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Tributary Association

June 12, 2012

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Re: Review of the Fishery Agency Salmon Protection Efforts

Gentlemen:

As part of our collective efforts to better understand how we can help improve Central Valley salmonid abundance, we retained the services of the consulting firm AECOM with Roy Leidy as the lead investigator. We asked AECOM to take on several tasks. One of them was to review the past efforts of the fishery agencies to improve the abundance of salmon

over the past few decades so that we can see where best we should focus our efforts in the future. Attached is that review titled "A Review and Comparison of Agency Restoration Strategies and Actions for Central Valley Listed Salmonids."

The review by AECOM contains several important findings that we would like you to consider as you develop programs in the future. "This review provides an overview of the organizational management structure under which salmon and steelhead are managed in California and the restoration strategies and actions of each of the three primary management agencies are discussed. A comparison of management actions among agencies is presented, followed by a summary discussion.

None of the three restoration plans reviewed adequately provide a clear and succinct strategy for recovering Central Valley anadromous salmonid stocks to viable and sustainable levels. The principal reason is that these plans were prepared by different agencies for different purposes largely independent of one another. This has lead to numerous inconsistencies and disconnects among the three plans. No plan tells a complete and compelling story that outlines the path to recovery of anadromous salmonids." This review finds that one or more of these recovery plans have several deficiencies that are detailed in the attached report.

The review concludes: "We recommend that a new science-based and pragmatic restoration strategy be developed that is candid about the opportunities for anadromous salmonid restoration. Once created, the plan should be routinely revised to reflect new information, accomplishments, and failures. If a more comprehensive coordinated approach is not taken, it would appear that the resource agencies will continue developing independent management strategies leaving anadromous salmonid resources at risk".

We believe a much more holistic approach to salmon protection is needed than that currently provided by the state and federal fishery agencies, including actions in the Delta and the ocean. Considerable work has been conducted in upstream areas to enhance fish passage, including the construction of state of the art fish screens, over a billion dollars has been spent on CVPIA actions and millions of acre-feet have recently been dedicated to salmon with scant effect except for perhaps improvement for spring run salmon on a few streams. Without a holistic approach, these efforts could be squandered by predation in the Bay-Delta or other stressors that adversely affect fish during their various life-cycles. In addition to no single comprehensive strategic approach to salmon restoration, there are no integrated performance measures to gauge success or failure of actions. A comprehensive overhaul of these programs is needed.

We intend these comments to be constructive. A small group of us would like to meet with you soon to discuss this review by AECOM and find ways that we can collaborate to help make these programs more effective . We suggest a short meeting in afternoon almost any day during the last week in June starting on the 25th. Please contact Jerry Johns at jjohnswater@gmail.com with dates and times work for you and he will help coordinate a calendars. We look forward to working with you in your efforts to improve the abundance of salmon in the Central Valley.

Sincerely yours,

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A Review and Comparison of Agency Restoration Strategies and Actions for

Central Valley Listed Salmonids

Prepared for:

Salmon Recovery Group

AECOM

May 2012

A Review and Comparison of Agency Restoration Strategies and Actions for

Central Valley Listed Salmonids

Prepared for:

Salmon Recovery Group:
State and Federal Contractors Water Agency
Northern California Water Association
San Joaquin River Group Authority

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AECOM

May 2012

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EXECUTIVE SUMMARY

The National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game have the primary on-the-ground responsibility to identify and implement actions that manage Central Valley salmon and steelhead populations. While the ultimate goals of these three agencies are to ensure the viability of salmon and steelhead stocks into the future, their respective "blueprints" for achieving the common goal vary and are often inconsistent. This review examines the key management strategies of the three resource agencies by comparing and contrasting each agency's plan for achieving the goal of viable, "naturally" produced salmonid stocks

This review provides an overview of the organizational management structure under which salmon and steelhead are managed in California and the restoration strategies and actions of each of the three primary management agencies are discussed. A comparison of management actions among agencies is presented, followed by a summary discussion.

None of the three restoration plans reviewed adequately provide a clear and succinct strategy for recovering Central Valley anadromous salmonid stocks to viable and sustainable levels. The principal reason is that these plans were prepared by different agencies for different purposes largely independent of one another. This has lead to numerous inconsistencies and disconnects among the three plans. No plan tells a complete and compelling story that outlines the path to recovery of anadromous salmonids.

Specifically this review finds that one or more of these recovery plans have the following deficiencies:

(1) Lack of specificity as to which anadromous salmonid stock benefits from specific recovery/conservation actions;

(2) Lack of specificity as to which streams the actions apply to;

(3) Failure to include actions for known anadromous salmonid streams;

(4) Failure to identify involved parties or lead agency responsible for recovery actions;

(5) Failure to address some anadromous salmonid stocks;

(6) Inconsistent and variable level of conservation efforts for specific streams;

(7) No evaluations of the population-level benefits of actions generally or by specific stream;

(8) Inconsistent recovery goals among the agencies;

(9) No consistent timeline for implementing or completing conservation actions;

(10) No secure long-term funding sources; and

(11) No integrated performance measures to gauge success/failure of actions.

Only the NMFS plan recognized the enormous restoration measures implemented to date at a cost of over $1 billion. Even after efforts supported by these funds over a long period of time, a significant sustained positive trend in fish populations has not materialized. It would seem appropriate to begin a restoration strategy by recognizing this failure and asking why there has not been sufficient progress in meeting restoration objectives. Questions should address project selection, management structure, funding sources, and quantifiable benefits toward recovery for the various salmonid stocks. The answers to these critical questions should drive, in part, the restoration strategy.

Of the three plans, the NMFS plan is the most thoughtful from a science perspective. The NMFS plan attempts to lay out processes to recover listed anadromous salmonids by following a science-based approach that examines the reasons behind current problems limiting recovery, then proposing actions to address those problems. Even so, the draft of the NMFS plan received 652 comments, many of which focused on coordination and compatibility among agencies. The lack of sufficient coordination among the three resource agencies is a key factor that is apparent when examining all the inconsistencies among plans, including the general lack of agreement among agencies as to what actions should be implemented and by whom.

We recommend that a new science-based and pragmatic restoration strategy be developed that is candid about the opportunities for anadromous salmonid restoration. Once created, the plan should be routinely revised to reflect new information, accomplishments, and failures. If a more comprehensive coordinated approach is not taken, it would appear that the resource agencies will continue developing independent management strategies leaving anadromous salmonid resources at risk.

A REVIEW AND COMPARISON OF AGENCY RESTORATION STRATEGIES AND ACTIONS FOR CENTRAL VALLEY LISTED SALMONIDS (May 2012)

BACKGROUND

There are two federal agencies and one state agency that have the primary on-the-ground responsibility to identify and implement actions that strive to manage Central Valley salmon and steelhead stocks at population levels that will ensure their viability into the future. These agencies are the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (CDFG). While the ultimate goals of these three agencies are the same - ensuring the viability of salmon and steelhead stocks - their respective "blueprints" for achieving the common goal vary and are often inconsistent. This review examines the key management strategies of the three resource agencies by comparing and contrasting each agency's plan for achieving the goal of viable, "naturally" produced salmonid stocks into the future.

The review first describes the listing status of Central Valley salmonids, followed by an overview of the organizational management structure under which salmon and steelhead are managed. Next the restoration strategies and actions of each of the three agencies are discussed. Finally, a comparison of management actions among agencies is presented, followed by a summary discussion.

LISTING STATUS OF CENTRAL VALLEY SALMONIDS

Table 1 summarizes the federal Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 *et seq*.) and California Endangered Species Act (CESA; Fish and Game Code, sections 2050 *et seq*.) listing status of Central Valley salmon and steelhead stocks addressed in this paper. Not all stocks listed or of concern to the federal government are similarly of concern to the state. For example, neither the Central Valley Late Fall-run Chinook Salmon Evolutionarily Significant Unit (ESU) nor the California Central Valley Steelhead Distinct Population Segment (DPS) have any special state status at this time.

PACIFIC SALMON AND STEELHEAD MANAGEMENT OVERVIEW

There are six state and federal agencies involved in managing salmon resources in marine and freshwater environments of California. The authorizing legislation, relationships between agencies, and management processes are discussed for each agency in the following sections. These narratives are summarized overviews that may omit some of the complexity and interaction between and within organizations. The Pacific Fisheries Management Council (PFMC) is discussed first because many of the regulations and management goals originate with the PFMC. The NMFS is discussed second because of its close relationship with the PFMC in both advisory and implementing roles. The Fish and Game Commission of California (Commission) and the CDFG are the third and fourth organizations discussed because they implement many of the freshwater and nearshore marine regulations for both sport and commercial fisheries. The USFWS is the fifth agency discussed because, while they are responsible for assessing progress towards specific management goals, they do not set regulations or actively

Table 1 Listing Status of Central Valley Salmonids.				
Species	**Current ESA Listing Status**	**Current CESA Listing Status**	**Critical Habitat Status**	**Recovery Plan Status**
Sacramento Winter-run Chinook Salmon ESU	Endangered[1] 4 January 1994	Endangered 22 September 1989	Final 16 July 1993	Draft October 2009
Central Valley Spring-run Chinook Salmon ESU	Threatened[2] 16 September 1999	Threatened 5 February 1999	Final 2 January 2006	Draft October 2009
Central Valley Fall-run Chinook Salmon ESU	Species of Concern[3,4] 15 April 2004	None CDFG "Species of Special Concern"	Not Applicable	Not Applicable
Central Valley Late Fall-run Chinook Salmon ESU	Species of Concern[5] 15 April 2004	None	Not Applicable	Not Applicable
California Central Valley Steelhead DPS	Threatened[6] 19 March 1998	None	Final 2 January 2006	Draft October 2009

Notes:

[1] The ESU includes all naturally spawned populations of winter-run in the Sacramento River and its tributaries, as well as two artificial propagation programs: winter-run from the Livingston Stone National Fish Hatchery (NFH), and winter-run in a captive broodstock program maintained at Livingston Stone NFH and the University of California Bodega Marine Laboratory.

[2] The ESU includes all naturally spawned populations of spring-run in the Sacramento River and its tributaries, including the Feather River, as well as the Feather River Hatchery spring-run program.

[3] "Species of Concern" identify species about which NMFS has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA.

[4] Sacramento and San Joaquin rivers and their tributaries between Keswick Dam and the Merced River.

[5] Sacramento and San Joaquin rivers and their tributaries between Keswick Dam and the Merced River.

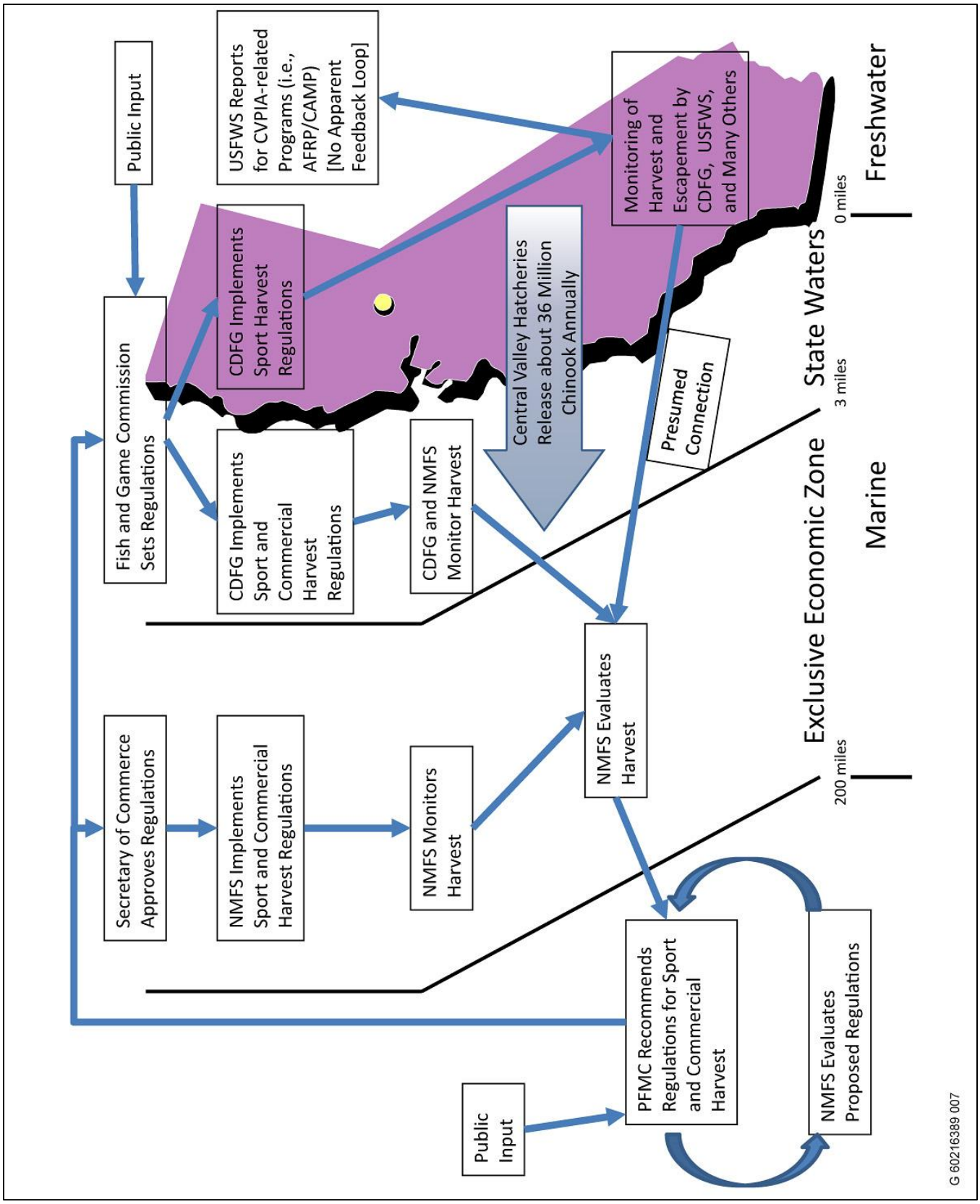
[6] The DPS includes all naturally spawned anadromous *O. mykiss* populations (steelhead) below natural and man-made impassable barriers in the Sacramento and San Joaquin rivers and their tributaries, excluding steelhead from San Francisco and San Pablo bays and their tributaries, as well as two artificial propagation programs: the Coleman NFH and Feather River Hatchery steelhead hatchery programs.

manage anadromous fish populations. Finally, the role of the Pacific States Marine Fisheries Commission (PSMFC) is summarized although it has no regulatory or management authority.

PACIFIC FISHERIES MANAGEMENT COUNCIL

AUTHORIZING LEGISLATION

The PFMC was established by the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Public Law 94-265, as amended). The PFMC has jurisdiction over the exclusive economic zone (EEZ) off Washington, Oregon, and California where they manage salmon fisheries. The EEZ extends from 3 to 200 miles off the coast (Figure 1). The PFMC does not manage any steelhead stocks.



Source: AECOM 2012

Figure 1 **General Management Structure for Chinook Salmon in California**

INTERAGENCY RELATIONSHIPS

Management measures developed by the PFMC are recommended to the Secretary of Commerce through the NMFS. Once approved, management measures are implemented by NMFS. These same recommendations may be adopted by California for state marine waters from 0 to 3 miles offshore.

FISH MANAGEMENT

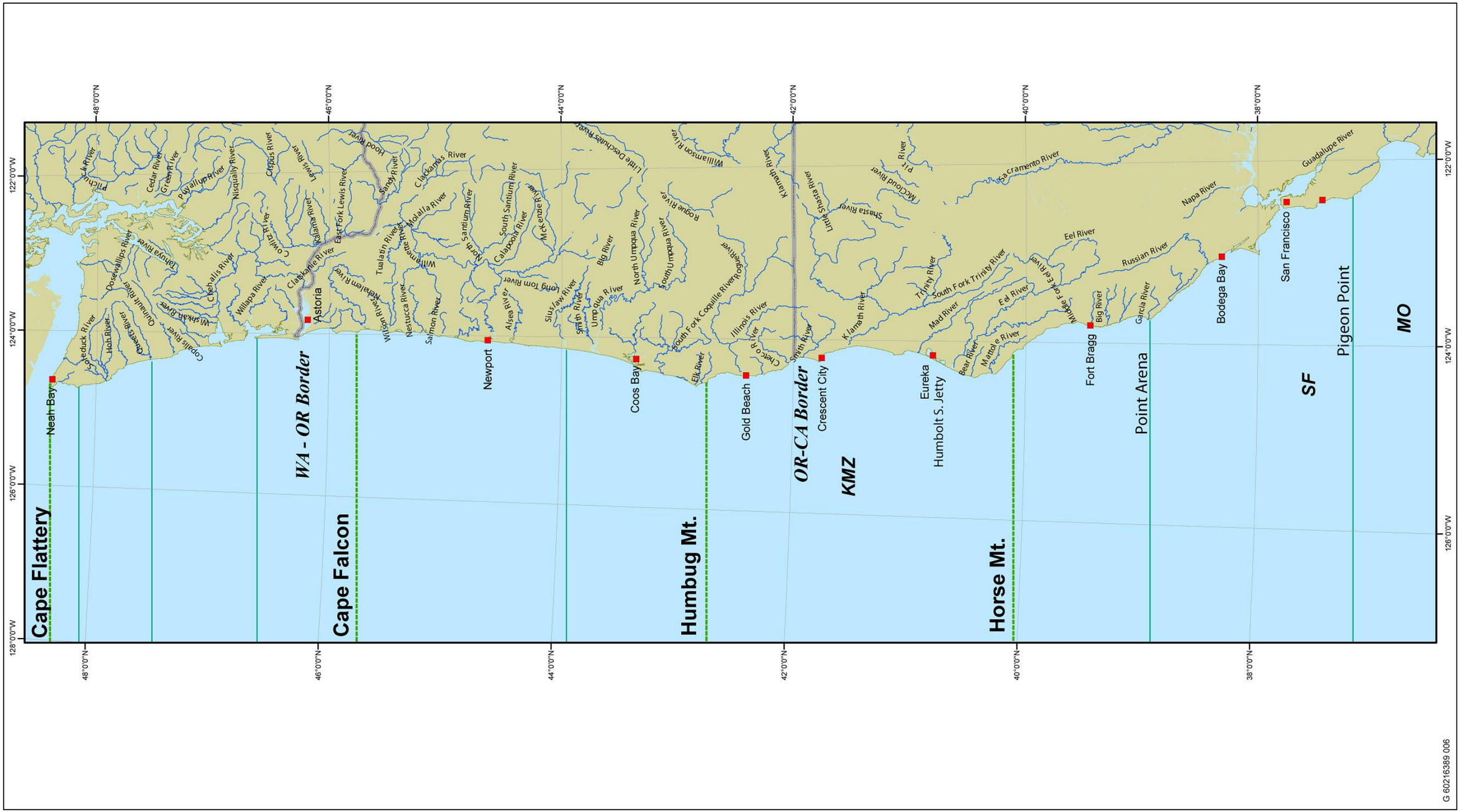
The PFMC manages salmon through the *Salmon Fishery Management Plan* (*FMP*; PFMC 2003). The *only* salmonid species managed are Chinook, coho, and pink salmon (in odd-numbered years). The plan also includes all species listed under the ESA that could be affected by PFMC-managed fisheries. Harvest is allocated between commercial, recreational, tribal, ports, ocean, and inland areas. Conservation objectives are based on achieving *maximum sustained yield* or *maximum sustained production*. Objectives are set through joint coordinated consultation with other state, federal, and tribal managers. These conservation objectives are generally expressed as annual spawner escapement for major salmon stocks or at specific locations.

