecosystem quality, water quality, water management, and levee system integrity. The following CALFED Program components were developed to solve issues in the problem areas:

- Levee System Integrity Program (LSIP)
- Water Quality Program (WQP)
- Ecosystem Restoration Program (ERP)
- Water Use Efficiency Program (WUEP)
- Water Transfer Program (WTP)
- Watershed Program (WP)
- Storage
- Conveyance
- Environmental Water Account (EWA)
- Science Program
- Multi-Species Conservation Strategy (MSCS)
- Governance Plan

Most CALFED Program elements are described in technical appendices to the PEIS/PEIR. Storage and Conveyance are described separately. The EWA is an operational strategy intended to improve fish protection while not adversely affecting water supply.

All aspects of the CALFED Program are interrelated and interdependent. Ecosystem restoration is dependent upon supply and conservation. Supply is dependent upon water use efficiency and consistency in regulation. Water quality is dependent upon water use efficiency and consistency in regulations, improved conveyance, levee stability and healthy watersheds.

The CALFED Program includes a framework guiding implementation that addresses the scope, complexity, and duration of the CALFED Program, and the relative uncertainty regarding the CALFED Program's approach in resolving issues in the problem areas. Implementation is supported by an Implementation Plan that describes Stage 1 actions, CALFED Program integration, governance, and financing. In addition, a Science Program is included to carry out monitoring, assessment and research; and a MSCS will be followed to achieve compliance with the ESA. Implementation of the CALFED Program will be guided by an adaptive management approach with monitoring of performance to help modify (adapt) future actions and contribute to decision making. Also, the CALFED Program will be guided by the principle of balanced implementation of CALFED Program elements.

The term of this programmatic biological opinion includes Phase III of the CALFED Program (30 years or more), provided the CALFED Program remains in compliance with this programmatic biological opinion. NMFS will evaluate the CALFED Program's consistency with this biological opinion at numerous points in the future, including:

- During review of annual reports submitted by the CALFED Program.
- During subsequent, tiered informal and formal consultation on Action Specific Implementation Plans (ASIPs).
- After 4 years of implementation when sufficient data is collected and analyzed to fully evaluate the effectiveness of the WMS, together with other conservation elements, in meeting the conservation objectives of the CALFED Program.
- At the conclusion of Stage 1 to assess the Program's compliance in achieving the conservation objectives established in the CALFED "Milestones."

If NMFS determines that the CALFED Program is not in compliance with this biological opinion, the CALFED Agencies will reinitiate this programmatic consultation. In addition, refer to the Reinitiation Statement in this consultation for further reasons for reinitiation.

The following sections describe the CALFED Program and its elements in greater detail.

Levee System Integrity Program (LSIP)

The LSIP's goal is to improve levees and levee management in the legal Delta and will investigate the level of levee work in Suisun Marsh, which together define its scope. All projects under the LSIP will be implemented to be fully consistent with other CALFED Program elements, including the ERP, Conveyance, and MSCS. Project-specific plans will incorporate appropriate elements of these other programs and strategies. Individual projects pursued under the LSIP, including each of the levee plans described below, will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA. The LSIP is comprised of the following five elements in the Delta, and a plan for Suisun Marsh levees:

Delta Levee Base Level Protection Plan. The CALFED Program will provide funding to participating local agencies in the Delta to reconstruct certain Delta levees to a uniform, base-level standard. The tentative standard is the Public Law (PL) 84-99 Delta Specific Standard (PL 84-99). Constructing levees to the PL 84-99 criteria is a prerequisite for, but not a guarantee of, post-flood Federal disaster assistance. This plan will evaluate the estimated 520 miles of non-Federal levees in the Delta and recommend levee segments that should conform with the Delta Specific Standard criteria. In addition, a funding mechanism will be established to support the routine inspection and maintenance of levees in the Delta, and for emergency response.

Delta Levee Special Improvement Projects. These projects will target areas that will provide flood protection above base-level standards for some islands protecting public benefits such as water quality, the ecosystem, life and personal property, agricultural production, cultural resources, recreation, and local and Statewide infrastructure. The scope of the Delta Levee Special Improvement Projects encompasses the Delta and levees bordering the northern Suisun Bay from Van Sickle Island to Montezuma Slough. Maintenance of upgraded levees will occur in conformance with specific criteria, consistent with meeting ERP objectives.

Delta Levee Subsidence Control Plan. The goal of this plan is to minimize the risk to levee integrity from land subsidence, in coordination with other CALFED Program elements. Measures will be implemented to reduce, eliminate, or reverse subsidence within a "zone of influence" (approximately 0-500 ft) adjacent to affected levees. Subsidence control techniques include:

- Geotechnical engineering principles and practices in conjunction with proven construction methods.
- Modifying seepage control, dewatering efforts, excavations, and land management activities near levees to best manage levee integrity.
- Strategically locating and constructing stability and drainage berms.
- Restricting practices such as land leveling, ditching, and certain other ground surface modifications within the zone of influence.
- Promoting high ground water levels and vegetation growth, where appropriate, to limit subsidence due to oxidation.

Delta Levee Emergency Management and Response Plan. The goals of this plan are to enhance existing emergency management response capabilities in the Delta, and to develop a stable funding source for emergency response. Future planning will concentrate on improving funding, resources, and response by State and Federal agencies; integrating response by all levels of government; clarification of regulatory procedures; and improving dispute resolution procedures.

Delta Levee Risk Assessment and Risk Management Strategy. The goals of this strategy are to quantify the risks to Delta levees, evaluate the consequences, and develop an appropriate risk management strategy by the end of Stage 1.

Suisun Marsh Levee System Plan. The CALFED Program will evaluate whether to include the Suisun Marsh levee system in the Levee Integrity Plan, and, if included, what level of protection is appropriate. This plan will evaluate the appropriate level of protection for Suisun Marsh levees, evaluate the best method of protection, and implement the method during Stage 1. This plan may protect part of the levee system by rehabilitating and maintaining some levees to protect managed wetlands and develop new tidal wetlands. Implementation will incorporate ERP and MSCS actions, consistent with NMFS-approved recovery plans.

Proposed Levee System Integrity Program Stage 1 Actions

The CALFED Agencies will evaluate the following LSIP actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the LSIP.

- Initiate the Levee Program Coordination Group. Develop and implement an outreach, coordination, and partnering program with local landowners including individuals, cities, counties, reclamation districts, resource conservation districts, water authorities, irrigation districts, farm bureaus, other interest groups, and the general public to assure participation in planning, design, implementation, and management of levee projects (yr 1).
- Obtain short-term Federal and State funding authority as a bridge between the existing Delta Flood Protection Authority (AB 360) and long-term levee funding (yr 1-5).
- Obtain long-term Federal and State funding (yr 1-7).
- Conduct project level environmental documentation and obtain appropriate permits for each action/group of actions (yr 1-7).
- Implement demonstration projects for levee designs, construction techniques, sources of material, reuse of dredge material, and maintenance techniques that maximize ecosystem benefits while still protecting lands behind levees. Give priority to those levee projects which include both short (i.e., construction) and long-term (i.e., maintenance and design) ecosystem benefits, and provide increased information (yr 1-7).
- Adaptively coordinate Delta levee improvements with ecosystem improvements by incorporating successful techniques for restoring, enhancing, or protecting ecosystem values developed by levee habitat demonstration projects or ecosystem restoration projects into levee projects. Continue to develop techniques as major levee projects are implemented (yr 1-7).
- Fund levee improvements up to PL 84-99 criteria in Stage 1; e.g., proportionally distribute available funds to entities making application for cost sharing of Delta levee improvements (yr 1-7).
- Further improve levees which have significant Statewide benefits in Stage 1; e.g., State-wide benefits to water quality and highways (yr 1-7).

- Coordinate Delta levee improvements with Stage 1 water conveyance, water quality improvements (yr 1-7).
- Enhance existing emergency response plans; e.g., establish a revolving fund, refine command and control protocol, stockpile flood fighting supplies, establish standardized contacts for flood fighting and recovery operations, and outline environmental considerations during emergencies (yr 1-7).
- Implement current Best Management Practices (BMPs) to correct subsidence effects on levees. Assist CALFED Program's Science Program activities to quantify the effect and extent of inner-island subsidence and its linkages to all CALFED Program objectives (yr 1-7).
- Develop BMPs for the reuse of dredge materials (yr 1).
- Institute a program for using Bay and Delta dredge material to repair Delta levees and restore Delta habitat (yr 1-7).
- Complete total risk assessment for Delta levees and develop and begin implementation of risk assessment options as appropriate to mitigate potential consequences (yr 1-7).
- Complete the evaluation of the best method for addressing the Suisun Marsh levee system (yr 1-2).

Water Quality Program (WQP)

The CALFED Program's WQP will strive to create water quality conditions that fully support a healthy and diverse ecosystem and the multiplicity of human uses of water. The geographic scope of the WQP encompasses five regions: the legal Delta; the Bay Region which includes Suisun Bay and Marsh, San Pablo Bay, and the San Francisco Bay watershed; the Sacramento River Region, bounded by the ridge tops of the Sacramento River watershed or hydrologic region; the San Joaquin River Region which includes both the San Joaquin River and Tulare Lake hydrologic basins; and, SWP and CVP service areas outside the Central Valley.

The CALFED Program's Water Quality Technical Group has identified the following water quality parameters of concern to beneficial uses: mercury, selenium, trace metals (copper, cadmium, and zinc), pesticides (carbofuran, chlorodane, chloropyrifos, DDT, diazinon, PCBs, and toxaphene), drinking water disinfection by-product precursors (bromide and total organic carbon), dissolved oxygen and oxygen reducing substances, ammonia, salinity (total dissolved solids), temperature, turbidity and sedimentation, pathogens, nutrients (nitrogen and phosphorus), pH (alkalinity), chloride, boron, sodium absorption ratio, and toxicity of unknown origin. These parameters provide the focal points for developing and implementing the CALFED Program's water quality actions. The July 2000 WQP Plan, a technical appendix to the CALFED Program's Final PEIS/PEIR, provides a full description of the WQP. Individual projects pursued under the WQP will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA.

Water Quality Program Plan

The WQP, largely through its agency-stakeholder Water Quality Technical Group, has developed programmatic actions to address water quality parameters of concern and beneficial use impairments. Water quality impairments or problems and associated programmatic actions to treat these problems are described in the WQP Plan. The WQP Plan is organized by the following sections: low dissolved oxygen and oxygen depleting substances, drinking water, mercury, pesticides, organochlorine pesticides, salinity, selenium, trace metals, turbidity and sedimentation, toxicity of unknown origin, and a section on implementation strategy. The environmental water quality components, including proposed actions, were transferred to and are now administered under the ERP. However, to maintain consistency between the Draft PEIS and Final PEIS, CALFED Agencies have left the environmental components in the WQP Plan.

Proposed Water Quality Program Stage 1 Actions

The CALFED Agencies will evaluate the following water quality actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the WQP Plan.

General Water Quality Actions

- Prepare project level environmental documentation and permitting as needed (yr 1-7).
- Coordinate with other CALFED Program elements to ensure that in-Delta actions maximize potential for Delta water quality improvements (yr l-7).
- Continue to clarify use of and fine-tune water quality performance targets and goals (yr l-7).

Environmental Water Quality Action:

Conduct the following mercury evaluation and abatement work:

Cache Creek:

- Risk appraisal and advisory for human health impacts of mercury (yr l-5).
- Support development and implementation of Total Maximum Daily Load (TMDL) for mercury (yr l-7).
- Determine bioaccumulation effects in creeks and the Delta (yr l-4).
- Source, transport, inventory, mapping and speciation of mercury (yr l-7).
- Information Management/Public Outreach (yr 5-7).
- Participate in Stage 1 remediation (drainage control) of mercury mines as appropriate (yr 3-5).
- Investigate sources of high levels of bioavailable mercury (yr 4-7).

Sacramento River:

- Investigate sources of high levels of bioavailable mercury; inventory, map, and refine other models (yr 3-7).
- Participate in remedial activities (yr 7).

Delta:

- Research methylization (part of bioaccumulation) process in Delta (yr l-2).

- Determine sediment mercury concentration in areas that would be dredged during levee maintenance or conveyance work (yr 3-7).
- Determine potential impact of ecosystem restoration work on methyl mercury levels in lower and higher trophic level organisms (yr 3-5).

Conduct the following pesticide work:

- Develop diazinon and chlorpyrifos hazard assessment criteria with the CDFG and the Department of Pesticide Regulations (yr 1).
- Support development and implementation of a TMDL for diazinon (yr l-7).
- Develop BMPs for dormant spray and household uses (yr l-3).
- Study the ecological significance of pesticide discharges (yr-1-3).
- Support implementation of BMPs (yr 2-7).
- Monitor to determine effectiveness (yr 4-7).

Conduct the following trace metals work:

- Determine spatial and temporal extent of metal pollution (yr 3-7).
- Determine ecological significance and extent of copper contamination (yr l-3).
- Review impacts of other metals such as cadmium, zinc, and chromium (yr 1).
- Participate in Brake Pad Partnership to reduce introduction of copper (yr 1-7).
- Partner with municipalities on evaluation and implementation of stormwater control facilities (yr 2-5).
- Participate in remediation of mine sites as part of local watershed restoration and Delta restoration (yr 2-7).

Conduct the following selenium work:

- Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions; determine bioavailability of selenium under several scenarios (yr l-5).
- Evaluate and, if appropriate, implement real-time management of selenium discharges (yr 1-7).
- Expand and implement source control, treatment, and reuse programs (yr l-7).
- Coordinate with other programs (yr l-7); e.g., recommendations of San Joaquin Valley Drainage Implementation Program, and CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways.

Conduct the following sediment reduction work/organochlorine pesticides:

- Participate in implementation of the United States Department of Agriculture (USDA) sediment reduction program (yr l-7).
- Promote sediment reduction in construction areas and urban stormwater, and other specific sites (yr l-7).
- Implement stream restoration and revegetation work (yr 4-7).
- Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions (yr 4-7).
- Coordinate with ERP on sediment needs (yr l-3).

Conduct the following work addressing dissolved oxygen (DO) and oxygen depleting substances (including nutrients):

- Complete studies of causes for DO sag in San Joaquin River near Stockton (yr l-2).
- Define and implement corrective measures for DO sag (yr l-7).

- Encourage regulatory activity to reduce nutrients discharged by unpermitted dischargers (yr l-7).
- Develop inter-substrate DO testing in conjunction with the ERP (yr 2-4).
- Study nutrient effects on beneficial uses (yr 4-7).
- Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations (yr 1-7).
- Support finalizing investigation of methods to reduce constituents that cause low DO for inclusion in TMDL recommendation by the Central Valley Regional Water Quality Control Board (yr 2).
- Support finalization of Basin Plan Amendment and TMDL for constituents that cause low DO in the San Joaquin River (yr 2).
- Support implementation of appropriate source and other controls as recommended in the TMDL (yr 3).
- Participate in identifying unknown toxicity and addressing as appropriate (yr l-7).

Drinking Water Quality Actions

Actions specific to drinking water improvements:

- Work with Bay Area water suppliers as they develop a Bay Area Blending/ Exchange Project (yr 1-7).
- Address drainage problems in the San Joaquin Valley to improve downstream water quality (yr 1-7).
- Implement source controls in the Delta and its tributaries (yr 1-7).
- Support ongoing efforts of the Delta Drinking Water Quality Council (yr 1-7).
- Invest in treatment technology demonstrations (yr 1-7).
- Control runoff into the California Aqueduct and other similar conveyances (yr 1-7+).
- Address water quality problems at the North Bay Aqueduct (yr 1-7).
- Conduct comprehensive evaluations, pilot programs, and full scale actions to reduce Total Organic Carbon (TOC) contribution through control of algae, aquatic weeds, agricultural runoff, and watershed improvements (yr 1-7).
- Improve DO concentrations in the San Joaquin River near Stockton (yr 1-3).
- Study recirculation of export water to reduce salinity and improve DO in the San Joaquin River. If feasible, and consistent with ERP goals and objectives, implement a pilot program (yr 1-4).

Ecosystem Restoration Program (ERP)

The ERP will improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta estuary and its watershed to support sustainable populations of diverse plant and animal species. All CALFED Program elements will contribute in varying degrees to this goal, with the ERP being the principal CALFED Program element designed to restore the ecological health of the Bay-Delta system. The ERP includes actions throughout the Bay-Delta watershed, focusing on the restoration of ecological processes and important habitats. The

CALFED Program proposes to improve ecosystem quality for the Bay-Delta system in order to reduce conflicts among beneficial uses of California's water. Individual projects pursued under the ERP will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA.

The primary geographic focus area of the ERP is the Sacramento-San Joaquin Delta, Suisun and San Pablo Bay, the Sacramento River below Shasta Dam, the San Joaquin River below the confluence with the Merced River, and their major tributary watersheds directly connected to the Bay-Delta system below major dams and reservoirs. This primary geographic focus area is divided into 14 ecological management zones (discussed in ERP Plan Volume II). The secondary geographic focus area is the upper watersheds surrounding the primary focus area and Central and South San Francisco Bay and their local watersheds.

Success of the CALFED Program hinges upon the full and successful funding and implementation of the ERP, MSCS, other existing and tiered biological opinions, as well as other environmental commitments. Although NMFS anticipates that some ERP actions will be refined or altered, based upon new information and adaptive management, the successful implementation of nearly all actions is necessary to achieve the species recovery goals identified in the ERP. The ERP is not designed as mitigation for projects to improve water supply reliability or to bolster the integrity of Delta levees, although it is expected that the environmental benefits associated with implementation of the ERP will facilitate the review of such projects. Improving ecological processes and increasing the amount and quality of habitat are co-equal with other CALFED Program goals related to water supply reliability, water quality, and levee system integrity.

The ERP is comprised of a Strategic Plan and a two-volume restoration plan: Volume I which describes the ecosystem elements or attributes (ecological processes, habitats, species and species groups, and anthropogenic stressors) the program addresses; and, Volume II which presents the ecological management zones and proposed programmatic actions. The ERP would require individual section 7 consultations for actions which may affect listed species.

Ecosystem Restoration Program Strategic Plan and Goals

The ERP Strategic Plan contains the following goals and objectives:

- Goal 1: Achieve recovery of at-risk native species dependent on the Delta and Suisun Bay as the first step toward establishing large, self-sustaining populations of these species; support similar recovery of at-risk native species in San Francisco Bay and the watershed above the estuary; and minimize the need for future endangered species listings by reversing downward population trends of native species that are not listed.
- Goal 2: Rehabilitate natural processes in the Bay-Delta estuary and its watershed to fully support, with minimal ongoing human intervention, natural aquatic and associated terrestrial biotic communities and habitats, in ways that favor native members of those communities.

- Goal 3: Maintain and/or enhance populations of selected species for sustainable commercial and recreational harvest, consistent with the other ERP goals.
- Goal 4: Protect and/or restore functional habitat types in the Bay-Delta estuary and its watershed for ecological and public values such as supporting species and biotic communities, ecological processes, recreation, scientific research, and aesthetics.
- Goal 5: Prevent the establishment of additional non-native invasive species and reduce the negative ecological and economic impacts of established non-native species in the Bay-Delta estuary and its watershed.
- Goal 6: Improve and/or maintain water and sediment quality conditions that fully support healthy and diverse aquatic ecosystems in the Bay-Delta estuary and watershed; and eliminate, to the extent possible, toxic impacts to aquatic organisms, wildlife, and people.

There are several objectives under each goal. ERP goals and objectives are integrated with those of the CALFED Program's MSCS, WQP, and Nonnative Invasive Species Strategic Plan.

The ERP Strategic Plan also presents and describes:

- An ecosystem based management approach for restoring and managing the Bay-Delta ecosystem.
- An adaptive management process that is sufficiently flexible and iterative to respond to changing Bay-Delta conditions and to incorporate new information about ecosystem structure and function.
- The value and application of conceptual models in developing restoration actions and defining information needs, with examples of their development and use.
- Institutional and administrative considerations necessary to implement adaptive management, to ensure scientific credibility of the restoration program and to engage the public in the restoration program.
- Decision rules and criteria to help guide the selection and prioritization of restoration actions.
- Opportunities and constraints to be considered in developing a restoration program.

Ecosystem Restoration Program Plan

The ERP Plan is composed of two volumes. Volume I presents the elements or components of the ERP. These "ecosystem elements" are organized into four categories: ecological processes (e.g., central valley stream flows, Bay-Delta hydrodynamics, bay-delta aquatic foodweb); habitats (e.g., tidal perennial aquatic, saline emergent wetland, riparian and riverine aquatic); species and species groups (species designated for recovery, species designated for contribute to recovery, species assemblages designated for enhance and/or conserve biotic communities, harvested species to be maintained and/or enhanced); and, stressors (e.g., water diversions, nonnative invasive species, contaminants, gravel mining). Consult ERP Plan Volume I for the complete list and description of ERP ecosystem elements (total of 106 elements).

ERP Plan Volume II identifies over 600 programmatic actions to be implemented throughout the Bay-Delta estuary and its watershed over the 30-year period of the CALFED Program. Volume II also gives targets for the ecosystem elements (e.g., acres of tidal fresh emergent wetland to be restored). Volume II is organized by Ecological Management Zones. The primary ERP geographic focus area is divided into 14 Ecological Management Zones: Sacramento-San Joaquin Delta, Suisun Marsh/North San Francisco Bay, Sacramento River, North Sacramento Valley, Cottonwood Creek, Colusa Basin, Butte Basin, Feather River/Sutter Basin, American River Basin, Yolo Basin, Eastside Delta Tributaries, San Joaquin River, East San Joaquin, and West San Joaquin. Each zone is further divided into Ecological Management Units. Under each Ecological Management Zone are the ecosystem elements and associated proposed programmatic actions and restoration targets that the ERP will address in that zone. There is also a section in Volume II that gives ERP targets, MSCS species goal prescriptions, and MSCS conservation measures for species and species groups ecosystem elements.

Proposed Ecosystem Restoration Program Stage 1 Actions

CALFED Agencies will evaluate the following ERP actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the ERP:

- Develop and implement an outreach, coordination, and partnering program with local landowners and individuals, cities, counties, reclamation districts, the Delta Protection Commission, resource conservation districts, water authorities, irrigation districts, farm bureaus, other interest groups, and the general public to assure participation in planning design, implementation, and management of ecosystem restoration projects (yr l-7).
- Conduct project level environmental documentation and permitting as needed for each bundle of Stage 1 actions (yr l-7).
- Fully coordinate with other ongoing activities which address ecosystem restoration in the Bay-Delta system; e.g., CVPIA, Four Pumps Agreement, Non-native Invasive Species Task Force (yr l-7).
- Implement habitat restoration in the Delta, Suisun Bay and Marsh, and Yolo Bypass to improve ecological function and facilitate recovery of endangered species consistent with the goals of the ERP Strategic Plan and MSCS. Habitat restoration efforts in Stage 1 will: restore 2,000 acres of tidal perennial aquatic habitat; restore 200 acres of deep open water nontidal perennial aquatic habitat; restore 300 acres of shallow open water nontidal perennial aquatic habitat; enhance and restore 50 miles of Delta slough habitat; enhance and restore 50 to 200 acres of midchannel islands; restore 8,000 to 12,000 acres of fresh emergent (tidal) wetlands; restore 4,000 acres of fresh emergent (non-tidal) wetlands; restore 25 miles of riparian and riverine aquatic habitat; restore 1,000 to 2,000 acres of perennial grassland; and establish 8,000 to 12,000 acres of wildlife-friendly agricultural habitat. These actions represent approximately one-fourth of the acreage identified in the ERP to be restored during the 30-year implementation period (yr 1-7).
- Implement large-scale restoration projects on select streams and rivers (e.g., Clear Creek, Deer Creek, and the Tuolumne River) that would include implementation of all long-term

restoration measures in coordination with the watershed management common program and monitoring of subsequent ecosystem responses to learn information necessary for making decisions about implementing similar restorations in later stages (yr l-7).

- Implement an EWA that acquires water for ecosystem and species recovery needs, substantially through voluntary purchases in the water transfer market in its first few years and developing additional assets over time (yr l-7).
- Pursue full implementation of ERP upstream flow targets, over and above EWA assets and regulatory actions, through voluntary purchases of at least 100,000 acre-feet of water by the end of Stage 1. Evaluate how the ERP water acquisitions and EWA water acquisitions will be integrated most effectively (yr 1-7).
- Complete targeted research and scientific evaluations needed to resolve the high priority issues and the uncertainties identified in the ERP Strategic Plan (e.g., instream flow, non-native organisms, and Bay-Delta food web dynamics) to provide direction for implementing the adaptive management process and information necessary for making critical decisions in later stages (yr l-7).
- Establish partnerships with universities for focused research (yr l-7).
- Acquire floodplain easements, consistent with ecosystem and flood control needs along the Sacramento and San Joaquin Rivers (yr 4-7).
- Continue high priority actions that reduce direct mortality to fishes (yr 1-7):
    - Screen existing unscreened or poorly screened diversions in the Delta, on the Sacramento River, San Joaquin River, and tributary streams based on a systematic priority approach.
    - Remove select physical barriers to fish passage.
- Continue gravel management, e.g., isolate gravel pits on San Joaquin River tributaries and relocate gravel operations on Sacramento River tributaries. Most gravel work would be implemented in subsequent stages with designs and plans for ecosystem reclamation of gravel mining sites (yr l-7).
- Develop and begin implementing a CALFED Program comprehensive non-native (exotic) invasive species prevention, control, and eradication plan including the following (yr l-7):
    - Implement invasive plant management program in Cache Creek.
    - Develop ballast water management program.
    - Develop early-response invasive organism control programs.
    - Evaluate CALFED Program implementation actions and how those actions may benefit non-native species to the detriment of native species or the Bay-Delta ecosystem.
- Provide incremental improvements in ecosystem values throughout the Bay-Delta system in addition to habitat corridors described above, e.g., pursue actions that are opportunity-based (willing sellers, funding, permitting), provide incremental improvements on private land through incentives, and develop partnerships with farmers on “environmentally friendly” agricultural practices (yr l-7).
- Incorporate ecosystem improvements with levee associated subsidence reversal plans (yr l-7).
- Evaluate the feasibility of harvest management to protect weaker fish stocks (yr l-7).

- Implement projects on selected streams to provide additional upstream fishery habitat by removing or modifying barriers (yr l-7).
- Assist in the preparation of detailed, ecosystem-based restoration and recovery plans for any priority species identified in the ERP Strategic Plan and the MSCS for which up-to-date plans are not available. Begin implementing appropriate additional restoration actions identified in these plans (yr 1-7).
- Identify and advance specific regional ERP goals (yr 1-7).

Additional draft ERP Stage 1 actions are presented by Ecological Management Zone in Appendix D of the ERP Strategic Plan.

Water Use Efficiency Program (WUEP)

The WUEP relies on a combination of technical assistance, incentives, and directed studies for the four WUEP elements: Agricultural Water Conservation, Urban Water Conservation, Water Recycling, and Managed Wetlands.

Technical assistance programs and directed studies will begin for all four elements. Incentive programs will be designed to award CALFED Program grant funding for projects that demonstrate potential to provide the CALFED Program water supply reliability, water quality, or ecosystem restoration benefits.

The WUEP includes water conservation and water recycling actions to facilitate efficient use of water at the regional and local level. Individual projects pursued under the WUEP will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA. The programmatic water use efficiency actions include the following:

<u>Water Conservation Related Actions</u>

- Work with the California Urban Water Conservation Council (CUWCC) and the Agricultural Water Management Council (AWMC) to identify appropriate urban and agricultural water conservation measures, set appropriate levels of effort, and, in the case of the urban effort, identify a proper entity and process to certify or endorse water suppliers that are implementing cost-effective feasible measures.
- Expand State and Federal programs to provide sharply increased levels of planning, technical, and financing assistance and develop new ways of providing assistance in the most effective manner.
- Assist urban water suppliers comply with the Urban Water Management Planning Act (UWMPA).
- Assist water suppliers and water users to identify and implement water management measures that can yield multiple benefits, including improved water quality and reduced ecosystem impacts.