There are three main subcommittees that assist the PFMC with its work. The Salmon Technical Team summarizes data, conducts population estimates, and evaluates the impacts of PFMC recommendations. The Salmon Advisory Subpanel helps develop the annual management options. The Model Evaluation Workgroup works with the population models to predict effects of harvest on escapement goals and allocations.

SEASON, LIMITS, GEAR RESTRICTIONS, QUOTAS, AND CATCH PROJECTIONS

In their annual preseason reports (e.g., PFMC 2011b), the PFMC recommends seasons, harvest quotas (Table 2), bag and length limits, and gear to be used in the commercial and recreational harvest of salmon.Quotas are set to manage fisheries in defined areas of the ocean that affect a specific stock or stocks of fish (Figure 2). The only quota-based fishery in California is Klamath Management Zone (KMZ) fishery. The PFMC sets catch limits from Humbug Mountain, Oregon south to the Humboldt South Jetty to actively manage fish returning to the Klamath River to ensure that tribal and hatchery escapements are met. Catch projections are calculated by the PFMC and are based on the escapement goals for a particular stock, the population expected within the ocean for a given year, and harvest percentages allowed that would ensure a large enough escapement from the ocean to meet the freshwater escapement goals. The catch projections are used for Central Valley origin fisheries because fish originating from the Central Valley are not managed via the quota system.

The catch projections overlap the quota area fisheries for the KMZ but extend beyond the KMZ to allow harvest of fish outside of this zone. For example, the quota for commercial troll caught Chinook salmon from Humbug Mountain to the Humboldt South Jetty is 6,100 fish compared to the projected commercial troll catch of 7,100 fish which extends south of the Humboldt South Jetty to Horse Mountain (Figure 2). Fish caught in the area between the Humboldt South Jetty and Horse Mountain are presumed to not be Klamath River fish. Coho salmon are managed entirely on the quota system and the only fishery is a recreational fishery from Cape Falcon to the Oregon/California border (Figure 2).



Source: Washington Department of Fish and Wildlife

Figure 2 **PFMC Marine Fisheries Management Zones**

Table 2 Summarized Fishery-specific Harvest Quotas for the 2011 Harvest Seasons.		
Fishery	**Chinook Quota**	**Coho Quota**
North of Cape Falcon		
Treaty Indian Troll	82,000	42,000
Non-Indian Commercial Troll	61,800	12,800
Recreational	33,700	67,200
North of Cape Falcon Total	105,600	122,000
South of Cape Falcon		
Commercial Troll	6,100	-
Recreational	-	18,000
Total South of Cape Falcon	**6,100**	**18,000**
Source: PFMC 2011b, Table 4		

MANAGEMENT GOALS

Management goals are set in the *FMP* by the PFMC where they are referred to as Conservation Objectives. These objectives are sometimes modified in the preseason reports (e.g., PFMC 2011a). For Central Valley salmon the objectives are as follows:

- For Sacramento fall and late fall-run Chinook between 122,000-180,000 natural and hatchery adult spawners are required (PFMC 2011a);
- For Sacramento spring-run Chinook NMFS ESA standards and recovery plans provide the management goal for this run. The present level (2011) of ocean fishery impacts are limited by measures constraining harvest on Sacramento winter-run and Klamath River fall-run Chinook salmon (PFMC 2011a: 89); and
- Sacramento River winter-run Chinook salmon were originally supposed to show an annual 31 percent increase in adult spawner replacement rate relative to the 1989-1993 replacement rate of 1.35 (PFMC 2003). This goal was revised to comply with the NMFS ESA consultation standard that influences the length and timing of the commercial and recreational fisheries south of Point Arena (PFMC 2011a: 89).

PROCESS FOR REGULATION CHANGES

The PFMC accepts recommendations for changes to ocean fisheries on an annual basis starting when the schedule for the revisions process and upcoming meetings are made available after the November meeting. Public input into the process begins in late February when the previous season's harvest and escapement data are released. The March PFMC meeting includes release of proposed options for the upcoming season. This meeting is followed by public hearings in late March or early April. Final recommendations are made to the Secretary of Commerce for

implementation on May 1. Changes in conservation objectives can be made without an amendment to the *FMP* through a federal court order, or if supported by a technical review of the best available scientific information.

NATIONAL MARINE FISHERIES SERVICE

AUTHORIZING LEGISLATION

The Magnuson-Stevens Fisheries Conservation and Management Act (Public Law 94-265) along with the ESA are the federal laws that authorize NMFS's mission. Organized within the Department of Commerce, NMFS manages marine resources and related habitat, including anadromous salmonids. There are two divisions within NMFS that collaborate to manage salmon and steelhead resources in California. The Sustainable Fisheries Division manages the commercial and recreational fisheries for sustainable harvest. It also collects data on fishery operations, administers grant programs, and supports research. The Protected Resources Division is responsible for the conservation and management of endangered species. It develops regulations and management measures to protect and conserve these species. This is the division that conducts ESA-related consultations for actions that may affect listed Central Valley anadromous salmonids.

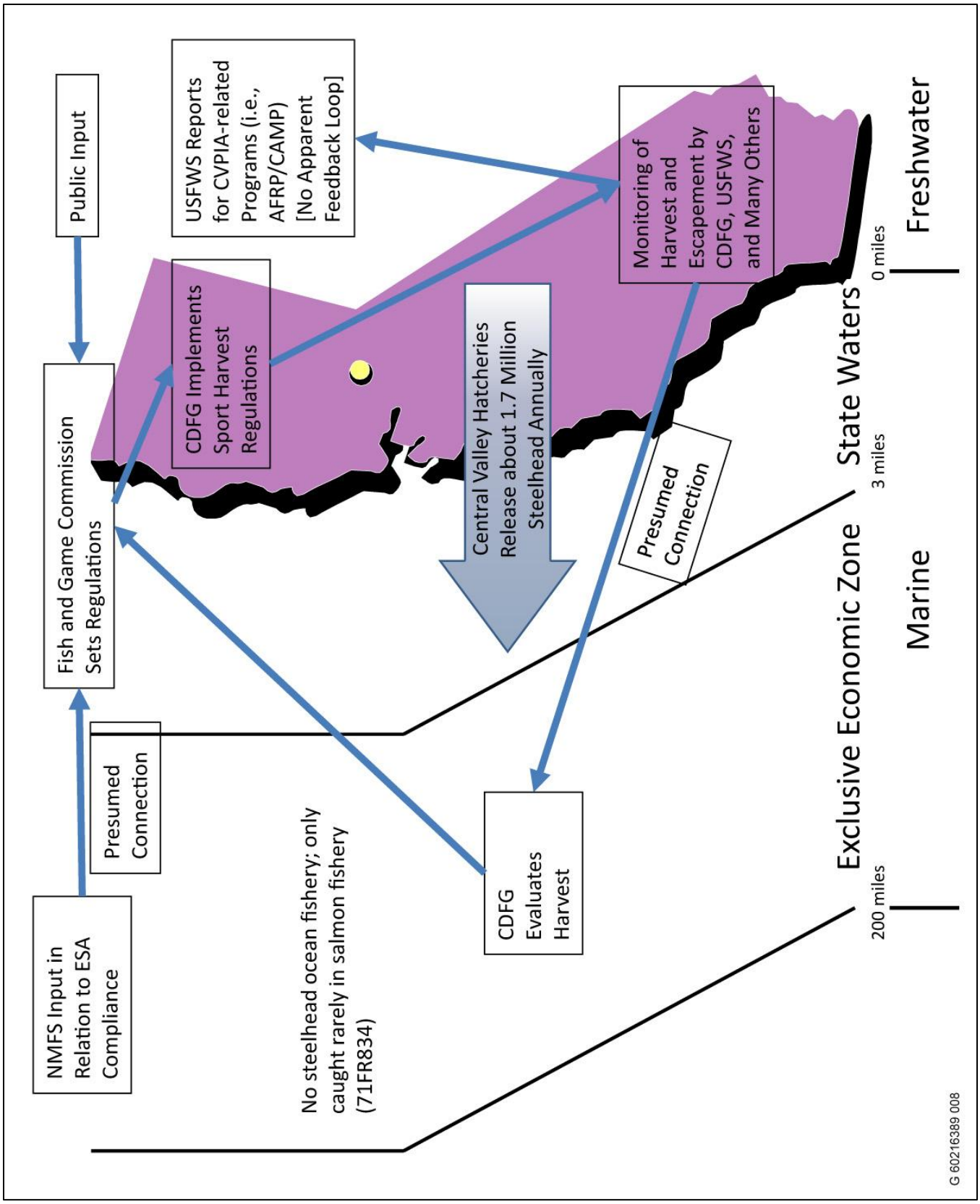
INTERAGENCY RELATIONSHIPS

The relationship between NMFS and the other federal agencies is complex because they work in both advisory and implementation roles (Figures 1 and 3). In the case of Chinook salmon, although the PFMC recommends management actions to the Secretary of Commerce, many of these actions are developed by NMFS for the PFMC. NMFS is also responsible for evaluating the effects of management recommendations and for providing feedback for PFMC's consideration. Once the Secretary of Commerce accepts a set of recommendations, NMFS is responsible for implementing them. In addition, NMFS is both the action and consulting agency for ESA compliance with these regulations. The results of these internal ESA consultations are fed back to the PFMC for implementation to avoid jeopardy and to aid in recovery of ESA-listed species.

Although the specific area of responsibility for NMFS is the EEZ, the Protected Resources Division of NMFS works closely with the State of California on management actions that could affect listed Central Valley anadromous salmonids (Figures 1 and 3).

FISH MANAGEMENT

The NMFS provides primary data tracking and processing, runs numerous population models, and analyzes regulations proposed by PFMC to determine the affects of those regulations on salmon populations. This process applies to non-listed Chinook and coho salmon populations. The ESA-listed species are managed through the recovery planning process. Recovery plans establish the status of the population and the steps required to meet the delisting or down-listing criteria. The recovery plan for winter-run Chinook, spring-run Chinook, and Central Valley steelhead is currently in draft form (NMFS 2009). The public has been provided opportunity to comment on this plan and those comments have been analyzed (NMFS 2010), but a final recovery plan has not yet been produced.



Source: AECOM 2012

Figure 3 **General Management Structure for Steelhead in California**

CALIFORNIA FISH AND GAME COMMISSION AND CALIFORNIA DEPARTMENT OF FISH AND GAME

AUTHORIZING LEGISLATION

The Commission was created by Section 20, Article IV of the California Constitution. Fish and Game Code (FGC) Section 200.5 gives the Commission the authority to regulate taking and possession of fish through sport fishing activities. FGC Section 205 allows the Commission to establish and modify seasons, bag limits, size limits, possession limits, harvest areas, and method of harvest. Other legislation relevant to the management of salmon and steelhead by CDFG includes *The Salmon, Steelhead Trout, and Anadromous Fisheries Program Act of 1988* (California Senate Bill 2261) which mandated an increase in natural fish production. This act is now codified as Sections 6900-6930 of the FGC. Specifically, Section 6902 states that CDFG "…shall develop a plan and a program that strives to double the current natural production of salmon and steelhead trout resources." This goal was to be achieved by the year 2000, but it has yet to be met.

INTERAGENCY RELATIONSHIPS

The Commission and CDFG manage ocean salmon harvest within 3 miles from shore and in freshwater streams of the state (Figures 1 and 3). State regulations generally follow those recommended by the PFMC. Section 316.5 of the FGC states that the Commission may prohibit taking or possession of salmon in the same manner as regulated by federal laws or established by the U.S. Secretary of Commerce. This section gives the Commission authority to have different regulations than those recommended by the PFMC. If a different set of regulations were implemented, CDFG would have to consult with NMFS pursuant to the ESA.

FISH MANAGEMENT

In general, CDFG follows the escapement and harvest goals established by the PFMC and takes steps to ensure that the freshwater harvest conform to the overall PFMC plan (Boydstun 2001). The process for adopting commercial harvest regulations is identified in FGC Section 7650 which states that the state is required to adjust its regulations to ensure that there is no "substantial and adverse effect" on salmon management goals by state regulation. In essence, harvest regulations adopted by the Commission, for both fresh and saltwater, need to conform to the overall management goals established by the PFMC.

MANAGEMENT GOALS

Management goals for salmon populations in California are tied to those established in the *FMP* (PFMC 2003) and the preseason reports (e.g., PFMC 2011a). Increasing naturally produced salmon populations is an important goal of CDFG. As noted previously, FGC Section 6902 states that the CDFG shall work towards a doubling of naturally producing salmon populations. CDFG is required to "…consult with every public agency whose policies or decisions may affect…" the program goal of doubling naturally produced salmon and steelhead in California (FGC Section 6920(b)).

The management of Central Valley steelhead is primarily the responsibility of the Commission and CDFG. All hatchery-produced steelhead are marked by adipose fin clipping prior to release. The Commission sets that

harvest regulations for hatchery fish only. Anglers that catch unmarked steelhead must release those fish and only hatchery-marked fish can be harvested in compliance with the state regulations.

PROCESS FOR REGULATION CHANGES

Section 206 of the FGC establishes the process for regulation changes. This involves a series of Commission meetings in August, October, November, and December during which changes to fishing regulations may be considered. In the August meeting, the Commission receives input from staff, other public agencies (e.g., NMFS), and the public about possible changes. In the October and November meetings the Commission holds discussions regarding proposed changes including analysis by staff. By the end of the November meeting the Commission announces the regulations changes they intend to implement. At the December meeting the Commission may hear additional testimony relating to the proposed regulations. At or within 20 days of the December meeting, the Commission must finalize any regulation changes.

U.S. FISH AND WILDLIFE SERVICE

AUTHORIZING LEGISLATION

The Central Valley Project Improvement Act (CVPIA; Public Law 102-572, Title 34) was passed in 1992 and established changes in management of the Central Valley Project that focused on protection, restoration, and enhancement of fish and wildlife. Within the CVPIA, the Comprehensive Assessment and Monitoring Program (CAMP) was authorized by Section 3406(b)(16). The goals of the CAMP are to assess the overall effectiveness of the CVPIA actions and the relative effectiveness of habitat restoration methods. To meet the first goal, the CAMP relies on the Anadromous Fish Restoration Program (AFRP). The AFRP was created by the CVPIA (Section 3406(b)(1)) and charged with a goal of at least doubling the natural production of salmon and steelhead in the Central Valley by the year 2002 based on the estimated long-term average population levels of each stock between 1967 and 1991. The USFWS has the primary responsibility for implementing both the CAMP and AFRP.

INTERAGENCY RELATIONSHIPS

Both the AFRP and CAMP rely on other agencies for a variety of tasks. Perhaps the largest cross-agency pathway is with the Bureau of Reclamation which has substantial management responsibilities (especially those related to management of water) for CAMP as part of the CVPIA. In addition, the CAMP relies on other agencies (e.g., CDFG, California Department of Water Resources, and East Bay Municipal Utility District) for collection of data that is reported by CAMP. The AFRP relies on a host of federal, state, local, and private organizations for project implementation.

FISH MANAGEMENT

The USFWS functions primarily as a monitoring entity when it comes to Central Valley salmon and steelhead. They USFWS collects information as required under the CVPIA, but has no direct management function in relation to harvest quotas or escapement goals. The USFWS can participate in all the public/agency meetings that are held by the PFMC or Commission to set harvest regulations.

MANAGEMENT GOALS

As noted, the AFRP was given a goal by the CVPIA of at least doubling the long-term sustainable natural production of salmon and steelhead in the Central Valley (Section 3406(b)(1)). The AFRP production targets are set in the *Final Restoration Plan for the Anadromous Fish Restoration Program* (USFWS 2001). The specific production targets for adult fish are (USFWS 2001: 9):

- Fall and Late fall-run Chinook 818,000;
- Winter-run Chinook: 110,000;
- Spring-run Chinook: 68,000; and
- Steelhead: 13,000.

PROCESS FOR REGULATION CHANGES

While the USFWS does not implement any harvest-related actions, both the AFRP and CAMP have affects on salmon and steelhead populations. If it were necessary to make change to the AFRP and CAMP, Congressional action would be required.

PACIFIC STATES MARINE FISHERIES COMMISSION

AUTHORIZING LEGISLATION

The PSMFC was formed by a compact entered into in 1947 and subsequently approved by Congress (Public Law 232) with the states of Alaska, Idaho, Washington, Oregon, and California.

INTERAGENCY RELATIONSHIPS

The primary goal of the PSMFC is to help resource agencies and the fishing industry sustainably manage Pacific Ocean resources. Although the PSMFC has no regulatory or management authority it provides valuable functions related to fish management along the West Coast. First, it functions as a venue and forum that allows participating members to work on mutual concerns and those that cross state boundaries. Second, it collects and disburses grant funds for states and other organizations where money comes from a variety of state, federal, and other sources. Third, the PSMFC coordinates research and collects and manages data relating to interstate fisheries issues. The PSMFC is also a non-voting member of the PFMC.

AGENCY RESTORATION STRATEGIES AND ACTIONS

The three agencies use different terminologies to describe their respective plans. The USFWS states that its plan is a programmatic-level “restoration” plan that is designed to double the natural production of Central Valley anadromous fish. The NMFS plan is more specialized and focuses only on the “recovery” of listed anadromous salmonids – a subset of Central Valley anadromous fish. The CDFG “conservation” strategy describes Stage 2 restoration actions in the Central Valley. Some of these actions focus on the enhancement of naturally produced anadromous salmonids. While the approaches to each of the three plans vary due to the variety of resources covered, all plans are intended to result in viable and persistent populations of anadromous salmonids in the

Central Valley. Accordingly, this paper uses the terms “restoration,” “recovery,” and “conservation” interchangeably.

RESTORATION STRATEGY OF THE NATIONAL MARINE FISHERIES SERVICE

The Sacramento Office of Protected Resources within the NMFS issued in 2009 a *Public Draft Recovery Plan* (Recovery Plan; NMFS 2009) for the three federally-listed salmonids occurring in the Central Valley. The ultimate goal of any recovery plan is to improve the viability of listed species such that they can be removed from federal protection under the ESA. The Recovery Plan represents NMFS’s expert judgment on how to achieve the delisting goal for three stocks of Central Valley salmonids. As such, it is roadmap that describes the steps, strategies, and actions that must be taken to return the three listed salmonids to viable status, thereby ensuring their long-term (time scales greater than 100 years) persistence and evolutionary potential. Because the NMFS is the federal agency with the primary responsibility of meeting the requirements of the ESA for all listed anadromous fish species, this paper presents in some detail the elements of the Recovery Plan that will be compared later to the parallel actions of the USFWS and CDFG.

RECOVERY PLANS UNDER THE ESA

Section 4(f) of the ESA specifies the content of recovery plans. Specifically, Section 4(f) states:

“(1) RECOVERY PLANS.—The Secretary [Commerce or Interior] shall develop and implement plans hereinafter in this subsection referred to as ‘‘recovery plans’’ for the conservation and survival of endangered species and threatened species listed pursuant to this section, unless he finds that such a plan will not promote the conservation of the species. The Secretary, in development and implementing recovery plans, shall, to the maximum extent practicable—

(A) give priority to those endangered species or threatened species, without regard to taxonomic classification, that are most likely to benefit from such plans, particularly those species that are, or may be, in conflict with construction or other development projects or other forms of economic activity;

(B) incorporate in each plan—

(i) a description of such site-specific management actions as may be necessary to achieve the plan’s goal for the conservation and survival of the species;

(ii) objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of this section, that the species be removed from the list; and

(iii) estimates of the time required and the cost to carry out those measures needed to achieve the plan’s goal and to achieve intermediate steps toward that goal.

“(2) The Secretary, in developing and implementing recovery plans, may procure the services of appropriate public and private agencies and institutions and other qualified persons. Recovery teams appointed pursuant to this subsection shall not be subject to the Federal Advisory Committee Act.

"(3) The Secretary shall report every two years to the Committee on Environment and Public Works of the Senate and the Committee on Merchant Marine and Fisheries of the House of Representatives on the status of efforts to develop and implement recovery plans for all species listed pursuant to this section and on the status of all species for which such plans have been developed.

"(4) The Secretary shall, prior to final approval of a new or revised recovery plan, provide public notice and an opportunity for public review and comment on such plan. The Secretary shall consider all information presented during the public comment period prior to approval of the plan.

"(5) Each federal agency shall, prior to implementation of a new or revised recovery plan, consider all information presented during the public comment period under paragraph (4)."

It is important to note that the ESA does not mention, nor does it require, that recovery plans must focus only on "naturally" produced species, as opposed to captively bred specimens as are hatchery fish.

Hatchery-Origin Fish in ESA Listing Determinations and Recovery Planning

There is a common misconception that the NMFS only considers naturally produced fish in its listing determinations and recovery planning. This is not the case. The NMFS issued a final policy on the consideration of hatchery-origin fish in ESA listing determinations for Pacific salmon and steelhead on 28 June 2005 (NMFS 2005; 70 FR 37204).

Previous Actions by the NMFS

In 1978, Congress amended the ESA and provided the current language defining "species." Specifically, a "species" is defined to include to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." Just what constitutes a DPS and thus a "species" under the ESA, was a vexing issue among federal agencies which was not resolved until the NMFS issued its ESU policy on 20 November 1991 (NMFS 1991; 56 FR 58612). In that policy the NMFS determined that a DPS of a Pacific salmon or steelhead species is considered for listing if it meets two criteria:

(1) It must be substantially reproductively isolated from other conspecific (i.e., same species) population units; and

(2) It must represent an important component in the evolutionary legacy of the species.

According to Waples (1991) isolation does not need to be absolute, but must be sufficient to permit evolutionarily important differences to accrue in different populations. The second criterion would be met if the population contributed substantially to the ecological/genetic diversity of the species as a whole. The NMFS hatchery-origin fish policy states (NMFS 2005; 70 FR 37215):

> "A key feature of the ESU concept is the recognition of genetic resources that represent the ecological and genetic diversity of the species. These genetic resources can reside in a fish spawned in a hatchery (hatchery fish) as well as in a fish spawned in the wild (natural fish)."

Given the foregoing criteria, in delineating an ESU considered for listing, the NMFS must identify all components of the ESU, including natural fish and hatchery fish that are part of the ESU. The NMFS evaluates if hatchery fish have a level of genetic divergence relative to the local natural fish that is no more than what occurs within the ESU. Hatchery fish that meet this genetic divergence threshold: (1) are considered part of the ESU; (2) are considered in determining whether or not an ESU should be listed; and (3) are included in any listing of the ESU.

Furthermore, when the NMFS makes status determinations for ESUs, it considers the entire ESU, including hatchery fish if they have been designated part of the ESU. Notably, the NMFS applies the ESU policy in support of the conservation of naturally-spawning salmon and steelhead and the ecosystems upon which they depend. The support of naturally-spawning salmon and steelhead and the ecosystems upon which they depend stems from section 2(b) of the ESA which states, in relevant part (16 U.S.C. 1531(b)):

> "The purposes of this Act [i.e., ESA] are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved …"

Hatcheries are not part of a natural ecosystem, but can contribute to conserving natural self-sustaining populations if properly managed. Therefore, the emphasis is on naturally produced fish and the ultimate goal is to achieve viable, naturally produced fish that maintain the genetic legacy of the stock without the need for hatchery conservation programs.

At present, when the NMFS makes status determinations for Pacific salmon and steelhead ESUs, there are four factors considered key elements in the status determination: (1) abundance; (2) productivity; (3) genetic diversity; and (4) spatial distribution. The hatchery-origin fish policy states (NMFS 2005; 70 FR 37215):

> "The effects of hatchery fish on the status of an ESU will depend on which of the four key attributes are currently limiting the ESU, and how the hatchery fish within the ESU affect each of the attributes. The presence of hatchery fish within the ESU can positively affect the overall status of the ESU, and thereby affect a listing determination, by contributing to increasing abundance and productivity of the natural populations in the ESU, by improving spatial distribution, by serving as a source population for repopulating unoccupied habitat, and by conserving genetic resources of depressed natural populations in the ESU. Conversely, a hatchery program managed without adequate consideration of its conservation effects can affect a listing determination by reducing adaptive genetic diversity of the ESU, and by reducing the reproductive fitness and productivity of the ESU. In evaluating the effect of hatchery fish on the status of an ESU, the presence of a long-term hatchery monitoring and evaluation program is an important consideration."

In the Central Valley, the NMFS has determined that in addition to naturally spawned fish, two artificial propagation programs: winter-run from the Livingston Stone National Fish Hatchery (NFH), and winter-run in a captive broodstock program maintained at Livingston Stone NFH and the University of California Bodega Marine Laboratory are part of the ESU (Table 1). Similarly, the NMFS has determined in addition to naturally spawned fish, the Feather River Hatchery spring-run Chinook salmon program is part of the ESU (Table 1). No artificially produced Central Valley steelhead are considered part of the Central Valley Steelhead DPS by the NMFS (Table 1). A summary of the history of Central Valley Chinook salmon and steelhead hatcheries and the role of hatchery production in the management of Central Valley salmonids is discussed more fully in Appendix A.

NMFS-Defined Diversity Groups

The NMFS has identified four Chinook salmon "population groups or salmonid ecoregions" in the Central Valley that were defined based on climatological, hydrological, and geological characteristics. These four groups are termed "diversity groups" in the draft Recovery Plan, and are (Figure 4):

- The *basalt and porous lava diversity group* composed of the upper Sacramento River and Battle Creek watersheds;
- The *northwestern California diversity group* composed of streams that enter the mainstem Sacramento River from the northwest;
- The *northern Sierra Nevada diversity group* composed of streams tributary to the Sacramento River from the east, and including the Mokelumne River; and
- The *southern Sierra Nevada diversity group* composed of streams tributary to the San Joaquin River from the east.

The NMFS has identified six diversity groups for Central Valley steelhead as follows (Figure 5):

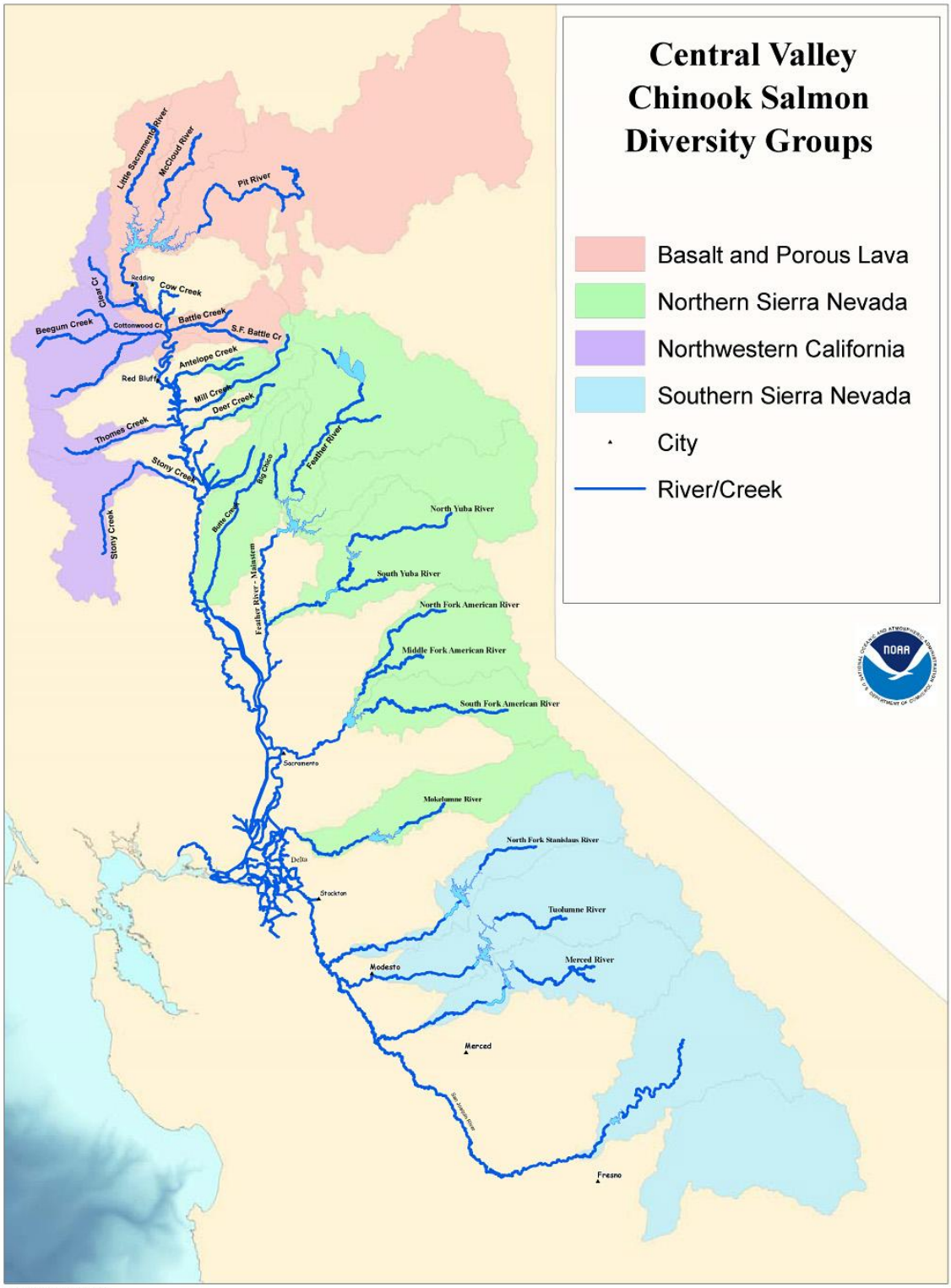
- The *basalt and porous lava diversity group* composed of the upper Sacramento River and Battle Creek watersheds;
- The *northwestern California diversity group* composed of streams that enter the mainstem Sacramento River from the west;
- The *northern Sierra Nevada diversity group* composed of streams tributary to the Sacramento River from the east, and including the Cosumnes River;
- The *southern Sierra Nevada diversity group* composed of streams tributary to the San Joaquin River from the east, including the Mokelumne River;
- The *central western diversity group* composed of streams in the Coast Range on the westside of the San Joaquin Valley; and
- The *Suisun Bay tributaries diversity group* composed of streams tributary to Suisun Bay.

Without explanation, the central western and Suisun Bay diversity groups are not discussed further in the draft Recovery Plan.

Strategy Elements

The near-term strategy to recovery identified by the NMFS includes these elements:

- Secure all extant populations;
- Begin collecting distribution and abundance data for steelhead in habitats accessible to anadromous fish;
- Minimize straying from hatcheries to natural spawning areas;



Source: NMFS 2009

Figure 4 Diversity Groups for the Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon ESUs in the Central Valley Domain.

Source: NMFS 2009

Figure 5 Diversity Groups for the Central Valley Domain Steelhead DPS in the Central Vally Domain

- Conduct critical research on fish passage above rim dams, reintroductions, and climate change; and
- List salmonids ESUs that are likely to be conservation-reliant (i.e., continued conservation management is likely to be required).

The long-term strategy identified by NMFS includes these elements:

- Ensure that every extant diversity group has a high probability of persistence;
- Until all ESU viability criteria have been achieved, no population should be allowed to deteriorate in its probability of persistence;
- High levels of recovery should be attempted in more populations than identified in the diversity group viability criteria because not all attempts will be successful;
- Individual populations within a diversity group should have persistence probabilities consistent with a high probability of diversity group persistence; and
- Within a diversity group, the populations restored/maintained at viable status should be selected to: (1) allow for typical meta-population processes; (2) allow for typical evolutionary processes, including the retention of the genetic diversity; and (3) minimize the susceptibility to catastrophic events.

Just how these near and long-term strategy elements translate into specific objectives and criteria is discussed next.

RECOVERY GOALS, OBJECTIVES, AND CRITERIA IDENTIFIED BY THE NMFS

As stated previously, the goal of the NMFS Recovery Plan is to remove Sacramento River winter-run Chinook salmon ESU, Central Valley spring-run Chinook salmon ESU, and Central Valley steelhead DPS from the federal list of endangered and threatened wildlife. The draft Recovery Plan identifies recovery priorities for currently occupied watersheds (Table 3).

In addition to the recovery priorities for occupied watersheds, the NMFS draft Recovery Plan also identifies reintroduction priorities for Central Valley watersheds (Table 4).

The criteria for delisting salmonids are also presented in the draft Recovery Plan. At the ESU/DPS level each Diversity Group must meet the following criteria:

- Winter-run Chinook Salmon
  - Three populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction (3 populations x 2,500 fish[1] = 7,500 fish).
- Spring-run Chinook Salmon
  - One population in the Northwestern California Diversity Group at low risk of extinction (2,500 fish).

[1] Population levels were established by the Central Valley Technical Recovery Team and described by Lindley et al. (2007).

Table 3
Recovery Priorities for Central Valley Watersheds Currently Occupied by Listed Salmonids.

Diversity Group	Watershed/Population	Species	Recovery Focus[1]
Northwestern California	Clear Creek	Spring-run	Core 1
		Steelhead	Core 1
	Cottonwood/Begum Creek	Steelhead	Core 2
		Spring-run	Core 2
	Thomes Creek	Steelhead	Core 2
		Spring-run	Core 3
Basalt and Porous Lava	Upper Sacramento River (Keswick to Red Bluff)	Winter-run	Core 1
		Spring-run	Core 2
		Steelhead	Core 2
	Cow Creek	Steelhead	Core 2
	Redding Area Tributaries	Steelhead	Core 2
	Battle Creek	Spring-run	Core 1
		Steelhead	Core 1
Northern Sierra Nevada	Antelope Creek	Steelhead	Core 1
		Spring-run	Core 2
	Mill Creek	Spring-run	Core 1
		Steelhead	Core 1
	Deer Creek	Spring-run	Core 1
		Steelhead	Core 1
	Big Chico Creek	Steelhead	Core 2
		Spring-run	Core 3
	Butte Creek	Spring-run	Core 1
		Steelhead	Core 2
	Lower Feather River	Spring-run	Core 2
		Steelhead	Core 2
	Lower Yuba River	Spring-run	Core 1
		Steelhead	Core 1
	Bear River	Spring-run	Core 3
		Steelhead	Core 3
	Lower American River	Steelhead	Core 2
	Cosumnes River	Steelhead	Core 3
	Lower Mokelumne River	Steelhead	Core 3
Southern Sierra Nevada	Calaveras River	Steelhead	Core 1
	Lower Stanislaus River	Steelhead	Core2

Table 3 Recovery Priorities for Central Valley Watersheds Currently Occupied by Listed Salmonids.			
Diversity Group	**Watershed/Population**	**Species**	**Recovery Focus[1]**
	Lower Tuolumne River	Steelhead	Core 2
	Lower Merced River	Steelhead	Core 2

Notes:

[1] Core 1 populations are those populations identified as having the highest priority for recovery action implementation. These populations must meet the recovery criteria for low risk of extinction.

Core 2 populations must have the potential to reach the biological recovery criteria for moderate risk of extinction and are of secondary importance in recovery efforts.

Core 3 populations may be present on an intermittent basis and are characterized as being dependent on other nearby independent populations for their existence, but are not expected to exceed the abundance criteria for high risk of extinction.