- Identify and implement practices to improve water management on managed wetlands.
- Gather better information on water use, identify opportunities to improve water use efficiency, and measure the effectiveness of conservation practices.
- Identify, in region-specific Strategic Plans for Agricultural Areas, quantifiable objectives to assure improvements in water management.

Water Recycling Actions:

- Assist local and regional agencies comply with the water recycling provisions in the UWMPA.
- Expand State and Federal recycling programs in order to provide increased levels of planning, technical, and financing assistance (both loans and grants), and develop new ways of providing assistance in the most effective manner.
- Provide regional planning assistance that can increase opportunities for use of recycled water.

Proposed Water Use Efficiency Program Stage 1 Actions

CALFED Agencies will evaluate the following WUEP actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the WUEP.

- Expand existing State and Federal agricultural Water Conservation Programs to support on farm and district efforts. Expand State and Federal programs to provide technical and planning assistance to local agencies and districts in support of local and regional conservation and recycling programs (yr 1-7).
- Expand existing State and Federal conservation programs to support urban water purveyor efforts. Expand State and Federal programs to provide technical and planning assistance in support of conservation and recycling programs (yr 1-7).
- Utilize AB 3616 of the AWMC to evaluate and endorse Agricultural Water Management Plans to implement cost-effective water management practices by agricultural districts. Identify and secure ongoing funding sources for Agricultural Water Management Council and its members seeking to actively participate in the development, review, and implementation of these plans (yr 1-7).
- Develop Urban Water Management Plan Certification Process - Select an agency to act as certifying entity, obtain legislative authority, carry out public process to prepare regulations, and implement program (yr 1-3).
- Implement Urban BMPs Certification Process. Implement a process for certification of water suppliers' compliance with terms of the Urban Memorandum of Understanding (MOU) with respect to BMPs analysis and implementation for urban water conservation. Provide funding support for the CUWCC to carry out this function (yr 1-7).
- Prepare a program implementation plan, including a proposed organizational structure consistent with the overall CALFED Program governance structure, for a competitive grant/loan incentive program for WUEP (yr 1). This will include:

    - Incentives in the agricultural sector that will consider several factors, including: (I) potential for reducing irrecoverable water losses; (ii) potential for attaining environmental and/or water quality benefits from WUEP measures which result in reduced diversions; (iii) regional variation in water management options and opportunities; (iv) availability and cost of alternative water supplies; and (v) whether the recipient area experiences recurrent water shortages due to regulatory or hydrological restrictions. Many of these factors are included in the Quantifiable Objectives for Agricultural Water Use Efficiency, and as such, the Quantifiable Objectives will be an important component of the agricultural incentive criteria.
    - Incentives in the urban sector will assist in identifying and implementing urban water conservation measures that are supplemental to BMPs in the Urban MOU process and are cost effective from a Statewide perspective.
    - Incentives for water recycling in the urban and agricultural areas.
    - Annual reporting and evaluation mechanisms to gauge effectiveness of the program.
- Finalize and implement the methodology for Refuge Water Management which was described in the June 1998 "Interagency Coordinated Program for Wetland Water Use Plan, Central Valley, California" (yr 1-3).
- Research effort to establish appropriate reference conditions for evaluating program progress, and to identify improved methods for WUEP (yr 1-7).
- Assess the need for additional water rights protections. Evaluate the need for additional State regulations or legislation providing protection for water right holders who have implemented WUEP measures and subsequently transferred water to other beneficial uses (yr 1-4).
- Water Management. Develop State legislation that requires appropriate measurement of water use for all water users in California (yr 1-3).
- Create a Public Advisory Committee to advise State and Federal agencies on structure and implementation of assistance programs, and to coordinate State, Federal, regional and local efforts for maximum effectiveness of program expenditures (yr 1).

Water Transfer Program (WTP)

The CALFED Program's WTP will encourage the development of a more effective water transfer market that facilitates water transfers and streamlines the approval process while protecting water rights, environmental conditions, and local economic interests. CALFED Agencies have legal and regulatory responsibility for review and approval of most water transfers and also have jurisdiction over many of the storage and conveyance facilities required to make water transfers work. These agencies are in a position to improve or facilitate the operations of the water market by adopting policies and implementing programs that will allow transfers to be completed efficiently while protecting the environment. The Strategic Plan for Implementation provides direction and prioritization for implementation of the CALFED Program's WTP, and includes the following actions:

Interactive California Water Market Information Web Site

- Develop the On Tap on-line water market information source for California water transfers.

Environmental, Socio-economic, and Water Resource Protection

- Recommend establishment of a California Water Transfers Information Clearinghouse (CWTIC) to ensure that decisions regarding proposed water transfers can be made with all parties in possession of complete and accurate information and to facilitate assessment of potential third party impacts.
- Require additional water transfer analysis regarding direct and indirect impacts. The California Department of Water Resources (DWR), Reclamation, and the State Water Resources Control Board (SWRCB) will require transfer proponents to provide analysis of the direct and indirect impacts of a proposed transfer, in addition to CEQA, ESA compliance or other environmental requirements.
- Develop improved tracking protocols to ensure that water transferred to an instream flow can be tracked and then delivered to the intended destination.
- Work with stakeholders and the State Legislature to assist local agencies in development of groundwater management programs to protect groundwater basins in water transfer source areas.

Technical, Operational, and Administrative Rules

- Work to streamline the current water transfer approval processes through development of new tools, clarification of existing policies, refinement of processes and addition of staff and resources.
- Work with stakeholder representatives to clarify and define what water is deemed transferrable under what conditions.
- Work with stakeholder representatives to resolve conflicts over carriage water criteria.
- Work with stakeholder representatives to develop criteria that protect other legal users of water from injury as a result of refill of a reservoir after the transfer of stored water.

Wheeling and Access to State/Federal Facilities

- Improve forecasting tools and more widely disclose potential pumping and conveyance capacity in project facilities, including limiting factors and inherent risks.
- Work with stakeholder representatives to consider modification of policies and procedures for transporting non-project water through existing project water conveyance facilities.
- Work with stakeholder representatives to develop cost criteria associated with transporting transferred water through State or Federal conveyance facilities.

Proposed Water Transfer Program Stage 1 Actions

CALFED Agencies will evaluate the following actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the WTP.

- Develop an Interactive Water Transfer Information Web-site. CALFED Agencies will develop, implement, and maintain an interactive, publicly available web-site called On TAP (by the end of year 2000) (yr 1).
- Establish the CWTIC to operate and maintain the On TAP web-site, collect and disseminate data and information relating to water transfers and potential transfer impacts, and perform research using historic data to understand water transfer impacts (by year 2001) (yr 1).
- Coordinate with CALFED Agencies to require water transfer applicants to provide additional impact assessment information (yr 1-4).
- Identify, arrange, fund, and carry out a specific number of targeted water transfers for in-stream environmental purposes as part of the ERP, with a goal of using these transfers to evaluate the effectiveness of and make any necessary improvements to the California Water Code Section 1707 procedures and tracking protocols (yr 1-3).
- Establish a groundwater assistance program to fund studies to gather groundwater data and to enable local entities to develop and implement local groundwater management/monitoring programs (yr 1-2).
- Develop a streamlined water transfer approval process including "pre-certification" of certain classes of transfers and expedited environmental review procedures (yr 1-6).
- Work with stakeholder representatives to clarify and define what water is deemed transferrable under what conditions (yr 1-3).
- Continue to work with stakeholder representatives to resolve conflicts over carriage water criteria (yr 1-3).
- Establish a refill criteria policy for reservoir storage based water transfers (yr 1).
- Begin forecast and disclosure processes of potential conveyance capacity in existing export facilities (Reclamation and DWR). This would be an on-going activity, occurring in conjunction with hydrologic forecasts (yr 1-7).
- Work with stakeholders to develop an agreed upon set of criteria and procedures governing the determination of transport system availability and costs, including the procedures to determine the fair reimbursement to the water conveyance facility operator (yr 1-3).

Watershed Program (WP)

The WP will use a comprehensive, integrated, basin-wide approach with a goal to improve conditions in the Bay-Delta system. This WP will emphasize local participation and provide financial and technical assistance for local watershed stewardship, and promote coordination and collaboration among watershed efforts.

The geographic scope of the WP encompasses the entire scope of the CALFED Program. The WP will support activities that provide benefits to the Delta, Suisun Bay, and Suisun Marsh.

The WP covers a broad geographic range and currently lacks project-specific measures for evaluation. Individual projects pursued under the WP will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA. CALFED will ensure that appropriate measures to conserve special status species are included in all program actions.

There are five WP elements: coordination and assistance; adaptive management and monitoring; education and outreach; integration with other CALFED Program elements; and watershed processes and relationships. These elements, associated proposed programmatic actions, and an implementation strategy are described in the WP Plan.

The primary objectives of the WP are:

- Facilitate and improve coordination, collaboration, and assistance among government agencies, other organizations, and local watershed groups.
- Develop watershed monitoring and assessment protocols.
- Support education and outreach.
- Integrate the WP with other CALFED Program elements.
- Define the relationship between watershed processes and the goals and objectives of the CALFED Program.
- Implement a strategy that will ensure support and long term sustainability of local watershed activities.

Watershed activities will be supported that:

- are community based
- are collaborative and are consistent with the CALFED Program
- address multiple watershed issues
- are coordinated with and supported at multiple levels
- provide ongoing implementation
- include monitoring protocols
- increase learning and awareness.

<u>Proposed Watershed Program Stage 1 Actions</u>

The CALFED Program will evaluate the following WP actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the WP Plan.

- Fund and implement community based watershed restoration, maintenance, conservation, and monitoring activities that support the goals and objectives of the CALFED Program (yr l-7).
- Assist local watershed groups and government agencies to address common issues, including roles and responsibilities, funding support, technical assistance, information exchange, and to ensure effective communication and implementation among government agencies and stakeholder groups (yr l-7).
- Implement a funding process and provide watershed stewardship funds to build the capacity of locally controlled watershed groups that ensure participation of local landowner groups (yr l-7).
- Improve the use and usefulness of existing or future watershed information management functions to provide data and other information to people involved in watershed management (yr 3-7).
- Ensure the completion of project level environmental documentation and permitting; assist with documentation and permitting processes as appropriate (yr l-7).
- Evaluate the benefits that accrue from watershed plans and projects designed to achieve CALFED Program goals and objectives (yr 3-7).
- Establish, fund, and maintain watershed restoration and maintenance assistance to aid local watershed groups and private landowners in project concept, design, and implementation (yr l-7).
- Collaborate with other CALFED Program and non-CALFED Program elements on watershed related activities (yr l-7).
- Provide appropriate information and assistance to stakeholders and the State Legislature to develop a Statewide umbrella Watershed Management Act (yr 1).

Water Management Strategy (WMS)

The WMS describes a framework to coordinate and integrate the water management tools in the program, evaluate the success of implementation efforts, and select additional tools needed to achieve the CALFED Program's water reliability objectives. The CALFED Program has identified three primary goals for the WMS: increase the utility of available water supplies (making water suitable for more uses and reuses); improve access to existing or new water supplies in an economically efficient manner, for environmental, urban and agricultural beneficial uses; and, improve flexibility of managing water supply and demand in order to reduce conflicts between beneficial uses and decrease system vulnerability.

The tools that will be used to achieve the goals and objectives of the WMS include: the WUEP (agricultural, urban, and wetland water conservation and water recycling); the WTP; Conveyance, including South Delta Improvements; Storage; and, operational strategies, such as real-time diversion management and an EWA. In addition to these primary tools, the WMS will rely on additional CALFED Program tools to provide additional benefits. These include the WP, the WQP, and real-time monitoring through the Science Program.

Storage

The CALFED Program has initiated the Integrated Storage Investigation (ISI) to provide a comprehensive assessment of alternative surface and groundwater storage options and their utility to overall water management.

Decisions to implement new or expanded surface and groundwater storage will be predicated upon completing site-specific feasibility studies and complying with all environmental review and permitting requirements. Individual storage projects pursued under the WMS will fully evaluate project-level alternatives that are consistent with the decision documents in conformance with the legal requirements of section 404 of the Clean Water Act, as implemented under the MOU between the EPA and the COE regarding implementation of section 404, as implemented under the Memorandum of Understanding for section 404 of the Clean Water Act for the CALFED Program. The level of analysis required for specific storage projects will depend upon the programs and related commitments of the CALFED Program, including those related to water use efficiency, water transfers, and the ERP, being implemented. Direct and indirect effects, as appropriate, will be addressed under section 7 or section 10 of the ESA.

Site-specific studies of storage opportunities will be coordinated under the ISI. Specifically, the ISI will evaluate surface storage, groundwater storage, power facility re-operation, and removal of barriers to fish passage and, where appropriate, the potential for conjunctive operation of these different types of storage. These investigations will contribute to compliance with the requirements, within the Clean Water Act Section 404 Guidelines, and pursuant to the MOU between EPA and the COE.

The range of total new storage evaluated in Phase II was from zero up to about six Million acre-feet (MAF). Maximum Sacramento River off-stream or enlarged on-stream surface storage potential is estimated to be about three MAF of storage, while south of Delta off-aqueduct surface storage potential is estimated to be about two MAF of storage. Other types of surface storage considered in Phase II include San Joaquin River tributary storage and in-Delta storage. The CALFED Program will evaluate the feasibility of expanding two existing reservoirs and constructing a new off-stream reservoir with a total capacity of 950 thousand-acre-feet (TAF); and a major expansion of groundwater storage for an additional 500 TAF to one MAF. In addition, the CALFED Program will study two potential reservoir locations through partnerships with local agencies.

The CALFED Program will continue to evaluate surface and groundwater storage opportunities; initiate permitting, NEPA and CEQA documentation; and proceed with construction, only if all conditions are satisfied. In addition, the CALFED Program will continue to refine and periodically update the WMS. ISI studies will evaluate the utility of specific storage projects in providing water quality, water supply reliability, and ecosystem benefits. This information, together with information gained from implementation of other CALFED Program elements and updated information on California's changing water management needs, will be considered in an Evaluation Framework. This Evaluation Framework will include: 1) a comprehensive hierarchy

of objectives for the CALFED Program; 2) well-defined measures of performance associated with the achievement of objectives; and 3) a basis for comparison of alternative long-term water management strategies. The Evaluation Framework will provide a structure for periodically updating the WMS and determining appropriate levels of the future investment in various water management tools.

Proposed Stage 1 Storage Actions

The CALFED Program will evaluate the following Storage actions proposed for implementation during Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the Storage program. Each storage action will require project-specific consultation under section 7 or a permit under section 10 of the ESA.

Groundwater Banking and Conjunctive Use The goal is to develop locally managed and controlled groundwater and conjunctive use projects with a total of 500 TAF to one MAF of additional storage. This effort includes developing partnerships with local agencies and landowners in both the north-of-Delta and south-of-Delta areas, and includes the potential construction of several south-of-Delta projects. Additional south-of-Delta and north-of-Delta projects, if feasible, could be constructed in later stages.

- Finalize agreements with new local project proponents for joint planning and development (yr 1).
- Begin feasibility studies (yr 1).
- Report on the performance of feasibility studies, implemented projects, and potential benefits and beneficiaries (yr 3).
- Implement early stages of the most promising projects (yr 1-5).
- Pursue implementation of additional projects (yr 1-7).
- Support legislation that supports groundwater management by local agencies at the sub-basin level.

Surface Storage CALFED Agencies identified a list of twelve potential surface storage projects that are in varying stages of the environmental review or feasibility process. Actions taken in Stage 1 will focus on completing the necessary studies (technical work and environmental reviews) needed before implementing or proceeding with the six surface storage projects:

- In-Delta storage project (approximately 250 TAF). CALFED will evaluate leasing or purchasing the Delta Wetlands project, and will evaluate initiating a new project, in the event that Delta Wetlands proves cost prohibitive or infeasible (Planning: yr 1-2, Construction: yr 3-7).
- Evaluate expanding CVP storage in Shasta Lake by approximately 300 TAF by raising the Shasta Dam by three to six feet (Planning: yr 1-4, Construction yr 6-7).
- Evaluate expanding Los Vaqueros Reservoir by up to 400 TAF with local partners as part of a Bay Area water quality and water supply reliability initiative. As an existing reservoir operated by the Contra Costa Water District (CCWD), the Los Vaqueros

Reservoir is subject to a number of mandates, agreements, and requirements in existing biological opinions. CALFED intends to work with CCWD and interested stakeholders to assure that previous commitments, including local voter approval required for expansion, are maintained (yr 1-7).

- Evaluate off-stream storage at Sites Reservoir, with a project capacity of up to 1.9 MAF (yr 1-5).
- Evaluate additional storage options in the upper San Joaquin River watershed. Consider additional storage capacity of between 250-700 TAF (yr 1-6).
- Evaluate enlarging Millerton Lake at Friant Dam or a functionally equivalent storage program in the region. The CALFED Program will join local partners to evaluate this project in Stage 1 (yr 1-6).

Power Facilities Re-operation Evaluation Evaluate the potential to re-operate some hydroelectric facilities to produce ecosystem benefits and water supply. The following ISI actions may be taken:

- Identify beneficiaries and negotiate cost sharing agreements (yr 1-7).
- Work with CALFED Agencies, the Public Utilities Commission, the SWRCB, the Federal Energy Regulatory Commission, and interested stakeholders to identify re-operation opportunities (yr 1-2).
- Develop environmental documentation on re-operation (yr 3-5).
- Perform feasibility studies and economic analyses (yr 3-5).
- Obtain permits, negotiate operating agreements, and seek site specific authorization including section 7 authorization. This may require design of facilities modifications to accommodate new operational priorities (yr 5-7).

Fish Migration Barrier Removal Evaluations To compliment ERP efforts to improve fish passage, the ISI Fish Migration Barrier Removal Program will identify obstructions, such as small dams, and consider modification or removal in order to restore anadromous fish access to critical upstream spawning and rearing habitat. The following actions will be taken:

- Work with CALFED Agencies, the SWRCB, local water agencies, and interested stakeholders to identify opportunities for modification or removal of obstructions such as small dams (yr 1-2).
- Develop environmental documentation (yr 3-5).
- Perform feasibility studies and economic analyses (yr 3-5).
- Obtain permits, negotiate agreements, and seek site specific authorization as required. This may require design on facilities modifications or removal actions. (yr 5-7).
- Identify beneficiaries and negotiate cost sharing agreements (yr 5-7).
- Begin construction (if needed) and begin new operations if conditions and linkages are satisfied (yr 6-7).

Conveyance

The CALFED Program will evaluate a through-Delta approach to conveyance based upon the existing Delta configuration with some modifications. The CALFED Program will evaluate the effectiveness of this conveyance approach, and add additional conveyance and/or other water management actions if necessary. The initial through-Delta conveyance will be continually monitored, analyzed, and improved to maximize the potential of the through-Delta approach to meet CALFED Program goals and objectives, consistent with the CALFED Program's Solution Principles. In the event of a finding that a through-Delta conveyance system is inadequate to achieve CALFED Program goals and objectives, additional actions may be implemented. The CALFED Program may also evaluate and pursue: 1) an isolated conveyance facility (a canal connecting the Sacramento River in the northern Delta to the SWP and CVP export facilities in the southern Delta); 2) source water blending or substitution; and/or 3) other actions through supplemental programmatic analysis.

As part of the Conveyance Program, the CALFED Program has incorporated the south Delta and north Delta regions to address conveyance improvements and related problems in Stage 1. Conveyance improvements for the South Delta set forth in the Final Programmatic EIR/EIS are identified as allowing SWP export capacity to increase from the current authorized levels with seasonal increases, as authorized in Corps Permit PN5820A. The proposed increases would allow up to 8,500 cfs pumping in 2003 and ultimately up to 10,300 cfs at the end of Stage 1. The EIR/EIS identifies a number of measures that will be part of the conveyance modifications including new fish screens, ecosystem restoration as part of the ERP, permanent operable barriers or their functional equivalent in selected South Delta channels, and other measures.

Improvements in export capabilities will be accompanied by associated operations which will maintain diversion capabilities for south Delta water users and provide for fish protection. CALFED implementing documents set forth a schedule for securing appropriate regulatory permits and completing a project-specific operations plan that addresses the potential impacts of increased pumping. This plan will need to reflect the nature and timing of the construction and operation of new project facilities and implementation of ecosystem improvements, and a more specific project description following completion of additional planning and environmental studies.

Decisions to implement conveyance actions will be predicated upon completing site-specific feasibility studies and complying with all environmental review and permitting requirements. Individual conveyance projects pursued under the WMS will fully evaluate all alternatives during tiered environmental review and will fully analyze and address direct and indirect effects under section 7 or section 10 of the ESA. Operational rules and facilities needed for use of additional export capability will be determined during ESA consultation on the project-specific environmental documentation prepared for the various conveyance elements.

Proposed Conveyance Stage 1 Actions (South Delta)

The CALFED Program will evaluate the following Conveyance actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the Conveyance Program.

- Pursue construction and evaluation of a 500 cfs test facility at the Tracy Pumping Plant to develop best available fish screening and salvage technology for the intakes to the SWP and CVP export facilities (yr 1-7).
- Pursue authorization for construction of a new screened intake for Clifton Court Forebay (CCFB) for the full export capacity of the SWP (yr 1-7).
- Implement the Joint Point of Diversion (JPOD) for the SWP and CVP (yr 1-7).
- Evaluate and decide on whether to retain a separate CVP intake facility or to consolidate with the SWP facility. An intertie between Clifton Court Forebay and the Tracy Pumping Plant will be required if the export location is consolidated at Clifton Court Forebay and will be evaluated if exports continue at both locations. Also, evaluate and potentially implement an intertie between the projects downstream of the export pumps (yr 1-7).
- Evaluate increased SWP pumping by 500 cfs from July through September (yr 1-4).
- Facilitate interim SWP export flexibility up to 8,500 cfs, with appropriate environmental constraints including ESA requirements (yr 4).
- Obtain permits including ESA authorization to use full SWP capacity of 10,300 cfs, consistent with all applicable operational constraints, for water supply and environmental benefits (yr 7).
- For purposes of the project level environmental analysis for the South Delta Improvements, evaluate various operable barrier configuration alternatives or their functional equivalents. All barrier operations will be done in conjunction with water operations to avoid impacts to fish. Potential barriers include the installation of a permanent fish migration barrier at the Head of Old River, and the construction of three permanent flow control structures at Old River at Tracy, Middle River upstream of Victoria Canal, and at Grant Line Canal. The Grant Line Canal barrier would be constructed and operated in accordance with conditions and directions specified by the USFWS, CDFG, and NMFS. (yr 1-7).
- Monitor barrier effects on fish, stages, circulation, and water quality (yr 1-7).
- Evaluate the dredging of selected channel segments (yr 3-7).

Additional Actions Required During Stage 1 (South Delta)

- Implement south Delta ERP goals (yr 1-7).
- Consolidate, extend, and screen local agricultural diversions based on priority and initiate a screen maintenance program (yr 1-7).
- Develop a strategy to resolve regional water quality problems including actions to improve San Joaquin River DO conditions and the San Joaquin River drainage as described in the CALFED Program's WQP. Evaluate the feasibility of re-circulation of water pumped from the Delta by the CVP and SWP. If feasible, and consistent with the CALFED Program's ecosystem restoration goals and objectives, implement a pilot program (yr 1-7).

- Continue implementation of the Vernalis Adaptive Management Plan. Include development of a long-term plan describing actions of the San Joaquin River Group Authority to improve water management practices (yr 1-7).

Proposed North Delta Stage 1 Actions

- Evaluate and implement improved operational procedures for the Delta Cross Channel (DCC) to address fishery and water quality concerns (yr 1-4).
- Evaluate a screened through-Delta facility with a diversion capacity of up to 4,000 cfs on the Sacramento River to improve drinking water quality in the event the water quality program measures do no result in continuous improvement toward CALFED drinking water goals. This evaluation would consider the effectiveness of water quality measures and how to operate the DCC in conjunction with this new diversion structure to improve drinking water quality, while maintaining fish recovery. If the environmental review demonstrates that this diversion facility is needed to address drinking water quality concerns, and can be constructed and operated without adverse effects to anadromous and estuarine fish, construction may begin late in Stage 1 subject to section 7 authorization (yr 1-4).
- Evaluate opportunities to resolve local flood concerns and create tidal wetlands and riparian habitat by constructing new setback levees, improving existing levees, and dredging channels in the north Delta, especially the channels of the lower Mokelumne River system. Any proposed channel modifications would be consistent with the CALFED Program's current direction on Delta conveyance and ecosystem goals (yr 1-7).
- Facilitate regionwide coordination of all CALFED Program related projects in the north Delta region (yr 1-7).

Proposed Stage 1 Actions Throughout the Delta Region

- Evaluate how water supplies can best provide a level of public health protection equivalent to Delta source water quality of 50 parts per billion (ppb) bromide and three parts per million (ppm) Total Organic Carbon (yr 1-7). This will include an equivalent level of investigation and studies on all of the actions which could be used to achieve the CALFED Program's targets.
- Evaluate the CALFED Program's progress toward measurable water quality goals and ecosystem restoration objectives, with particular emphasis on fish recovery (yr 6-7).
- Conduct additional environmental review to determine if construction of an isolated conveyance facility component of a dual Delta conveyance (presently not an element of the CALFED Program's Preferred Program Alternative) is warranted. A decision to construct such a facility would require separate environmental review and alternatives analysis that has not been done as part of the CALFED Program's programmatic analysis (yr 1-7).

Additional Actions Required During Stage 1 (Throughout the Delta Region)

- Fully implement actions, consistent with the MSCS, that mitigate for the direct and indirect environmental affects of project features and actions (yr 1-7).
- Improve flood control through levee improvements, levee setbacks, channel dredging, and floodplain restoration to be fully consistent with regional ERP actions (yr 1-7).
- Screen agricultural intakes to assure ecosystem protection (yr 1-7).

Environmental Water Account (EWA)

An essential goal of the CALFED Program is to provide increased water supply reliability to water users while at the same time assuring the availability of sufficient water to meet fish protection and restoration\recovery needs as one part of the overall ERP. As a means to achieve these objectives, the CALFED Program will provide commitments under the ESA and CESA to SWP and CVP export facilities only for the first four years of Stage 1. These commitments are based on fully providing water from existing regulatory means, a fully implemented EWA, flows and habitat restoration provided through the ERP, and the ability to obtain additional assets should they be necessary.

The EWA is a new water source provided to: (1) augment instream flows and Delta outflows; and (2) reduce Delta exports from CVP/SWP export facilities during key periods of fish and aquatic ecosystem concerns. The CALFED Agencies will also continue to work with other diverters in the Delta watershed to resolve local fishery-diversion conflicts based on the site-specific needs and opportunities for each diversion. The CALFED Agencies have crafted the EWA so that it has no effect on the existing water rights of other water right holders in the watershed.

Overall Purpose, Framework and Administration The EWA will be established, as part of the EWA Operating Principles Agreement (see Appendix B, hereby incorporated as part of this project description), to provide water for the protection and recovery of fish in addition to water available through existing regulatory actions related to project operations. The EWA Operating Principles Agreement will be interpreted to be consistent with this project description. To the extent that the EWA Operating Principles Agreement provides greater specificity, the EWA Operating Principles Agreement will be the controlling document.

The EWA will be funded jointly by the State and Federal governments and will be authorized to acquire, bank, transfer and borrow water and arrange for its conveyance. EWA assets will be managed by the State and Federal fish and wildlife agencies (the USFWS, NMFS, and CDFG) in coordination with project operators and stakeholders. Initial acquisition of assets for the EWA will be made by Federal and State agencies (Reclamation and DWR). Subsequently, it is anticipated that acquisitions may be made pursuant to a public process that may take advantage of other agencies or third parties to acquire assets.