Source: NMFS 2009, Table 3-1

- Two populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction (2 populations x 2,500 fish = 5,000 fish).
- Three populations in the Northern Sierra Diversity Group at low risk of extinction (3 populations x 2,500 fish = 7,500 fish).
- Two populations in the Southern Sierra Diversity Group at low risk of extinction (2 populations x 2,500 fish = 5,000 fish).
- Maintain Core 2 populations at moderate risk of extinction (Table 3).

► Central Valley Steelhead

- Two populations in the Northwestern California Diversity Group at low risk of extinction (2 populations x 2,500 fish = 5,000 fish).
- Two populations in the Basalt and Porous Lava Flow Diversity Group at low risk of extinction (2 populations x 2,500 fish = 5,000 fish).
- Three populations in the Northern Sierra Diversity Group at low risk of extinction (3 populations x 2,500 fish = 7,500 fish).
- Two populations in the Southern Sierra Diversity Group at low risk of extinction (2 populations x 2,500 fish = 5,000 fish).
- Maintain Core 2 populations at moderate risk of extinction (Table 3).

Table 4 Reintroduction Priorities for Central Valley Watersheds for Listed Salmonids.			
Diversity Group	**Watershed/Population**	**Species**	**Focus for Recovery[1]**
Basalt and Porous Lava	Little Sacramento River	Winter-run	Primary
		Spring-run	Primary
		Steelhead	Primary
	McCloud River	Winter-run	Primary
		Spring-run	Primary
		Steelhead	Primary
	Battle Creek	Winter-run	Primary
Northern Sierra Nevada	North Fork Feather River	Spring-run	Secondary
		Steelhead	Secondary
	Upper Yuba River	Spring-run	Primary
		Steelhead	Primary
	Upper American River	Spring-run	Secondary
		Steelhead	Primary
	Cosumnes River	Steelhead	Secondary
	Upper Mokelumne River	Steelhead	Secondary
Southern Sierra Nevada	Upper Stanislaus River	Steelhead	Secondary
	Upper Tuolumne River	Steelhead	Secondary
	Upper Merced River	Steelhead	Secondary
	San Joaquin River (Friant to Merced)	Spring-run	Primary

Notes:

[1] Primary priority watersheds have a high potential to support spawning populations of anadromous fish.

Secondary priorities have a moderate potential to support spawning populations of anadromous fish.

Source: NMFS 2009, Table 3-2

At the population level the draft Recovery Plan lists these delisting criteria (Core 1 and Core 2 combined):

- "For a population to be considered at low risk of extinction (i.e., <5 percent chance of extinction within 100 years), the population viability assessment must demonstrate that risk level or all of the following criteria must be met:
  - The effective population size must be >500 or the population size must be >2,500;
  - The population growth rate must show that a decline is not apparent or probable;
  - There must be no apparent or minimal risk of a catastrophic disturbance occurring; and

- Hatchery influence must be low, as determined by levels corresponding to different amounts, durations and sources of hatchery strays."

In summary, the draft Recovery Plan envisions the establishment of a number of populations of each listed salmonid within specific geographic areas (Diversity Groups) that have a low risk (<5 percent) of extinction over the long-term (100 years). Numerically, each population must exceed 2,500 adult fish. Using the criteria presented in the draft Recovery Plan delisting could occur when Core 2 populations have only a moderate risk of extinction and Core 1 populations achieve the following:

- Winter-run Chinook Salmon
  - Three populations at low risk of extinction with each population having a *minimum* population size of 2,500 fish (7,500 fish total for all populations).
- Spring-run Chinook Salmon
  - Nine populations at low risk of extinction with each population having a *minimum* population size of 2,500 fish (22,500 fish total for all populations).
- Central Valley Steelhead
  - Nine populations at low risk of extinction with each population having a *minimum* population size of 2,500 fish (22,500 fish total for all populations).

RECOVERY ACTIONS

NMFS states in the draft Recovery Plan:

> "Many complex and inter-related biological, economical, social, and technological issues must be addressed in order to recover anadromous salmonids in the Central Valley. Policy changes at the Federal, State, and local levels will be necessary to implement many of the recovery actions. For example, without substantial strides in habitat restoration, fish passage, and changes in water use, recovery will be difficult if not impossible."

The specific recovery actions for listed Central Valley salmonids identified by the NMFS in its draft Recovery Plan are summarized in tables in Appendices B through E. For each *Priority 1 Recovery Action*, the NMFS provides an estimate of the duration of the action, for example, "year 1 through year 10." NMFS provides for most actions, but not all, a 5-year cost estimate for implementation. Also, for each action, the NMFS lists involved parties, although it is not clear which party, if any, is the lead action agency.

RESTORATION STRATEGY OF THE CALIFORNIA DEPARTMENT OF FISH AND GAME

The CDFG's restoration strategy for Central Valley salmonids has its foundation in the CALFED Bay-Delta Program (CALFED) and the Ecosystem Restoration Program Plan (ERPP) *Volume III: Strategic Plan for Ecosystem Restoration* (ERP; CALFED 2000). Under the ERP, CDFG issued a draft *Conservation Strategy for Restoration of the Sacramento-San Joaquin Delta Ecological Management Zone and the Sacramento and San*

Joaquin Regions in July 2011 (Conservation Strategy; CDFG 2011). The draft was developed by CDFG; however, the draft states that the final version of this strategy is to be developed in consultation with the USFWS and NMFS who, along with the CDFG, are collectively known as the ERP Implementing Agencies.

The CDFG draft Conservation Strategy describes the ERP priorities and actions for Stage 2 of the CALFED Bay-Delta Program. The Conservation Strategy is stated to provide the rationale for restoration actions specific to the Delta Ecological Management Zone (EMZ) and the Sacramento Valley and San Joaquin Valley regions (CDFG 2011). The document states:

> "The Conservation Strategy serves as an update to the ERP Strategic Plan and follows the principle of a single-blueprint for ecosystem restoration and species recovery in accordance with the principals of ecosystem-based management. Having a single-blueprint is a key ingredient for a successful and effective restoration program. This single-blueprint is the vehicle for ensuring coordination between all resource management, conservation, and regulatory actions affecting the Bay-Delta ecosystem . . ."

The document states that the ERP Implementing Agencies (i.e., CDFG, USFWS, and NMFS) will use the ERP Stage 2 Conservation Strategy during the period from 2011 to 2030. Further, it states that the Conservation Strategy is intended "as a guide to the types and locations of restoration actions, it is not a prescription for restoration actions at any specific site." The focus area of the strategy extends from Shasta Dam on the Sacramento River in the north to Friant Dam on the San Joaquin River to the south, and includes the Delta westward to North San Francisco Bay and Suisun Marsh.

The Conservation Strategy is presented by geographic area:

- Sacramento-San Joaquin Delta EMZ;
- Sacramento Valley Region; and
- San Joaquin Valley Region.

Within each of these areas the Conservation Strategy identifies *Stage 2 Actions* to address restoration issues that have been grouped into broad categories:

- Ecosystem Processes;
- Habitats;
- Stressors; and
- Species.

The actions related to anadromous salmonids are summarized in tables in Appendices B through E.

The Conservation Strategy also discusses, by geographic area, the strategy's relationship to other planning efforts in each geographic area.

Implementation of the Conservation Strategy rests on:

- The continued coordination of the ERP Implementing Agencies managers with the Delta Stewardship Council;

- Integration of the Conservation Strategy into the planning efforts of the Delta Stewardship Council and the Delta Conservancy;
- Sustained funding of actions and ecosystem restoration activities; and
- The incorporation of uncertainty and adaptive management into planning, doing, evaluating, and responding to actions.

The Conservation Strategy includes a listing of ERP Strategic Goals and Objectives (Appendix B of the strategy) and for each goal and its subset of objectives ERP Performance Measures are identified (Appendix D of the strategy). While the performance measure targets and measure metrics are frequently listed as "to be determined," some key targets are identified. For example:

ERP GOAL 3. Maintain and/or enhance populations of selected species for sustainable commercial and recreational harvest, consistent with the other ERP strategic goals.

- **Objective 3-1.** Enhance fisheries for salmonids, white sturgeon, Pacific herring, and native cyprinid fishes.
- **Performance Measure 3-1.1a.** Progress towards maintaining population, or doubling established baseline (prescribed in the CVPIA for anadromous fish).
- **Targets.** 990,000 all races of Chinook salmon; 13,000 steelhead.
- **Metric.** To be determined.

No information is included in the Conservation Strategy identifying the lead agency for any restoration action, specific timelines for action implementation, or the projected costs of action implementation.

RESTORATION STRATEGY OF THE U.S. FISH AND WILDLIFE SERVICE

The *Final Restoration Plan for the Anadromous Fish Restoration Program* (Restoration Plan; USFWS 2001) is the oldest of the agency plans considered in this evaluation. Many of its restoration actions have been completed; however, those actions are not distinguished herein from those actions yet to be implemented. As has been stated previously, the CVPIA created the AFRP with the goal of making all reasonable efforts to double natural production of anadromous fish in the Central Valley. Out of the AFRP the USFWS developed the Restoration Plan. While the Restoration Plan is described as a programmatic-level document, it includes numerous site-specific recovery actions and evaluations. The geographic coverage of the Restoration Plan encompasses most of the Central Valley, including the Sacramento-San Joaquin Delta. The Restoration Plan excludes the San Joaquin River between Friant Dam and Mendota Pool pursuant to the CVPIA.

In developing the Restoration Plan the USFWS went through a process to prioritize watersheds based on their capacity to increase fish production. Recovery actions were prioritized based on the action's ability to promote natural processes leading to greater fish production. A process for implementing the recovery actions and for inter-agency cooperation was identified. An adaptive management approach was adopted to address scientific uncertainty. The USFWS's Restoration Plan does not include detailed narrative descriptions of why particular actions are necessary, but it rather presents a series of tables that state the action, what parties are likely to be

involved, and what priority level the action is (i.e., low, medium, or high). No information on the projected cost or timeline for each action is included.

Those actions in the Recovery Plan related to the recovery of anadromous salmonids are summarized in tables in Appendices B through E.

COMPARISON OF AGENCY SALMONID MANAGEMENT ACTIONS

While there are numerous local, state, and federal agencies and organizations that have a direct role in the conservation of listed salmonids in the Central Valley, ranging from non-profit watershed conservancies to the U.S. Bureau of Reclamation, the primary restoration responsibility rests with the NMFS, USFWS, and CDFG. Over the past 20 years numerous plans for salmonid restoration have been issued – largely revisiting the same issues and potential solutions over and over again. Enormous quantities of money have been devoted to conservation measures over this same period of time with mixed results depending on stock monitored, as measured by escapement to spawning. Today, there is no Central Valley anadromous salmonid stock that is not either listed under state or federal endangered species statues or considered as a "species of concern" by one or more agencies.

The primary restoration planning documents relied upon by each of the "big three" agencies were reviewed previously herein. A summary comparison of each agency's restoration actions is provided in Appendices B through E. In comparing actions among agencies keep in mind the following caveats:

- The planning documents were developed at different points in time;
- The USFWS's document is a programmatic restoration plan prepared pursuant to CVPIA; the NMFS's document is a draft recovery plan prepared pursuant to ESA; and the CDFG document is a draft conservation strategy is a guide stemming from CALFED;
- Some of the actions listed particularly in the USFWS and NMFS documents have been completed; and
- The total number of restoration actions among the agencies is variable due, in part, by how specific the restoration plan is (i.e., generalized actions for an entire geographic area versus site-specific actions listed stream-by-stream).

COMPARISON OF THE SIMILARITY OF AGENCY RECOVERY ACTIONS

The total number of restoration actions varies widely among agencies and region, with the USFWS typically identifying many more actions that NMFS and CDFG, particularly in the Sacramento River watershed (Tables 5 and 6). The difference is due, in part, to the tendency of the USFWS restoration plan, even though claiming to be programmatic, to be much more site-specific than the plans of the other two agencies. Even taking this

Table 5
Comparison of the Similarity of Agency Recovery Actions by Geographic Region.

Geographic Location	Total Number of Proposed Recovery Actions			Number of Occurrences When Recovery Actions are Similar Among All Three Agencies	Number of Occurrences When Recovery Actions are Similar Between Two Agencies			Number of Occurrences When Recovery Actions are Unique to Only One Agency		
	NMFS	USFWS	CDFG		NMFS + USFWS	NMFS + CDFG	USFWS + CDFG	NMFS	USFWS	CDFG
Central Valley-wide	19	14	8	2	7	0	0	10	4	0
Sacramento-San Joaquin Delta	14	26	9	2	5	1	0	6	4	3
Sacramento River Watershed	40	177	31	3	21	5	9	11	123	15
San Joaquin River Watershed	10	42	28	5	3	3	2	0	22	17
Total	**83**	**259**	**76**	**12**	**36**	**9**	**11**	**27**	**153**	**35**

Table 6
Relative Agreement Among Agencies on Recovery Actions.

Agency	Total Number of Recovery Actions for Central Valley	Recovery Actions Unique to Agency		Recovery Actions Similar Among All Three Agencies		Recovery Actions Similar Between Two Agencies					
						NMFS		USFWS		CDFG	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
NMFS	83	27	32.5	12	14.4	NA	NA	36	43.4	9	10.8
USFWS	259	153	59.1	12	4.6	36	13.9	NA	NA	11	4.2
CDFG	76	35	46.0	12	15.8	9	11.8	11	14.5	NA	NA

comparison limitation into account, the data clearly shows that rarely did all three agencies propose similar to identical restoration actions in comparison with the total number of actions proposed (Table 5). For example, in the Sacramento River watershed, out of the numerous actions identified, the three agencies only identified similar actions five times, and for the entire Central Valley the three agencies were only in agreement 12 times. Those 12 times of agency agreement comprise a small percentage of the total recovery actions identified by any given agency, ranging from 4.6 to 15.8 percent, depending on agency (Table 6).

A substantial proportion of a given agency's recovery actions were unique to that agency (Table 5). For example, the USFWS proposed 153 unique actions out of a total of 259 actions; this was over 59 percent of its total number of actions (Table 6). Similar substantial percentages of unique recovery actions are noted for NMFS and CDFG (Tables 5 and 6).

Also of interest is the frequency with which any two agencies agreed with each other. The NMFS and the USFWS were in agreement on 36 recovery actions, which was 43.4 percent of the total actions proposed by NMFS, but only 13.9 percent of the total actions identified by the USFWS (Tables 5 and 6). It should be noted that the NMFS in its draft Recovery Plan included numerous actions directly from the USFWS's AFRP restoration plan.

The CDFG's recovery actions were consistently out-of-sync with the federal agencies. For example, of the 76 total recovery actions identified by the CDFG, only 11.8 percent of the actions overlapped with actions proposed by the NMFS, and 14.5 percent overlapped with the USFWS (Table 6).

The often substantial disconnect among the three agencies as to what recovery actions are necessary suggest different agency goals and objectives as well as structural problems in inter-agency cooperation or communication. An examination deeper into the differences in the agency recovery documents is revealing.

SPECIFIC INCONSISTENCIES AMONG THE RECOVERY PLANNING DOCUMENTS

A review of Appendices B through E and the text of each agency document reveal specific inconsistencies that impair efficient and effective recovery planning and make the documents not very useful to managers. Essentially, there are three programs that overlap to some degree, but do not seem to take advantage of the benefits of combined and consistent planning. The key issues in comparing the recovery documents with examples follow.

One or more of the three planning documents was found to be inadequate due to:

(1) *Lack of specificity as to which anadromous salmonid stock benefits from specific recovery/conservation actions.*

The NMFS draft Recovery Plan consistently identifies species that benefit from each recovery action (Appendices B through E). The USFWS Restoration Plan is inconsistent in identifying the species that benefit, and the CDFG draft Conservation Strategy is even more inconsistent when identifying species when presenting its Stage 2 Actions.

The USFWS plan in presenting recovery actions frequently uses vague terms (e.g., anadromous fishes, salmonids, juvenile salmon, adult salmonids). Often, no specific anadromous salmonid is identified. The plan assumes the reader must know which stock is being referred to for specific actions.

Example:

> "Provide flows in the Calaveras River of suitable water temperature for all salmonid life stages." (Appendix E. Calaveras River. Action 2)

The CDFG plan has similar omissions to that of the USFWS, but the omissions are more frequent, leading the reader to assume to which stock the benefits accrue.

Example:

> "Improve the efficiency of screening devices on the Yuba River at Hallwood-Cordua and Brophy-South Yuba diversions, and construct screens at Brown's Valley water diversion and other unscreened diversions." (Appendix D. Yuba River. Action 2)

(2) *Lack of specificity as to which streams the actions apply to.*

This issue is typically a problem associated with the CDFG plan wherein the plan frequently presents generic actions. Generic actions are less than informative because they do not tell manager's anything about the scope of the problem, the potential costs to solve the problem, or who the interested parties are. It is also essentially impossible to evaluate the success of generic actions.

Example:

> "Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions." (Appendix E. Action 1)

(3) *Failure to include actions for known anadromous salmonid streams.*

The USFWS Restoration Plan does an excellent job in presenting site-specific recovery actions. The NMFS Recovery Plan is somewhat less specific, but generally covers most of the same streams as the USFWS plan. The CDFG Conservation Strategy, again due to its overly generic content does not directly address recovery actions in many streams as it should. The specific anadromous salmonid streams unaddressed by NMFS are: Cow Creek, Bear Creek, Cottonwood Creek, Paynes Creek, Elder Creek, Thomes Creek, Stony Creek, Big Chico Creek, Lindo Channel, Mud Creek, Bear River, Dry Creek, Auburn Ravine, Miner's Ravine, and the Cosumnes River.

The specific anadromous salmonid streams unaddressed by CDFG are: Clear Creek, Cow Creek, Bear Creek, Cottonwood Creek, Battle Creek, Paynes Creek, Antelope Creek, Elder Creek, Mill Creek, Thomes Creek, Stony Creek, Deer Creek, Lindo Channel, Mud Creek, Mokelumne River, and the Cosumnes River.

The NMFS plan includes streams upstream of the rim dams, something the two other plans do not directly address. Action items included in the NMFS plan include these streams upstream of the rim dams: Little Sacramento River, McCloud River, Yuba River, American River, Mokelumne River, Stanislaus River, and Tuolumne River.

(4) *Failure to identify involved parties or lead agency responsible for recovery actions.*

Both the NMFS and USFWS recovery plans identify involved parties, with rare exception by NMFS, but neither plan indicates which involved party for a given action is the lead party or action agency. Sometimes the lead is obvious, but not in all cases. The CDFG plan rarely identifies the involved parties or the lead agency.

Example:

> "Design, permit, and construct priority fish screen projects on the Sacramento River." (Appendix D. Sacramento River. Action 4)

Not only is it not known what projects CDFG is thinking of, but neither are the potential involved parties identified.

There is another problem, however, even when the interested parties are identified. There are numerous instances where a unique recovery action identified by one agency places the burden of implementation on another agency or agencies. These other agencies may, or may not, be able to implement the action for a variety of reasons. This is an area that requires inter-agency coordination and communication.

Example:

> "Eliminate sources of chronic sediment delivered to Mill Creek from roads and other near-stream development by out-sloping roads, out-sloping of diversion prevention dips, replacing under-sized culverts and applying other storm proofing guidelines."

Involved Parties: CDFG, U.S. Forest Service (Appendix D. Mill Creek. Action 1.9.2.3 from NMFS 2009)

(5) *Anadromous salmonid stocks not addressed*.

The NMFS Recovery Plan does not address, of course, fall-run or late fall-run Chinook salmon because these stocks are not listed pursuant to the ESA, even though they are both "species of concern." As noted previously, there are many examples, especially in the USFWS and CDFG plans where it is not clear which anadromous fish stocks are benefiting from the recovery action. The USFWS plan commonly does not mention which run of Chinook salmon it is referring to for a specific action. For some streams one agency plan will include an anadromous salmonid stock that is omitted by another agency's action on the same stream.

Example:

> NMFS notes the stocks benefited are spring-run Chinook salmon and steelhead. The CDFG plan only lists Chinook salmon, and generically at that. (Appendix D. Chinook salmon and steelhead. Action 1.9.6.1 from NMFS 2009)

Steelhead are omitted from some streams where they are known to occur, primarily in the CDFG plan.

(6) *Level of conservation efforts for specific streams inconsistent/variable*.

The number of recovery actions is variable among agencies and geographic regions (Table 5). Also, as discussed under inconsistency (3), some anadromous salmonid streams are not even recognized by some plans, leading to a clear bias in recovery planning. Even for those streams recognized by all three agencies as needing recovery actions, the level-of-effort may not be the same. For example, in the Yuba River NMFS identifies 2 recovery actions, the USFWS 12, and CDFG 5 (Appendix D. Yuba River. Various Actions).

(7) *There are no evaluations of the population-level benefits of actions generally or by specific stream.*

While evaluating the population-level benefits of specific actions in concert with other actions on a given stream may be difficult, it seems appropriate to undertake such a benefit/cost analyses. Is it more beneficial to restore spring-run Chinook salmon to Butte Creek or to Battle Creek? Perhaps both are required; however, priorities are important based on the expected return. The NMFS plan identifies *Recovery Focus* levels ranging from Core 1 to Core 3 for currently occupied watersheds, and *Focus for Recovery* levels of Primary or Secondary for reintroduction. Presumably these ratings reflect which streams are likely to provide the most benefit for recovery. It would be desirable to see in the NMFS Recovery Plan these ratings converted to numbers of fish escaping to spawning if the recovery actions are fully successful. Life history model(s) would be needed to provide this information.

Similarly, the USFWS rates its recovery actions from low to high, presumably as a measure of the level of production achieved or priority for implementation. However, both the USFWS and CDFG have an artificial goal of doubling anadromous fishes from baseline levels regardless of whether the goal is realistic. It would be useful to know what both the USFWS and the CDFG project in population growth as measured by escapement to spawning if the recovery actions are successful.

(8) *Recovery Goals Among the Agencies are Not the Same.*

As presented previously in this report, using the criteria presented in the NMFS draft Recovery Plan delisting could potentially occur when Core 2 populations have only a moderate risk of extinction and Core 1 populations achieve certain population sizes. Also as discussed previously, the USFWS Restoration Plan and the CDFG Conservation Plan contain specific targets related to doubling populations.

Ignoring fall and late fall-run Chinook for comparative purposes, it is clear that the minimum the recovery goals for NMFS and the minimum recovery goals for the USFWS and the CDFG are not even remotely the same (Table 7).

Clearly, the restoration goals must be reconciled among the agencies or management conflicts will become substantial problems. It is also important to remember that NMFS's goal is to down-list or de-list populations; a goal that is different and achievable at Chinook salmon population levels less than an arbitrary doubling goal. For steelhead, the arbitrary doubling goal does not even achieve long-term viability of the stock if the NMFS assessment is to be relied upon.

Table 7 Recovery Goals for ESA Listed Species Among Agencies.		
Stock	**Total *Minimum* Population Size Goals By Agency**	
	NMFS	**USFWS/CDFG**
Fall + Late Fall Run Chinook	NA	818,000
Winter-run Chinook	7,500	110,000
Spring-run Chinook	22,500	68,000
Central Valley Steelhead	22,500	13,000
Total	**52,500**	**1,009,000**

(9) *There is no consistent timeline for implementing or completing conservation actions.*

The original timeframe for doubling the baseline Chinook salmon and steelhead stocks under the CVPIA (passed in 1992) was the year 2002. Obvious, that timeline is now irrelevant. The original timeline for CDFG to double salmonid stocks was the year 2000. That timeline is also moot. The current CDFG plan only extends to the year 2030 and there is no goal of doubling stocks by that year, so the timeline appears open-ended. The NMFS plan does address the duration of each proposed action (see Table 8-2 in NMFS plan). The NMFS plan states that recovery of listed stocks could take 50 to 100 years, and some stocks could require human intervention indefinitely. Selected actions are recognized to run 5, 10, 20, or more years. For planning purposes it would be desirable for the agencies to collaborate on a more refined timeline for the next 20 years, recognizing the uncertainties of budgets, staffing, and recovery success will remain hard to anticipate.

(10) *Long-term funding sources need to be secured.*

The CDFG plan briefly discussed the funding of ERP actions but it does not address long-term funding needs. Similarly, the NMFS plan, while recognizing the need for billions of dollars in funding over time, does not discuss strategies for securing such funding. The USFWS plan does not address this problem. For example, section 3406(b) of the CVPIA identified 34 “restoration” activities that the USFWS and U.S. Bureau of Reclamation should undertake. By 2008, 16 years later and over $1 billion in obligated funds, only 7 of 34 restoration activities had been completed.

It would appear prudent to make a concerted inter-agency effort to explore opportunities for long-term, dedicated recovery funding at the state and federal level. Recovery plans that are at the mercy of large-scale economic changes, annual budget vagaries and other factors are at risk of not achieving their long-term goals. Programs that are not implemented appropriately because of funding limitations are inefficient and prone to be ineffective as well. This issue should be addressed in the recovery planning process. It has not been adequately addressed to date.

(11) *There are no integrated performance measures to gauge success/failure of actions.*

Only the CDFG plan addressed the issue of performance measures (CDFG 2011 Table D-1); however, there are many gaps remaining in the document before a complete set of performance measures is determined. Specifically, many of the performance measures identified in the CDFG plan do not yet have performance targets or performance metrics. The work begun by the CDFG should be integrated among all three agencies to develop, as much as feasible, a uniform and agreed to set of standards, targets, and metrics that will measure the progress of the recovery efforts. More work needs to be invested in this area to demonstrate the success of restoration efforts: this is always crucial in seeking funding for continued restoration.

(12) *Limited discussion of inter-agency integration.*

Only the CDFG plan contained a discussion of the role of the ERP Implementing Agencies. The CDFG plan candidly recognized that the implementation of the ERP needed to be more focused to meet the expectations of stakeholders. While projects were identified, budget and staffing issues hampered implementation. The CDFG stated that during Stage 1 just over 25 percent of the funding actually went to restoration projects, the remainder going to other activities. This ratio in funding, if sustained, will certainly adversely impact the recovery efforts because they will be perceived by managers and funding sources as inefficient and ineffective. One approach to correcting this imbalance is to create a process that better integrates inter-agency activities by removing roadblocks to action implementation. Streamlining permitting through programmatic agreements and reducing redundancy in bureaucracy are possible areas for improvement. In any case, much of the foregoing problems discuss in this paper demonstrate that dramatically improved inter-agency communication, coordination, and integration are necessary to tackle the massive restoration requirements in the Central Valley.

CONCLUDING DISCUSSION

While much of the discussion in this paper focuses on problems and conflicts between recovery plans, it is important to recognize that the existing management scheme has not been without its successes. Those successes, however, are limited. Perhaps the biggest success has been that no species have been extirpated and the listing status for all the Central Valley stocks has remained unchanged. In the face of rapid population growth, constrained water supply, recreational and commercial harvest, habitat degradation, and water quality concerns, ensuring that populations have not become more endangered is a worthwhile achievement. However, holding steady does not lead to recovery.

None of the three restoration plans reviewed adequately provide, even at the programmatic level, a clear and succinct strategy for recovering Central Valley anadromous salmonid stocks to viable and sustainable levels. The principal reason for this unfortunate outcome is that these plans were prepared by different agencies for different purposes largely independent of one another. No plan tells a complete and compelling story outlining anadromous salmonid restoration.

Recall that the CDFG's draft Conservation Strategy stated:

> "The Conservation Strategy serves as an update to the ERP Strategic Plan and follows the principle of a single-blueprint for ecosystem restoration and species recovery in accordance with the principals of ecosystem-based management. Having a single-blueprint is a key ingredient for a successful and effective

> restoration program. This single-blueprint is the vehicle for ensuring coordination between all resource management, conservation, and regulatory actions affecting the Bay-Delta ecosystem . . ."

If the Conservation Strategy is the "blueprint," then why is it so inconsistent with NMFS's draft Recovery Plan? The CDFG plan does not even adequately describe restoration measures implemented to date. Only the NMFS plan recognized the enormous restoration measures implemented to date at a cost of over $1 billion. Even after these efforts over a long period of time, a significant upward, sustained trend in fish population numbers has not materialized. It would seem appropriate to begin a restoration strategy by recognizing this failure and asking the question as to why there has not been sufficient progress in meeting the restoration objectives. Are we working on the wrong projects in the wrong places? Is it the management structure that consumes most of the available dollars before they can be directed to on-the-ground actions? Numerous questions should be asked and the answers to these critical questions should drive, in part, the restoration strategy.

Of the three plans, the NMFS plan is the most thoughtful from a science perspective. The NMFS plan attempts to lay out processes to recover listed anadromous salmonids by following a science-based approach that examines the reasons behind current problems limiting recovery, then proposing actions to address those problems. Even so, the draft of the NMFS plan received 652 comments. Many comments focused on coordination and compatibility, including the apparent lack of coordination between NMFS and other regulatory agencies during the development of the plan. The lack of *sufficient* coordination among the three resource agencies is a key factor that is apparent when examining all the inconsistencies among plans, including the general lack of agreement among agencies as to what actions should be implemented and by whom.

The CDFG draft Conservation Strategy is clearly not a "blueprint" for anadromous salmonid restoration. The NMFS "blueprint" does not include all the stocks of anadromous fish imperiled. The older USFWS restoration "blueprint" is out-of-date and should be updated or incorporated into a joint-agency plan.

Clearly, whatever the ERP Implementing Agencies are doing regarding anadromous salmonid restoration has not resulted in a positive trend towards recovery and is therefore inadequate. How this group communicates and coordinates its actions relative to salmonid restoration should be examined and adjusted. To develop a clear mission and a common set of restoration goals, identification of specific objectives, and actions is required. Instead of three inadequate restoration plans, there should be an attempt to prepare one inter-agency plan that recognizes the responsibilities of each agency, but nevertheless outlines a clear recovery strategy for all anadromous salmonid stocks in the Central Valley. Ideally, scientist from all three agencies should be under one organizational "anadromous salmonid restoration umbrella." A new "blueprint" should be developed using the draft Recovery Plan prepared by NMFS as the basis for the recovery strategies. This new "blueprint" should be a comprehensive restoration strategy that integrates the input of stakeholders at all levels of government and the private sector. Putting the best parts of the three existing plans into such a restoration strategy would be useful. Everyone responsible for management of anadromous fish in the Central Valley needs to be on the same page working from the same guiding document, and towards the common goal.

Finally, any new restoration strategy should be science-based, pragmatic, and candid about the opportunities for anadromous salmonid restoration. The plan should be routinely revised to reflect new information, accomplishments, and failures. If the recommended approach is not taken, it would appear that the resource agencies will continue to repeat the same debates into the future leaving the anadromous salmonid resource at risk.

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APPENDIX A

Hatchery Summary

SUMMARY OF CENTRAL VALLEY SALMON AND STEELHEAD HATCHERIES AND THE ROLE THEY PLAY IN THE MANAGEMENT OF CENTRAL VALLEY ANADROMOUS SALMONID STOCKS

The hatcheries operating in the Central Valley raise all runs of Chinook salmon and winter-run Central Valley steelhead (Table A-1). The need for creating hatcheries in the Central Valley is tied to mitigation for anadromous salmonid production lost when dams were constructed that blocked access to historical habitats (Table A-2). Some hatcheries also provide supplementation or enhancement of a population, typically fall-run Chinook salmon, in addition to mitigation for lost production (e.g., Feather River and Mokelumne River; JHRC 2001).

Table A-1
Central Valley Hatchery Production Targets.

Hatchery	Operating Agency[1]	Production Target (fish/year)[2]					
		Chinook Salmon				Central Valley Steelhead	Total Production
		Fall-run	Late Fall-run	Winter-run[3]	Spring-run[4]		
Coleman	USFWS	12,000,000	1,000,000	0	0	600,000	13,600,000
Livingston Stone	USFWS	0	0	250,000 max.	0	0	250,000 max.
Feather River	CDFG	8,000,000	0	0	5,000,000	450,000	13,450,000
Nimbus	CDFG	4,000,000	0	0	0	400,000	4,400,000
Mokelumne	CDFG	5,000,000	0	0	0	250,000	5,250,000
Merced	CDFG	1,000,000	0	0	0	0	1,000,000
Total	USFWS/ CDFG	30,000,000	1,000,000	250,000 max.	5,000,000	1,700,000	37,950,000

Notes:

1 USFWS = U.S. Fish and Wildlife Service.

CDFG = California Department of Fish and Game.

2 Production targets may or may not be met in any given year depending on escapement (run size).

3 Max. = maximum number of fish depending on escapement. This hatchery contribution to winter-run Chinook salmon is counted as part of the evolutionarily significant unit (ESU).

4 This hatchery contribution to spring-run Chinook salmon is counted as part of the ESU.

Winter-run Chinook salmon raised at Livingston Stone National Fish Hatchery (NFH) and spring-run Chinook salmon raised at the Feather River Hatchery are included in the winter-run and spring-run listed ESUs. At these two hatcheries compliance with the ESA is required. Compliance is either achieved through a Section 7 consultation or by approval by NMFS of a hatchery and genetics management plan (HGMP). Either of these two routes will provide the hatchery with an exemption from ESA Section 9 incidental take prohibitions or a biological opinion and incidental take permit.

Table A-2 Hatcheries, Operating Agencies, Purpose and ESA-listed Species Reared at Each Facility in the Central Valley					
Hatchery	**Operating Agency[1]**	**Funding Agencies[2]**	**Purpose[3]**	**ESA-Listed Species Raised**	**ESA Compliance Method[4]**
Coleman	USFWS	BOR	Mitigation	None	BO (1999) BA (2011)
Livingston Stone	USFWS	BOR	Mitigation	Winter-run Chinook	BO (1999) BA (2011)
Feather River	CDFG	DWR, Salmon Stamp	Mitigation, Enhancement	Spring-run Chinook	Draft HMGP (2009)
Nimbus	CDFG	BOR	Mitigation	Central Valley Steelhead	OCAP BO (2008) Draft HGMP (2007)
Mokelumne	CDFG	EBMUD, Salmon Stamp	Mitigation, Enhancement	Central Valley Steelhead	N/A
Merced	CDFG	Merced ID, DWR	Mitigation	None	N/A

Notes:

[1] USFWS = U.S. Fish and Wildlife Service.

CDFG = California Department of Fish and Game.

[2] BOR = Bureau of Reclamation, EBMUD = East Bay Municipal Utilities District, Merced ID = Merced Irrigation District, DWR = California Department of Water Resources.

[3] From Table 2 in JHRC 2001.

[4] BO = Biological Opinion, BA=Biological Assessment, HGMP=Hatchery and Genetics Management Plan, N/A= Not Applicable, Number in parenthesis ( ) is the year of the BO, BA, or HGMP.

The USFWS operates two facilities in the Central Valley that it considers part of the Coleman NFH Complex: Coleman NFH and Livingston Stone NFH (USFWS 2011). Funding for these two facilities is provided by the U.S. Bureau of Reclamation (BOR). Because their operations are linked they are combined in this discussion.

COLEMAN NFH COMPLEX

Coleman NFH was established in 1942 to mitigate for habitat lost by the construction of Shasta and Keswick dams. It was authorized by the Emergency Relief Appropriation Act of 1935 (49 Stat. 115) and the First Deficiency Appropriation Act Fiscal Year 1936 (49 Stat. 1622). Because the water supply at Coleman NFH was too warm to successfully raise the federally-endangered winter-run Chinook salmon, Livingston Stone NFH was built to fulfill this need and is included in the draft Recovery Plan for winter run Chinook salmon (NMFS 2009).

The production goals for the two facilities are:

- 12 million fall-run Chinook salmon (Coleman NFH);
- 1 million late fall-run Chinook salmon (Coleman NFH);
- 250,000 winter-run Chinook salmon (Livingston Stone NFH); and
- 600,000 Central Valley steelhead (Coleman NFH).

There are multiple purposes for these facilities that are linked to the runs of fish raised. The main purpose for rearing fall and late fall-run Chinook salmon is to mitigate for impacted harvest opportunities when of 187 miles salmonid habitat was lost upstream of Shasta Dam.