Baseline Level of Protection DWR and Interior will provide a baseline of environmental protection. The CALFED Agencies recognize that the SWRCB may adjust the CVP and SWP

responsibilities for complying with the 1995 Delta Water Quality Control Plan (WQCP), as part of its on-going Bay-Delta Water Rights Hearings. The outcome of those hearings may affect the nature of this baseline. The CVP's and SWP's regulatory baseline, primarily for fish needs, identified as Tier 1 in the EWA discussion below, will include:

- **1993 Winter-run Salmon Biological Opinion (NMFS)**

- **1995 Delta Water Quality Control Plan (SWRCB)**
  At this time, the CVP and SWP are responsible for meeting flow related objectives contained in this plan. The CALFED Agencies recognize that the SWRCB may adjust or re-allocate the responsibilities for meeting the 1995 Delta Water Quality Control Plan, as part of its ongoing Bay-Delta Water Rights hearings. Adjustment of responsibility to meet the Plan does not affect the baseline level of protection for purposes of the EWA.

  Appropriate CALFED Agencies will develop a strategy to deal with the rare circumstances when the CVP obligation under the WQCP exceeds the 450 TAF annual cap for use of CVPIA Section 3406(b)(2) water. In the strategy, developed in conjunction with part of the Governor's Drought Contingency Plan, the Agencies will use their available resources to create an insurance policy to eliminate impacts to water users, while not adversely affecting other uses.

- **1995 Delta Smelt Biological Opinion (USFWS)**
  The export curtailment contained in the 1995 Delta Smelt Biological Opinion (item 2 on page 19), commonly referred to as the " 2 to 1 Vernalis flow/export ratio", will be met by Section 3406(b)(2) of the CVPIA and EWA. This objective calls for the SWP and CVP to reduce combined exports, below what is allowed in the 1995 Water Quality Control Plan during a 31-day period in April and May. The 1995 WQCP allows exports to be 100% of the base San Joaquin River flow at Vernalis during the April-May pulse period. The CVP reduction in pumping will be conducted pursuant to the accounting policy for Section 3406(b)(2) of the CVPIA and/or through reimbursement by the EWA. The SWP will be reimbursed by the EWA for its participation in reducing exports pursuant to the 2 to 1 Vernalis flow/export ratio.

  The CVP and SWP will be operated pursuant to the terms of the San Joaquin River Agreement through 2011. While the SJRA is in effect, the exports may be reduced beyond what is called for by the 2 to 1 Vernalis flow/export ratio and San Joaquin River flows may be augmented by water acquired from upstream sources during that same time period. Such an augmentation will not be included as part of the SWP share of Vernalis flow. While operating per the SJRA, the SWP and CVP will also receive reimbursement from the EWA or pursuant to Section 3406(b)(2) for the additional curtailment. If the SJRA is not implemented for any reason, the operations will default back to the biological opinion operation, as per the terms of the SJRA.

- **Full Use of 800 TAF Supply of Water Pursuant to Section 3406(b)(2) of the CVPIA in Accordance with Interior's October 5, 1999 Decision, clarified as follows**:

  Water Resulting from Refill of Reservoirs ("Reset"): Water which is available under the (b)(2) Policy as a result of refill of reservoirs following upstream releases ("reset") will not be used in a manner which results in increased export reductions. Upstream releases of (b)(2) water pumped by the SWP and made available to the EWA will not be subject to the "reset" provision.

  Export Curtailments which Result in Increased Storage ("Offset"): Where a prescribed (b)(2) export curtailment results in a reduction in releases from upstream reservoirs and hence increased storage, the charge to the (b)(2) account will be offset to the extent that the increased storage will result in increased delivery (beyond forecast delivery at the time of the export curtailment) to south-of-Delta CVP contractors in the remainder of the water year. If such deliveries cannot be increased in that water year, such additional water stored in upstream reservoirs shall be available for other (b)(2) uses without charge. Where the delivery to export users in the remainder of the water year will not be increased and end-of-year storage will be increased, there will be no offset to the charge to the (b)(2) account.

The Secretary of the Interior is expected to make a decision later this year on Trinity River flows, pursuant to the original Trinity authorization, the Trinity Restoration Act of 1984, and the CVPIA. The substance of the decision is unknown and therefore cannot be addressed at this time. It is separate and will not be affected by the ROD for the CALFED Program.

Other Environmental Protections The regulatory baseline above also assumes that other environmental protections contained in biological opinions, regulations or statutes remain in place. These protections include, without limitation, Level 2 refuge water supplies, as required by the CVPIA. The CVP will use its share of the benefits from joint point of diversion, to the extent available, to provide water required by its Level 2 refuge water supply mandates, but using such benefits will not create any limitation on the Level 2 supply available for refuges.

Operating Rules The ground rules for operating the EWA are detailed in the EWA Operating Principles Agreement, executed by DWR, Reclamation, CDFG, the USFWS, and NMFS. The ground rules are based on the principle that the EWA will provide flows allowing fish recovery while not resulting in uncompensated reductions in deliveries to south of Delta CVP/SWP contractors.

Asset Development Immediate development of assets for the first year is critical to EWA success. Initial water purchases and lease of groundwater storage will be secured from willing sellers by the end of 2000. In addition to assets to be acquired annually, as shown in a following table, an initial one-time acquisition of 200 TAF of south-of-Delta storage or its functional equivalent will be acquired from a variety of sources to assure the effectiveness of the EWA and provide assurances for SWP and CVP water supply/deliveries. This initial deposit will also provide

collateral for the first year's borrowing. The related storage is intended to function as long-term storage for other EWA assets as they become available.

Borrowing agreements will allow the EWA to borrow water from the CVP and SWP for necessary actions during a water year as long as the water can be repaid without affecting the following year's allocations. To the extent practicable, borrowing from the SWP and CVP will be shared. The limitations on borrowing will be developed as part of the agreement. Source shifting agreements with south-of-Delta water providers for 100 TAF will be used to enhance the effectiveness of the EWA, and to help provide assurance that SWP and CVP water deliveries will not be affected by EWA operations. To provide regulatory stability during the initial period of Stage 1, the CALFED Agencies will provide a commitment, subject to legal requirements, that for the first four years of Stage 1, there will be no reductions, beyond existing regulatory levels, in CVP or SWP Delta exports resulting from measures to protect fish under the ESA and CESA. This commitment will be based on the availability of three tiers of assets:

> **Tier 1** is baseline water, provided by existing regulation and operational flexibility. The regulatory baseline consists of the biological opinions on winter-run salmon and delta smelt, 1995 Delta Water Quality Control Plan, and 800 TAF of CVP yield pursuant to CVPIA Section 3406(b)(2).
>
> **Tier 2** consists of the assets in the EWA combined with the benefits of the ERP and is an insurance mechanism that will allow water to be provided for fish over and above Tier 1, when needed without reducing deliveries to water users. Tier 1 and Tier 2 are, in effect, a water budget for the environment and will be used to avoid the need for Tier 3 assets as described subsequently.
>
> **Tier 3** is based upon the commitment and ability of the CALFED Agencies to make additional water available should it be needed. It is unlikely that assets beyond those in Tier 1 and Tier 2 will be needed to meet ESA requirements. However, if further assets are needed in specific circumstances, Tier 3 will be provided. In considering the need for Tier 3 assets, the fish and wildlife agencies will consider the views of an independent science panel. Although the CALFED Agencies do not anticipate needing access to Tier 3 water assets, the CALFED Agencies will prepare an implementation strategy for Tier 3 by August 2001, establish a timely scientific panel process, and identifying tools and funding should implementation of Tier 3 prove necessary.

Table 1. List of EWA assets. Some assets may be replaced by functional equivalents, if determined to be appropriate by the EWA Managing Agencies (USFWS, CDFG, NMFS)

Action Description	Water Available Annually(Average)
SWP Pumping of (b)(2)/ERP Upstream Releases[1]	40,000 acre-feet[2]
EWA Use of Joint Point[3]	75,000 acre-feet
Export/Inflow Ratio Flexibility	30,000 acre-feet
500 cfs SWP Pumping Increase	50,000 acre-feet
Purchases - South of Delta	150,000 acre-feet
Purchases - North of Delta[4]	35,000 acre-feet
TOTAL	380,000 acre-feet
Storage acquisition	200,000 acre-feet of storage, filled when acquired in Year 1
Source-shifting agreement	100,000 acre-feet at any time

[1]The EWA and the SWP will share equally the (b)(2) and ERP upstream releases pumped by the SWP after they have served their (b)(2) and ERP purposes.

[2]The amount of water derived from the first four actions will vary based on hydrologic conditions.

[3]The EWA will share access to joint point, with the CVP receiving 50% of the benefits.

[4]This is the amount of water targeted for the first year; higher amounts are anticipated in subsequent years.

Science Program

The CALFED Science Program includes implementing the Comprehensive Monitoring, Assessment, and Research Program (CMARP) as an integral aspect of the overall CALFED Program. The scope of the Science Program will encompass all elements of the CALFED Program: ecosystem restoration, water supply reliability, water use efficiency and conservation, water quality, and levees integrity. The purpose of the Science Program is to provide new information and scientific interpretations necessary to implement, monitor, and evaluate the success of the CALFED Program. The Science Program will build on the work of the Interagency Ecological Program (IEP) and other scientific efforts in the CALFED Program area.

The CALFED Program is organized around the concept of adaptive management because there is incomplete knowledge of how the ecosystem functions, the effects of human stressors on ecosystem structure and function, and the ecological and other effects of individual CALFED Program

actions. Monitoring key system functions (or indicators), completing focused research to obtain better understanding, and staging implementation based on information gained are all central to the adaptive management process.

In order to better integrate scientific review into the CALFED Program, the Governor and the Secretary of the Interior will appoint an independent science board to provide oversight and peer review for the overall program. Also, specific independent science panels may be convened as standing bodies or on an as needed basis. For example, the Science Program will assist with convening an independent science panel t review the implementation and operation of the EWA. In addition, the existing ERP Interim Science Board will likely become the ERP Science Panel, and provide ongoing independent review of the ERP.

The CALFED Science Program will accomplish the following in stage 1:

- Appoint and independent science board for the CALFED Program as a whole by the middle of 2001.
- Appoint and independent science panel for the EWA by the middle of 2001.
- Coordinate existing monitoring and scientific research programs.
- refine the set of ecological, operational , and other predictive models that will be used in the evaluative process by the end of 2001.
- Establish performance measures and indicators, and a consistent strategy of on-going development of these, for each of the program areas.
- Develop an annual science report, format and content, which includes:

    - **S** Status of the species and effectiveness of efforts to improve conditions, including EWA, ERP and water management strategies, and provide recommendations to maximize fishery benefits while minimizing impacts to water supply.
    - **S** Assessment of progress and effectiveness of each program element as indicated by performance measures and indicators.
    - **S** Complete feasibility study to establish and construct CALFED Science Center
    - **S** Recommend research and/or program adjustments.

- Prepare first annual report by the end of 2001

CALFED intends to invest approximately $ 300 million in the science program during stage 1.

<u>Other Proposed Science Program Stage 1 Actions</u>

In addition, the CALFED Program will evaluate the following Science Program actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions for the Science Program.

- Periodic review and refinement of the monitoring, data assessment and research plan from a long term perspective (yr l-7).

- Periodic review and refinement of the monitoring, data assessment and research plan from a short term perspective which would include all elements of the Phase III, Stage 1 Program (yr l-7).
- Help management define triggers and time periods which determine the need for a change in program direction (yr l-7).
- Continue to develop and refine conceptual models to be used in evaluating actions undertaken by the programs. In keeping with the adaptive management format, the models will be continually updated with information generated by program actions (yr l-7).
- Evaluate the effectiveness of the adaptive management process on the program decision making process (yr l-7).
- Review the progress toward achieving overall CALFED Program goals and objectives and whether individual programs are progressing at similar paces (yr l-7).
- Complete monitoring identified by the Diversion Effects on Fisheries Team to provide feedback on actual diversion effects of south Delta pumps (yr 2-7).
- Design long-term, system wide, baseline monitoring with focused research to increase understanding of ecological processes and ways to reduce uncertainty; definition of needed studies is currently under development (yr 1-7).
- Provide available data on need to reduce bromides, total dissolved solids, total organic carbon, pesticides and heavy metals (yr 5).
- Provide available data on water quality in the south Delta and lower San Joaquin River (yr l-7).
- Monitor and assess the impacts of water use efficiency measures on water demands and available supplies, and develop better information for water balances in the Bay-Delta system (yr l-7).
- Prepare annual reports on status and progress, including such information as: performance of habitat restoration actions compared to expected results, summaries of any new information on the relative importance of various stressors, and any need for adjustments in actions or conceptual models (yr l-7).
- Analyze status and need for adjustments of actions for later stages (yr 5-7).
- Monitor and report land use changes, such as agricultural land conversion, resulting from CALFED Program actions (yr 2-7).
- Hire an interim science leader and subsequently hire a chief scientist (yr 1-2).
- Appoint an Independent Science Board and an independent science panel for the EWA (yr 1-2).
- Coordinate existing monitoring and scientific research programs (yr 1-7).
- Refine the set of ecological, operational, and other predictive models that will be used in the evaluation process (yr 1-2).
- Establish and refine performance measures and indicators for each of the program areas (yr 1-7).

Multi-Species Conservation Strategy (MSCS)

The MSCS serves as a biological assessment for the CALFED Program and describes the CALFED Program strategy for achieving compliance with the ESA, CESA, and Natural Community Conservation Planning Act during implementation of the CALFED Program. As a biological assessment, it summarizes the CALFED Program and analyzes its effects on 244 listed, proposed, and candidate species, and species of concern. As a "conservation strategy" it outlines conservation goals for species that will be effected by the Program, and identifies strategies for achieving those goals and ESA compliance.

Conservation Goals and Prescriptions

The MSCS identifies conservation goals for 244 species as well as species prescriptions and conservation measures to achieve these goals. The CALFED Program has established a goal to recover 19 species, contribute to the recovery of 25 species, and maintain 200 species. A goal of "recovery" was established for those species whose recovery is dependent on restoration of the Delta and Suisun Bay/Marsh systems. Recovery is achieved when the decline of a species is arrested or reversed, threats to the species are neutralized, and the species long-term survival in nature is assured. Recovery is equivalent, at minimum, to the requirements for de-listing a species under ESA and CESA. With respect to anadromous salmonids within the MSCS Focus Area, recovery is equivalent, at a minimum, to completing the actions within the ERP Ecological Management Zones that are required for delisting a species under the federal and state ESAs. The goal "contribute to recovery" was assigned to species for which CALFED Program actions affect only a limited portion of the species' range and/or CALFED Program actions have limited effects on the species. To achieve the goal of contributing to a species' recovery, the CALFED Agencies are expected to undertake some of the actions under its control and within its scope that are necessary to recover the species. The goal "maintain" was assigned to species expected to be minimally affected by CALFED Program actions. For this category, the CALFED Agencies will avoid, minimize, and compensate for any adverse effects to the species commensurate with the level of effect on the species. Actions may not actually contribute to the recovery of the "maintain" species; however, at a minimum, they will be expected to not contribute to the need to list a species or degrade the status of a listed species. The CALFED Agencies will also, to the extent practicable, improve habitat conditions for these species.

Specific prescriptions were developed to achieve the conservation goals described above for each species. The prescriptions incorporate the measures identified in State and Federal recovery plans, where available, other relevant information, and professional judgment. Prescriptions include measures to enhance habitats and species and are not directly linked to the CALFED Program's adverse impacts.

As the CALFED Program proceeds during the next 30 years, it is anticipated that California's landscapes could change significantly and that new information will be available through research and monitoring. Consequently, species goals and prescriptions will likely change through time through adaptive management, and as new recovery plans are finalized or updated.

Framework for Federal Endangered Species Act Compliance

The CALFED Agencies will take actions necessary to meet the following conditions: 1) the fishery protections elements of the Program must be implemented as descried in the EIS/EIR, including the ERP and EWA implementation and funding commitments; 2) Tier 3 measures must be provided, if and when needed; and, 3) implementation of the milestones must be demonstrated; and 4) the initial and annual assets of the EWA must be acquired for the EWA.

The program will be continuously monitored to ensure that it is implemented as intended and the elements necessary for regulatory commitments, i.e., conditions as described in the Conservation Agreement are implemented. In the event that information from monitoring or any other source indicates that any of the Program elements necessary for regulatory commitments are not being met or will not be met, notification will be provided, by the agency which developed the information, to the affected Agencies, as appropriate. Upon notification, the affected agencies will meet promptly to identify and assess measures which can be taken to remedy any noncompliance or anticipated noncompliance with the conditions, and will immediately implement measures. If NMFS determines that a situation of noncompliance exists and the affected agencies are unable to remedy noncompliance within a reasonable time period that NMFS prescribes, not to exceed 60 days, the regulatory commitments will be suspended or terminated. Upon a determination of noncompliance, formal consultation will be reinitiated and NMFS will issue a new or amended biological opinion with conditions prescribing alternative regulatory requirements. If the compliance with the conditions set out above is subsequently achieved, the initial regulatory commitments may be revised and reflected through new or amended programmatic biological opinions. Nothing described here will affect NMFS from exercising our regulatory authority.

The MSCS describes program-level strategies to achieve compliance with ESA, including strategies to address the indirect effects of actions taken under the CALFED Program, and strategies for completing tiered consultations, as appropriate. The CALFED Program's compliance strategies will, in part, be developed and implemented as part of future CALFED Program projects tiered from this programmatic biological opinion.

Entities implementing CALFED Program actions which may effect listed species will be required to develop Action Specific Implementation Plans (ASIPs). ASIPs will be developed for individual CALFED Program actions or groups of actions when enough detailed information is available about the actions to analyze fully their impacts on species and habitats, and develop appropriate measures to avoid, minimize, and compensate for impacts. Specifically, individual projects that qualify for consultation will be evaluated within the context of the program as a whole, which includes major elements designed to improve the environmental baseline and lead to the recovery of targeted species. These major elements will be subject to on-going monitoring, evaluation, and the application of adaptive management. Site specific biological opinions will take into account the environmental benefits that accrue from the CALFED Program.

Service Area Effects

Implementation of the CALFED Program's Preferred Program Alternative related to water supply reliability will be determined largely in an incremental fashion through an adaptive management process. Because of this, it is not possible to accurately estimate the scope of potential service area effects on species and habitats. Project-level or site-specific impacts may not be known until Phase III of the CALFED Program (implementation). Therefore, the CALFED Program strategy for addressing indirect effects in the service areas includes identifying a short-term strategy based on critical species needs for recovery and restoration, and a long-term strategy for dealing with impacts that cannot be predicted when the biological opinions are issued.

CALFED Agencies will use a two-step process to address potential service area effects that are currently unknown. First, CALFED Agencies will determine the potential presence and scope of any service area effects. Then, to address the effects it has identified, CALFED Agencies will integrate proactive, conservation planning approaches with specific conservation measures. To do this, CALFED Agencies will develop the four conservation measures listed below during Phase III.. These measures, as described in the MSCS on pages 4-17 and 4-18, attempt to address these effects at the project level and at the program level.

- Providing technical assistance and other support to entities preparing Habitat Conservation Plans (HCPs) or conservation programs addressing effects of land use changes in the service areas.
- Evaluating each future water supply reliability program or project during planning and including appropriate measures to address indirect effects in the ASIPs. This may include implementing the applicable conservation measures already in the MSCS to conserve species relative to service area effects or developing new measures.
- Developing or contributing to conservation programs to address the critical needs of species in CALFED Program service areas not already covered by conservation plans.

Governance Plan

The interim governance structure will be in place from the time of the Programmatic ROD until a long-term permanent structure is adopted through State and Federal legislation. For interim governance, CALFED Agencies propose adoption of the current CALFED Program structure being used during the planning stage, but adapted for implementation. The interim governance structure, including identification of how decisions will be made, will be set forth in a new Implementation MOU which the agencies will develop and execute by the time of the ROD. The current structure is made up of the Policy Group reporting to the Governor of California and the Secretary of the Interior, public advisory groups, the CALFED Program Executive Director and staff, and State and Federal agencies and teams. This structure, with additions and modifications, will serve to bridge the gap until a permanent commission is established.

Interim Program Management Responsibilities The LSIP management will remain with DWR, CDFG, and other existing agencies. The CALFED Program will continue to manage the ERP, in

coordination with the appropriate agencies. The State and Federal fish and wildlife agencies (CDFG, USFWS, NMFS) will manage the EWA assets, in coordination with the ERP and water project operations (Reclamation and DWR). CALFED Program will be assigned program management for the WP. The CALFED Program and appropriate agencies (such as Reclamation, EPA, DHS, DWR, and SWRCB) will manage the WQP. For the WTP, CALFED Program will provide program direction, oversight, and coordination among CALFED Program areas and among agencies with jurisdiction over water transfers and use of project facilities. Agencies with jurisdiction over water transfers would retain authority to implement any changes in their own policies or procedures. DWR, Reclamation, and CALFED Program will manage the WUEP. DWR, Reclamation, and CALFED Program will manage the Storage Program Element. Reclamation and DWR will manage the Conveyance Program element. CALFED Program will manage the Science Program (as consistent with the Implementation MOU).

Milestones

Milestones are a list of ERP, MSCS, and WQP actions the CALFED Program will fully implement in Stage 1 to address covered species. Milestones are a subset of the ERP actions the fish and wildlife agencies expect will be implemented in Stage 1, to achieve the Program's conservation goals. The complete list of milestones appears in Appendix C. A full description of the function and significance of the milestones to this consultation is included in the Appendix.

The Program's objectives for ecosystem restoration are to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse plants and animal species. The ERP, MSCS, and WQP are the principal Program elements designed to meet these objectives. Implementation of the ERP will be informed by the Science Program, which will conduct pertinent research, and monitor and evaluate the implementation of ERP, MSCS, and WQP actions. The ERP, MSCS, WQP, and the Science Program are directly relevant and important for FESA, CESA and NCCPA compliance. To ensure that the ERP, MSCS, and WQP are implemented in a manner and to an extent sufficient to sustain programmatic FESA, CESA and NCCPA compliance for all Program elements, the USFWS, NMFS and CDFG (fish and wildlife agencies) have developed Milestones for ERP, MSCS, and WQP implementation. The Milestones include Science Program actions that are relevant for ERP, MSCS, and WQP implementation. The fish and wildlife agencies have concluded that the Milestones, if achieved along with expected additional ERP actions, define an adequate manner and level of ERP, MSCS, and WQP implementation for Stage 1.

The ERP, MSCS, and WQP are the Program's blueprint for the restoration of the Bay-Delta. The MSCS is not a separate blueprint or supplemental restoration program and does not supplant the ERP. The measures and goals in the MSCS are consistent with the ERP's measures and goals. However, the MSCS is a conservation strategy and a regulatory compliance strategy for the entire Program. The MSCS addresses the potential adverse effects and beneficial effects of all Program actions, including ERP actions and other Program actions such as levee system integrity actions, water conveyance actions and storage actions. Based in large part on the ERP, the MSCS' premise is that the Program as a whole, including all Program elements, will improve and increase

aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta. The ERP therefore serves two purposes: 1) to achieve Program objectives for ecosystem restoration and species recovery, and 2) to enable actions from all Program elements to be completed in compliance with FESA, CESA and the NCCPA through implementation of ASIPs.

To serve both of these purposes, ERP implementation must be informed both by the best available scientific information and by information about the implementation of other Program actions. Information about the implementation of other Program actions is necessary to ensure that they do not conflict or limit the success of the ERP. In addition, ERP restoration actions must be implemented concurrent, and at a commensurate level, with the implementation of other Program actions to ensure that the Program as a whole continues to increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta. The Milestones are intended to establish, based on the best information currently available, a group of actions derived from the ERP, MSCS, and WQP that 1) establish an adequate level of implementation during Stage 1, 2) would not be inhibited by proposed Stage 1 actions in other Program elements, and 3) would enable proposed Stage 1 actions in other Program elements to be completed in compliance with FESA, CESA and the NCCPA through implementation of ASIPs.

The Program's development of annual, near-term, and long-term ERP implementation priorities and strategies will be based on the goals and objectives of the ERP Strategic Plan, the MSCS, FESA recovery plans, and implementation plans developed for specific ecological management zones, and will be informed by the Science Program. The Milestones represent the MSCS' goals and objectives with respect to the ERP. As with ERP implementation priorities and strategies generally, the fish and wildlife agencies intend that the Science Program will provide information concerning the Milestones. Specifically, the fish and wildlife agencies will seek review within the Science Program of 1) whether other Program elements conflict with implementation priorities and strategies so as to limit the success of the ERP, MSCS, and WQP, and 2) whether the implementation priorities and strategies will ensure that the Program as a whole continues to increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta. As the Science Program develops information about implementation, the USFWS, NMFS and CDFG will revise the Milestones as necessary, consistent with the FESA and the NCCPA.

The CALFED Program will develop annual ERP implementation plans using the ERP Strategic Plan for Ecosystem Restoration and the MSCS. Members of the Science Program, the Agency/Stakeholder Ecosystem Team ("ASET") the CALFED Program will work cooperatively to develop annual ERP implementation plans and to define the long-term priorities for the ERP. The fish and wildlife agencies will participate fully in the process for developing annual ERP implementation plans. The fish and wildlife agencies' participation will include, but not be limited to, participation in the ASET. Through participation in the annual ERP implementation plan process, the fish and wildlife agencies will help ensure 1) that each plan is based on the best available information regarding ecosystem restoration and the Bay-Delta system, 2) that each plan will achieve substantial progress toward meeting the Milestones, and 3) that the Science Program will provide information to achieve applicable Milestones. As new information becomes available and conceptual models are tested and refined as part of this process, the fish and

wildlife agencies anticipate that priorities reflected in the Milestones may change, and that new issues or questions may emerge. Through the annual ERP implementation process, Science Program members, the CALFED Program, and ASET members may propose revisions to the Milestones based on pertinent new information. If the fish and wildlife agencies determine that the proposed revisions are warranted and are consistent with FESA and the NCCPA, the Fish and wildlife agencies will revise the Milestones accordingly.

The Fish and wildlife agencies will not approve revisions to the Milestones that would cause or allow an effect to Covered Species or critical habitat designated under FESA that was not considered in the programmatic regulatory determinations, or would otherwise require the re-initiation of consultation under 50 CFR §402.16. Consequently, the USFWS and NMFS expect that their approved revisions to Milestones can be incorporated in each agency's programmatic biological opinions without re-initiating consultation under §7 of FESA. CDFG will incorporate its approved revisions to the Milestones by amending the CDFG Approval and Supporting Findings for the MSCS.

It will not be possible to gauge the progress of Milestone implementation for a few years, once Phase III begins. Consequently, over the first four years the Wildlife Agencies will base success of Program Implementation upon the criterion that the ERP is fully funded (at least $150 million from dedicated funding sources annually through Stage 1 for the ERP, and an additional $50 million EWA funding annually for the first four years). However, the criterion for success at the end of Stage 1 will be implementation of the Stage 1 Milestones.

The Program will submit an annual report to the Governor, the Secretary of the Interior, the State Legislature and the Congress that describes the status of implementation of all Program elements by December 15 of each calendar year. The report will document the status of all actions taken to meet Program objectives in Stage 1. Among the actions addressed in the report will be the completion of key projects and milestones identified in the ERP. Progress in achieving the ERP-MSCS Milestones will be included in the portion of the annual reports concerning the ERP.

Summary of Key Planned Actions

If key program actions are not implemented at this programmatic level, or new information becomes available, consultation would be reinitiated at the programmatic level to ascertain how the lack of implementation of any actions, or new information, effects the evaluation of effects upon listed species associated with the overall implementation of the suite of actions being considered and the subsequent conclusions made in this biological opinion. The following key actions are considered relevant to this biological opinion and part of the project description and, are therefore, requisite in conducting the effects analysis:

Program-wide

1. The conservation actions described in the Description of the Proposed Action will be implemented, including, but not limited to, the ERP Plan, the WQP Plan, the WP Plan, and

the MSCS and, where applicable, its strategy for addressing indirect, service area effects. The determination of whether and to what extent a specific action results in indirect effects will be made on a case by case basis in accordance with legal requirements. These actions will be implemented consistent with the Science Program and adaptive management, as described in the **Description of the Proposed Action**.

2. CALFED Agencies will obtain funding sufficient to implement the conservation elements and strategies, as necessary, to implement this biological opinion.

3. The various CALFED Program elements, strategies, and projects will be implemented in concert with the ERP, MSCS, EWA, and WQP to achieve the multiple goals of the CALFED Program. The CALFED programs will be implemented such that the net effects to species and their habitats are positive and are consistent and in conformance with State and Federal recovery goals.

4. To the extent that a CALFED action is not subject to Section 7 of the ESA and is likely to result in the take of listed species, a permit under section 10 of the ESA will be required

5. The CALFED Program will utilize comprehensive monitoring and adaptive management to assess projects and programs.

6. The CALFED Program will implement projects to achieve the milestones (Appendix C) established for the ERP, MSCS, and WQP.

7. Discharges into surface water bodies and waterways resulting from CALFED Program actions will comply with the standards set forth in the Description of the Proposed Action for the biological opinion on the Environmental Protection Agency's Promulgation of Numeric Criteria for Priority Toxic Pollutants for the State of California; California Toxics Rule (CTR) (USFWS File No. 1-1-98-F-21), in accordance with applicable implementation plans.

8. Entities implementing CALFED Program actions will comply with all applicable environmental laws.

9. DWR, to the extent required by law, and Reclamation will consult on all new and modified water contracts from a CALFED Program action that may affect listed species.

Levee System Integrity Program

10. Levee integrity improvement elements will be consistent with ERP actions and MSCS conservation measures, so that levee integrity and ecosystem and species recovery advance simultaneously.

11. The USFWS, NMFS, and CDFG will be involved in planning Levee System Integrity Program projects to ensure that ERP implementation is not impaired by levee program actions and adverse effects of levee actions are fully mitigated.

12. Development and implementation of CALFED Program plans for rehabilitating Suisun Marsh levees will be consistent with the goals of the ERP and MSCS, including State and Federal recovery plans.

13. Levee repair/improvements will be constructed using levee set-backs and soft-fixes (bio-technical solutions) to the extent practicable.

Water Quality Program

14. The CALFED Program will implement projects to achieve the milestones established for the WQP in Stage 1.

Ecosystem Restoration Program

15. The CALFED Program will implement projects to achieve the milestones established for the ERP in Stage 1.

16. The ERP will be implemented in a manner that will achieve species prescriptions and recovery goals of covered species by year 30 of the CALFED Program. Stage 1 milestones establish the trajectory for achieving recovery goals for the first 7 years.

Water Use Efficiency Program

17. Development and implementation of the WUEP will be consistent with the goals and objectives of the ERP and MSCS, including State and Federal recovery plans. Program actions and associated conservation measures will be planned in conjunction with the USFWS, NMFS, and CDFG, in compliance with FESA, CESA, and NCCPA, as appropriate. Program development will be coordinated with other CALFED Programs (WQP, ERP, MSCS, and Science Program).

Water Transfers Program

18. No water transfers resulting from CALFED Program actions will occur if they would result in adverse effects on fish and wildlife until consultation under section 7 is completed or section 10 permit is issued. Reclamation and DWR will consult on all proposed 3rd party water transfers that may affect listed species and their native habitats, as appropriate. Additionally, the EWA will not be charged for curtailed 3rd party transfer opportunities.

19. EWA, CVP, and Level 4 Refuge water supply transfers will have priority for conveyance over other transfer obligations (as consistent with the Operating Principles Agreement for the EWA).

Watershed Program

20. Development and implementation of the Watershed Program will be consistent with the goals of the ERP and MSCS, including State and Federal recovery plans. Program actions will be planned in conjunction with the USFWS, NMFS, and CDFG, in compliance with FESA, CESA, and NCCPA, as appropriate. Program development will be coordinated with other CALFED Programs (WQP, ERP, MSCS, and Science Program). Program actions will be funded so that it is assured that appropriate conservation measures for listed species will be included in program actions, as appropriate.

Water Management Strategy

Specific key actions are provided for storage, conveyance, EWA, and other programs.

Storage

21. Storage sites will be selected through a screening process which includes applicable environmental requirements.

22. Following the initiation of consultation, CALFED Agencies will comply with section 7(d) of the ESA, which prohibits making any irreversible or irretrievable commitment of resources, for any potential new storage site or modified storage site prior to achieving project-specific compliance under section 7(a)(2) of the ESA.

23. Tiered project specific analyses of potential storage improvements will identify and result in the selection of alternatives that are capable of being mitigated with appropriate mitigation sites and operational requirements; where the compensatory mitigation is highly likely to be successful; with the project specific compensatory mitigation implemented concurrent with, or in advance of, the adverse effects associated with construction and implementation of the project; where construction and operation of the project will not result in jeopardy to listed or proposed species or adverse modification of critical habitat; and where the project will not result in substantial degradation of the aquatic environment.

24. Conveyance structures (e.g., canals, pipelines), recreation, roads, and similar developments associated with or proposed in conjunction with proposed expansions of existing storage facilities or proposed new storage facilities will be evaluated thoroughly for their impacts to Federal or State listed species and those species evaluated consistent with the MSCS, as appropriate. If, through the informal or formal consultation process, it is determined by the USFWS, NMFS, and CDFG (for State listed species) that project-related impacts would threaten the long-term viability of Federal or State listed species or

those species evaluated under the MSCS, the proposed project(s) will be modified or dropped from consideration.

Conveyance

25. To the extent consistent with the Service's regulatory authority, any CALFED agency that proposes to develop water for delivery or application outside current contract service areas would comply with ESA requirements under section 7 or 10, as appropriate, if listed species may be affected.

26. In proceeding with the South Delta Improvement Program, CALFED Agencies shall implement ecosystem restoration in the lower San Joaquin river and south Delta (generally, south of Empire Cut) in advance of or concurrent with impacts resulting from south Delta facility improvements.

27. When the CDFG, NMFS and Service, in consultation with the CALFED Agencies, determine that a diversion requires screening, CALFED Agencies will secure written agreements from willing land owners to allow access for screening of agricultural and municipal diversions to protect fish consistent with the screening priorities established by the CALFED Program. The agreement will provide that if monitoring is necessary, access for monitoring will be allowed with reasonable notification. If the CALFED Program is not substantially achieving screening program objectives, the CALFED Agencies will reinitiate informal or formal consultation.

28. When implementing EWA export reductions, the water cost associated with decreased exports will be charged against current facilities capabilities as constrained by current regulation. Any future increases in exports resulting from CALFED conveyance improvements will have operational rules developed through consultation with the fish and wildlife agencies to ensure consistency with EWA Operating Principles, and the goals of restoration and recovery for aquatic species.

29. In the interim, prior to installation of permanent operable barriers, DWR will apply for and obtain permits to allow the continued operation of the temporary barriers.

30. Prior to increasing pumping above current authorized levels, operational rules for use of additional export capability will be determined through an open CALFED process and ESA consultation on the project-specific environmental documentation prepared for the various conveyance elements. To offset potential impacts and to provide for recovery of fishery populations, additional measures will be developed which would allow for protection of fish. These additional measures may include, which are phased over time, but are not limited to (a) screening, (b) new standards which limit the timing and magnitude of exports and water supply releases at key periods of fish concern, or (c) a combination of the two. ESA coverage for such actions would come from separate consultation for OCAP or in consultations tiered from this opinion.

31. An isolated conveyance facility will be evaluated as an alternative in the event it is determined that a through-Delta system will not accomplish the CALFED Programs' goals for restoration and recovery of listed species, or its WQP goals. The study will be developed through a peer-review process to ensure objective analysis.

EWA

32. All EWA fixed assets (i.e., purchases) are acquired each year.

33. The EWA Operational Principles Agreement is signed and fully implemented.

34. The project agencies shall request clarification with the USFWS, CDFG and NMFS on any points that appear to be ambiguous related to fishery actions for the EWA.

35. If EWA assets are depleted and the USFWS, NMFS, and CDFG determine Tier 3 is necessary, Tier 3 assets will be available to protect fish.

36. As new water storage and conveyance projects are being planned, potential fishery impacts will be assessed. If necessary, to offset potential impacts and to provide for recovery of fishery populations, operational rules will be developed which would allow for protection of fish. These operational rules may include but not limited to (a) limits on the timing and magnitude of exports and water supply releases at key periods of fish concern, and (b) new sharing formulae to increase EWA assets, which would allow the EWA to offset impacts and implement restoration actions. ESA coverage for such actions would come from separate consultation for OCAP or in consultations tiered from this opinion, as appropriate.

Science Program

37. The Science Program will complete annual reports describing program progress and compliance of all CALFED program actions within this biological opinion.

Multi-Species Conservation Strategy

38. CALFED agencies will consult with NMFS or request technical assistance, as appropriate, to determine whether any future CALFED Program actions (including water transfers and permanent assignment of water) may affect listed or proposed species before signing a ROD or a FONSI which is tiered from the PEIS. This determination will consider both direct and indirect effects, if any, of specific actions. Evaluation of whether and to what extent the specific action results in indirect effects will be made on a case by case basis in accordance with legal requirements.

39. The list of evaluated species will be reviewed and revised periodically by the USFWS, NMFS, and CDFG to add and remove species, as appropriate, and to review the recovery objective (R, r, or m) for species for their appropriateness.

40. NMFS will work closely with other CALFED agencies, water users and others, providing them with maps of listed species habitats within service areas. NMFS will guide entities through the consultation process or provide technical assistance, as appropriate, to address project-specific effects.

41. Entities implementing CALFED Program actions will complete tiered, project-specific consultation with the USFWS, NMFS, and CDFG, as appropriate, through completion of ASIPs, as described in the MSCS.

42. The CALFED agencies will closely coordinate with the USFWS, NMFS, and CDFG during development and implementation of all ASIPs.

43. To the extent that the CALFED Program actions result in changes to land use practices and the impact analysis required by the MSCS shows effects to listed species, ESA, CESA and NCCPA compliance, as appropriate, will occur. The strategy for addressing impacts as described in the MSCS includes appropriate tools such as: (1) assisting with or contributing to completion and implementation of HCPs that address service area effects, as described in section 10(a) of the ESA; (2) including measures to address indirect effects in ASIPs and completing project-specific section 7 consultations on the ASIPs; (3) contributing towards or developing and implementing a conservation program that addresses species critical needs; and implementing the applicable conservation measures, relative to service area impacts, already in the MSCS.

44. The CALFED Program will monitor the baselines of the species addressed in this opinion. Monitoring (for the life of the CALFED Program's Preferred Program Alternative) will be implemented immediately to test and track the CALFED Program's objective that species' baseline's are stable or increasing.

45. Any project-specific effects to listed species will be consulted upon following project-specific analysis and prior to the effect, and the CALFED agencies shall be adequately funded and staffed to complete tiered project-specific consultations from this opinion and track implementation of conservation actions.

II. Status of Listed Species and Critical Habitat

The **Sacramento River winter-run chinook salmon** (*Oncorhynchus tshawytscha*) are listed as endangered under the ESA (January 4, 1994, 50 FR 440). This Evolutionarily Significant Unit[1] (ESU) consists of the Sacramento River population in California's Central Valley. Designated critical habitat for Sacramento River winter-run chinook salmon includes the waterways, bottom, and water of the waterways and adjacent riparian zones of the Sacramento River from Keswick Dan, Shasta County (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge (June 16, 1993, 58 FR 33212). This critical habitat designation includes the river water, river bottom (including those areas and associated gravel used by winter-run chinook salmon as a spawning substrate), and the adjacent riparian zone used by fry and juveniles for rearing. In areas westward from Chipps Island, including San Francisco Bay to the Golden Gate Bridge, it includes the estuarine water column, essential foraging habitat, and food resources used by the winter-run chinook salmon as part of their juvenile out-migration or adult spawning migration.

Central Valley spring-run chinook salmon (*O. tshawytscha*) are listed as threatened under the ESA (September 16, 1999, 64 FR 50394). This ESU consists of spring-run chinook salmon occurring in the Sacramento River Basin. Designated critical habitat for Central Valley spring-run chinook salmon includes all river reaches accessible to listed chinook salmon in the Sacramento River and its tributaries in California, except for reaches on Indian lands. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge (February 16, 2000, 65 FR 7764). This above critical habitat designation include all waterways, substrate, and adjacent riparian zones. Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years); and (3) Indian tribal lands.

Central Valley steelhead (*O. mykiss*) are listed as threatened under the ESA (March 19, 1998, 63 FR 13347). This ESU consists of steelhead populations in the Sacramento and San Joaquin River Basins in California's Central Valley. Designated critical habitat for Central Valley steelhead includes all river reaches accessible to listed steelhead in the Sacramento and San Joaquin rivers and their tributaries in California, except for reaches on Indian lands. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez

[1]For purposes of conservation under the Endangered Species Act, an Evolutionarily Significant Unit (ESU) is a distinct population segment that is substantially reproductively isolated from other conspecific population units and represents an important component in the evolutionary legacy of the species (Waples 1991).

Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years); (3) Indian tribal lands; and (4) areas of the San Joaquin River upstream of the Merced River confluence (February 16, 2000, 65 FR 7764).

Central California Coast steelhead (*O. mykiss*) were listed as threatened by NMFS on August 18, 1997 (62 FR 43937). This ESU includes all naturally-produced steelhead (and their progeny) in coastal California streams from the Russian River to Aptos Creek, and the drainages of Suisun, San Pablo, and San Francisco Bays. Critical habitat was designated for the Central California Coast steelhead ESU on February 16, 2000 (65 FR 7764), and includes all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Russian River to Aptos Creek, California (inclusive), and the drainages of San Francisco, San Pablo, and Suisun Bays. Also included are all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay to the Golden Gate Bridge. Excluded are areas above specific dams or above longstanding naturally impassable barriers

Following are descriptions of the general life histories and population trends of listed species that may be directly or indirectly affected by the proposed action.

A. Chinook Salmon

1. General Life History

Chinook salmon historically ranged from the Ventura River in southern California north to Point Hope, Alaska, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991).

Of the Pacific salmon, chinook salmon exhibit arguably the most diverse and complex life history strategies. Healey (1986) described 16 age categories for chinook salmon, 7 total ages with 3 possible freshwater ages. Two generalized freshwater life-history types were described by Healey (1991): “stream-type” chinook salmon reside in freshwater for a year or more following emergence, whereas “ocean-type” chinook salmon migrate to the ocean within their first year.

Chinook salmon mature between 2 and 6+ years of age (Myers *et al.* 1998). Freshwater entry and spawning timing are generally thought to be related to local water temperature and flow regimes (Miller and Brannon 1982). Runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and actual time of spawning (Myers *et al.* 1998). Spring-run chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and finally spawn in the late summer and early autumn. Fall-run chinook salmon enter freshwater at an

advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991).

Central Valley spring-run chinook salmon adults are estimated to leave the ocean and enter the Sacramento River from March to July (Myers *et al*. 1998). Spring-run chinook spawning typically occurs between late-August and early October with a peak in September. Spawning typically occurs in gravel beds that are located at the tails of holding pools (USFWS 1995). Eggs are deposited within the gravel where incubation, hatching, and subsequent emergence takes place. The upper preferred water temperature for spawning adult chinook salmon is 55E F (Chambers 1956) to 57E F (Reiser and Bjornn 1979). Length of time required for eggs to develop and hatch is dependant on water temperature and is quite variable. In Butte and Big Chico creeks, emergence of spring-run chinook typically occurs from November through January. In Mill and Deer creeks, colder water temperature delay emergence to January through March (CDFG 1998).

Post-emergent fry seek out shallow, nearshore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. In Deer and Mill creeks, juvenile spring-run chinook usually spend 9-10 months in their natal streams, although some may spend as long as 18 months in freshwater. Most "yearling" spring-run chinook move downstream in the first high flows of the winter from November through January (USFWS 1995; CDFG 1998). In Butte and Big Chico creeks, spring-run chinook juveniles typically exit their natal tributaries soon after emergence during December and January, while some remain throughout the summer and exit the following fall as yearlings. In the Sacramento River and other tributaries, juveniles may begin migrating downstream almost immediately following emergence from the gravel with emigration occurring from December through March (Moyle, *et al*. 1989; Vogel and Marine 1991). Fry and parr may spend time rearing within riverine and/or estuarine habitats including natal tributaries, the Sacramento River, non-natal tributaries to the Sacramento River, and the Delta.

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers *et al*. 1998). Fisher (1994) reported that 87 percent of returning spring-run adults are three-years-old based on observations of adult chinook trapped and examined at Red Bluff Diversion Dam between 1985 and 1991.

Adult Sacramento River winter-run chinook salmon leave the ocean and migrate through the Sacramento-San Joaquin Delta to the upper Sacramento River from December through June. Spawning generally occurs between mid-April and July, and occasionally into early August. The majority of winter-run chinook salmon spawning occurs upstream of Red Bluff Diversion Dam in the vicinity of Redding, California. The eggs are fertilized and buried in the river gravel where they incubate and hatch in approximately a two-month period.

Emergence of the fry from the gravel begins during early July and continues through September. Fall and winter emigration behavior by juveniles varies with streamflow and hydrologic conditions. Most juveniles redistribute themselves to rear in the Sacramento River through the fall and winter months. Some winter-run chinook salmon juveniles move downstream to rear in the

lower Sacramento River and Delta during the late fall and winter. Smolting and ocean entry typically occurs between January and April.

2. Population Trends - Sacramento River Winter-run Chinook Salmon

Historically, the winter run chinook salmon was abundant in the McCloud, Pit, and Little Sacramento rivers. Construction of Shasta Dam in the 1940s eliminated access to all of the historic spawning habitat for winter-run chinook salmon in the Sacramento River Basin. Since then, the ESU has been reduced to a single spawning population confined to the mainstem Sacramento River below Keswick Dam; although some adult winter-run chinook have been observed in Battle Creek, tributary to the upper Sacramento River, in recent years. The fact that this ESU is generally comprised of a single population with very limited spawning and rearing habitat increases its risk of extinction due to local catastrophe or poor environmental conditions. There are no other natural populations in the ESU to buffer it from natural fluctuations.

Quantitative estimates of run-size are not available for the period prior to the completion of Red Bluff Diversion Dam in 1966. CDFG estimated spawning escapement of Sacramento River winter-run chinook salmon at 61,300 (60,000 mainstem, 1,000 in Battle Creek, and 300 in Mill Creek) in the early 1960s, but this estimate was based on "comparisons with better-studied streams" rather than actual surveys. During the first 3 years of operation of the counting facility at Red Bluff Diversion Dam (1967-1969), the spawning run of winter-run chinook salmon averaged 86,500 fish. From 1967 through the mid-1990's, the population declined at an average rate of 18 percent per year, or roughly 50 percent per generation. The population reached critically low levels during the drought of 1987-1992; the 3-year average run size for period of 1989 to 1991 was 388 fish. However, the trend in the past 5 years indicates the population may be recovering. The most recent 3-year (1997-1999) average run-size was 2,220 fish.

Additional historical and recent published chinook salmon abundance information are summarized in Myers *et al.* (1998).

3. Population Trends - Central Valley Spring-run Chinook Salmon

Historically, spring-run chinook salmon were predominant throughout the Central Valley, occupying the upper and middle reaches of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit rivers, with smaller populations in most other tributaries with sufficient habitat for over-summering adults (Stone 1874; Rutter 1904; Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). Before the construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River (Fry 1961). Following the completion of Friant Dam, the native population from the San Joaquin River and its tributaries was extirpated. Spring-run chinook salmon no longer exist in the American River due to the existence and operation of Folsom Dam.

Natural spawning populations of Central Valley spring-run chinook salmon are currently restricted to accessible reaches in the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (CDFG 1998; USFWS, unpublished data). With the exception of Butte Creek and the Feather River, these populations are relatively small ranging from a few fish to several hundred. Butte Creek returns in 1998 and 1999 numbered approximately 20,000 and 3,600, respectively (CDFG unpublished data). On the Feather River, significant numbers of spring-run chinook, as identified by run timing, return to the Feather River Hatchery. However, coded-wire-tag information from these hatchery returns indicates substantial introgression has occurred between fall-run and spring-run chinook populations in the Feather River due to hatchery practices.

Additional historical and recent published chinook salmon abundance information are summarized in Myers *et al.* (1998).

C. Steelhead

1. General Life History

Steelhead exhibit perhaps the most complex suite of life history traits of any species of Pacific salmonid. They can be anadromous or freshwater resident. Resident forms are usually called rainbow trout. Winter steelhead generally leave the ocean from August through April, and spawning occurs between December and May (Busby *et al.* 1996). The timing of upstream migration is generally correlated with higher flow events and associated lower water temperatures. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby *et al*. 1996; Nickelson *et al*. 1992). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al*. 1996).

Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986; Everest 1973). The length of the incubation period for steelhead eggs is dependant on water temperature, dissolved oxygen concentration, and substrate composition. In late spring and following yolk sac absorption, alevins emerge from the gravel as fry and begin actively feeding in shallow water along perennial stream banks (Nickelson *et al*. 1992).

Summer rearing takes place primarily in higher velocity areas in pools, although young-of-the-year are also abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al*. 1992). Juveniles feed on a wide variety of aquatic and terrestrial insects (Chapman and Bjornn 1969), and emerging fry are sometimes preyed upon by older juveniles. Juveniles live in freshwater from one to four years (usually two years in the California) (Barnhart 1986), then smolt and migrate to the sea from

February through April. Although some steelhead smolts may outmigrant during the fall and early winter months.

California steelhead typically reside in marine waters for one to two years prior to returning to their natal stream to spawn as three- or four-year olds (Busby *et al.* 1996).

2. Population Trends - Central Valley steelhead

Central Valley steelhead once ranged throughout most of the tributaries and headwaters of the Sacramento and San Joaquin basins prior to dam construction, water development, and watershed perturbations of the 19th and 20th centuries (McEwan and Jackson 1996; CALFED 2000). In the early 1960s, the California Fish and Wildlife Plan estimated a total run size of about 40,000 adults for the entire Central Valley including San Francisco Bay (CDFG 1965). The annual run size for this ESU in 1991-92 was probably less than 10,000 fish based on dam counts, hatchery returns and past spawning surveys (McEwan and Jackson 1996).

At present, all Central Valley steelhead are considered winter-run steelhead (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940's (IEP Steelhead Project Work Team 1999). McEwan and Jackson (1996) reported wild steelhead stocks appear to be mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill creeks and the Yuba River. However, naturally spawning populations are also known to occur in Butte Creek, and the upper Sacramento mainstem, Feather, American, Mokelumne, and Stanislaus rivers (CALFED 2000). It is possible that other naturally spawning populations exist in Central Valley streams, but are undetected due to lack of monitoring and research programs. The recent implementation of new fisheries monitoring efforts has found steelhead in streams previously thought not to contain a population, such as Auburn Ravine, Dry Creek, and the Stanislaus River (IEP Steelhead Project Work Team 1999).

3. Population Trends - Central California Coast steelhead

Only two estimates of historic (pre-1960s) abundance specific to this ESU are available: an average of about 500 adults in Waddell Creek in the 1930s and early 1940s (Shapovalov and Taft 1954), and 20,000 steelhead in the San Lorenzo River before 1965 (Johnson 1964). In the mid-1960s, 94,000 adult steelhead were estimated to spawn in the rivers of this ESU, including 50,000 fish in the Russian River and 19,000 fish in the San Lorenzo River (CDFG 1965). Recent estimates indicate an abundance of about 7,000 fish in the Russian River (including naturally-produced steelhead) and about 500 fish in the San Lorenzo River. These estimates suggest that recent total abundance of steelhead in these two rivers is less than 15 percent of their abundance in the mid 1960s. Recent estimates for several other streams (Lagunitas Creek, Waddell Creek, Scott Creek, San Vincente Creek, Soquel Creek, and Aptos Creek) indicate individual run sizes of 500 fish or less. Steelhead in most tributaries to San Francisco and San Pablo bays have been virtually extirpated (McEwan and Jackson 1996). Fair to good runs of

steelhead still apparently occur in coastal Marin County tributaries. In a 1994 to 1997 survey of 30 San Francisco Bay watersheds, steelhead occurred in small numbers at 41 percent of the sites, including the Guadalupe River, San Lorenzo Creek, Corte Madera Creek, and Walnut Creek (Leidy 1997). Presence/absence data available since the proposed listing show that in a subset of streams sampled in the central California coast region, most contain steelhead (Adams et al. 1999). While there are several concerns with these data (e.g., uncertainty regarding origin of juveniles), NMFS believes it is generally a positive indicator that there is a relatively broad distribution of steelhead in smaller streams throughout the region.

Little information is available regarding the contribution of hatchery-produced fish to natural spawning of steelhead, and little information on present run sizes or trends for this ESU exists. However, given the substantial rates of declines for stocks where data do exist, the majority of natural production in this ESU is likely not self-sustaining (62 FR 43937).

Generally, life history characteristics and habitat requirements for Central California Coast steelhead are similar to those described for Central Valley steelhead. However, Central California Coast steelhead typically migrate shorter distances and spawn in smaller, rainfall-fed streams compared to the larger, snowmelt-fed spawning streams and rivers occupied by Central Valley steelhead. Adult Central California Coast steelhead spawn in tributaries to San Francisco, San Pablo, and Suisun Bays. Outmigrants may utilize tidal marsh areas, non-tidal freshwater marshes, and other shallow water areas in the bays as rearing areas for short periods prior to their emigration to the sea.

Additional historical and recent published steelhead abundance are summarized in NMFS west coast steelhead status review (Busby *et al.* 1996).

III. Environmental Baseline

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area (50 CFR §402.02). The action area includes a large portion of California's Central Valley. The following Central Valley streams below major water storage reservoirs are included in the action area: the Sacramento River downstream of Keswick Dam to the Sacramento-San Joaquin Delta; Clear Creek downstream of Whiskeytown Dam to its confluence with the Sacramento River; the Feather River downstream of Oroville Dam to its confluence with the Sacramento River; the Yuba River downstream of Englebright Dam to its confluence with the Feather River; Stony Creek downstream of Black Butte Reservoir to its confluence with the Sacramento River; the Bear River downstream of Camp Far West Dam to its confluence with the Feather River; the American River downstream of Nimbus Dam to its confluence with the Sacramento River; the Mokelumne River downstream of Camanche Dam to the Sacramento-San Joaquin Delta; the Calaveras River downstream of New Hogan Dam to the Sacramento-San Joaquin Delta; the Stanislaus River downstream of New Melones Dam to its confluence with the San Joaquin River; the Tuolumne

River downstream of New Don Pedro Dam to its confluence with the San Joaquin River; the Merced River downstream of New Exchequer Dam to its confluence with the San Joaquin River, the San Joaquin River downstream of Friant Dam to the Sacramento-San Joaquin Delta; and the Sacramento-San Joaquin Delta. Additional watersheds within the action area include Mill Creek, Deer Creek, Paynes Creek, Battle Creek, Butte Creek, Big Chico Creek, Thomes Creek, Cottonwood Creek, and other watersheds from the valley floor to the boundaries of national forest lands. Central Valley Project (CVP) and State Water Project (SWP) service areas outside the Central Valley are also part of the action area.

Profound alterations to the riverine habitat of the Central Valley began with the discovery of gold in the middle of the last century. Dam construction, water diversion, and hydraulic mining soon followed, launching the Central Valley into the era of water manipulation and coincident habitat degradation. A number of documents have addressed the history of human activities, present environmental conditions, and factors contributing to the decline of salmon and steelhead species in the Central Valley. For example, NMFS has prepared range-wide status reviews for west coast chinook (Myers *et al.* 1998) and steelhead (Busby *et al.* 1996). Information is also available in Federal Register notices announcing ESA listing proposals and determinations for some of these species and their critical habitat (June 16, 1993, 58 FR 33212; January 4, 1994, 50 FR 440; March 19, 1998, 63 FR 13347; September 16, 1999, 64 FR 50394; February 16, 2000, 65 FR 7764). The final Programmatic Environmental Impact Statement/Report for the CALFED Bay-Delta Program (July 2000) (CALFED 2000) and the final PEIS for the CVPIA (October 1999) (DOI 1999a) provide an excellent summary of historical and recent environmental conditions for salmon and steelhead in the Central Valley. For the purposes of this document, a general description of the environmental baseline for Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead is based on a summarization of these documents.