The USFWS operated these two hatcheries under a biological opinion (BO) that was to expire in December 1999. The USFWS re-initiated consultation with NMFS and updated the biological assessment (BA) which lead to extensions of the BO (USFWS 2011). In July 2011, the USFWS submitted a BA evaluating the effects of facility operations on listed Central Valley salmonids and other threatened and endangered species (USFWS 2011). This assessment was prepared in the format of an HGMP and when approved by NMFS should guide hatchery operations and provide ESA clearance under the 4(d) rules for incidental take of listed species.

According to the BA, fall and late fall-run Chinook salmon are managed to mitigate for lost harvest, both in-river recreational harvest and ocean commercial and sport fisheries (USFWS 2011). Winter-run Chinook salmon are managed as part of the integrated recovery program and returning adults are expected to spawn under natural conditions (USFWS 2011). The steelhead raised by Coleman NFH are not part of the DPS, but are managed in part as mitigation for the Central Valley Project and to support harvest in the Sacramento River and recovery in Battle Creek (USFWS 2011).

FEATHER RIVER HATCHERY

The Feather River Hatchery was built in the 1967 to mitigate for habitat lost by the construction of Oroville Dam (ICF Jones & Stokes 2010). The hatchery's mission was not only mitigation but enhancement of salmon runs (ICF Jones & Stokes 2010; JHRC 2001). This hatchery spawns and rears fall-run Chinook, spring-run Chinook, Central Valley steelhead, and coho. The steelhead produced in this hatchery are not included as part of the Central Valley DPS population (NMFS 1998; 63 FR 13347). The coho are stocked into Lake Oroville as part of the inland coldwater salmon program (ICF Jones & Stokes 2010). This is the only facility that raises spring-run Chinook salmon. Spring-run produced in this hatchery are included as part of the Central Valley spring-run ESU.

The Thermalito Annex is considered part of the Feather River Hatchery (ICF Jones & Stokes 2010). This facility receives Chinook salmon fry from Feather River Hatchery, rears them for a period of time before they are released (ICF Jones & Stokes 2010).

Currently, the California Department of Water Resources (DWR) has a ESA Section 4(d) permit that allows them to operate the fish ladder in such a way that spring-run Chinook salmon can be accurately separated from fall-run Chinook (Cavallo et al. 2009). A draft HGMP has been prepared for the hatchery that if approved by NMFS would allow continued operation of the facility under the newer Section 4(d) regulations (Cavallo et al. 2009). The draft HGMP was scheduled to be submitted to NMFS by mid-January 2012. The hatchery currently operates with the goal of producing 2 million spring-run Chinook smolts (at about 60 fish per pound) annually (Cavallo et al. 2009).

This facility was built with funds from the DWR and the Delta Pumps Fish Protection Agreement and also receives funding from the state Salmon Stamp Program (JHRC 2001). The Salmon Stamp funds support the production of fall-run Chinook salmon intended for recreational and commercial harvest (ICF Jones & Stokes 2010).

NIMBUS HATCHERY

Nimbus Hatchery is located on the American River just downstream of Nimbus Dam. It was constructed at the same time that Folsom Dam was completed in 1955 (Leitritz 1969).

The Nimbus Hatchery was constructed to mitigate for the loss of about 85 percent (Lietritz 1969) of the salmonid habitat above Folsom Lake that was blocked by construction of Folsom and Nimbus dams (Lee and Chilton 2007).

The Nimbus Hatchery raises both fall-run Chinook salmon and Central Valley winter steelhead (Lee and Chilton 2007). The steelhead reared here are not considered part of the Central Valley DPS. The current management goal as identified in the draft HGMP is to annually release 430,000 steelhead at about four fish per pound (Lee and Chilton 2007). There is no goal for returning adults.

Both Folsom and Nimbus dams are federal facilities owned and managed by the BOR. The BOR provides funding to CDFG to operate the Nimbus Hatchery.

MOKELUMNE RIVER FISH HATCHERY

The Mokelumne River Fish Hatchery was built by East Bay Municipal Utilities District (EBMUD) in 1964 and was substantially reconstructed in 2001 (ICF Jones & Stokes 2009). This hatchery was built to offset for the loss of salmon and steelhead spawning and rearing habitat upstream of Camanche Dam. According to the JHRC (2001) the hatchery has both mitigation and enhancement roles. This facility raises fall-run Chinook salmon and Central Valley steelhead. These steelhead are not considered part of the Central Valley steelhead DPS.

According to the 2010 Final Hatchery and Stocking Program EIR/EIS, CDFG has started the HGMP process for all affected hatchery programs (ICF Jones & Stokes 2010, Appendix K). As of January 2012 internal draft HGMPs for Central Valley steelhead and fall-run Chinook salmon programs at the Mokelumne River Fish Hatchery have been prepared; however, they were not yet ready for public distribution.

The hatchery is operated by CDFG with funding provided by the EBMUD for the mitigation portion of the mission and from the state Salmon Stamp Program for the enhancement part of the mission (ICF Jones & Stokes 2010).

MERCED HATCHERY

The Merced River Hatchery went into operation in 1970 to mitigate for habitat lost to salmonids from the construction of Crocker-Huffman, McSwain, and New Exchequer dams. The hatchery is downstream of Crocker-Huffman Dam.

The hatchery is funded in part by Merced Irrigation District (the owner of the upstream dams) and also by an agreement between DWR and CDFG to mitigate for salmon losses at the south Delta water diversion in accordance with the Delta Fish (Four Pumps) Agreement (*aka* Delta Pumping Plant Fish Protection Agreement; JHRC 2001).

The facility currently raises fall-run Chinook salmon with an annual production goal of 1 million fish. Because no federally-listed fish are raised at this facility and there are no Central Valley steelhead present (Vogel 2007), there are no ESA compliance documents needed for its operation and an HGMP has not yet been prepared. An HGMP process was initiated in January 2012.

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APPENDIX B

Comparison of Actions throughout the Central Valley

Appendix B
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids throughout the Central Valley.

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Harvest, hatchery effects, habitat loss and degradation, and water management	1.2.1 Promote Central Valley resource managers to cooperatively develop and implement an ecosystem based management approach that integrates harvest, hatchery, habitat, and water management, in consideration of ocean conditions and climate change.	CDFG, DWR, NMFS, PFMC, Reclamation, SWRCB, USFWS								
Winter-run Spring-run Steelhead	Habitat loss and degradation	1.2.2 Support programs to provide educational outreach and local involvement in restoration, including programs like Salmonids in the Classroom, Aquatic Wild, Adopt a Watershed, school district environmental camps, and other programs teaching the effects of human land use on anadromous fish survival.	CDFG, DWR, NMFS, PFMC, Reclamation, SWRCB, USFWS					Salmonids Anadromous fish	Central Valley-wide Central Valley-wide	Action 1. Support programs to provide educational outreach and local involvement in restoration, including programs like Salmonids in the Classroom, Aquatic Wild, and Adopt a Watershed and school district environmental camps. Action 2. Develop programs to educate the public about anadromous fish issues, such as the effects of poaching and environmental contaminants, especially contaminants in urban runoff.	Local schools, CDFG, USFWS, NMFS CDFG, USFWS, NMFS, Water Education Foundation, California Teachers Association
Winter-run Spring-run Steelhead	Habitat degradation	1.2.3 Develop a monitoring program to determine the level of entrainment at individual diversions. Prioritize diversions based on this monitoring and screen those that are determined to have the greatest impacts on juvenile survival.	CDFG, DWR, NMFS, USFWS								
Winter-run Spring-run Steelhead	Habitat loss and degradation	1.2.4 Provide additional funding for increased law enforcement to reduce illegal take of anadromous fish, stream alteration, and water pollution and to ensure adequate protection for juvenile fish at pumps and diversions.	CDFG, NMFS					Anadromous fish	Central Valley-wide	Provide additional funding for increased law enforcement to reduce illegal take of anadromous fish, stream alteration, and water pollution and to ensure adequate protection for juvenile fish at pumps and diversions.	CDFG, USFWS, USBR, DWR
Winter-run Spring-run Steelhead	Habitat loss and degradation	1.2.5 Control or relocate the discharge of irrigation return flows and sewage effluent, and restore riparian forests to help provide suitable water temperatures for anadromous salmonids.	ACOE, City and County planners, NMFS, SWRCB, USFWS	Food web Aquatic habitat	Decline in productivity and the aquatic food web Upland areas	Action 3. Determine potential impacts of ammonium and other contaminants of primary productivity. Listed in the Delta narrative. Action 4. Determine contaminant and runoff impacts of agriculture and urban areas, and develop predictions of effects on the ecosystem from future expansion of these land uses. Listed in the Delta narrative.	SWRCB, regional water quality control boards Not stated.	Not stated.	Central Valley-wide	Action 3. Reduce toxic chemical and trace element contamination.	CDFG, USFWS, SWRCB, RWQCBs

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Winter-run Spring-run Steelhead	Habitat loss and degradation	1.2.6 Implement and evaluate actions to minimize and/or eliminate the effects of exotic (non-native invasive) species (plants and animals) on production of anadromous fish.	Department of Boating and Waterways	Food web	Decline in productivity and the aquatic food web	Action 1. Determine how to alleviate the negative impacts of non-native species and contaminant toxicity on the pelagic food web. Listed in the Delta narrative.	Not stated.	Anadromous fish	Central Valley-wide	Evaluation 10. Evaluate the effects of exotic species on production of anadromous fish	IEP agencies
				Ecosystem	Non-native invasive species	Action 1. Continue implementing CDFG's California Aquatic Invasive Species Management Plan to prevent new introductions; limit or eliminate NIS populations; and reduce economic, social, and public health impacts of NIS infestation. Listed in the Delta narrative.	CDFG				
				Ecosystem	Non-native invasive species	Action 3.Continue research and monitoring programs to increase understanding of the invasion process and the role of established NIS in the Delta's ecosystem. Listed in the Delta narrative.	Not stated.				
				Ecosystem	Non-native invasive species	Action 5. Standardize methodology for sampling programs to measure changes in NIS populations over a specific timeframe. Listed in the Delta narrative.	Not stated.				
				Ecosystem	Non-native invasive species	Action 6. Collect and analyze water quality sampling data for correlation analysis between NIS distribution and habitats. Listed in the Delta narrative.	Not stated.				
				Ecosystem	Non-native species	Action 7 Complete an assessment of existing NIS introductions and identify those with the greatest potential for containment or eradication; this assessment also would be used to set priority control efforts. Listed in the Delta narrative.	Not stated.				

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Winter-run Spring-run Steelhead	Habitat loss and degradation	1.2.7 Restore tributaries by evaluating the feasibility of screening or relocating diversions, switching to alternative sources of water for upstream diversions, restoring and maintaining a protected riparian strip, limiting excessive erosion, enforcing dumping ordinance, removing toxic materials or controlling their source, replacing bridge and ford combinations with bridges or larger culverts and installing siphons to prevent truncation of small streams at irrigation canals, and implement actions to address harmful effects.	Caltrans, USFS, SWRCB					Not stated.	Central Valley-wide	Evaluation 11. Encourage the restoration of small tributaries by evaluating the feasibility of screening or relocating diversions, switching to alternative sources of water for upstream diversions, restoring and maintaining a protected riparian strip, limiting excessive erosion, enforcing dumping ordinance, removing toxic materials or controlling their source, replacing bridge and ford combinations with bridges or larger culverts and installing siphons to prevent truncation of small streams at irrigation canals.	CDFG, USFWS, USBR
Winter-run Spring-run Steelhead	Habitat loss	1.2.8 Conduct Central Valley-wide assessment of keystone dams and passage opportunities and implement programs to restore access to properly functioning habitat that was historically available.	CDFG, DWR, NMFS, Reclamation, USFWS, USFS								
Winter-run Spring-run Steelhead	Habitat loss	1.2.9 Evaluate passage at small dams or other anthropogenic obstructions and implement fish passage per NMFS criteria.	CDFG, DWR, NMFS, Reclamation, USFWS, USFS								
Winter-run Spring-run Steelhead	Water management	1.2.10 Increase integration of the State and Federal water projects through shared storage and conveyance agreements.	DWR, Reclamation								
Winter-run Spring-run Steelhead	Water management	1.2.11 Secure agreements with or purchase water rights from landowners and Federal and State agencies to provide additional instream flows.	DWR, Reclamation, county water agencies								
Winter-run Spring-run Steelhead	Hatchery effects	1.2.12 Form a hatchery science review panel to review Central Valley hatchery practices. The panel should address the issues contained within the following six hatchery-related actions.	CDFG, DWR, NMFS, Reclamation, USFWS								
Winter-run Spring-run Steelhead	Hatchery effects	1.2.13 Evaluate impacts of out-planting and broodstock transfers among hatcheries on straying and population structure and evaluate alternative release strategies.	CDFG, DWR, NMFS, Reclamation, USFWS								

Appendix B
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids throughout the Central Valley.

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Hatchery effects	1.2.14 Evaluate whether production levels are appropriate and if they could be adjusted according to expected ocean conditions.	CDFG, DWR, NMFS, Reclamation, USFWS								
Winter-run Spring-run Steelhead	Hatchery effects	1.2.15 Evaluate the potential to modify hatchery procedures to benefit native stocks of salmonids and implement beneficial modifications.	CDFG, DWR, NMFS, Reclamation, USFWS					Salmonids	Central Valley-wide	Evaluation 2. Evaluate the potential to modify hatchery procedures to benefit native stocks of salmonids.	CDFG, DWR, USFWS, USBR
Winter-run Spring-run Steelhead	Hatchery effects	1.2.16 Evaluate and avoid potential competitive displacement of naturally produced juvenile salmonids with hatchery-produced juveniles by implementing release strategies for hatchery-produced fish designed to minimize detrimental interactions.	CDFG, DWR, NMFS, Reclamation, USFWS					Juvenile salmonids	Central Valley-wide	Evaluation 3. Evaluate and avoid potential competitive displacement of naturally produced juvenile salmonids with hatchery produced juveniles by implementing release strategies for hatchery produced fish designed to minimize detrimental interactions.	CDFG, DWR, USFWS, USBR
Winter-run Spring-run Steelhead	Hatchery effects	1.2.17 Evaluate and implement specific hatchery spawning protocols and genetic evaluation programs to maintain genetic diversity in hatchery and natural stocks.	CDFG, DWR, NMFS, Reclamation, USFWS					Salmonids	Central Valley-wide	Evaluation 4. Evaluate and implement specific hatchery spawning protocols and genetic evaluation programs to maintain genetic diversity in hatchery and natural stocks.	CDFG, DWR, USFWS, USBR
Winter-run Spring-run Steelhead	Hatchery effects	1.2.18 Evaluate a program to tag and fin-clip all or a significant portion of hatchery-produced fish as a means of collecting better information regarding harvest rates on hatchery and naturally produced fish and effects of hatchery-produced fish on naturally produced fish.	CDFG, DWR, NMFS, Reclamation, USFWS					Salmonids	Central Valley-wide	Evaluation 7. Evaluate a program to tag and fin-clip all or a significant portion of hatchery-produced fish as a means of collecting better information regarding harvest rates on hatchery and naturally produced fish and effects of hatchery-produced fish on naturally produced fish.	CDFG, DWR, USFWS, USBR, NMFS, EBMUD
Steelhead	Lack of data	1.2.19 Implementation of a comprehensive life history monitoring plan for Central Valley steelhead that will result in basin-wide (Sacramento and San Joaquin) estimates of hatchery and wild steelhead population abundance, production diversity, and distribution.	CDFG, NMFS, USFWS					Chinook salmon	Central Valley-wide	Evaluation 1. Evaluate the need to revise harvest regulations to increase spawning escapement of naturally produced Chinook salmon.	CDFG, Pacific Fisheries Management Council, NMFS, USFWS
								Chinook salmon	Central Valley-wide	Evaluation 5. Evaluate the transfer of disease between hatchery and natural stocks.	CDFG, DWR, USFWS, USBR
								Anadromous fish	Central Valley-wide	Evaluation 8. Evaluate the direct and indirect effects of contaminates on production of anadromous fish.	CDFG, USFWS, RWQCBs, SWRCB
								Steelhead	Central Valley-wide	Evaluation 9. Evaluate the ability of streams for which target production	CDFG,

Appendix B Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids throughout the Central Valley.											
NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
										levels exists for Chinook salmon but not for steelhead to support natural production of steelhead.	USFWS

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APPENDIX C

Comparison of Actions for the Sacramento-San Joaquin Delta

Appendix C
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento-San Joaquin Delta.

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Water management	1.5.1 Develop alternative water operations and conveyance systems that ensure multiple and suitable salmonid rearing and migratory habitats for all Central Valley salmonids and that restore the ecological flow characteristics of the Delta ecosystem.	BDCP agencies and stakeholders								
Winter-run Spring-run Steelhead	Habitat loss and degradation	1.5.2 Large-Scale Habitat Restoration – Identify funding and direct restoration of 80,000 acres of tidal marsh, 130,000 acres of terrestrial grasslands, and 60,000 acres of floodplain habitat. Floodplain habitats should be restored to appropriate elevations using Frequently Activated Floodplain principles and modeling. The habitats should be along primary migration and rearing corridors, and connected in ecologically beneficial ways. This will require separating levee systems from active river and estuary channels, restoring dendritic channel systems in areas where this habitat feature existed historically, and allowing for natural developmental processes to maintain habitats.	ACOE, DWR, Reclamation	Native fish and wildlife Native fish and wildlife	Upland areas Upland areas	Action 1. Acquire land and easement interests for willing sellers in the East and South Delta that will accommodate seasonal floodplain areas, and shifts in tidal and shallow subtidal habitats due to future sea level rise. Action 5. Restore large-scale riparian vegetation along waterways wherever feasible, including opportunities for setback levees.	Not stated. Not stated.	Anadromous fish Anadromous fish	Delta Delta	Evaluation 4. Evaluate potential benefits of and opportunities for increasing salmonid and other anadromous fish production through improved riparian habitats in the Delta. Evaluation 6. Evaluate benefits of and opportunities for additional tidal shallow-water habitat as rearing habitat for anadromous fish in the Delta.	SWP and CVP contactors, The Nature Conservancy, IEP agencies SWP and CVP contactors, The Nature Conservancy, IEP agencies
Winter-run Spring-run Steelhead	Habitat loss and degradation	1.5.3 Integrate the Ecosystem Restoration Program and the Calfed Science Program into an effort to restore the Delta ecosystem. Note: "Calfed Science Program" is under the Delta Stewardship Council and is now called the Delta Science Program as of 3 Feb 2010.	USFWS, Calfed								
Winter-run Spring-run Steelhead	Predation	1.5.4 Implement programs and measures designed to control non-native predatory fish (e.g., striped bass, largemouth bass, and smallmouth bass), including harvest management techniques, non-native vegetation management, and minimizing structural barriers in the Delta, which attract non-native predators and/or that delay or inhibit migration.	CDFG, Sport fish community								

Appendix C
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento-San Joaquin Delta.