In general, the human activities that have affected listed Central Valley anadromous salmonids and their habitats consist of: (1) dam construction that blocks previously accessible habitat; (2) water development activities that affect the water quantity, timing, and quality; (3) land use activities such as agriculture, flood control, urban development, mining, and logging that can degrade aquatic habitat; (4) hatchery operation and practices; (5) harvest activities; and (6) ecosystem restoration actions.

1. Habitat Blockage

Hydropower, flood control, and water supply dams of the CVP, SWP, and other municipal and private entities have permanently blocked or hindered salmonid access to historical spawning and rearing grounds. Clark (1929) estimated that originally there were 6,000 miles of salmon habitat in the Central Valley system and that 80 percent of this habitat had been lost by 1928. Yoshiyama *et al*. (1996) calculated that roughly 2,000 miles of salmon habitat was actually available before dam construction and mining, and concluded that 82 percent is not accessible today. Clark (1929) did not give details about his calculation. Whether Clark's or Yoshiyama's calculation is used, only remnants of their former range remain accessible today in the Central Valley (CDFG 1998).

In general, large dams on every major tributary to the Sacramento River, San Joaquin River, and Delta block salmon and steelhead access to the upper portions of the respective watersheds. On the Sacramento River Keswick Dam blocks passage to historic spawning and rearing habitat in the upper Sacramento, McCloud and Pit rivers. On the Feather River Oroville Dam and associated facilities block passage to the upper Feather River watershed. Nimbus Dam blocks access to most the American River Basin. On the San Joaquin River, water development projects in the 19th century eliminated fall-run chinook salmon that spawned in the mainstem of the river. Friant Dam construction in mid-1940's has been associated with the elimination of spring-run chinook salmon in the San Joaquin River upstream of the Merced River (DOI 1999a).

2. Water Development Activities

The diversion and storage of natural flows by dams and diversion structures on Central Valley waterways have depleted streamflows and altered the natural cycles by which juvenile and adult salmonids base their migrations. Depleted flows have contributed to higher temperatures, lower dissolved oxygen levels, and decreased recruitment of gravel and large woody debris. In addition, the altered flow regime below several Central Valley dams has impaired the regeneration of riparian vegetation. Historical seasonal flow patterns included high flood flows in the winter and spring with declining flows throughout the summer and early fall. As flows declined during the summer, the seeds from willows and cottonwood trees, deposited on the recently created sand bars, would germinate, sprout, and grow to maturity. The roots of these plants would follow the slowly receding water table, allowing the plants to become firmly established before the next rainy season. With the completion of upstream reservoir storage projects throughout the Central Valley, the seasonal distribution of flows differs substantially from historical patterns. The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round that diminish natural channel forming, riparian vegetation, and foodweb functions.

Water diversions for irrigated agriculture, municipal and industrial use, and managed wetlands are found throughout the Central Valley. Hundreds of small and medium size water diversions exist along the Sacramento River, San Joaquin River and their tributaries. Although efforts have been made in recent years to screen some of these diversions, many remain unscreened. Depending on the size, location, and season of operation, these unscreened intakes entrain many life stages of aquatic species, including juvenile salmonids. More than 2,000 unscreened diversions in the Delta entrain resident and anadromous fishes.

3. Land Use Activities

About 150 years ago, the Sacramento River was bordered by up to 500,000 acres of riparian forest, with bands of vegetation literally spreading four to five miles (Resources Agency 1989). By 1979, riparian habitat along the Sacramento River diminished to 11,000-12,000 acres or about 2 percent of historic levels (McGill 1979). More recently, about 16,000 acres of remaining

riparian vegetation has been reported (McGill 1987). The degradation and fragmentation of riparian habitat has resulted mainly from flood control and bank protection projects, together with the conversion of riparian land to agriculture (Jones and Stokes Associates 1993).

Increased sedimentation resulting from agricultural and urban practices within the Central Valley is a primary cause of salmonid habitat degradation. Sedimentation can adversely effect salmonids during all freshwater life stages by clogging, or abrading gill surfaces; adhering to eggs; inducing behavioral modifications; burying eggs or alevins; scouring and filling pools and riffles; reducing primary productivity and photosynthetic activity; and affecting intergravel permeability and dissolved oxygen levels. Embedded substrates can reduce the production of juvenile salmonids and hinder the ability of some over-wintering juveniles to hide in the gravels during high flow events.

Land use activities associated with road construction, urban development, logging, mining, agriculture, and recreation have significantly altered fish habitat quantity and quality through alteration of streambank and channel morphology; alteration of ambient stream water temperatures; degradation of water quality; elimination of spawning and rearing habitat; fragmentation of available habitats; elimination of downstream recruitment of gravel and large woody debris; and removal of riparian vegetation resulting in increased streambank erosion. Agricultural practices have eliminated large trees and logs and other woody debris that would have been otherwise recruited to the stream channel. Large woody debris influences stream morphology by affecting pool formation, channel pattern and position, and channel geometry.

Historically in the Sacramento/San Joaquin Delta, tidal marshes provided a highly productive estuarine environment for juvenile anadromous salmonids. During the course of their downstream migration, juvenile winter-run chinook, spring-run chinook, and steelhead utilize the Delta's estuarine habitat for seasonal rearing, and as a migration corridor to the sea. Since the 1850s, reclamation of Delta islands for agricultural purposes caused the cumulative loss of 94 percent of the Delta's tidal marshes (Monroe *et al*. 1992).

In addition to the degradation and loss of estuarine habitat, downstream migrant juvenile salmon in the Delta have been subject to adverse conditions created by water export operations of the CVP and SWP. Specifically, juvenile salmon have been adversely affected by: (1) water diversion from the mainstem Sacramento River into the Central Delta via the manmade Delta Cross Channel; (2) upstream or reverse flows of water in the lower San Joaquin River and southern Delta waterways; and (3) entrainment at the CVP/SWP export facilities and associated problems at Clifton Court Forebay. Juvenile salmonids are exposed to increased water temperatures in the Delta during the late spring and summer due to the loss of riparian shading, and by thermal inputs from municipal, industrial, and agricultural discharges.

4. Hatchery Operation and Practices

Five hatcheries currently produce chinook salmon in the Central Valley and four of these also produce steelhead. Releasing large numbers of hatchery fish can pose a threat to wild chinook and

steelhead stocks through genetic impacts, competition for food and other resources between hatchery and wild fish, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production (Waples 1991). The genetic impacts of artificial propagation programs in the Central Valley are primarily caused by the straying of hatchery fish and the subsequent hybridization of hatchery and wild fish. In the Central Valley, practices such as trucking smolts to distant sites for release and the transferring of eggs between hatcheries contribute to elevated straying levels (DOI 1999a).

5. Harvest

Extensive ocean recreational and commercial troll fisheries for chinook salmon exist along the Central California coast, and an inland recreational fishery exists in the Central Valley for chinook salmon and steelhead. Ocean harvest of Central Valley chinook is estimated using an abundance index, called the Central Valley Index (CVI). The CVI harvest rate is the ratio of salmon harvested south of Point Arena (where 85 percent of Central Valley chinook are caught) to the CVI escapement.

Since 1970, the CVI ocean harvest index for winter-run chinook salmon has generally ranged between 0.50 and 0.80. In 1990 when additional harvest restrictions to protect winter-run chinook were first imposed by NMFS and Pacific Fisheries Management Council (PFMC), the CVI harvest rate was near the highest level at 0.79. Through the early 1990's, the ocean harvest index was below this level: 0.71 in 1991, 0.71 in 1992, 0.72 in 1993, 0.74 in 1994, 0.78 in 1995 and 0.64 in 1996. In 1996 and 1997, NMFS issued biological opinions which concluded that incidental ocean harvest of winter-run chinook represented a significant source of mortality to the endangered population, even though ocean harvest was not a key factor leading to the decline of the population (National Marine Fisheries Service 1996, 1997). As a result of these opinions, measures were developed and implemented by the PFMC, NMFS, and CDFG to reduce ocean harvest impacts by approximately 50 percent.

There are limited data on spring-run chinook ocean harvest rates. An analysis using CWT spring-run from the Feather River Hatchery estimate harvest rates were 18 percent to 22 percent for age-3 fish, 57 percent to 85 percent for age-4 fish, and 97 percent to 100 percent for age-5 fish (CDFG 1998).

Historically, in California, almost half of the river sportfishing effort was in the Sacramento-San Joaquin River system, particularly upstream from the city of Sacramento (Emmett *et al*. 1991). Since 1987, the Fish and Game Commission has adopted increasingly stringent regulations to reduce and virtually eliminate the in-river sport fishery for winter-run chinook. Present regulations include a year-round closure to salmon fishing between Keswick Dam and the Deschutes Road Bridge and a rolling closure to salmon fishing on the Sacramento River between the Deschutes Road Bridge and the Carquinez Bridge. The rolling closure spans the majority of months adult winter-run chinook salmon are ascending the Sacramento River to their spawning grounds. These closures have virtually eliminated impacts on winter-run chinook by recreational angling in freshwater.

To address potential incidental take of chinook salmon that occurs in the recreational trout fishery, the California Fish and Game Commission adopted in 1992 gear restrictions (all hooks must be barbless and a maximum 2.25 inches in length) to minimize hooking injury and mortality caused by trout anglers incidentally catching winter-run chinook. That same year, the Commission also adopted regulations which prohibited any salmon from being removed from the water to further reduce the potential for injury and mortality to winter-run chinook from the trout and steelhead fishery.

Specific regulations for the protection of spring-run chinook salmon in Mill, Deer, Big Chico, and Butte creeks were added to the existing CDFG regulations in 1994. Existing regulations, including those developed for winter-run chinook provide some level of protection for Central Valley spring-run chinook (CDFG 1998).

There is little information on steelhead harvest rates in California. Hallock *et al.* (1961) estimated that harvest rates for Sacramento River steelhead from the 1953-54 through 1958-59 seasons ranges from 25.1 percent to 45.6 percent assuming a 20 percent non return rate of tags. Staley (1976) estimated the harvest rate in the American River during the 1971-72 and 1973-74 seasons to be 27 percent. The average annual harvest rate on adult steelhead above Red Bluff Diversion Dam for the three year period 1991-92 through 1993-94 is 16 percent (McEwan and Jackson 1996).

6. Ecosystem Restoration

Preliminary, significant steps towards the largest ecological restoration project yet undertaken in the United States have occurred during the past four years and continue to proceed in California's Central Valley. The CALFED Bay-Delta Program, in coordination with other Central Valley efforts including those implemented through the CVPIA, has implemented numerous habitat restoration actions that benefit Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, and their critical habitat. These restoration actions include the installation of fish screens, modification of barriers to improve fish passage, and habitat acquisition and restoration. The majority of these recent restoration actions address key factors for decline of these ESUs and emphasis has been placed in tributary drainages with high potential for winter-run chinook salmon, spring-run chinook salmon, and steelhead production. Additional actions that are currently underway that benefit Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead include new efforts to enhance fisheries monitoring and conservation actions to address artificial propagation. In the Delta, approximately 1,500 acres of land have been purchased for restoration activities since 1996. Restoration of these Delta areas primarily involves flooding lands previously used for agriculture, thereby creating additional wetland areas and rearing habitat for juvenile salmonids.

A beneficial action unrelated to the CALFED Program includes the Environmental Protection Agency's remedial actions at Iron Mountain Mine. The completion of a state-of-the-art lime neutralization plant is successfully removing significant concentrations of toxic metals in acidic

mine drainage from the Spring Creek Watershed. Containment loading into the upper Sacramento River from Iron Mountain Mine has shown measurable reductions since the early 1990's.

IV. Effects of the Action

The following section discusses the direct and indirect effects on Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, Central California Coast steelhead, and/or their designated critical habitat that are expected to result from the proposed action. Cumulative effects (effects of future State, local, or private actions on endangered and threatened species or critical habitat) are discussed separately at the end of this section.

A. General Effects

The CALFED Program is intended to increase water availability for agricultural and urban users while providing for recovery of anadromous salmonids and other species. Species recovery is to be accomplished largely through improvements to habitat, including increased water availability at key times to benefit particular species. The CALFED Program will affect species in the Sacramento River Basin, San Joaquin River Basin, Sacramento-San Joaquin Delta, and Suisun Marsh and Bay for a period of 30 years or more. Both beneficial and adverse impacts to Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, and Central California Coast steelhead are expected from the various component programs and strategies (see below). The huge scale and extended time frame of the CALFED Program implies that the overall effect of the CALFED Program will be determined not only by the implementation of specific actions, but by the order and location in which the actions are implemented and the successful use of adaptive management to modify actions to target a desired outcome.

B. Specific Effects

Levee System Integrity Program (LSIP)

The LSIP would reduce the risk to the ecosystem of catastrophic breaching of Delta levees by maintaining and improving the integrity of the levee system. Reduced likelihood of catastrophic breaching of Delta levees would reduce the likelihood of rapid hydrodynamic and salinity changes caused by sudden changes in Delta outflow and channel flow conditions. Although infrequently, species would benefit from the reduced frequency of sudden salinity shifts that could adversely affect habitat or delay transport to areas providing for specific species needs, such as spawning and rearing habitat. The change in flow and water quality conditions attributable to catastrophic breaching of levees also could increase entrainment in Delta diversions, depending on the change in the distribution of a species and the timing of breaches relative to the vulnerability of specific

life stages. Reduced risk of catastrophic breaching would reduce the risk of unexpected increased entrainment events.

Levee construction and maintenance actions will occur primarily under two of the five parts of the LSIP (i.e., the Delta Levee Base Level Protection Plan and Delta Levee Special Improvement Projects), plus the added plan for Suisun Marsh levees. These actions have the potential to adversely impact anadromous salmonids due to (1) noise, vibration, siltation, input of contaminants, or other impacts to aquatic habitat related to construction activities such as dredging, addition of material to achieve required cross section, installation of rip rap, or road repair; and (2) degradation or loss of shaded riverine aquatic habitat or shallow water habitat due to removal of vegetation or debris and installation, repair, or replacement of rip rap for bank protection. Disturbance and increased turbidity from in-channel construction may impair chinook salmon or steelhead feeding or cause avoidance of habitat in the immediate vicinity of the project site (Berg 1982; Feist et al. 1992; Knudsen et al. 1992). If inadequate cover remains, small fish may be more vulnerable to predation (Savino and Stein 1982). Many construction impacts and some of the other impacts to fish habitat can be avoided or minimized by using accepted construction time windows, best management practices, and habitat revegetation and restoration techniques. Plans for Delta Levee Special Improvement Projects must include explicit provisions for the protection of fish and wildlife habitat.

The inherent nature of levees used for flood control typically leads to poor-quality fish habitat that is channelized, relatively uniform with deep, fast-moving water, limited in productivity, and lacking vegetation, instream woody material, or other cover for fish (Michny and Hampton 1984; DeHaven 1999). Large, rip-rapped areas lacking riparian vegetation with shaded riverine aquatic habitat may limit the viability of the Sacramento River to support anadromous fish (Jones and Stokes 1993). Studies have shown high preference of juvenile salmonids for natural shoreline areas, indicating that continued suppression of shaded riverine aquatic habitat could hinder the successful rearing of juvenile salmonids (USFWS 1993). Continued maintenance of existing Delta levees will perpetuate poor-quality fish habitat. Therefore, major changes to levee design (i.e., in particular, using setback levees) will be required to truly improve habitat and minimize impacts to fish in leveed areas.

The ERP Plan and CALFED Stage 1 milestones call for the installation of setback levees and other measures to improve fish habitat in leveed river reaches and Delta channels and sloughs. Coordination of the LSIP with the ERP will allow for concurrent planning and implementation of significant habitat restoration along with levee improvements (see *Summary of Key Planned Actions* and *Ecosystem Restoration Program*).

The Delta Levee Emergency Management and Response Plan and Delta Levee Risk Assessment and Risk Management Strategy components of the LSIP primarily will focus on planning and funding issues related to emergency levee repairs and risks that may lead to levee failure, respectively. From NMFS' perspective, emergency levee repairs in the Delta are problematic in that they usually are required when flows are high in the winter. Juvenile anadromous salmonids are abundant in the Delta during this period, which is outside the construction time window usually

allowed by NMFS for in-channel work in the Delta. The Delta Levee Emergency Management and Response Plan will include environmental considerations in the planning process as a Stage 1 action. The risk assessment required as a Stage 1 action under the Delta Levee Risk Assessment and Risk Management Strategy may identify the levees that are most vulnerable to failure. If these levees are targeted for maintenance work during accepted construction time windows before they fail, the number of emergency levee repairs required in the Delta may decline during Phase III.

The Subsidence Control Plan is likely to only minimally affect anadromous salmonid fishes because it focuses on land use practices on the land side of Delta levees.

Water Quality Program (WQP)

The WQP is intended to improve water quality primarily through the control of contaminant sources, increased enforcement of existing regulatory programs, and provision of incentives for action that goes beyond current regulatory programs. Potential actions would address contaminants from mine drainage, urban and industrial runoff, wastewater and industrial discharge, agricultural drainage and runoff, and unknown origins (e.g., toxicity events affecting aquatic organisms that cannot be attributed to specific causes).

Reducing the quantity of contaminants (e.g., metals and toxic elements, organics and pesticides, etc.) that enter the Bay-Delta and tributaries would be expected to benefit especially resident fishes, but also anadromous salmonids. Receiving contaminants from river inflow and bi-directional tidal flow from the Bay, the Delta would benefit from WQP elements implemented upstream in the Sacramento River and San Joaquin River Regions and downstream in the Bay Region. Reduced contaminants could substantially increase system productivity which should lead to increased survival, growth, and reproduction. Fish should benefit from reduced metabolic stress and increased survival. Vulnerable salmonid life stages such as eggs and larvae especially may benefit from reductions in localized inputs of pollutants or suspended sediments. The WQP will aggressively address at least three water quality issues that are of particular importance to anadromous salmonids: (1) mercury levels in Cache Creek, (2) mercury levels in the Delta, and (3) dissolved oxygen (DO) levels in the San Joaquin River near Stockton.

Cache Creek is designated critical habitat for Central Valley steelhead, although both fish passage and elevated mercury levels present significant problems in this drainage. The WQP includes actions focused on mercury evaluation and abatement in Cache Creek. Stage 1 actions include remediation (i.e., drainage control) of mercury mines as appropriate and development and implementation of a TMDL for mercury.

Mercury is common in sediment in the Bay-Delta system (USACE et al. 1998). Methylization of mercury, which increases its potential for bioaccumulation, tends to occur when inorganic mercury is exposed to air. This is likely to happen when dredged sediment is used for levee maintenance and repair, and in habitat restoration projects such as creation of wetlands or shallow water habitat that may be used by salmonids. The WQP includes management and research elements that will focus on the methylization process in the Delta, mapping sediment mercury concentration in areas

that would be dredged during levee maintenance work, and determining the potential impact of ecosystem restoration work on methyl mercury levels in lower and higher trophic level organisms. This work will be coordinated with both the ERP and the CMARP component of the SP.

The WQP will address low DO levels that occur in the Bay-Delta system, especially in the San Joaquin River near Stockton during the late summer and fall. This action is of particular pertinence to salmonid fishes, because the low DO may act as a water quality barrier to adult fall-run chinook salmon that migrate upstream to spawn in the Merced, Tuolumne, and Stanislaus Rivers between September and December. Fall-run chinook salmon is a candidate for listing under the ESA by NMFS, and is a major species targeted for recovery by CALFED. Under the WQP, CALFED will include completing studies of causes for DO depletion in San Joaquin River near Stockton, supporting finalization of Basin Plan Amendment and TMDL for constituents that cause low DO, and developing inter-substrate DO testing in conjunction with ERP.

Some actions proposed under the WQP to achieve program goals involve manipulating flow and water temperature (i.e., to influence DO), in-channel construction (e.g., installation of operable barriers in the south Delta and a screened diversion structure on the Sacramento River in the north Delta), and general flexibility in storage and operations as well as conveyance improvements to address drinking water quality problems. These actions may impact anadromous salmonids and are discussed in the *Levee System Integrity Program* and *Water Management Strategy* effects analyses.

Ecosystem Restoration Program (ERP)

The ERP is intended to achieve or contribute to the recovery of anadromous salmonids and several other species found in the Bay-Delta through the implementation of proactive restoration actions. The ERP Plan identifies over 600 programmatic actions addressing several ecosystem elements and that will be implemented throughout the Sacramento-San Joaquin River basin and Bay-Delta. These actions will be implemented in all ecological management zones. Several streams and rivers that are designated critical habitat for Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead, and are important habitat for Central Valley fall/late fall-run chinook salmon (e.g., Battle Creek, Clear Creek, Deer Creek, Cosumnes River, San Joaquin River, and Tuolumne River) specifically are targeted for large-scale restoration. ERP actions are expected to substantially improve conditions for chinook salmon and steelhead, and contribute to species recovery. Major categories of these actions and their effects on anadromous salmonids include the following:

Protection, restoration, and management of diverse habitat types. Restore tidal action to Delta sloughs; restore tidal and non-tidal wetlands; improve levee and berm management practices to protect and enhance riparian and shaded riverine aquatic habitat; protect and restore riparian vegetation; restore stream side-channel habitat where appropriate; terminate or modify programs that remove Instream woody material from stream channels; improve land management and grazing practices in stream riparian zones; purchase streambank conservation easements from willing

sellers; and modify in-channel structures or features to eliminate predator habitat. These actions would improve habitat for salmonids by increasing shaded riverine aquatic habitat and Instream woody material, providing varied water depth and velocity, increasing ecosystem productivity and salmonid food supply, and reducing predatory and competitive interactions. This could lead to increased fish growth, fecundity, and survival (Miller and Simenstad 1997; DeHaven 1999).

Provide instream flows and habitat conditions in Bay-Delta tributaries sufficient for fish protection and recovery. Manage reservoirs (e.g., through establishing minimum cold-water pool size, installing temperature control devices, negotiating and implementing adequate flow release schedules, and using real-time management) and watersheds (e.g., through pumping groundwater, enhancing riparian vegetation, reducing drainage inputs of warm agricultural and urban runoff, developing and implementing watershed management plans, eliminating unpermitted diversions, and acquiring water from willing sellers) to ensure adequate streamflows and water temperatures. These actions would reduce mortality of chinook salmon and steelhead eggs and larvae, which are particularly vulnerable to elevated water temperatures and stranding; increase growth rates of rearing juvenile fish, improve juvenile and adult migration success, and decrease predatory and competitive interactions by increasing available habitat.

Improve Delta outflow during key periods. Prescribe the source, timing, and magnitude Delta outflow for key periods, and use real-time management. These actions would improve survival by promoting successful migration of juvenile and adult salmonids through the Delta, and reducing juvenile entrainment at the SWP/CVP export facilities.

Reconnect Bay-Delta tributaries with their floodplains. Maintain or restore stream meander configurations, install setback levees, develop and implement floodplain management plans, acquire flood easements, purchase floodplain lands from willing sellers, convert leveed lands to tidal wetland/slough complexes, remove levees that hinder tidal and floodflows, and conserve remaining natural floodplain topography. These actions would improve habitat for salmonids by increasing shaded riverine aquatic habitat and Instream woody material, providing varied water depth and velocity, increasing ecosystem productivity and salmonid food supply, and reducing predatory and competitive interactions. This could lead to increased fish growth, fecundity, and survival (DeHaven 1999).

Assess and limit the negative effects of hatchery propagation on natural anadromous salmonid populations. Limit hatchery stocking if populations of chinook salmon or steelhead can be sustained by natural production; adopt methods for selecting spawning adults for hatchery use from an appropriate cross section of the adult population; limit the stocking of steelhead and chinook salmon fry and smolts to natal watersheds; and select spawning adults of appropriate genetic makeup to minimize genetic contamination of existing hatchery and naturally-producing populations. These actions would help to maintain the genetic integrity of naturally spawning populations.

Restore aspects of the sediment erosion and deposition regime. Maintain, improve, or supplement gravel recruitment and natural sediment transport in streams; improve spawning gravel

and gravel availability in streams; relocate instream and floodplain gravel mining and artificially introduce gravels to compensate for sediment trapped by dams; and develop and implement appropriate land use plans that allow the natural recruitment of sediments. Spawning habitat abundance and gravel quality would improve as a result of implementing these actions. This may increase spawning success and egg and larval survival.

Eliminate fish passage barriers, and reduce fish entrainment and stranding. Remove dams to provide access to historical spawning and rearing habitat; install or upgrade fish passage facilities at dams; remove or modify culvert crossings or other barriers; install state-of-the-art, positive-barrier screens on water diversions; improve existing screens and bypass systems; eliminate or consolidate water diversions; and assess and develop recommendations to reduce stranding in floodplains, toe drains, shallow ponds, and levee borrow areas. These actions would reduce entrainment of juvenile fish and stranding of juvenile and adult fish. This would improve migration success and survival and increase adult spawning success.

Implementation of ERP actions that are intended to benefit other species may adversely affect anadromous salmonids. Such conflicts likely would be resolved through oversight by the Governance Plan or MSCS that would provide for prioritization of water needs (see *Summary of Key Planned Actions*). Preparation of ASIPs and consultation with the fish and wildlife agencies will be required prior to implementation of ERP actions.

Water Use Efficiency Program (WUEP)

The purpose of the WUEP is to increase water conservation and recycling primarily in the urban and agricultural sectors of California. Programmatic actions generally focus on expanding State and federal water recycling programs and providing planning, technical, and financial assistance to local water suppliers. This program is expected to benefit fish because water savings could reduce the demand for Delta exports, increase water available for transfers, delay the need for new water facilities, and improve water quality. Reduced demands could increase reservoir and diversion operation flexibility, and allow flow management to meet species needs or to more closely approximate the natural seasonal flow variability. Reestablishing natural seasonal flow variability (i.e., pattern and magnitude) could reactivate and maintain ecological processes and structures that sustain healthy fish, wildlife, and plant populations. Reduced contaminant delivery resulting from reduced applied water and subsequent reduced runoff would improve water quality, which could lead to improved fish health, survival, and productivity. Species also could benefit from reduced entrainment and impingement impacts due to reduced diversions, modifications in flow timing and reservoir releases, improved in-stream water quality, and increased water available for ecosystem purposes.

Water Transfer Program (WTP)

The WTP proposes a framework of actions, policies, and processes that, collectively, will facilitate water transfers and the further development of a statewide water transfer market. Therefore, this program likely will increase the occurrence of water transfers in the Sacramento-San Joaquin drainage. This would affect fisheries and aquatic resources primarily through changes to riverine flow and export. Several factors, including the source of water for a transfer and the timing, magnitude, and pathway of each transfer, influence the likelihood for potentially significant impacts. To the extent that transfers are consistent with ecosystem needs and purposes, fisheries and aquatic ecosystems would benefit. The WTP may allow water to be obtained for the EWA (see *Water Management Strategy*), which by definition will benefit fish including steelhead and chinook salmon. Benefits could include reestablishing the natural seasonal flow and salinity variability, and reduced entrainment and impingement impacts associated with reduced or rescheduled diversions. Conversely, potentially significant adverse impacts may result from transfers for agricultural and urban uses if proper planning and management of specific transfers are not undertaken. Adverse effects on species could include reduced habitat abundance attributable to flow effects, reduced transport and attraction in response to flow effects, and increased entrainment attributable to flow effects on species movement and distribution relative to the location and volume of diversions. To address these potential adverse effects, water transfers facilitated through the WTP that may affect threatened or endangered salmonids or other species will require further consultation with the appropriate fish and wildlife agencies (see *Summary of Key Planned Actions*).

Implementing the WTP will affect water operations by increasing the availability of the SWP/CVP facilities for water transfers of non-project water. Therefore, the WTP may contribute to the need for modifications to the conveyance system. These may include in-channel construction activities which could adversely impact anadromous salmonids (see *Water Management Strategy*).

Watershed Program (WP)

The WP will provide financial and technical assistance to local watershed programs that focus on achieving multiple objectives in the areas of water supply reliability, flood management, environmental restoration, and water quality. This assistance will benefit anadromous salmonids if it supports watershed level habitat restoration actions such as improving riparian habitat or fish passage, restoring wetlands, stream banks, or stream morphology, or reducing pollutant loads. Beneficial watershed-level impacts may also improve habitat conditions downstream.

Potential watershed activities that are expected to improve flows in upstream areas also would improve flows in the Delta. Ecosystem-level benefits could include a closer approximation of natural seasonal flow variability, restoration of natural sediment delivery and movement, reduced contaminant input, increased productivity, and restoration of the natural ecosystem structure, such as floodplain connectivity. Species benefits primarily would accrue from increased habitat

abundance due to improved flow conditions and increased survival, growth, and reproduction in response to improved water quality.

CALFED will promote local watershed stewardship and encourage watershed actions that include monitoring protocols and increase community learning and awareness. This should benefit fish if it encourages collection of data that may be used to make more informed fish and water management decisions, and discourages human behavior that adversely affects the watershed (e.g., destruction of fish habitat).

Flood control actions (e.g. levee construction or maintenance) implemented as part of the WP may adversely affect fish, as could construction associated with other in-channel or riparian zone actions. Impacts may occur due to disturbance of existing aquatic or riparian biological communities, mobilization of sediments, and input of contaminants. Impacts to anadromous salmonids may be avoided or minimized through the use of accepted construction time windows and best management practices (see *Levee System Integrity Program*). These activities would require further consultation with appropriate fish and wildlife agencies (see *Summary of Key Planned Actions*).

Water Management Strategy (WMS)

Storage

The ISI component of CALFED's WMS would be expected to benefit anadromous salmonids because it will contribute to increased flexibility in the timing, magnitude, and duration of reservoir releases and exports from the CVP/SWP pumps. This should provide increased opportunity for releases of water that would benefit steelhead and chinook salmon (e.g., to maintain adequate water temperature or reduce take at the export facilities). Large, long-term surface storage is suited to rapidly discharging or receiving large volumes of water, an advantage in real-time management of high river flow periods or environmental storage releases. Cold-water pool volume could increase with increased on-stream reservoir capacity. A portion of new storage may be allocated to environmental water supplies and could provide beneficial impacts through enhancement of seasonal flow needs for steelhead and chinook salmon. Species could benefit from increased productivity and improved conditions affecting movement. Total Delta outflow, however, would be reduced because total exports will increase. The diversion of water to required to fill additional storage would additionally reduce outflow. Adverse effects of reduced outflow would depend on timing and reduction in magnitude relative to base outflow conditions.

Filling in-Delta storage could adversely affect fish species, depending on the location of the storage and diversion facilities and the timing, magnitude, duration, and frequency of diversions. As discussed above, Delta outflow would be reduced. In addition, the magnitude of net reverse flow could increase in some Delta channels. Changes in Delta outflow and channel flow could affect the distribution of rearing or outmigrating chinook salmon and steelhead, potentially increasing entrainment in CVP/SWP export facilities and other Delta diversions. Depending on the location of the diversion intake, some species populations may be more affected than others. For

example, diversion from the Mokelumne channels or the San Joaquin River channel could result in potentially greater effects on Mokelumne River or San Joaquin River chinook salmon than on chinook salmon from the Sacramento River. Although the diversion into in-Delta storage would be screened, entrainment-related losses would occur, including predation, abrasion, and impingement. The operations flexibility of in-Delta storage, however, would provide the opportunity to avoid and minimize adverse effects on Delta fish species through diversions during periods when flow conditions would be minimally affected and when Delta species are least vulnerable to the effects of diversions. If diversions to in-Delta storage allow reoperation of other Delta diversions, lower diversions during periods of high fish vulnerability could benefit Delta fish species by reducing entrainment losses and potential adverse effects of Delta flows on species distribution.

For in-Delta storage, discharge directly to Delta export and diversion facilities could increase operational flexibility, potentially benefitting fish species present in the Delta by minimizing exports or diversions during periods of high fish vulnerability. Discharge for environmental benefits could, given appropriate timing, improve Delta flow conditions—reducing the magnitude of net reverse flow and increasing Delta outflow during periods of potentially high fish sensitivity. Export or diversion of in-Delta storage discharged to Delta channels, however, could result in adverse effects by increasing fish entrainment.

Simulated operations demonstrated that increased storage in and upstream of the Delta could enable average annual CVP and SWP exports to increase by 500-700 TAF (an 8-12% annual increase). The simulated increase primarily occurs during January-March and in September. Higher exports could adversely affect the population abundance of Delta species through increased entrainment-related losses, including losses of winter-, spring-, and fall-run chinook salmon. In addition, increased exports would increase the magnitude of net reverse flow conditions in Old and Middle Rivers and possibly in the lower San Joaquin River. Net reverse flow conditions are counter to natural net flow conditions in Delta channels and could reduce productivity, impair species movement, and increase entrainment in Delta diversions. Species adversely affected could include chinook salmon and steelhead. Increases of annual exports of this magnitude will require ongoing consultation with the fish and wildlife agencies.

All proposed new reservoir construction is off-stream, and consequently should not directly impede juvenile or adult salmonid migration. However, construction of storage facilities could cause short-term adverse impacts downstream due to mobilization of sediments and input of contaminants.

Implementation of the ISI will result in increased pumping of groundwater. Although the ISI also provides for actions such as groundwater monitoring and modeling, the intent is to develop the groundwater supply for agricultural, urban, and environmental uses. Under present use levels, groundwater overdrafts already occur in both Sacramento and San Joaquin Valleys during some years (CDWR 1998). Groundwater overdrafts may affect aquifer size and depth, and hence recharge to streams such as the San Joaquin River. However, the ISI will be implemented in

concert with the ERP, MSCS, EWA, and WQP and in such a way that the net effects to species and their habitats will be positive (see *Summary of Key Planned Actions* and *Governance Plan*).

Conveyance

South Delta

As with the ISI, the modifications to conveyance proposed under the WMS is expected to benefit anadromous salmonids because they will contribute to increased flexibility in the timing, magnitude, and duration of reservoir releases and exports from the CVP/SWP pumps. Many of the proposed modifications to conveyance in the south Delta will provide for either fully utilizing the existing export capacity or increasing the export capacity at the SWP Banks Pumping Plant (e.g., constructing a new screened intake at CCFB, implementing a SWP/CVP JPOD, changing the SWP pumping rules to increase expert pumping limits, and installing a barriers at the head of Old River). Increased export capacity will benefit anadromous salmonids because it will provide for wheeling and storage that otherwise would not be available for EWA or other environmental water. However, there is some question whether adequate storage of EWA water south of the Delta (e.g., in San Luis Reservoir, Metropolitan Water District's Diamond Valley Reservoir, or groundwater storage) will be available, which may limit the benefit of increased export capacity to anadromous salmonids. Total exports are expected to increase throughout Phase III and will be facilitated by increased export capacity at the SWP pumps, potentially reducing total outflow from the Delta or contribute to increased magnitude or frequency of reverse flows. This may adversely impact anadromous salmonids unless compensated for through the EWA or other environmental water releases.

Screening the intake at CCFB to NMFS criteria ultimately should decrease the take of juvenile salmonids by reducing or eliminating entrainment at the SWP export facilities. CALFED intends to secure permits by the middle of 2003 to increase SWP pumping up to 8,500 cfs and potentially 100 TAF per month. SWP pumping is intended to be increased to the maximum capacity of 10,300 cfs by the end of Stage 1 (i.e., 2007). Prior to increasing pumping above current authorized levels, operational rules for use of additional export capability will be determined through ESA consultation on the project-specific environmental documentation prepared for the various conveyance elements. To offset potential impacts and to provide for recovery of fishery populations, additional measures will be developed which would allow for protection of fish. These additional measures may include (a) screening, (b) new standards which limit the timing and magnitude of exports and water supply releases at key periods of fish concern, or a combination of the two. The agencies are discussing the installation of fish screen modules of 2,500 cfs each at Clifton Court Forebay. However, entrainment of fish at the pumps could increase during the interim period before the diversion is fully screened due to increased fish attraction to greater export flow. Other negative effects (e.g., increased predation, impingement, and abrasion) associated with water diversions also may increase with the greater volume of water exported. Both screening the intake and increasing water exports will require further consultation with the appropriate fish and wildlife agencies. Potential adverse impacts to fish populations will have to be monitored carefully throughout the 30-year period of Phase III.

Installation and closure of an operable barrier at the head of Old River would direct San Joaquin River flow down the main San Joaquin River channel and past Stockton. The barrier would benefit outmigrating juvenile chinook salmon and steelhead from the San Joaquin River Basin by directing their movement along the San Joaquin River pathway and away from the CVP and SWP south Delta export intakes. The likelihood of successful outmigration increases as juvenile salmonids are directed further downstream. The barrier may also benefit adult chinook salmon through improved dissolved oxygen and water temperature conditions that result from increased net flow past Stockton.

Alternatively, closure of the barrier without a concomitant reduction in exports would increase net flow toward the CVP/SWP pumps, primarily through Turner Cut, Middle River, and Old River. Net flow toward the export facilities counters the natural net flow conditions in Delta channels and could reduce productivity, impair species movement, and increase entrainment of anadromous salmonids and other species in Delta diversions. Installation and operation of this barrier will require ongoing consultation with the fish and wildlife agencies to minimize adverse effects.

Construction of barriers on other south Delta channels, such as Middle River and Old River near the CVP's Tracy fish facility, or their functional equivalent may be necessary to alleviate the reduced water levels caused by closure of the head of Old River barrier in combination with CVP and SWP export operation. The barriers would diminish tidal flow, reducing connectivity to other Delta channels and altering basic hydraulic features that affect sediment and nutrient movement, water quality conditions (for example, water temperature and dissolved oxygen), and productivity. Barriers are expected to affect water quality because circulation would be reduced for the area bounded by the barriers. Reduced circulation could change stratification patterns and flow movement that potentially affect dissolved oxygen and water temperature. Anadromous salmonids and other species could be adversely affected by loss of habitat, change in water quality conditions (including water temperature and dissolved oxygen), and impeded access to resources and conditions that allow a species to survive and reproduce. Construction and operation of the barriers likely will require ongoing consultation with the fish and wildlife agencies.

Dredging to enlarge south Delta channels, including Middle River and Old River, would increase the channel depth and further alter the natural structural features. In the short term, dredging would remove benthic communities and mobilize fine sediments. Maintenance dredging may be required over the long term, resulting in periodic short-term impacts. Dredging also may cause levee instability, which could require additional revetment and levee maintenance activities. Impacts to anadromous salmonids may be avoided or minimized through the use of accepted construction time windows and best management practices (see *Levee System Integrity Program*). These activities would require further consultation with appropriate fish and wildlife agencies. If channel enlargement is the result of setting back existing levees, salmonid habitat would potentially be increased. Installation of setback levees will be completed in coordination with the ERP (see *Summary of Key Planned Actions* and *Ecosystem Restoration Program*).

North Delta

The proposed North Delta Improvements are designed to address flood control, water quality, fish, and water supply reliability. Actions include modification of the Delta Cross Channel gates, channel dredging and/or setback levees in the Mokelumne River, and the creation of additional floodplain, wildlife, and fish habitat. Under the Preferred Program, north Delta improvements also include the study and evaluation of a screened diversion facility on the Sacramento River with a range of diversion capacities up to 4,000 cfs. This diversion facility between the Sacramento and Mokelumne rivers would likely include a fish screen, pumps, and facilities for upstream fish passage.

Under the Preferred Program Alternative, the DCC may be closed from September through July and possibly all months, which would increase survival of juvenile salmon and steelhead entering the Delta from the Sacramento River during October-January and May 20-June 30 compared to DCC operation at the present. While the additional closure of the DCC relative to present operation is viewed as beneficial to Sacramento River origin juvenile salmon and steelhead, it may increase the frequency and magnitude of net reverse flow conditions in the lower San Joaquin River. This increase in net reverse flow could adversely affect juvenile salmon and steelhead entering the Delta through Georgian Slough and the San Joaquin river. A diversion channel on the Sacramento River could minimize this effect of DCC closures depending on the configuration of the various in delta barriers anticipated as part of the south Delta program .

Construction and operation of a screened diversion facility on the Sacramento River may be pursued during Stage 1 if the evaluations demonstrate that this facility is necessary to address drinking water quality concerns and it can be constructed without adversely affecting fish populations. The fish screens would be designed to prevent juvenile and adult fish from leaving the Sacramento River and entering the new channel with the flow diverted into the Mokelumne River. Although the fish screen facility would mitigate potential entrainment impacts, other potential adverse effects would have to be addressed prior to constructing this diversion. Existing relationships indicate that reduced flow in the Sacramento River (from flow exiting through the diversion) would cause an increase in the proportion of flow entering Georgiana Slough. Chinook salmon outmigration in the Sacramento River primarily occurs from December through May. The proportion of juveniles moving from the Sacramento River and into Georgiana Slough, therefore, is expected to increase with increased flow diverted through the Sacramento to Mokelumne River channel. Survival of chinook salmon that move into the Central Delta via the DCC and Georgiana Slough is less than survival of fish that continue down the Sacramento River toward Rio Vista. USFWS studies indicate that the survival of fish following the Sacramento River route toward Rio Vista may be several times higher than survival of fish entering the DCC and Georgiana Slough. The actual magnitude of survival, however, is uncertain and depends on other factors, including water temperature and flow or salinity. In addition, abrasion, increased predation, impingement on fish screens or other diversion structures, stress from being handled, and movement to inappropriate habitat would reduce the survival of fish contacting the fish screens.

Potential impacts to adult chinook salmon and steelhead could arise from a new channel which would direct additional Sacramento River water into the Mokelumne River channels and the central Delta. In combination with reduced flow down the Sacramento River channel, chinook salmon and steelhead adults migrating upstream to spawn may be attracted to the Mokelumne River channels and subsequently to the Sacramento River. The fish screen at the diversion facility on the Sacramento River would prevent movement of adult fish into the Sacramento River. Although fish ladders or other passage facilities may be constructed, the efficiency of moving fish to the Sacramento River will depend on many factors, some level of migration delay and blockage is likely. Adverse impacts may include mortality, reduced fecundity or reproductive success, and straying, potentially affecting the fitness of natural spawning and rearing populations in appropriated habitats. The addition of Sacramento River flow to the Mokelumne River channels could also confuse adult chinook salmon returning to spawn and delay outmigration of juveniles to the ocean. The flow reduction in the Sacramento River downstream of the diversion may reduce smolt survival, because there is a strong, positive flow-abundance relationship for juvenile chinook salmon in this reach of the Sacramento River (Brandes and McClain, in press).

The diversion of additional Sacramento River water into the Mokelumne River channels and the central Delta would increase the frequency and magnitude of natural channel net flow direction in the Lower San Joaquin River, but reduce the magnitude of natural net channel flow in the Sacramento River below the diversion, primarily during February to June. Natural net flow conditions in the Lower San Joaquin River channel could increase productivity, enhance species movement, and reduce entrainment in Delta diversions. The effects of reduced flow in the Sacramento River below the diversion could adversely affect habitat

Dredging to enlarge the Mokelumne River would increase the channel depth and further alter the natural structural features. In the short term, dredging would remove benthic communities and mobilize fine sediments. Maintenance dredging may be required over the long term, resulting in periodic short-term impacts. Dredging also may cause levee instability, which could require additional revetment and levee maintenance activities. Impacts to anadromous salmonids may be avoided or minimized through the use of accepted construction time windows and best management practices (see *Levee System Integrity Program*). These activities would require further consultation with appropriate fish and wildlife agencies. If channel enlargement is the result of setting back existing levees, salmonid habitat would potentially be increased. Installation of setback levees will be completed in coordination with the ERP (see *Summary of Key Planned Actions* and *Ecosystem Restoration Program*).

Environmental Water Account (EWA)

The EWA is part of CALFED's Water Management Strategy, designed to improve fisheries protection while providing improvements in water quality and waters supply reliability. The purpose of the EWA is to provide water for fisheries protection and recovery beyond that available through existing regulatory actions. The EWA will be managed by NMFS, FWS, and

DFG to address the real-time needs of the fisheries resources in the Central Valley, with an emphasis in the delta.

The EWA is currently designed to be implemented for four years and contains initial assets totaling 380,000 acre-feet of water available annually. During Stage 1, the EWA can be used to augment instream flows, augment delta outflows, improve delta hydrodynamics, and curtail CVP/SWP exports during key periods of fishery concern. The EWA is based upon the concept that flexible management of water will achieve fishery and ecosystem benefits more efficiently and to a greater degree than a completely prescriptive regulatory approach. Development and use of the EWA will require coordination with the other components of the WMS (i.e., conveyance and storage).

The ability of the EWA to provide for additional fisheries protection over pre-CALFED baseline conditions will depend to a large degree on its implementation. It is anticipated that EWA water will be available to reduce Delta exports during key rearing and outmigration periods for juvenile chinook salmon and steelhead. Additional EWA benefits to anadromous salmonids may include improved flow and temperature conditions for spawning, rearing, and migration in upstream areas. However, management of the EWA must also address potential adverse effects. Changes in reservoir release patterns may adversely affect anadromous salmonids by reducing reservoir carryover storage levels and increasing downstream water temperatures. Fluctuations in reservoir releases may dewater redds or strand juvenile fish. As the EWA managers, NMFS, FWS, and DFG must fully consider potential upstream effects during the implementation of EWA actions.

Implementation of the EWA is anticipated to significantly benefit anadromous salmonids, particularly rearing and outmigrating juveniles in the delta. A number of computer simulations conducted during the CALFED planning effort demonstrated benefits to juvenile anadromous salmonids can be realized in virtually all water years. In general, benefits to anadromous salmonids in the delta can be achieved by reducing water exports at times when fish are most vulnerable to pumping and exports can be increased when fish are less vulnerable.

If the EWA is not fully implemented, project operations will return to baseline operations as defined prior to CALFED: (the WQCP, 1993 winter-run chinook salmon biological opinion, 1995 biological opinion on OCAP for delta smelt and splittail, and CVPIA implementation including the 800,000 acre-feet supply of water pursuant to Section 3406(b)(2) in accordance with Interior's October 5, 1999 decision as clarified previously in the document). In addition, the following clarifications are set forth: 1) CVP/SWP will implement both the flow and export provisions of either VAMP or, in the absence of VAMP, the flows and export curtailments in the 1995 biological opinion on OCAP; 2) if or when the yellow light level in the incidental take statement is reached, as identified in the1995 OCAP biological opinion, the CVP/SWP will immediately reinitiate consultation and implement actions to reduce the amount or extent of take and reduce the indirect effects of project operations on fish as deemed necessary by the fishery resource agencies; 3) all new projects which may affect the environmental baseline identified in this opinion and the 1995 OCAP opinion will be subject to section 7 consultation to avoid and/or minimize the affects of those actions; and 4) other necessary regulatory provisions which may be required to meet the needs of listed species (e.g. spring run chinook salmon and steelhead).

Science Program

Implementing the Science Program may adversely affect anadromous salmonids through take of fish during monitoring and research efforts. However, overall beneficial effects are expected because the Science Program will obtain, analyze, and interpret modeling results and data that will be used to guide implementation of the different CALFED programs and strategies. The success of programs and actions continually will be evaluated, and the Science Program will provide recommendations for adaptive management that is to promote species restoration. CALFED will use the Science Program to measure progress towards meeting prescriptions for MSCS evaluated species primarily by monitoring the distribution and abundance of habitat types over time. Many of the programs and actions proposed by CALFED have not been implemented previously on a large scale (e.g., installation of setback levees) or a statewide scale (e.g., the WUEP). The beneficial effects of implementing other more common actions, such as restoration of wetlands or shaded riverine aquatic habitat, are not well understood. Information obtained through the Science Program will lead to better understanding and greater ability to predict the effects of implementing particular actions on salmonids and other species.

Science program monitoring and research activities that should provide information used to promote restoration of anadromous salmonids include studies of food web and fish population dynamics in the Delta, real-time monitoring for enhanced fish protections and flexible operations for water suppliers, and water quality monitoring in the San Joaquin River. Many of the actions proposed under the ERP, WQP, and other CALFED programs involve monitoring and research components. These components will be implemented in coordination with the Science Program. Additionally, the Science Program likely will inherit several ongoing monitoring and research studies from the IEP. These studies may form the basis for long-term data sets that contain both pre- and post-CALFED data, which may prove critical for evaluating the overall success of CALFED.

Monitoring and research of juvenile salmonids in the Bay-Delta system likely will involve their collection during periodic fish sampling. Collection methods may include electroshocking in shallow, freshwater areas. Outmigrant trapping or trawling are commonly used in deeper or more saline locations. These collection methods all may lead to mortality of fish, although the greatest mortality likely would occur from trawling due to abrasion of fish while the trawl is in motion. Electroshocking and outmigrant trapping equipment and techniques have been improved in recent years to reduce fish mortality, but still would physically and physiologically stress fish. Delayed mortality or permanent injury may be incurred. Fright responses or minor injuries resulting from collection or handling may temporarily impair feeding or increase vulnerability to predation or injury once fish are released.

Sampling mortality of juvenile salmonids is expected to be acceptably low if normal precautions against it are taken. Electroshocking equipment may be adjusted to reduce mortality or injury. Stress or injury resulting from handling may be reduced if juvenile salmonids are anesthetized prior to handling, and allowed to recover from the effects of the anesthetic prior to release

(Summerfelt and Smith 1990). Juvenile salmonids, if anesthesized and held in cool water, tend to be robust compared to larval salmonids or other species such as delta smelt. Monitoring and research that is to occur through the Science Program likely will be conducted by experienced crews using established sampling protocols that have explicit take limits established through consultation with the fish and wildlife agencies.

Data collected from adult steelhead and chinook salmon likely will be collected in upstream areas by observation only (e.g., by snorkeling, at fish passage facilities, or during redd counts). Snorkel observations may be the preferred method of data collection for juvenile salmonids in upstream areas as well. Because these methods do not involve physically handling the fish, their effects likely would be limited to minor, temporary fright responses. Carcass surveys may similarly disturb remaining live adult steelhead or chinook salmon that are preparing to spawn.

Multi-Species Conservation Strategy (MSCS)

The MSCS encompasses all CALFED program elements and strategies and is the guiding document for species conservation throughout Phase III. Its implementation is expected to greatly benefit anadromous salmonids. In the MSCS, Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley fall/late fall-run chinook salmon, and Central Valley steelhead have been assigned the conservation goal of recovery ("R"). With respect to anadromous salmonids within the MSCS focus area, recovery is equivalent, at a minimum, to completing the actions within the ERP Ecological Management Zones that are required for delisting a species under the federal and state ESAs. Central California Coast steelhead is expected to be minimally affected by CALFED, and therefore has been assigned a conservation goal of maintain ("m"). The MSCS also describes how goals will be achieved through species prescriptions, which are targets that describe the future expected changes in evaluated species' habitats and populations with full implementation of CALFED. If evaluated species prescriptions are achieved, CALFED goals for evaluated species will have been met. CALFED is expected to undertake all of the actions within the ERP Ecological Management Zones necessary to recover Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley fall/late fall-run chinook salmon, and Central Valley steelhead, and is expected to avoid, minimize, and compensate for the adverse effects of its actions on Central California Coast steelhead.

The MSCS contains two types of conservation measures: (1) measures to avoid, minimize, and compensate for the adverse effects to evaluated species caused by individual CALFED actions, and (2) measures to enhance evaluated species that are not directly linked to CALFED's adverse effects, are consistent with the ERP, and may be milestones. Both types of measures will be implemented through the use of ASIPs that will be developed for specific CALFED actions or bundles of actions. The MSCS also allows for additional, project-specific conservation measures to be included in ASIPs.

The MSCS could adversely impact anadromous salmonids if their habitat requirements conflict with the conservation measures recommended for other species (e.g., releases of water at

inappropriate times or of inadequate temperature). Implementation of such measures could reduce the feeding, growth, spawning success, or survival of steelhead or chinook salmon. These types of adverse impacts likely will be avoided because the conservation measures will be included in ASIPs which will require consultation with the fish and wildlife agencies. CALFED will use the Science Program to ensure proper implementation of the MSCS.

Governance Plan

The CALFED Program is to be implemented in stages over a period of 30 years. Project descriptions and funding sources have been most clearly identified for actions that are to occur during Stage 1 (i.e., the first 7 years of Phase III). However, the CALFED Governance Program provides a framework that includes the following provisions for oversight of both short- and long-term implementation:

- **#** Grouping of actions to ensure beneficial impacts (i.e., resulting primarily from ERP actions) are concurrent in time and location with adverse impacts. Actions are intended to take place in an integrated framework and not independently of the other programs. The Governance Program is to establish reliable short-term and long-term funding for each program element and for each bundle of Stage 1 actions;

- **#** Using ASIPs to ensure adequate, site-specific and tiered consultations with the resource agencies prior to the implementation of specific actions. The ASIPs will serve as the biological assessments for these actions, and NMFS will use the ASIPs to develop action-specific biological opinions that include incidental take statements. Compliance with the terms and conditions of existing biological opinions, and thus consistency with previous NMFS consultations, will be assured in the action-specific biological opinions.

- **#** Using the Science Program to direct research and monitor impacts to species populations. Research and monitoring related to Stage 1 actions will be used to develop adaptive management strategies and direct implementation of later actions. CALFED objectives will remain fixed over time, but the actions may be adjusted to assure that the solution is durable. Adaptations are expected to be necessary as conditions change and as more is learned about the system and how it responds;

- **#** Using species-specific, Stage 1 milestones to ensure that beneficial impacts of the CALFED Program are significant, broad, and occur at an acceptable pace. These milestones have been developed from the ERP/WQP targets and programmatic actions, and MSCS conservation measures. The milestones also include Science Program actions that are relevant for ERP, WQP, and MSCS implementation. Progress toward attaining all milestones will be continually reviewed by the resource agencies. Milestones may be revised to provide for the protection of species through adaptive management; and

- # Using key planned actions for additional guidance in CALFED Program implementation.

Use of the above mechanisms to provide oversight would be expected to lead to an overall beneficial impact of implementation of the CALFED Program to chinook salmon and steelhead.

C. Overall Effects

The CALFED Program is intended to increase water availability for agricultural and urban users over a period of 30 years while providing for recovery of anadromous salmonids and other species. Groundwater pumping, reservoir storage, and water exports for agricultural and urban use all are expected to increase. Although these actions could have substantial adverse effects on Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, and Central California Coast steelhead, more water is expected to be made available to benefit species at key times. Specifically, the increased development of water sources, combined with increased efficiency in water use under the WUEP, water transfers under the WTP, and in conveyance will allow assets to accrue in the EWA component of the WMS. The CALFED Program assures that additional environmental water will be available as needed under Tier 3 of the WMS, even during periods of drought. Lack of adequate Tier 3 water will trigger reinitiation of consultation with the fish and wildlife agencies at the programmatic level.

The ERP and WQP should provide overall beneficial impacts to anadromous salmonids by greatly improving fish habitat and water quality, respectively. Generally, negative impacts of in-channel construction actions implemented under the LSIP, ERP, WP, Storage, and Conveyance elements can be avoided and minimized using best management practices and appropriate time windows for construction, and coordination with the ERP. Projects involving levee construction and maintenance in particular will be coordinated with the ERP to not only minimize adverse impacts, but to restore fish habitat through installing setback levees where possible. The SWP/CVP export facilities, which constitute a major source of mortality for outmigrating juvenile salmonids, are to be screened.

Oversight of the CALFED Program is critical to assure that adverse impacts to anadromous are avoided and minimized, and that habitat restoration and species recovery occur as planned. This oversight will involve the active participation of the fish and wildlife agencies, and will be achieved through use of the Governance Program, ERP, Science Program, and MSCS. ASIPs will be used to evaluate the impacts of specific actions. Progress toward achieving ERP/WQP targets and programmatic actions, MSCS conservation measures, and Stage 1 milestones will continually be evaluated. Adaptive management will be used as needed.

V. Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act.

Non-Federal actions which may affect listed species within the action area considered in this biological opinion include changes in State angling regulations, State hatchery practices, voluntary State or private sponsored habitat restoration activities, changes in agricultural practices or the demand for agricultural products, and increased population growth and urbanization.