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Habitat loss and degradation	1.5.5 Enhance the Yolo Bypass by re-configuring Fremont and Sacramento weirs to (1) allow for fish passage through Fremont Weir for multiple species; (2) enhance lower Putah Creek floodplain habitat; (3) improve fish passage along the toe drain/Lisbon Weir; (4) enhance floodplain habitat along the toe drain; (5) eliminate stranding events; and (6) create annual spring inundation of at least 8,000 cfs to fully activate the Yolo bypass floodplain.	Reclamation, DWR	Native fish and wildlife	Floodplains	Action 1. Continue coordination with Yolo Basin Foundation and other local groups to identify, study, and implement projects on public and private land with willing participants, to create regionally significant improvements in habitat and fish passage.	Yolo Basin Foundation. Others not stated.				
				Native fish and wildlife	Floodplains	Action 3. Pursue opportunities for land and easement acquisitions in the Yolo Bypass and along the lower Cosumnes and San Joaquin rivers, which could be utilized as floodplain inundation areas in the near term or in the future.	Not stated.				
Winter-run Spring-run Steelhead	Water management	1.5.6 Implement Actions IV.1 through IV.6 of the Reasonable and Prudent Alternative described in the NMFS BO on the long-term operations of the CVP/SWP (NMFS 2009): ► Action IV.1 Modify DCC gate operations and evaluate methods to control access to Georgiana Slough and the Interior Delta to reduce diversion of listed fish from the Sacramento River into the southern or central Delta.	Reclamation, DWR	Aquatic species	Bay-Delta hydraulics	Action 1. Conduct further Delta Cross Channel Gate operational and fish survival studies.	Not stated.	Juvenile Chinook salmon		Operational Target 1. Close Delta Cross Channel (DDC) up to 45 days in the November through January period. Operational details omitted herein.	CALFED agencies
				Aquatic species	Bay-Delta hydraulics	Action 4. Study the effectiveness of nonphysical barriers in controlling fish movements at key channel intersections. No specific intersections noted.	Not stated.	Chinook salmon Anadromous fish	Delta	Operational Target 3. Maximize DCC closure from May 21 through June 15 when anadromous species are abundant in the lower Sacramento River.	CALFED agencies, U.S. Coast Guard, boating interests
								Juvenile Chinook salmon	Delta	Supplemental Action Requiring Water 11. Close the DCC during the November through January period beyond the 45-day limit defined under Operational Target 1 should meeting one of the triggers stipulated in Operational Target 1 require additional closure.	CALFED agencies
								Anadromous salmonids	Delta	Evaluation 5. Evaluate opportunities to provide modified operations and a new or improved control structure for the DCC and Georgiana Slough or other methods at those locations to assist in the successful migration of anadromous salmonids.	SWP and CVP contractors IEP agencies

Appendix C
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento-San Joaquin Delta.

NMFS (2009)				CDFG (2011)				USFWS			
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		► **Action IV.2** Control the net negative flows toward the export pumps in Old and Middle rivers to reduce the likelihood that fish will be diverted from the San Joaquin or Sacramento rivers into the southern or central Delta.						Chinook salmon	Delta	Supplemental Action Not Requiring Water 16. Construct and operate a barrier at the head of Old River to improve conditions for Chinook salmon migration and survival if Evaluation 1 determines that a barrier can be operated to improve conditions for salmon with minimal adverse effects on other Delta species. Evaluation 1. In conjunction with Evaluation 2, evaluate whether a temporary rock barrier at the head of Old River can be operating during the 30-day April through May pulse flow period to improve conditions for Chinook salmon migration and survival with minimal adverse effects on other Delta species.	CALFED agencies
								Anadromous fish	Delta	Evaluation 9. Continue to evaluate the effects of Delta hydraulic conditions such as net reverse flows on anadromous fish.	SWP and CVP contractors IEP agencies
		► **Action IV.3** Curtail exports when protected fish are observed near the export facilities to reduce mortality from entrainment and salvage.						Juvenile Chinook salmon	Delta	Operational Target 2 and Supplemental Action Requiring Water 14. When the DCC is closed, limit the average SWP and CVP exports to no greater than 35% of Delta inflow if Evaluation 3 determines that a relatively high ratio of Delta export to inflow limits juvenile salmon survival through the Delta.	CALFED agencies
								Winter-run	Delta	Operational Target 4. Maintain an average export to inflow ratio of no more than 45% during February in dry years by increasing the ratio to ~55% in early February and decreasing the ratio to ~35% in late February when winter-run Chinook salmon smolts are present in the Delta.	CALFED agencies

Appendix C
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento-San Joaquin Delta.

NMFS (2009)				CDFG (2011)				USFWS			
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								Delta smelt	Delta	Supplemental Action Requiring Water 6. In conjunction with operation of a barrier at the head of Old River and consistent with efforts to conduct Evaluations 1 and 2, Maximize the difference between flows and export rates at levels greater than those required under the delta smelt BO during the 30-day April and May pulse flow period.	CALFED agencies
								Not stated.	Delta	Supplemental Action Requiring Water 7. When a barrier at the head of Old River is not operational, limit the combined SWP and CVP exports to 1,500 cfs or maintain a Vernalis inflow to total export ratio of 5 to 1 during the 30-day April through May pulse flow period.	
								Anadromous fish	Delta	Operational Target 5. Minimize fish losses and predation at facilities by operating state and federal pumps interchangeable when this operation achieves a net benefit to anadromous fish production in the Delta.	CALFED Agencies
								Not stated.	Delta	Supplemental Action Requiring Water 12. Limit the average SWP and CVP exports to no greater than 35% of Delta inflow in July.	CALFED agencies
								Chinook salmon	Delta	Evaluation 2. Evaluate in conjunction with Evaluation 1 the impacts of San Joaquin River Delta inflow and SWP and CVP export rates on salmon smolt survival through the San Joaquin Delta.	IEP agencies
								Late fall-run	Delta	Evaluation 3. Evaluate the effect of a low (~35%) versus a high (~65%) SWP and CVP export to Delta inflow ratio on the survival of coded-wire-tagged, late fall-run Chinook salmon smolts migrating through the Delta when the DCC is closed.	IEP agencies
								Juvenile salmon	Delta	Evaluation 11. Evaluate whether Delta inflow and export rates and other Delta hydrodynamic parameters effect juvenile salmon survival when the DCC is closed.	SWP and CVP contractors IEP agencies

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								Juvenile anadromous fish	Delta	Supplemental Action Not Requiring Water 15. Implement actions to reduce losses of juvenile anadromous fish resulting from unscreened or inadequately screened diversions in the Delta and Suisun Marsh, even of Evaluation 12 determines significant benefits to juvenile anadromous fish can be achieved by screening.	Diverters, CDFG, DWR, USBR, USFWS, NMFS, SWRCB, ACOE
		► **Action IV.4** Improve fish screening and salvage operations to reduce mortality from entrainment and salvage. ► **Action IV.5** Establish a technical group to assist in determining real-time operational measures, evaluating the effectiveness of the actions, and modifying them if necessary. ► **Action IV.6** Do not implement the South Delta Barriers Improvement Program.						Juvenile anadromous fish	Delta	Evaluation 12. Evaluate the benefits to juvenile anadromous fish of and opportunities for screening diversions and relocating riparian diversions in the Delta and Suisun Marsh.	SWP and CVP contractors IEP agencies
Winter-run Spring-run Steelhead	Water management	1.5.7 Develop a comprehensive governance system that has reliable funding, takes advantage of established and effective ecosystem restoration and science programs, and has clear authority to determine priorities and strong performance measures to ensure accountability to the new governing doctrine of the Delta; operation of coequal goads of Delta ecosystem restoration and protection and reliable water supply.	CDFG, DWR, NMFS, Reclamation, SWRCB, USFWS, water contractors								
Winter-run Spring-run Steelhead	Water management	1.5.8 Following the first autumn flows exceeding 15,000 cfs at Wilkins Slough, maintain suitable rearing and migratory habitats for emigrating winter-run salmon throughout the Sacramento River and distributaries in the Delta through the end of April.	CDFG, DWR, NMFS, Reclamation, SWRCB, USFWS, water contractors					Anadromous fish Striped bass	Delta	Supplemental Action Requiring Water 9. During May, maintain at least 13,000 cfs daily flow in the Sacramento River at the I Street Bridge and 9,000 cfs at Knights Landing to improve transport of eggs and larval striped bass and other young anadromous fish.	CALFED agencies

Appendix C
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Winter-run Spring-run Steelhead	Water management	1.5.9 Provide pulse flows of at least 20,000 cfs measured at Freeport periodically during the winter-run emigration season to facilitate outmigration past Chipps Island (i.e., December-April).	CDFG, DWR, NMFS, Reclamation, SWRCB, USFWS, water contractors					Anadromous fish	Delta	Evaluation 8. Evaluate the benefits of short-term pulsed Delta inflows (Five days or less) on the migration rate and survival of anadromous fish.	SWP and CVP contactors, IEP agencies
				Native fishes	Water diversions	Action 1. Continue participation in the Sacramento Valley-Delta Fish Screen Program to reduce entrainment mortality of juvenile fish by installing state-of-the-art fish screens on Sacramento River and Delta diversions as determined to be appropriate based on new information. No specific sites noted.					
				Aquatic biota	Contaminants	Action 3. Improve coordination with the regional water quality control boards and other entities on evaluating ecological effects from pesticides, methods to reduce pesticide and nutrient impacts, and methods to reduce toxicity.	Not stated.				
				Aquatic biota	Contaminants	Action 5. Work with the regional water quality control boards and other entities to participate in an integrated monitoring program that evaluates water and sediment pollution and toxicity, and tissue contamination, and ecological impacts to key species.	Regional WQCBs				
								Not stated.	Delta	Supplemental Action Requiring Water 10. During the last half of May, ramp (linearly) the total SWP and CVP export level from what it is at the end of the 30-day April and May pulse flow period to that export level proposed by the SWP and CVP to meet the requirements of the 1995 WQCP on June 1.	CALFED agencies
								Migrating fish	Delta	Evaluation 7. Evaluate the benefit of and opportunities for new technologies to improve water quality and to guide migrating fish.	SWP and CVP contactors, IEP agencies
								Anadromous fish	Delta	Evaluation 10. Evaluate the potential effects of reductions in food chain organisms in the Delta and Suisun Bay on anadromous fish production.	SWP and CVP contractors IEP agencies

Appendix C
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento-San Joaquin Delta.

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Fall-run San Joaquin Chinook	Delta	Evaluation 13. Evaluate the potential effects of Delta export rate during the fall on the upstream migration of adult San Joaquin Chinook salmon.	SWP and CVP contractors IEP agencies

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APPENDIX D

Comparison of Actions for the Sacramento River Watershed

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.6.1 Restore and maintain a continuous meander belt along the Sacramento River from Keswick downstream to Colusa. ▸ Pursue these opportunities, consistent with efforts conducted pursuant to Senate Bill 1086 to create a meander belt from Keswick Dam to Colusa to recruit gravel and large woody debris, to moderate temperatures and to enhance nutrient input. Also pursue actions under the Sacramento River Flood Control Project and the Central Valley Plan for Flood Control.	ACOE, DWR, CDFG, TNC, USFWS					Anadromous fishes	Upper mainstem Sacramento River	Action 9. Pursue opportunities, consistent with efforts conducted pursuant to Senate Bill 1086, to create a meander belt from Keswick Dam to Colusa to recruit gravel and large woody debris, to moderate temperatures and to enhance nutrient input.	Upper Sacramento River Fisheries and Riparian Habitat Advisory Council, CDFG, ACOE, USFWS, USBR, DWR, NMFS
								Salmonids	Upper mainstem Sacramento River	Evaluation 4. Evaluate the contribution of large woody debris and boulders in the upper mainstem Sacramento River to salmonid production and rearing habitat quality.	CDFG, USFWS, USBR, RWQCB, NMFS
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.6.2 Restore and maintain a continuous 60-mile stretch of riparian habitat and functioning floodplains of an appropriate, science-based width to maintain ecologically viable flood-prone lands along both banks of the Sacramento River between Colusa and Verona. ▸ Separate levee systems from active river channels, restore dendritic channel systems in areas where this habitat feature existed historically, and allow for the natural development of floodplain habitats. Pursue actions under the Sacramento River Flood Control Project and the Central Valley Plan for Flood Control.	ACOE, DWR, SAFCA,CDFG, TNC, USFWS					Anadromous fishes	Upper mainstem Sacramento River	Evaluation 2. Evaluate opportunities to incorporate flows to restore riparian vegetation from Keswick Dam to Verona that are consistent with the overall river regulation plan.	USFWS, USBR, NMFS, CDFG, USRFHAC
								Not stated.	Upper mainstem Sacramento River	Evaluation 5. Identify opportunities for restoring riparian forests in channelized sections of the upper mainstem Sacramento River that are appropriate with flood control and other water management constraints.	USRFHAC, The Nature Conservancy, CDFG, ACOE, USFWS, USBR, DWR, NMFS

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.6.3 Restore and maintain a continuous 70-mile stretch of riparian habitat and maintain existing floodplain terraces along both banks of the Sacramento River between Verona and Collinsville. Restore floodplain areas as necessary to achieve the restoration targets described in action 1.5.2. ▸ Seek opportunities through the ACOE's Sacramento River Bank Protection Project, the Central Valley Plan for Flood Control, and other flood management programs and agencies such as SAFCA, to protect existing riparian habitat, restore riparian, protect remaining floodplain terraces, and integrate floodplain bench designs into levee repair projects.	ACOE, DWR, CDFG, CDPR, USFWS, local agencies, NGOs	Variety of species.	Riparian and riverine aquatic habitat	Action 1.Acquire title or easements for river corridor meander zones on appropriate rivers and streams throughout the Sacramento Valley. No specific streams noted.	Not stated.				
				Not stated.	Natural floodplains and flood processes	Action 1. Restore 50-100 miles of tidal channels in the Yolo Bypass by constructing a network of channels within the bypass that connect to the Delta. Channels should be effectively drain all flooded lands in the bypass after flood flows cease entering the bypass from Fremont and Sacramento weirs.	Not stated.				
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.6.4 Relocate the M&T Ranch fish screen (Sacramento River at confluence with Big Chico Creek) and water diversion from its current location to a downstream, geomorphically stable, river reach and relocate the 3000,000 cubic yards of dredged gravel to upstream reaches of the Sacramento River for spawning habitat enhancement.	No parties listed.	Not stated.	Central Valley streamflows	Action 2. Continue implementation of short (e.g., gravel dredging) and long-term solutions to protect M&T Llano Seco infrastructure.	Not stated.	Not stated.	Big Chico Creek	Action 1. Relocate and screen the M&T Ranch Diversion on Big Chico Creek.	M&T Ranch owners, Western Canal Water District, USFWS, USBR, NMFS, CDFG, DWR

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.6.5 Develop and implement an ecological flow tool for the Sacramento River below Keswick and Shasta Dams and use in conjunction with Frequently Activated Floodplain (FAF) tools and hydrodynamic river models to create and implement a floodplain inundation program that allows for existing functional floodplains to be activated in two out of three years for at least seven days between mid-March to mid-May.	No parties listed.								
Winter-run Spring-run Steelhead	Water management	1.6.6 Implement a Sacramento River flow management plan that balances carryover storage needs with instream flow and water temperature needs for winter-run, spring-run, and steelhead based on runoff and storage conditions, including flow fluctuation and ramping criteria	No parties listed.					Winter-run Other anadromous fishes	Upper mainstem Sacramento River	Action 1. Implement a river flow regulation plan that balances carryover storage needs with instream flow needs consistent with the 1993 BO for winter-run Chinook salmon based on runoff and storage conditions, including minimum recommended flows at Keswick and Red Bluff Diversion dams.	USFWS, USBR, NMFS, CDFG, (Tehama-Colusa Canal Authority (TCCA)
								Anadromous salmonids	Upper mainstem Sacramento River	Action 2. Implement a schedule for flow changes that avoids, to the extent controllable, dewatering redds and isolating or stranding juvenile anadromous salmonids, consistent with SWRCB Order 90-5.	USFWS, USBR, CDFG, SWRCB, NMFS
								Winter-run	Upper mainstem Sacramento River	Action 3. Continue to maintain water temperatures at or below 56°F from Keswick Dam to Bend Bridge to the extent controllable, consistent with the 1993 BO for winter-run Chinook salmon and with SWRCB Order 90-5.	USFWS, USBR, CDFG, SWRCB, NMFS
								Anadromous fishes	Upper mainstem Sacramento River	Evaluation 1. Continue study to refine a river regulation program, consistent with SB 1086, that balances fish habitats with the flow regime and addresses temperatures, flushing flows, attraction flows, emigration, channel and riparian corridor maintenance.	USFWS, USBR, CDFG, SWRCB, NMFS, USRFHAC