State angling regulations are generally moving towards greater restrictions to protect listed fish species. Through seasonal and area closures, greater numbers of adult listed fish are expected to complete their migration to upstream spawning areas. Mass marking of juvenile anadromous fish produced at Central Valley hatcheries could allow for the implementation of selective ocean and in-river harvest. A selective fishery that targets only externally marked hatchery production and that releases unmarked naturally spawned fish may significantly reduce harvest rates on listed salmonids. In general, these changes in State angling regulations are expected to increase populations of listed salmonids.

State hatchery practices could reduce natural stocks of listed salmonids and their overall populations through competition, reduction in genetic diversity, and disease transmission resulting from hatchery introductions. However, whether hatchery practices adversely affect listed salmonids may also depend on other factors such as predation and habitat quantity and quality. Efforts are currently underway between NMFS and the State to modify existing hatchery practices in ways to augment salmon and steelhead populations without having detrimental effects on naturally spawning populations. Through the close evaluation of practices at all Central Valley salmon and steelhead hatcheries, the State is expected to determine the effects on wild populations and take steps to change these practices if needed.

State and/or privately sponsored habitat restoration activities may have short-term negative effects associated with in-water construction. The effects of such actions are expected to be temporary and localized. The overall outcome is expected to benefit listed salmonids. An exception is the potential increase in non-native species to levels detrimental to native species, including listed salmonids, as an outcome of the reestablishment of aquatic areas in the action area. Mitigation strategies for such activities are identified in the CALFED Bay-Delta Program.

Changes in agricultural practices or the demand for agricultural produces could adversely effect listed salmonids if they result in agricultural interests being less willing to sell water for fish and wildlife purposes. Changes in demand could change the ratio of permanent to annual crops such that water availability on an annual basis for certain CALFED Programs (e.g. the Environmental Water Account) is affected. This is particularly of concern if the opportunities to acquire water for

fish and wildlife purposes is decreased. CALFED Program efforts though the Water Use Efficiency and Conservation Program and Storage may minimize or mitigate these potential effects.

Increased population growth and urbanization in the action area may negatively impact water quality, riparian function, and stream productivity, adversely affecting listed salmonids. Population growth creates a demand for land for residential, commercial and infrastructure use. Current estimates anticipate that California's population will triple between the year 2000 and the year 2040. Not only is this expected to put tremendous pressure on agricultural land and public services but it will challenge CALFED's ability to provide quality aquatic habitat for listed salmonid species. CALFED program efforts through the Ecosystem Restoration Program (with its primary objective of long-term ecological benefits), and the Water Quality, Watershed, and Storage Programs, may minimize or mitigate these potential effects.

VI. Conclusion

The Federal CALFED Co-Lead Agencies and the State of California have made commitments to uphold the ESA during implementation (Phase III) of the CALFED Bay-Delta Program by review of individual actions and initiation of Section 7 consultations on actions that may affect listed species under the jurisdiction of NMFS. By doing so along with implementing the program as described, including the key planned actions described previously in this biological opinion, combined with the current status of Sacramento River Winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, and Central California Coast steelhead, the environmental baseline for the action area, the anticipated direct, indirect, and cumulative effects of the proposed action, it is NMFS' biological opinion that implementation of the CALFED Bay-Delta Program's Preferred Program Alternative is not likely to jeopardize the continued existence of Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, or Central California Coast steelhead. NMFS has also determined that the action, as proposed, is not likely to destroy or adversely modify critical habitat for these species.

This no-jeopardy determination, at the programmatic scale, is not intended to, nor does it preclude NMFS from making future jeopardy determinations based on the effects analysis for action specific implementation programs.

Due to the programmatic nature of this biological opinion, the project- and action-specific information necessary to determine the amount and extent of incidental take of Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead and/or Central California Coast steelhead associated with individual CALFED Bay-Delta Program activities/actions is lacking. Therefore, incidental take of these listed anadromous salmonids is not authorized in this programmatic biological opinion. Thus, the Federal CALFED CO-Lead Agencies will initiate individual Section 7 consultations with NMFS for action-specific implementation programs which may affect these listed anadromous salmonids. Future biological opinions that are tiered under this programmatic opinion will estimate, evaluate, and authorize the

amount and extent of incidental take associated with action specific plans that cannot be avoided or mitigated and will not preclude survival and recovery of the listed species.

VIII. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or to develop information. NMFS recommends that the CALFED Bay-Delta Program, through the Federal co-lead agencies:

1. Provide annual accomplishment reports to NMFS regarding implementation of CALFED Bay-Delta programs, activities, and actions.

2. In addition to the goals of ERP, incorporate the viable salmonid population (VSP)[2] concept (NMFS 1999) into the anadromous salmonid goals of the CALFED Bay-Delta Program.

3. Actions to restore and create waterfowl habitat along Central Valley waterways should be designed in a manner to avoid the creation of predatory fish holding habitat and prevent the entrapment of juvenile and adult salmonids.

4. CALFED action agencies should coordinate closely with non-federal action agencies on activities affecting listed species within the action area to assure avoidance and minimization of potential cumulative adverse effects.

IX. Reinitiation Notice

This concludes the programmatic consultation on the implementation of the Preferred Program Alternative for the CALFED Bay-Delta Program as described in the July 2000 Final EIS/EIR. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the actions has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of agency actions that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. This programmatic biological opinion does not provide incidental take authorization. However, it is expected that the Federal co-leads for the CALFED Bay-Delta Program will initiate individual Section 7 consultations with NMFS for actions/activities which may affect listed anadromous salmonids.

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[2]A *viable salmonid population* (VSP) is an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation (random or directional), local environment variation, and genetic diversity changes (random or directional) over a 100-year time frame.

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APPENDIX A

CALFED BAY-DELTA PROGRAM

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

(Magnuson-Stevens Fishery Conservation and Management Act - EFH Consultation)

CALFED BAY-DELTA PROGRAM

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

(Magnuson-Stevens Fishery Conservation and Management Act - EFH Consultation)

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) set forth new mandates for the National Marine Fisheries Service (NMFS), regional fishery management councils, and federal action agencies to identify and protect important marine and anadromous fish habitat. The Councils, with assistance from NMFS, are required to delineate "essential fish habitat" (EFH) in fishery management plans (FMPs) or FMP amendments for all managed species. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding potential adverse effects of their actions on EFH, and respond in writing to NMFS' conservation recommendations. In addition, NMFS is required to comment on any state agency activities that would impact EFH. Although the concept of EFH is similar to that of "Critical Habitat" under the Endangered Species Act, measures recommended to protect EFH are advisory, not proscriptive.

The Pacific Fisheries Management Council has delineated EFH for west coast groundfish (PFMC 1998a) and coastal pelagic species (PFMC 1998b) and is currently delineating EFH for Pacific Coast Salmon through amendment 14 to the Pacific Coast Salmon FMP (PFMC 1999). Species within the action area of the preceding biological opinion which require EFH consultation are Chinook Salmon (*Oncorhynchus tshawytscha*), Northern anchovy (*Engraulis mordax*), and Starry flounder (*Platichthys stellatus*).

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

Essential fish habitat (EFH) is defined in the MSFCMA as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity...". NMFS regulations further define "waters" to include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" to include sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" to mean the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" to cover a species' full life cycle.

The geographic extent of EFH for coastal pelagic species and west coast groundfish includes waters, substrates and biological communities within bays and estuaries of the Pacific coast seaward from the high tide line (MHHW) or extent of upriver saltwater intrusion. This includes waters of Suisun Bay and Marsh which are within the action area of the preceding biological opinion.

For Pacific coast salmon, the geographic extent of EFH currently being considered includes both marine and freshwater habitat. For purposes of this consultation, Pacific coast salmon EFH corresponds to "Critical Habitat" designated under the Endangered Species Act for Sacramento River winter-run chinook (58 FR 33212), Central Valley Spring-run chinook salmon, and Central Valley Steelhead (65 FR 7764).

LIFE HISTORY AND HABITAT REQUIREMENTS

Northern Anchovy and Starry Flounder

Northen anchovy are small, short-lived fish typically found in schools near the surface. They rarely exceed four years of age and 18 cm total length. They eat phytoplankton and zooplankton by either filter feeding or biting, depending on the size of the food. Sexual maturity occurs at age two. Spawning occurs during every month of the year, increasing in late winter and early spring, peaking from February to April. Preferred spawning temperature is 14ºC and eggs are most abundant at temperatures of 12ºC to 16ºC. Females spawning batches of eggs throughout the spawning season at intervals as short as seven to ten days. Both eggs and larvae are typically found near the surface.

Starry flounder are an important member of the inner continental shelf and shallow sublittoral communities. Most spawning occurs in estuaries or sheltered inshore bays, in less than 45 m of water. Eggs and larvae are epipelagic; juveniles and adults are demersal. Eggs occur at or near the surface over water 20-70 m deep. Larvae are found in estuaries to 37 km offshore. Juveniles are found in estuaries and the lower reaches of major coastal rivers. Adults also occur in estuaries or their freshwater sources year-round. Juveniles prefer sandy to muddy substrates, and adults prefer sandy to coarse substrates. Eggs are found in polyhaline to euhaline waters; juveniles are found in mesohaline to fresh water; adults and larvae are found in euhaline to fresh water. Starry flounder are not considered to be a migratory species, however, adults move inshore in late winter-early spring to spawn and offshore and deeper in the summer and fall, but these coastal movements are generally less than 5 km. Adults and juveniles are known to swim great distances up major coastal rivers (>120 km) but not following any migratory trend. In California, starry flounder spawn from November-February, peaking in December. Larvae are planktivorous. Juveniles and adults are carnivorous. Large fish fed on a wider variety of items, including crabs and other more mobile foods. In other areas, clams and benthic fishes are an important part of the starry flounder's diet.

Chinook Salmon

General life history information for chinook salmon is summarized in the preceding biological opinion. Further detailed information on chinook salmon ESUs are available in the NMFS status review of chinook salmon from Washington, Idaho, Oregon, and California (Myers et al., 1998), and the NMFS proposed rule for listing several ESUs of chinook salmon (NMFS, 1998).

Population trends for Sacramento River winter-run and Central Valley Spring-run chinook salmon are also presented in the preceding biological opinion. Trends in abundance of fall- and late fall-run chinook within the Sacramento and San Joaquin River Basins and Delta are mixed, but the number of natural spawners has been quite high (5-year geometric mean was 190,000 natural spawners for the Sacramento River Basin). Populations in the San Joaquin Basin have experienced booms and busts but currently appear to be on an upward trend in abundance.

II. PROPOSED ACTION.

The proposed action is described in Part I of the preceding biological opinion for the endangered Sacramento River winter-run chinook salmon, threatened Central Valley spring-run chinook salmon, and threatened Cental Valley Steelhead.

III. EFFECTS OF THE PROJECT ACTION

The following is a general description of the non-fishing related activities that directly or cumulatively, temporarily or permanently may threaten the physical, chemical and biological properties of the habitat utilized by west coast groundfish species (starry flounder), coastal pelagic species (northern anchovy) or Pacific coast salmon and their prey within the proposed project area. The direct result of these threats is that the function of EFH may be eliminated, diminished or disrupted.

Potential impacts to Pacific coast salmon EFH, specifically Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead, due to the proposed action have been described in the preceding biological opinion. These potential impacts would also apply to Central Valley fall and late-fall run chinook salmon.

Adverse effects of the proposed action on west coast groundfish (starry flounder) EFH and coastal pelagic species (northern anchovy) EFH may occur through water diversions, aquatic habitat restoration or enhancement activities, and changes in agricultural practices. Various life stages of coastal pelagic species or west coast groundfish may be effected by water diversions through entrapment or impingement on intake screens. Aquatic habitat restoration or enhancement activities may result in the loss of habitat upon with various life stages of coastal pelagic species or groundfish rely. Changes in agricultural practices may cause changes in water quality through the introduction of fertilizers, herbicides, insecticides, animal wastes, and other chemicals to the extent that EFH for coastal pelagic species and/or groundfish is affected.

IV. CONCLUSION

Upon review of the anticipated effects of the CALFED Bay-Delta Preferred Program Alternative (the proposed action), including the Multi-Species Conservation Strategy (MSCS), NMFS believes that on a programmatic level the proposed action is not likely to adversely effect Pacific coast

salmon EFH. However, while the proposed project action includes efforts to increased aquatic habitat quality overall the potential still exists to imposes limited adverse affects on EFH for coastal pelagic species or west coast groundfish.

V. EFH CONSERVATION RECOMMENDATIONS

Pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Act, NMFS recommends that the conservation recommendations included in the preceding programmatic biological opinion be adopted as EFH Conservation Recommendations for Pacific coast salmon. NMFS also recommends, as an additional EFH Conservation Recommendation, that action specific EFH consultations be completed for CALFED Program actions prior to their implementation in order to assess the effects on coastal pelagic species, west coast groundfish, and/or Pacific coast salmon EFH, as appropriate.

VI. CALFED FEDERAL CO-LEAD AGENCY STATUTORY REQUIREMENTS

The Magnuson-Stevens Act (Section 305(b)(4)(B)) and Federal regulations (50 CFR Section 600.920(j)) to implement the EFH provisions of the MSFCMA require federal action agencies to provide a written response to EFH Conservation Recommendations within 30 days of its receipt. Federal action agencies included in this consultation are the CALFED Federal Co-Lead Agencies (Bureau of Reclamation, Fish and Wildlife Service, Army Corps of Engineers, Environmental Protection Agency, National Marine Fisheries Service, and Natural Resources Conservation Service). The appropriate federal agency implementing the CALFED action is responsible for responding to EFH Conservation Recommendations. A preliminary response is acceptable if final action cannot be completed within 30 days. The final response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on delineated EFH. If the response is inconsistent with our EFH Conservation Recommendations, it must provide an explanation of the reasons for not implementing them. Because the EFH designation for Pacific coast salmon has yet to be approved, this regulation does not apply to this EFH until approved by the Secretary of Commerce at which time the 30 day period will commence.

References

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APPENDIX B

CALFED BAY-DELTA PROGRAM

ENVIRONMENTAL WATER ACCOUNT OPERATING PRINCIPLES AGREEMENT

INSERT FINAL EWA OPERATING PRINCIPLES AGREEMENT

APPENDIX C

CALFED BAY-DELTA PROGRAM

CALFED Ecosystem Restoration Program Stage 1 Milestones (Final August 25, 2000)

Table C-1. CALFED Ecosystem Restoration Program Stage 1 Milestones (Final August 25, 2000)

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Delta and East Side Tributaries		
Ecological Processes		
Develop a methodology for evaluating delta flow and hydrodynamic patterns and begin implementation of an ecologically based plan to restore conditions in the rivers and sloughs of the Delta sufficient to support targets for the restoration of aquatic resources.	Bay-Delta Hydrodynamics	Central Valley chinook salmon and steelhead, green sturgeon, delta smelt, longfin smelt, and Sacramento splittail
Develop and implement temperature management programs within major tributaries in the Eastside Delta Tributaries EMZ. The goal of the programs should be achievement of the ERP temperature targets for salmon and steelhead. The programs shall include provisions to: a) develop accurate and reliable water temperature prediction models; b) evaluate the use of minimum carryover storage levels and other operational tools; c) evaluate the use of new facilities such as temperature control devices; and d) recommend operational and/or physical facilities as a long-term solution.	Central Valley Stream Temperatures	Central Valley fall/late fall-run chinook salmon and steelhead
Provide a fall or early winter outflow that emulates the first "winter" rain through the Delta.	Central Valley Streamflow	all Central Valley salmonids
Complete a fluvial geomorphic assessment of coarse sediment supply needs and sources to maintain, improve, or supplement gravel recruitment and natural sediment transport processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas, and the regeneration of riparian vegetation. Develop and implement a program to reduce erosion and maintain gravel recruitment on at least one tributary within the Eastside Delta Tributaries EMZ.	Coarse Sediment Supply	all races of chinook salmon, steelhead, splittail, delta smelt, green sturgeon, bank swallow, California yellow warbler, western yellow-billed cuckoo, Least Bell's vireo, valley elderberry longhorn beetle, Norther California black walnut

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop floodplain management plans, including feasiblility studies to construct setback levees, to restore and improve opportunities for rivers to inundate their floodplain on a seasonal basis for at least one tributary within the Eastside Delta Tributary EMZ.	Natural Floodplain and Flood Processes	all Central Valley salmonids, Sacramento splittail, delta smelt, longfin smelt, western yellow-billed cuckoo, California yellow warbler, Least Bell's vireo, San Joaquin Valley woodrat, Valley elderberry long-horn beetle, Northern California black walnut
Habitats		
In the Sacramento-San Joaquin Delta EMZ, cooperatively enhance at least 15% of the ERP target for wildlife friendly agricultural practices.	Agricultural Lands	greater sandhill crane, giant garter snake, Swainson's hawk
Restore a minimum of 15 miles of slough habitat (widths less than 50 to 75 feet) in each of the North, East, South, Central and West Delta EMUs that allows for the colonization of delta mudwort and delta tule pea.	Delta Sloughs	all Central Valley salmonids, delta smelt, Sacramento splittail, Sacramento perch, giant garter snake,delta mudwort, delta tule pea
Restore a minimum of 500, 250, 1,000, and 2,500 acres of nontidal emergent wetland in the North, East, South, and Central and West Delta Ecological Management units respectively. Establish at least one population of bristly sedge in each EMU.	Fresh Emergent Wetland (nontidal)	giant garter snake, California black rail, bristly sedge
Restore a minimum of 500, 500, 4,000, and 5,000 acres of tidal emergent wetland in the North, East, South, and Central and West Delta Ecological Management units respectively.	Fresh Emergent Wetland (tidal)	all Central Valley salmonids, green sturgeon, longfin smelt, delta smelt, Sacramento splittail, California black rail, Mason's lilaeopsis, delta mudwort, delta tule pea
Conduct surveys to locate potential habitat restoration sites capable of supporting Antioch dunes evening primrose, Contra Costa wallflower, and Lange's metalmark butterfly. Enhance 50 acres of low to moderate quality Antioch inland dune scrub habitat to support these species. Annually monitor establishment success.	Inland Dune Scrub	Lange's metalmark butterfly, Antioch dunes evening primrose, Contra Costa wallflower

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Restore a minimum of 125 acres of channel islands and 125 acres of shoals in the Delta.	Midchannel Islands and Shoals	all Central Valley salmonids, Sacramento splittail, delta smelt, black rail
Develop and implement a program to establish, restore, and maintain riparian habitat to improve floodplain habitat, salmonid shaded riverine aquatic habitat, and instream cover along at least one tributary within the Eastside Delta Tributary EMZ	Riparian and Riverine Aquatic Habitats	Central Valley steelhead, fall/late fall-run chinook salmon, western yellow-billed cuckoo, Valley elderberry long-horn beetle, riparian brush rabbit, California yellow warbler, Least Bell's vireo, little willow flycatcher, delta coyote thistle
Implement 25 percent of the ERP target for diverse, self-sustaining riparian community for each EMU in the Sacramento-San Joaquin Delta EMZ.	Riparian and Riverine Aquatic Habitats	Central Valley fall/late fall-run chinook salmon, steelhead, western yellow-billed cuckoo, little willow flycatcher, California yellow warbler
Restore a minimum of 300 acres of self-sustaining or managed diverse natural riparian habitat along the Mokelumne River, Cosumnes River, and Calaveras River and protect existing riparian habitat.	Riparian and Riverine Aquatic Habitats	Central Valley fall/late fall-run chinook salmon, steelhead, western yellow-billed cuckoo, little willow flycatcher, California yellow warbler, Valley elderberry long-horn beetle
Enhance, protect and restore 1,000 to 1,500 acres of seasonal wetlands in the East Delta EMU for optimum greater sandhill crane habitat.	Seasonal Wetlands	greater sandhill crane, Swainson's hawk
Restore a minimum of 500, 250, 500, and 750 acres of tidal perennial aquatic habitat in the North, East, South, and Cental and West Delta Ecological Management units respectively.	Tidal Perennial Aquatic Habitat	all Central Valley salmonids, delta smelt, Sacramento splittail, longfin smelt, green sturgeon
Stressors Reduction		

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop and implement a program to address inadequate instream flows for steelhead and chinook salmon on streams within Eastside Delta tributaries. Where appropriate provide adequate flows for Sacramento splittail and green sturgeon.	Dams and Other Structures	steelhead, fall/late fall-run chinook salmon, green sturgeon, Sacramento splittail
Provide unimpeded upstream and downstream passage for salmon and steelhead on Eastside Delta tributaries.	Dams and Other Structures	all Central Valley salmonids
Assist in the development and implementation of a black and clapper rail impact reduction program.	Disturbance	California black rail, California clapper rail
Develop and begin implementation of a program to reduce or eliminate the influx of non-native aquatic species in ship ballast water.	Invasive Aquatic Organisms	all covered fish species
Complete installation of fish passage facilities at Bellota Weir, Clements Dam, and Cherryland Dam on the Calaveras River and provide passage flows.	Dams and Other Structures	Central Valley fall/late fall-run chinook salmon and steelhead
Develop and begin implemention of a demonstration program to reduce invasive non-native plant abundance within at least one EMU in the Delta.	Invasive Aquatic Plants	Susiun Marsh aster, Mason's lilaeopsis, delta mudwort, delta tule pea
Implement a program to improve fish passage and reduce predation on juvenile salmonids below Woodbridge Dam on the lower Mokelumne River that includes the following elements: (1) improving the form and function of the stream channel; (2) rebuilding the Woodbridge Dam fish passage and diversion screening facilities to minimize losses of downstream migrating salmon and steelhead; and (3) improving the fish bypass discharge.	Predation and Competition	Central Valley fall/late fall-run chinook salmon, steelhead
Consolidate and screen 50 small agricultural diversions in the Delta, prioritized according to size, location, and season of operation.	Water Diversions	all R and r covered fish

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Upgrade screens at Southern Energy's Contra Costa power plants with screens acceptable to the Fish and wildlife agencies.	Water Diversions	all R and r covered fish
Actions to minimize or eliminate low dissolved oxygen conditions (DO sag) in lower San Joaquin River near Stockton (from Phase II Report): • Complete studies of causes for DO sag in San Joaquin River near Stockton. • Define and implement corrective measures for DO sag. • Finalization of investigation of methods to reduce constituents that cause low DO for inclusion in total maximun daily load (TMDL) recommendation by the Central Valley RWQCB. • Finalization of Basin Plan Amendment and TMDL for constituents that cause low DO in the San Joaquin River. • Implement appropriate source and other controls and other management practices, as recommended in the TMDL, to reduce anthropogenic oxygen depleting substances loadings and minimize or eliminate low DO conditions.	dissolved oxygen, oxygen depleting substances, nutrients, total organic carbon (TOC)	Salmonids, delta smelt, Sacramento splittail, longfin smelt, green sturgeon
Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations. (from Phase II Report)	oxygen depleting substances, nutrients, TOC, ammonia	Salmonids, Sacramento splittail
Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers. (from Phase II Report)	dissolved oxygen, oxygen depleting substances, nutrients	Salmonids, Sacramento splittail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Actions to reduce fine sediment loading to streams, especially Tuolumne, Merced, Stanislaus, Cosumnes, Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban stormwater runoff, and other specific sites. • Implement stream restoration and revegetation work. • Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.	turbidity/ sedimentation	Salmonids
Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following mercury evaluation and abatement work in the Cache Creek watershed (from Phase II Report): • Support development and implementation of TMDL for mercury. • Determine bioaccumulation effects in creek and Delta. • Source, transport, inventory, mapping and speciation of mercury. • Participate in Stage 1 remediation (drainage control) of mercury mines as appropriate. • Determine sources of high levels of bioavailable mercury	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following mercury evaluation and abatement work in the Delta (from Phase II Report): • Determine methylization (part of bioaccumulation) process in Delta. • Determine sediment mercury concentration in areas that would be dredged during levee maintenance or conveyance work. • Determine potential impact of ecosystem restoration work on methyl mercury levels in lower and higher trophic level organisms.	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following pesticide work (from Phase II Report): • Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations. • Support development and implementation of a TMDL for diazinon. • Develop BMPs for dormant spray and household uses. • Determine the ecological significance of pesticide discharges. • Support implementation of BMPs. • Monitor to determine effectiveness of BMPs	carbofurans, chloropyrifos, diazinon	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, possibly other species depending on type of actions and specific sites.

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following selenium work: • Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions; determine bioavailability of selenium under several scenarios (from Phase II Report). • Evaluate and, if appropriate, implement real-time management of selenium discharges (from Phase II Report). • Expand and implement source control, treatment, and reuse programs (from Phase II Report). • Coordinate with other programs; e.g., recommendations of San Joaquin Valley Drainage Implementation Program, CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways (from Phase II Report). • Support development and implementation of TMDL for selenium in the San Joaquin River watershed (focus on Grassland area).	selenium	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs on agricultural lands and other specific sites. • Implement BMPs for urban/industrial stormwater runoff and discharges to reduce PCB and organochlorine pesticides.	chlorodane, DDT, PCBs, toxaphene	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following trace metals work (from Phase II Report): • Determine spatial and temporal extent of metal pollution. • Determine ecological significance and extent of copper contamination. • Evaluate impacts of other metals such as cadmium, zinc, and chromium. • Participate in Brake Pad Partnership to reduce introduction of copper. • Partner with municipalities on evaluation and implementation of stormwater control facilities. • Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.	cadmium, copper, zinc	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following unknown toxicity work (from Phase II Report): • Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.	toxicity of unknown origin	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon
Suisun Marsh and North San Francisco Bay		
Habitats		
Restore and maintain a minimum of three linear miles of riparian habitat along corridors of existing riparian scrub and shrub vegetation in each of the Ecological Management Units of the Suisun Marsh/North San Francisco Bay Ecological Management Zone.	Riparian and Riverine Aquatic Habitats	Sacramento splittail, all Central Valley salmonids, Valley elderberry long-horn beetle, riparian brush rabbit, California yellow warbler, Least Bell's vireo, little willow flycatcher

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
In the Suisun Marsh/North San Francisco Bay EMZ, restore a minimum of 7,000 acres of Saline Emergent Wetland by restoring tidal action in the Suisun Bay and Marsh Ecological Management Unit (including 200 acres of muted tidal marsh along the Contra Costa shoreline) and a cumulative total of 1,000 acres in the Napa River, Sonoma Creek, Petaluma River, and San Pablo Bay Ecological Management Units. Restore high marsh and high-marsh upland transition habitat in conjunction with restoration of saline emergent wetland. Develop cooperative programs to acquire, in fee-title or through a conservation easement, the land needed for tidal restoration, and complete the needed steps to restore the wetlands to tidal action. Begin aggressive program of control of non-native plant species that are threatening the known populations of Suisun thistle, Suisun Marsh aster, soft bird's beak, and Point Reyes bird's beak. - Bring into protection at least 25% of currently occupied, but unprotected Suisun Marsh aster habitat, spread throughout the North, East, South Delta and Napa River Ecological Units, and ensure appropriate management. -Expand suitable tidal slough habitat for Suisun Marsh aster by 25 linear miles. -Identify at least three protected and managed sites for introduction of at least three additional populations of Suisun thistle; increase overall population size at least threefold. -Establish at least one new population of soft bird's beak with high likelihood of success in restored habitat in each of the Suisun Bay and Marsh EMU, the Napa River EMU, and the Petaluma River EMU. -Establish at least one new Point Reyes bird's beak population in the Petaluma River and San Pablo Bay EMUs.	Saline Emergent Wetland	All Central Valley salmonids, delta smelt, longfin smelt, Sacramento splittail, Suisun song sparrow, San Pablo song sparrow, California Clapper rail, California black rail, Suisun thistle, soft bird's beak, Point Reyes bird's-beak, salt marsh harvest mouse, Suisun ornate shrew, San Pablo California vole, Suisun aster, salt marsh common yellow throat

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Restore suitable, occupied slough edge habitat for delta mudwort and delta tule pea by at least 5 miles in the Suisun Bay and Marsh EMU and by at least 10 miles in the Napa River EMUs. Bring at least 25% the currently existing but unprotected occurrences of delta mudwort and delta tule into protection through purchase or conservation agreement, and ensure appropriate management.	Saline Emergent Wetland	all Central Valley salmonids, delta smelt, Sacramento splittail, California black rail, Mason's lilaeopsis, delta mudwort, delta tule pea
In the Suisun Marsh/North San Francisco Bay Ecological Management Zone, restore and manage a minimum of 500 acres of seasonal wetland, and improve management of a minimum of 7,000 acres of existing, degraded seasonal wetland in a manner that provides suitable habitat for salt marsh harvest mouse, San Pablo California vole, and Suisun ornate shrew.	Seasonal Wetlands	salt marsh harvest mouse, San Pablo California vole, Suisun ornate shrew
Restore a minimum of 400 acres of tidal perennial aquatic habitat in the Suisun Marsh/North San Francisco Bay Ecological Management Zone.	Tidal Perennial Aquatic Habitat	all Central Valley salmonids, delta smelt, Sacramento splittail, longfin smelt

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop a cooperative program to acquire, manage and restore 100 acres of vernal pools and 500 to 1,000 acres of adjacent buffer areas in the Suisun Marsh/North San Francisco Bay EMZ. Protect all existing known occurrences of Crampton's tuctoria through conservation easement or purchase from willing sellers (including CNDDB Element Occurrence #2 and any new populations that are found). Identify at least two protected and managed sites for introduction of additional populations; begin introduction and monitor for success. Manage at least 250 acres of the ERP target for vernal pools near the Jepson Prairie preserve as suitable habitat for alkali milk vetch. Establish new populations on protected and appropriately managed lands. Bring 50% of currently unprotected, existing populations into protection through purchase or conservation agreement, and ensure appropriate management.	Vernal Pools	Delta green ground beetle, Crampton's tuctoria, Alkali milk- vetch
Stressors Reduction		
Develop a program to consolidate, screen, or eliminate 25% of the unscreened diversions in Suisun Marsh.	Water Diversions	all R and r covered fish
Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations. (from Phase II Report)	oxygen depleting substances, nutrients, TOC, ammonia	Salmonids, Sacramento splittail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers. (from Phase II Report)	dissolved oxygen, oxygen depleting substances, nutrients	Salmonids, Sacramento splittail
Actions to reduce fine sediment loading to streams, especially Tuolumne, Merced, Stanislaus, Cosumnes, Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban stormwater runoff, and other specific sites. • Implement stream restoration and revegetation work. • Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.	turbidity/ sedimentation	Salmonids
Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following pesticide work (from Phase II Report): • Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations. • Support development and implementation of a TMDL for diazinon. • Develop BMPs for dormant spray and household uses. • Determine the ecological significance of pesticide discharges. • Support implementation of BMPs. • Monitor to determine effectiveness of BMPs	carbofurans, chloropyrifos, diazinon	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, possibly other species depending on type of actions and specific sites.
Conduct the following selenium work: • Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions; determine bioavailability of selenium under several scenarios (from Phase II Report). • Evaluate and, if appropriate, implement real-time management of selenium discharges (from Phase II Report). • Expand and implement source control, treatment, and reuse programs (from Phase II Report). • Coordinate with other programs; e.g., recommendations of San Joaquin Valley Drainage Implementation Program, CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways (from Phase II Report). • Support development and implementation of TMDL for selenium in the San Joaquin River watershed (focus on Grassland area).	selenium	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs on agricultural lands and other specific sites. • Implement BMPs for urban/industrial stormwater runoff and discharges to reduce PCB and organochlorine pesticides.	chlorodane, DDT, PCBs, toxaphene	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake
Conduct the following trace metals work (from Phase II Report): • Determine spatial and temporal extent of metal pollution. • Determine ecological significance and extent of copper contamination. • Evaluate impacts of other metals such as cadmium, zinc, and chromium. • Participate in Brake Pad Partnership to reduce introduction of copper. • Partner with municipalities on evaluation and implementation of stormwater control facilities. • Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.	cadmium, copper, zinc	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following unknown toxicity work (from Phase II Report): • Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.	toxicity of unknown origin	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon
Sacramento River Basin		
Ecological Processes		

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Construct a network of channels totaling 20 miles within the Sutter and Yolo Bypasses that effectively drains flooded lands after floodflows stop entering the bypasses. The channels should be designed to allow juvenile anadromous and resident fish to move from rearing and migratory areas. Develop and begin implementation of a program in the Yolo Basin to restore channel-floodplain connectivity and floodplain processes. Design natural stream channel configurations and expand floodplain overflow areas in the lower Cache and Putah Creek floodplains, as well as in channels and sloughs of the upper Yolo Bypass to provide connections with the Delta in a manner consistent with flood control requirements. Diversions (water source) into the Yolo Basin should not result in direct or indirect adverse impacts to salmonids. Project design features would include sloughs and creek channels, setback levees, and wetlands, where feasible and consistent with flood protection.	Natural Floodplain and Flood Processes	Central Valley chinook salmon and steelhead, Sacramento splittail
Develop and implement temperature management programs within major tributaries in the Sacramento River Basin. The goal of the programs should be achievement of the ERP temperature targets for salmon and steelhead. The programs shall include provisions to: a) develop accurate and reliable water temperature prediction models; b) evaluate the use of minimum carryover storage levels and other operational tools; c) evaluate the use of new facilities such as temperature control devices; and d) recommend operational and/or physical facilities as a long-term solution.	Central Valley Stream Temperatures	Central Valley fall/late fall-run chinook salmon and steelhead

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop and implement a program to address the thermal impacts of irrigation return flows in the Sacramento River Basin. The goal of the program should be achieve Basin Plan objectives for water temperature. The program should include provisions to: a) identify locations of irrigation return flows with thermal impacts; b) develop measures to avoid or eliminate thermal impacts from irrigation return flows; and c) prioritize problem sites based on impacts to chinook salmon and steelhead. If feasible, proceed with implementation of some or all actions to address thermal impacts of irrigation return flows.	Central Valley Stream Temperatures	Central Valley fall/late fall-run chinook salmon and steelhead
Design and begin implementation of an ecologically based streamflow regulation plan for Yuba River, Butte Creek, Big Chico Creek, Deer Creek, Mill Creek , Antelope Creek, Battle Creek, Cottonwood Creek, and Clear Creek.	Central Valley Streamflow	all Central Valley salmonids, green sturgeon, Sacramento splittail, western yellow-billed cuckoo, yellow warbler, Least Bell's vireo
Complete a fluvial geomorphic assessment of coarse sediment supply needs and sources to maintain, improve, or supplement gravel recruitment and natural sediment transport processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas, and the regeneration of riparian vegetation. Develop and implement a program to reduce erosion and maintain gravel recruitment on at least one tributary within each EMZ in the Sacramento River Basin.	Coarse Sediment Supply	all races of chinook salmon, steelhead, splittail, delta smelt, green sturgeon, bank swallow, California yellow warbler, western yellow-billed cuckoo, Least Bell's vireo, valley elderberry longhorn beetle, Norther California black walnut

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop floodplain management plans, including feasiblility studies to construct setback levees, to restore and improve opportunities for rivers to inundate their floodplain on a seasonal basis for at least one tributary within each of the EMZs in the Sacramento River Basin. Among the areas to be included are the lower 10 miles of Clear Creek, Antelope Creek, and Deer Creek, and the lower reach of Cottonwood Creek.	Natural Floodplain and Flood Processes	all Central Valley salmonids, Sacramento splittail, delta smelt, longfin smelt, western yellow-billed cuckoo, California yellow warbler, Least Bell's vireo, San Joaquin Valley woodrat, Valley elderberry long-horn beetle, Northern California black walnut
Protect 15,000 acres within the Inner River Zone areas between Red Bluff and Colusa reaches within identified the Sacramento River Conservation Area. Establish between 3 and 5 habitat preserves for bank swallows along the upper reaches of the Sacramento River capable of supporting 5000 bank swallow burrows between the towns of Colusa and Red Bluff.	Stream Meander	all Central Valley salmonids, steelhead, western yellow-billed cuckoo, Least Bell's vireo, Swainson's hawk, Valley elderberry longhorn beetle, bank swallow
Habitats		
In the American River Basin, Butte Basin, Colusa Basin, Feather River/Sutter Basin EMZs, cooperatively enhance at least 15 to 25% of the ERPP target for wildlife friendly agricultural practices.	Agricultural Lands	greater sandhill crane, giant garter snake, Swainson's hawk

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop and implement a program to establish, restore, and maintain riparian habitat to improve floodplain habitat, salmonid shaded riverine aquatic habitat, and instream cover along at least one tributary within each of the following Ecological Management Zones: American River Basin, Butte Basin, Colusa Basin, Cottonwood Creek, Feather River/Sutter Basin, North Sacramento Valley, Sacramento River, and Yolo Basin. While restoring habitat conditions in the American River EMZ, maintain continuous corridors of suitable riparian habitat for valley elderberry longhorn beetle. Protect existing known occurrences of northern California black walnut native stands through conservation easement or purchase. Identify at least 3 protected and managed sites for introduction of additional populations of northern California black walnut; begin introduction and monitor for success. Population creation should be part of a broader effort to restore riparian areas which historically contained walnut.	Riparian and Riverine Aquatic Habitats	all Central Valley salmonids, western yellow-billed cuckoo, Valley elderberry long-horn beetle, California yellow warbler, Least Bell's vireo, little willow flycatcher
In the Cottonwood Creek EMZ, complete (1) long-term agreements with local landowners to establish, restore, and maintain riparian communities along 25 percent of the upper and 25 percent of the lower reaches of Cottonwood Creek, and (2) the development of a comprehensive watershed management plan that supports local land use decisions to protect existing riparian and restore lost riparian.	Riparian and Riverine Aquatic Habitats	all Central Valley salmonids, California yellow warbler, western yellow-billed cuckoo, Least Bell's vireo, little willow flycatcher

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Restore 2 miles of the 10 mile target of riparian habitat restoration along the lower reaches of each of the following tributaries: Battle, Clear, Deer, Mill, Butte, Big Chico, Antelope, Feather, Yuba, and Bear Rivers.	Riparian and Riverine Aquatic Habitats	all Central Valley salmonids, California yellow warbler, western yellow-billed cuckoo, little willow flycatcher, Least Bell's vireo, Valley elderberry long-horn beetle
Implement 25 percent of the ERP target for enhancing, protecting, and restoring seasonal wetlands in the following EMZs: American River Basin, Butte Basin, Colusa Basin, and Feather River/Sutter Basin.	Seasonal Wetlands	greater sandhill crane, Swainson's hawk, giant garter snake
Stressors Reduction		
Develop and implement a program to address inadequate instream flows for steelhead and chinook salmon on streams within Sacramento River Basin tributaries. Where appropriate provide adequate flows for Sacramento splittail and green sturgeon.	Dams and Other Structures	all Central Valley salmonids, green sturgeon, Sacramento splittail
Provide unimpeded upstream and downstream passage for salmon and steelhead on Sacramento River Basin tributaries.	Dams and Other Structures	all Central Valley salmonids, green sturgeon, Sacramento splittail
On Big Chico Creek, repair the Lindo Channel weir and fishway at the Lindo Channel box culvert at the Five Mile Diversion to improve upstream fish passage.	Dams and Other Structures	all Central Valley salmonids
Develop and implement a solution to improve passage of upstream migrant adult fish and downstream migrant juvenile fish Battle Creek.	Dams and Other Structures	all Central Valley salmonids, green sturgeon
Evaluate the feasibility of constructing fish passage facilities at the Grays Bend-Old River-Freemont weir complex at the upper end of the Yolo Bypass.	Dams and Other Structures	all Central Valley salmonids

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop a program to reduce or eliminate fish stranding in the Sacramento, Feather and Yuba rivers and the Colusa Basin drain and Sutter Bypass in the active stream channels, floodplains, shallow ponds and borrow areas. Develop protocols for ramping flow reductions. Conduct surveys of stranding under a range of flow conditions and recommend solutions.	Stranding	all Central Valley salmonids, green sturgeon, lonfin smelt, Sacramento splittail
Install positive barrier fish screens on all diversions greater than 250 cfs in all EMZs and 25% of all smaller unscreened diversions in the Sacramento River Basin. Among those diversions to be screened are the DWR Pumping Plants and 50% of small diversion located on east side of Sutter Bypass, the Bella Vista diversion in the upper Sacramento River near Redding, East-West Diversion Weir, Weir 5, Weir 3, Guisti Weir and Weir 1 in the Sutter Bypass, White Mallard Dam, Morton Weir, Drivers Cut Outfall and Colusa Shooting/Tarke Weir Outfall and associated diversion screens in the Butte Sink..	Water Diversions	all R and r covered fish
Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations. (from Phase II Report)	oxygen depleting substances, nutrients, TOC, ammonia	Salmonids, Sacramento splittail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Actions to minimize or eliminate inter-substrate low dissolved oxygen conditions in salmonid spawning and rearing habitat, especially in the Mokelumne, Cosumnes, American, Merced, Tuolumne, and Stanislaus Rivers (from Phase II Report and Water Quality Program Plan): • Develop inter-substrate DO testing for salmonid spawning and rearing habitat. • Conduct comprehensive surveys to assess the extent and severity of inter-substrate low DO conditions. • Develop and begin implementing appropriate best management practices (BMPs), including reducing anthropogenic fine sediment loads, to minimize or eliminate inter-substrate low DO conditions.	dissolved oxygen, turbidity/ sedimentation	Salmonids
Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers. (from Phase II Report)	dissolved oxygen, oxygen depleting substances, nutrients	Salmonids, Sacramento splittail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Actions to reduce fine sediment loading to streams, especially Tuolumne, Merced, Stanislaus, Cosumnes, Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban stormwater runoff, and other specific sites. • Implement stream restoration and revegetation work. • Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.	turbidity/ sedimentation	Salmonids
Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following mercury evaluation and abatement work in the Cache Creek watershed (from Phase II Report): • Support development and implementation of TMDL for mercury. • Determine bioaccumulation effects in creek and Delta. • Source, transport, inventory, mapping and speciation of mercury. • Participate in Stage 1 remediation (drainage control) of mercury mines as appropriate. • Determine sources of high levels of bioavailable mercury	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following mercury evaluation and abatement work in the Sacramento River (from Phase II Report): • Determine, inventory, and sources of high levels of bioavailable mercury • Refine mercury models. • Participate in remedial activities.	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake
Conduct the following pesticide work (from Phase II Report): • Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations. • Support development and implementation of a TMDL for diazinon. • Develop BMPs for dormant spray and household uses. • Determine the ecological significance of pesticide discharges. • Support implementation of BMPs. • Monitor to determine effectiveness of BMPs	carbofurans, chloropyrifos, diazinon	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, possibly other species depending on type of actions and specific sites.
Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs on agricultural lands and other specific sites. • Implement BMPs for urban/industrial stormwater runoff and discharges to reduce PCB and organochlorine pesticides.	chlorodane, DDT, PCBs, toxaphene	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following trace metals work (from Phase II Report): • Determine spatial and temporal extent of metal pollution. • Determine ecological significance and extent of copper contamination. • Evaluate impacts of other metals such as cadmium, zinc, and chromium. • Participate in Brake Pad Partnership to reduce introduction of copper. • Partner with municipalities on evaluation and implementation of stormwater control facilities. • Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.	cadmium, copper, zinc	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following unknown toxicity work (from Phase II Report): • Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.	toxicity of unknown origin	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon
San Joaquin River Basin		
Ecological Processes		

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop and implement temperature management programs within major tributaries in the San Joaquin River Basin. The goal of the programs should be achievement of the ERP temperature targets for salmon and steelhead. The programs shall include provisions to: a) develop accurate and reliable water temperature prediction models; b) evaluate the use of minimum carryover storage levels and other operational tools; c) evaluate the use of new facilities such as temperature control devices; and d) recommend operational and/or physical facilities as a long-term solution.	Central Valley Stream Temperatures	Central Valley fall/late fall-run chinook salmon and steelhead
Develop and implement a program to address the thermal impacts of irrigation return flows in the San Joaquin River Basin. The goal of the program should be achieve Basin Plan objectives for water temperature. The program should include provisions to: a) identify locations of irrigation return flows with thermal impacts; b) develop measures to avoid or eliminate thermal impacts from irrigation return flows; and c) prioritize problem sites based on impacts to chinook salmon and steelhead. If feasible, proceed with implementation of some or all actions to address thermal impacts of irrigation return flows.	Central Valley Stream Temperatures	Central Valley fall/late fall-run chinook salmon and steelhead

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Complete a fluvial geomorphic assessment of coarse sediment supply needs and sources to maintain, improve, or supplement gravel recruitment and natural sediment transport processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas, and the regeneration of riparian vegetation. Develop and implement a program to reduce erosion and maintain gravel recruitment on at least one tributary within each EMZ within the San Joaquin River Basin. In the East San Joaquin Basin EMZ, complete fluvial geomorphic assessments on all tributaries.	Coarse Sediment Supply	all races of chinook salmon, steelhead, splittail, delta smelt, green sturgeon, bank swallow, California yellow warbler, western yellow-billed cuckoo, Least Bell's vireo, valley elderberry longhorn beetle, Northern California black walnut
Develop floodplain management plans, including feasiblility studies to construct setback levees, to restore and improve opportunities for rivers to inundate their floodplain on a seasonal basis for at least one tributary within each of the EMZs in the San Joaquin River Basin. Among the areas to be included are at least 10 miles of stream channel in the West San Joaquin EMZ.	Natural Floodplain and Flood Processes	all Central Valley salmonids, Sacramento splittail, delta smelt, longfin smelt, western yellow-billed cuckoo, California yellow warbler, Least Bell's vireo, San Joaquin Valley woodrat, Valley elderberry long-horn beetle, Northern California black walnut
Develop a cooperative program to restore salmonid spawning and rearing habitat in the Tuoloumne, Stanislaus, and Merced Rivers that includes the following elements: (1) reconstructing channels at selected sites by isolating or filling in inchannel gravel extraction areas; (2) increasing natural meander by removing riprap and relocating other structures that impair stream meander; and (3) restoring more natural channel configurations to reduce salmonid predator habitat and improve migration corridors.	Stream Meander (also Predation and Competition)	Central Valley fall/late fall-run chinook salmon, steelhead, western yellow-billed cuckoo, California yellow warbler, bank swallow
Restore and maintain a defined stream-meander zone and increase floodplain habitat on the San Joaquin River between Vernalis and the mouth of the Merced River.	Stream Meander	Sacramento splittail, Central Valley fall/late fall-run chinook salmon, steelhead, bank swallow

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Establish a river meander corridor between the Chowchilla Bypass and Mendota Pool to expand the floodway corridor to convey increased anticipated floodflows and restore floodplain habitat.	Stream Meander	Sacramento splittail, Central Valley fall/late fall-run chinook salmon, steelhead, bank swallow
Habitats		
In the San Joaquin River and West San Joaquin Basin EMZs, cooperatively enhance at least 15 to 25% of the ERPP target for wildlife friendly agricultural practices	Agricultural Lands	Swainson's hawk, greater sandhill crane, giant garter snake
In the West San Joaquin Basin EMZ, restoring or create 100 acres of fresh emergent wetland habitat.	Fresh Emergent Wetland	giant garter snake
In the West San Joaquin Basin EMZ, restore or enhance 1,000 acres of perennial grassland associated with existing or proposed wildlife corridors, wetlands, or floodplain habitats.	Perennial Grasslands	Swainson's hawk, greater sandhill crane
Develop and implement a program to establish, restore, and maintain riparian habitat to improve floodplain habitat, salmonid shaded riverine aquatic habitat and instream cover along at least one tributary within the East San Joaquin and San Joaquin River EMZs.	Riparian and Riverine Aquatic Habitats	Central Valley steelhead, fall/late fall-run chinook salmon, western yellow-billed cuckoo, Valley elderberry long-horn beetle, riparian brush rabbit, California yellow warbler, Least Bell's vireo, little willow flycatcher, delta coyote thistle

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Implement 25 percent of the ERP target for diverse, self-sustaining riparian community for all EMZs in the San Joaquin River Basin. Bring at least three of the currently existing but unprotected delta coyote thistle occurrences into protection through purchase or conservation agreement, and ensure appropriate management. Increase suitable habitat for delta coyote thistle by at least 20% and the number of populations and individuals by at least 10% through habitat management and protection. Establish two new riparian brush rabbit habitat preserves within the historical range of the species. Protect and enhance a minimum of 150 contiguous acres of mature, shrub-rich riparian forest and associated highwater refugia on the San Joaquin River, between the Merced River confluence and Vernalis, and on each of the east-side tributaries (the Stanislaus, Tuolumne and Merced rivers) for habitat values and as potential riparian brush rabbit re-introduction sites.	Riparian and Riverine Aquatic Habitats	San Joaquin Valley woodrat, delta coyote thistle, western yellow-billed cuckoo, Valley elderberry long-horn beetle, riparian brush rabbit
Stressors Reduction		

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop and implement a program to address inadequate instream flows for steelhead and chinook salmon on streams within San Joaquin River tributaries. Where appropriate provide adequate flows for Sacramento splittail and green sturgeon.	Dams and Other Structures	steelhead, fall/late fall-run chinook salmon, green sturgeon, Sacramento splittail
Provide unimpeded upstream and downstream passage for salmon and steelhead on San Joaquin River Basin tributaries.	Dams and Other Structures	steelhead, fall/late fall-run chinook salmon
Initiate a feasibility study of restoring steelhead migration into upper watershed areas (e.g., upstream of major low-elevation dams) in at least one San Joaquin River Basin EMZ Tributary.	Dams and Other Structures	steelhead
Install positive barrier fish screens on all diversions greater than 250 cfs in all EMZs and 25% of all smaller unscreened diversions in the San Joaquin River Basin. Among those diversions to be screened are the El Solyo, Patterson, and West Stanislaus irrigation district diversions.	Water Diversions	all R and r covered fish

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Actions to minimize or eliminate low dissolved oxygen conditions (DO sag) in lower San Joaquin River near Stockton (from Phase II Report): • Complete studies of causes for DO sag in San Joaquin River near Stockton. • Define and implement corrective measures for DO sag. • Finalization of investigation of methods to reduce constituents that cause low DO for inclusion in total maximun daily load (TMDL) recommendation by the Central Valley RWQCB. • Finalization of Basin Plan Amendment and TMDL for constituents that cause low DO in the San Joaquin River. • Implement appropriate source and other controls and other management practices, as recommended in the TMDL, to reduce anthropogenic oxygen depleting substances loadings and minimize or eliminate low DO conditions.	dissolved oxygen, oxygen depleting substances, nutrients, total organic carbon (TOC)	Salmonids, delta smelt, Sacramento splittail, longfin smelt, green sturgeon
Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations. (from Phase II Report)	oxygen depleting substances, nutrients, TOC, ammonia	Salmonids, Sacramento splittail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Actions to minimize or eliminate inter-substrate low dissolved oxygen conditions in salmonid spawning and rearing habitat, especially in the Mokelumne, Cosumnes, American, Merced, Tuolumne, and Stanislaus Rivers (from Phase II Report and Water Quality Program Plan): • Develop inter-substrate DO testing for salmonid spawning and rearing habitat. • Conduct comprehensive surveys to assess the extent and severity of inter-substrate low DO conditions. • Develop and begin implementing appropriate best management practices (BMPs), including reducing anthropogenic fine sediment loads, to minimize or eliminate inter-substrate low DO conditions.	dissolved oxygen, turbidity/ sedimentation	Salmonids
Assess the ecological effects of low DO conditions in Suisun Marsh due to adding oxygen-depleted water from anthropogenic sources (from Water Quality Program Plan).	dissolved oxygen, oxygen depleting substances, nutrients, TOC	Delta smelt, Sacramento splittail, longfin smelt, salmonids, green sturgeon
Encourage regulatory activity to reduce discharge of oxygen reducing substances and nutrients by unpermitted dischargers. (from Phase II Report)	dissolved oxygen, oxygen depleting substances, nutrients	Salmonids, Sacramento splittail

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Actions to reduce fine sediment loading to streams, especially Tuolumne, Merced, Stanislaus, Cosumnes, Napa, and Petaluma Rivers, and Sonoma Creek, due to human activities (from Phase II Report and Water Quality Program Plan): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs in construction areas, on agricultural lands, for urban stormwater runoff, and other specific sites. • Implement stream restoration and revegetation work. • Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions.	turbidity/ sedimentation	Salmonids
Conduct the necessary research to determine no adverse ecological/biological effects threshold concentrations for mercury in sediments and key organisms in the Bay-Delta estuary and its watershed.	mercury	Salmonids, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following pesticide work (from Phase II Report): • Develop diazinon and chlorpyrifos hazard assessment criteria with CDFG and the Department of Pesticide Regulations. • Support development and implementation of a TMDL for diazinon. • Develop BMPs for dormant spray and household uses. • Determine the ecological significance of pesticide discharges. • Support implementation of BMPs. • Monitor to determine effectiveness of BMPs	carbofurans, chloropyrifos, diazinon	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, possibly other species depending on type of actions and specific sites.

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following selenium work: • Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions; determine bioavailability of selenium under several scenarios (from Phase II Report). • Evaluate and, if appropriate, implement real-time management of selenium discharges (from Phase II Report). • Expand and implement source control, treatment, and reuse programs (from Phase II Report). • Coordinate with other programs; e.g., recommendations of San Joaquin Valley Drainage Implementation Program, CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways (from Phase II Report). • Support development and implementation of TMDL for selenium in the San Joaquin River watershed (focus on Grassland area).	selenium	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following actions in reduce organochlorine pesticide inputs to streams (from Phase II Report): • Participate in implementation of USDA sediment reduction program. • Implement sediment reduction BMPs on agricultural lands and other specific sites. • Implement BMPs for urban/industrial stormwater runoff and discharges to reduce PCB and organochlorine pesticides.	chlorodane, DDT, PCBs, toxaphene	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Conduct the following trace metals work (from Phase II Report): • Determine spatial and temporal extent of metal pollution. • Determine ecological significance and extent of copper contamination. • Evaluate impacts of other metals such as cadmium, zinc, and chromium. • Participate in Brake Pad Partnership to reduce introduction of copper. • Partner with municipalities on evaluation and implementation of stormwater control facilities. • Participate in remediation of mine sites as part of local watershed restoration and Delta restoration.	cadmium, copper, zinc	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon, giant garter snake, salt marsh harvest mouse, California clapper rail, California black rail
Conduct the following unknown toxicity work (from Phase II Report): • Conduct appropriate studies to identify unknown toxicity, and develop management actions as appropriate.	toxicity of unknown origin	Salmonids, delta smelt, longfin smelt, Sacramento splittail, green sturgeon
Research Milestones		
Develop and implement a comprehensive monitoring, assessment and research program (CMARP) for terrestrial and aquatic habitats and species populations acceptable to the fish and wildlife agencies. Conduct rangewide surveys for all "R" and "r" covered plants and animals in the MSCS Focus Area.		

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Develop and begin implementation of a study to determine appropriate conditions for the germination and establishment of riparian woody plants along the Sacramento River and San Joaquin River. Complete development of a cooperative program to plant vegetation on unvegetated riprapped banks consistent with flood control requirements.		
Conduct a study to investigate the effects of the road through Olcott Lake on vernal pool hydrology and impacts on vernal pool species.		
Conduct instream flow studies to determine the flows necessary to support all life stages of anadromous and estuarine fish species.		
Conduct an investigation of in-channel structures that focuses on the following issues: (1) habitat suitability for both predator and prey fishes; (2) predator-prey interactions; and (3) recommendations for reducing predation on juvenile salmonids.		
Conduct experimental introductions of Sacramento perch into nontidal perennial aquatic habitats		
Assess the impact of hatchery practices on naturally spawning populations of chinook salmon and steelhead and operate hatcheries in a manner consistent with safe genetic practices that will maintain genetic integrity of all Central Valley anadromous salmonid populations.		

Milestones	Ecosystem Element/Water Quality Parameter	MSCS "R" and "r" Covered Species that would Benefit from Achieving Milestones
Through the use of existing, expanded, and new programs, monitor adult anadromous salmonid returns to each watershed within the MSCS focus area. Monitoring techniques, data compilation and analysis, and reporting should be standardized among researchers and watersheds to the greatest extent possible.		