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Water management	1.6.7 Implement Action I.3.1 and I.3.2 (Long-term and interim operations of RBDD) of the RPA described in the NMFS BO on the long-term operations of the CVP/SWP (NMFS 2009) and install NMFS-approved, state-of-the-art fish screens on the Sacramento River at the Tehama-Colusa Canal Diversion point.	DWR, Reclamation, TCCA					Chinook salmon	Upper mainstem Sacramento River	Action 4. Continue to raise the gates of the Red Bluff Diversion Dam (RBDD) for a minimum duration form September 15 through at least May 14 to protect adult and juvenile Chinook salmon migrations, consistent with the 1993 BO for winter-run Chinook salmon and with SWRCB Order 90-5, and accommodate water delivery using appropriate pumping facilities.	USFWS, USBR, SWRCB, NMFS, CDFG, TCCA
								Anadromous fishes	Upper mainstem Sacramento River	Evaluation 3. Continue the evaluation to identify solutions to passage at RBDD, including measures to improve passage when the RBDD gates are in the raised position from September 15 through at least May 14.	USFWS, USBR, CDFG, TCCA, NMFS
								Chinook salmon Steelhead	Upper mainstem Sacramento River	Action 5. Construct an escape channel for trapped adult Chinook salmon and steelhead from the Keswick Dam stilling basin to the Sacramento River, as designed by NMFS and USBR.	USFWS, USBR, NMFS, CDFG
				Not stated.	Water diversions	Action 4. Design, permit, and construct priority fish screen projects on the Sacramento River. No specific projects noted.	Not stated.	Anadromous fishes	Upper mainstem Sacramento River	Action 6. Continue to implement the Anadromous Fish Screen Program.	Diverters, USFWS, USBR,, NMFS, CDFG, CDWR
								Juvenile salmon	Upper mainstem Sacramento River	Action 7. Implement structural and operational modifications to the GCID water diversion facility to minimize impingement and entrainment of juvenile salmon.	GCID, USFWS, USBR, CDFG, NMFS, SWR
								Anadromous fishes	Upper mainstem Sacramento River	Action 8. Remedy water quality problems from toxic discharges associated with Iron Mountain Mine and water quality problems associated with metal sludge in Keswick Reservoir, consistent with the Comprehensive Environmental Response, Compensation, and Liability Act and the Clean Water Act.	USEPA, SWRCB, USFWS, USBR, NMFS, CDFG

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Chinook salmon Steelhead	Upper mainstem Sacramento River	Action10. Implement operational modifications to Anderson-Cottonwood Irrigation District (ACID) diversion dam to eliminate passage and stranding problems for Chinook salmon and steelhead adults and early life stages; eliminate toxic discharges from the canal and implement structural modifications to improve the strength of the fish screens.	ACID, USFWS, USBR, CDFG, RWQCB, NMFS
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.6.8 Develop and implement a long-term gravel augmentation plan to enhance Sacramento River spawning habitat downstream of Keswick and Shasta dams.	CDFG, NMFS, Reclamation, USFWS					Salmonids	Upper mainstem Sacramento River	Action 11. Develop and implement a program for restoring and replenishing spawning gravel, where appropriate, in the Sacramento River.	CDFG, USFWS, USBR, NMFS, DWR
Spring-run	Habitat degradation and loss	1.7.1.1 Operate the Clear Creek weir to separate spring-run and fall-run Chinook salmon.	USFWS								
Spring-run Steelhead	Habitat degradation and loss	1.7.1.2 Develop and implement a spawning gravel budget and implement a long-term augmentation plan in Clear Creek.	Reclamation, USFWS					Spring-run Fall-run Late Fall-run	Clear Creek	Action 5. Replenish gravel on Clear Creek and restore gravel recruitment blocked by Whiskeytown Dam.	CDFG, USFWS, USBR, BLM, WSRCD
Spring-run Steelhead	Habitat degradation and loss	1.7.1.3 Develop and implement optimal Clear Creek flow schedules to mimic the natural hydrograph (including spring pulse flows and winter spillway releases to restore a proper functioning system) and use instream flow study results to guide flow schedule development.	Reclamation, USFWS					Spring-run Fall-run Late Fall-run	Clear Creek	Action 1. Release to Clear Creek 200 cfs October 1 to June 1 from Whiskeytown Dam for spring-, fall-, and late fall-run Chinook salmon spawning, egg incubation, emigration, gravel restoration, spring flushing and channel maintenance; release 150 cfs, or less from July through September to maintain ≤60°F temperatures in stream sections utilized by spring-run Chinook salmon. Both release should be within the average total annual unimpaired flows to the Clear Creek watershed.	CDFG, USFWS, USBR, SWRCB
Spring-run Steelhead	Water temperature	1.7.1.4 Develop a real time water temperature model to track the coldwater pool in Whiskeytown Reservoir and budget releases to Clear Creek to meet daily water temperature of 60°F at the Igo gauge from June to September 15 and 56°F from September 15 to October 31.	Reclamation, USFWS								

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Spring-run Steelhead	Clear Creek	Evaluation 1. Evaluate the feasibility of reestablishing habitat for spring-run Chinook salmon and steelhead in Clear Creek, including ensuring that water temperatures five miles downstream of Whiskeytown Dam do not exceed upper temperature limits for each of the life history stages present in the creek from June 1 to November 1, ≤60°F for holding of prespawning adults and for rearing of juveniles, and ≤56°F for egg incubation.	CDFG, USFWS, USBR
								Spring-run Fall-run Late Fall-run	Clear Creek	Action 3. Remove sediment from behind McCormick-Saeltzer Dam on Clear Creek and provide fish passage wither by removing the dam or improving fish passage facilities.	McCormick-Saeltzer Dam owners, CDFG, USFWS, USBR, NRCS, WSRCD
								Spring-run Fall-run Late Fall-run	Clear Creek	Action 2. Halt further habitat degradation on Clear Creek and restore channel conditions from the effects of past gravel mining.	CDFG, USFWS, USBR, BLM, Western Shasta Resource Conservation District (WSRCD), NPS, NRCS
								Spring-run Fall-run Late Fall-run	Clear Creek	Action 4. Develop an erosion control and stream corridor protection program or Clear Creek to prevent habitat degradation due to sedimentation and urbanization.	CDFG, USFWS, USBR, BLM, WSRCD, NRCS
								Spring-run Fall-run Late Fall-run	Clear Creek	Action 6. Preserve the productivity of habitat in the Clear Creek watershed through cooperative watershed management and development of a watershed management analysis and plan.	CDFG, USFWS, USBR, BLM
								Fall-run Steelhead	Cow Creek	Action 1 Supplement flows in Cow Creek with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to provide flows for suitable passage and spawning for fall-run Chinook salmon and adequate summer rearing habitat for juvenile steelhead.	Diverters, CDFG, USFWS, USBR, SWRCB

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Fall-run Steelhead	Cow Creek	Action 2. Screen all diversions ton Cow Creek to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, DWR
								Fall-run Steelhead	Cow Creek	Action 3. Improve passage on Cow Creek at agricultural diversion dams.	Diverters, CDFG, USFWS, USBR
								Fall-run Steelhead	Cow Creek	Action 4. Fence select riparian corridors within the Cow Creek watershed to exclude livestock.	NRCS, Landowners, CDFG, USFWS, USBR
								Fall-run Steelhead	Bear Creek	Action 1 Supplement flows in Bear Creek with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to provide flows for suitable passage and spawning of juvenile and adult Chinook salmon and steelhead during spring and early fall.	Diverters, CDFG, USFWS, USBR
								Fall-run Steelhead	Bear Creek	Action 2. Screen all diversions ton Bear Creek to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, DWR
Winter-run Spring-run Steelhead	Habitat loss	1.8.1.1 Develop and implement a salmon reintroduction plan to re-colonize historic habitats above Keswick and Shasta dams into the Little Sacramento River. ► Conduct feasibility study ► Conduct habitat evaluation ► Conduct 3-5 year pilot testing program ► Implement long-term fish passage program	CDFG, NMFS, Reclamation, USFWS	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted.	Not stated.				

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Habitat loss	1.8.2.1 Develop and implement a salmon reintroduction plan to re-colonize historic habitats above Keswick and Shasta dams into the McCloud River. ▸ Conduct feasibility study ▸ Conduct habitat evaluation ▸ Conduct 3-5 year pilot testing program ▸ Implement long-term fish passage program	CDFG, NMFS, Reclamation, USFWS	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted.	Not stated.				
								Spring-run Fall-run Steelhead	Cottonwood Creek	Action 1. Establish limits on instream gravel mining operations by working with state and local agencies to protect spawning gravel and enhance recruitment of spawning gravel to the Sacramento River in the valley sections of Cottonwood Creek.	ACOE, Shasta and Tehama counties, California Division of Mines, CDFG, USFWS, USBR
								Spring-run Fall-run Steelhead	Cottonwood Creek	Action 2 Restore the stream channel of Cottonwood Creek to prevent the ACID siphon from becoming a barrier to the migration of spring- and fall-run Chinook salmon and steelhead.	ACID, gravel miners USFWS, USBR
								Fall-run	Cottonwood Creek	Action 3. Eliminate adult fall-run Chinook stranding by stopping attraction flows in Crowley Gulch or by constructing a barrier at the mouth of Crowley Gulch.	ACID, CDFG, USFWS, USBR
								Salmonids	Cottonwood Creek	Action 4. Facilitate watershed protection and restoration to reduce water temperatures and siltation in Cottonwood Creek to improve holding, spawning, and rearing habitats for salmonids.	Landowners, CDFG, USFWS, USBR
								Not stated	Cottonwood Creek	Action 5. Establish, restore, and maintain riparian habitat on Cottonwood Creek.	ACID, Gravel miners, Landowners, USFWS, USBR

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.8.3.1 Develop and implement a salmon reintroduction plan to re-colonize historic habitats after implementation of the Battle Creek Restoration Project.	CDFG, NGOs, NMFS, PG&E, Reclamation, USFWS	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted.	Not stated.	Winter-run Spring-run Steelhead	Battle Creek	Evaluation 2. Evaluate the feasibility of establishing naturally spawning populations of winter-run and spring-run Chinook salmon and steelhead through a comprehensive plan to restore Battle Creek.	CDFG, USFWS, USBR, NMFS
								Not stated.	Battle Creek	Evaluation 4. Develop a comprehensive restoration plan for Battle Creek that integrates CNFH operations	WSRCD, CDFG, USFWS, USBR
Winter-run Spring-run Steelhead	Habitat degradation and loss	1.8.3.2 Fully fund and implement the Battle Creek Restoration Project through Phase 2.	CDFG, NMFS, PG&E, Reclamation, USFWS					Winter-run Spring-run Fall-run Steelhead	Battle Creek	Evaluation 3. Evaluate alternatives for providing a disease-safe water supply to CNFH to that winter-, spring- and fall-run Chinook salmon and steelhead would have access to an additional 41 miles of Battle Creek habitat.	CDFG, USFWS, USBR
								Spring-run Steelhead Fall-run Late fall-run	Battle Creek	Action 1. Continue to allow adult spring-run Chinook salmon and steelhead passage above the Coleman National Fish Hatchery (CNFH) weir on Battle Creek. After a disease-safe water supply becomes available to the CNFH, allow passage of fall- and late fall-run Chinook salmon and steelhead above the CNFH weir. In the interim, prevent anadromous fish from entering the main hatchery water supply by blocking fish ladders at Wildcat Canyon, Eagle Canyon, and Coleman diversion dams.	USFWS, USBR, CDFG, NMFS
								Anadromous salmonids	Battle Creek	Action 2. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to increase flows past PG&E's hydropower diversions in two phases to provide adequate holding, spawning and rearing habitat for anadromous salmonids in Battle Creek.	CDFG, PG&E, USFWS, USBR, NMFS, FERC

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Chinook salmon	Battle Creek	Action 3. Construct barrier racks at the Gover Diversion Dam and waste gates from the Gover Canal to prevent adult Chinook salmon from entering Gover Diversion.	Gover Diversion Dam owners, CDFG, USFWS, USBR
								Chinook salmon	Battle Creek	Action 4. Screen Orwick Diversion Dam to prevent entrainment of juvenile salmonids and straying of adult Chinook salmon.	Orwick Diversion Dam owners, USFWS, USBR, NMFS, CDFG, DWR, BLM
								Chinook salmon Steelhead	Battle Creek	Action 5. Screen tailrace of Colman Powerhouse to eliminate attraction of adult Chinook salmon and steelhead into an area with little spawning habitat and contamination of the CNFH water supply.	CDFG, PG&E, USBR, USFWS
								Anadromous salmonids	Battle Creek	Action 6. Construct fish screens on all PG&E diversions, as appropriate, after both phases of upstream flow actions (see Action 1) are completed and fish ladders on Coleman and Eagle Canyon diversion dams are opened.	PG&E, USFWS, USBR, NMFS, CDFG, DWR
								Adult salmonids	Battle Creek	Action 7. Improve fish passage in Eagle Canyon by modifying a bedrock ledge and boulders that are potential barriers to adult salmonids, and rebuild fish ladders on Wildcat and Eagle Canyon diversion dams.	CDFG, USFWS, USBR
								Juvenile Chinook salmon Steelhead	Battle Creek	Action 8. Screen CNFH intakes 2 and 3 to prevent entrainment of juvenile Chinook salmon and steelhead.	USFWS, USBR, CDFG, WSRCD
								Anadromous salmonids	Battle Creek	Evaluation 1. Evaluate the effectiveness of fish ladders at PG&E diversions.	CDFG, PG&E, USFWS, USBR
								Fall-run Steelhead	Paynes Creek	Action 1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve spawning, rearing and migration opportunities for fall-run Chinook salmon and steelhead in Paynes Creek.	Diverters, CDFG, BLM, USFWS, USBR, Tehama Co. RCD

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Fall-run Steelhead	Paynes Creek	Action 2. Restore and enhance spawning gravel in Paynes Creek.	CDFG, BLM, USFWS, USBR, Tehama Co. RCD
Spring-run Steelhead	Water management	1.9.1.1 Restore instream flows in Antelope Creek during upstream and downstream migration periods through water exchange agreements and provide alternative water supplies to Edwards Ranch and Los Molinos Mutual Water Company in exchange for instream fish flows.	CDFG, Edwards Ranch, Los Molinos Water Company					Spring-run Fall-run Late fall-run Steelhead	Antelope Creek	Action 1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to allow passage of juvenile and adult spring-, fall- and late fall-run Chinook salmon and steelhead.	Diverters, CDFG, USFWS, USBR, USFS
Spring-run Steelhead	Water management	1.9.1.2 Restore in Antelope Creek connectivity of the migration corridor during upstream and downstream migration periods by implementing Edwards and Penryn fish passage and entrainment improvement projects and identify and construct a defined stream channel for upstream and downstream fish migration.	CDFG, Edwards Ranch					Not stated.	Antelope Creek	Evaluate the creation of a more defined stream channel in Antelope Creek to facilitate fish passage by minimizing water infiltration into the streambed and maintaining flows to the Sacramento River.	Landowners, CDFG, USFWS, USBR
								Not stated.	Elder Creek	Action 1. Work with Tehama County to develop an erosion control ordinance to minimize sediment input into Elder Creek.	Tehama County, CDFG, USFWS, USBR, Tehama Co. RCD, NRCS
								Not stated.	Elder Creek	Evaluation 1. Evaluate the feasibility of constructing a fish passage structure over the Corning Canal Siphon on Elder Creek.	CDFG, USFWS, USBR, TCCA
Spring-run Steelhead	Habitat degradation and loss	1.9.2.1 Implement a Mill Creek anadromous fish passage study (AFRP Website 2005) that will evaluate fish passage at all agricultural diversions to determine if they meet NMFS' fish passage criteria. Design and install state-of-the-art fish passage facilities at diversions that currently do not meet the passage criteria.	CDFG, USFWS					Not stated.	Mill Creek	Evaluation 1. Develop and implement an interim fish passage solution at Clough Dam on Mill Creek until such time that a permanent solution is developed and accepted by landowners.	Diverters, Mill Creek Conservancy, Los Molinos Municipal Water Company, CDFG, DWR, USFWS, USBR, Vina Resource Conservation District

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run Steelhead	Habitat degradation and loss	1.9.2.2 Conduct a study designed to determine adult fish passage flows at critical riffles and fish ladders in Mill Creek. Develop a water exchange agreement with all Mill Creek water users to allow implementation of those flows.	CDFG, Mill Creek water users					Adult and juvenile Spring-run Fall-run Late fall-run Steelhead	Mill Creek	Action 1. Continue to provide instream flows in the valley reach of Mill Creek to facilitate the passage of adult and juvenile salmonids.	Mill Creek Conservancy Landowners, CDFG, USFWS, USBR, DWR
Spring-run Steelhead	Habitat degradation	1.9.2.3 Eliminate sources of chronic sediment delivered to Mill Creek from roads and other near-stream development by out-sloping roads, constructing diversion prevention dips, replacing under-sized culverts and applying other storm proofing guidelines.	CDFG, USFS					Not stated.	Mill Creek	Action 2. Preserve the habitat productivity of Mill Creek through cooperative watershed management and development of a watershed strategy.	CDFG, Mill Creek Conservancy, USFWS, USBR, Vina Resource Conservation District
								Fall-run	Mill Creek	Action 3. Improve spawning habitats in lower Mill Creek for fall-run Chinook salmon.	CDFG, Mill Creek Conservancy, USFWS, USBR, Vina Resource Conservation District
								Not stated.	Mill Creek	Action 4. Establish, restore, and maintain riparian habitat along the lower reaches of Mill Creek.	County agencies, California State University at Chico, CDFG, USFWS, USBR, Mill Creek Conservancy, Los Molinos School District, Vina Resource Conservation District

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Salmonids	Thomes Creek	Action 1. Modify gravel mining methods on Thomes Creek to reduce their effects on salmonid spawning habitats.	Gravel miners, Tehama County Planning Commission, CDFG, DWR, USFWS, USBR
								Not stated.	Thomes Creek	Action 2. Employ the most ecologically sound timber extraction practices by implementing the Forest Plan on federal lands within the Thomes Creek drainage.	Landowners, USFWS, USFS, California Department of Forestry and Fire Protection, Tehama-Colusa Canal Authority
								Not stated.	Thomes Creek	Action 3. Modify and employ the most ecologically sound grazing practices by implementing the Forest Plan on federal lands and through partnerships on private and state-owned land within the Thomes Creek drainage.	Landowners, USFS, USFWS, USBR, Tehama Colusa Resource Conservation District
								Chinook salmon Steelhead	Thomes Creek	Action 4. Reduce use of seasonal diversion dams on Thomes Creek that may be barriers to migrating Chinook salmon and steelhead.	Henleyville and Paskenta diversion dam operators, CDFG, USFWS, USBR
								Not stated.	Thomes Creek	Evaluation 1. Identify and evaluate restoring highly erodible watershed areas in the Thomes Creek watershed.	CDFG, USFWS, USBR
								Chinook salmon	Thomes Creek	Evaluation 2. Monitor water quality throughout Thomes Creek and identify limiting conditions for salmon.	CDFG, USFWS, USBR
Spring-run Steelhead	Habitat degradation	1.9.3.1 Develop and implement a water exchange agreement with the Deer Creek Irrigation District and the Stanford Vina Ranch Irrigation Company and dedicate fish passage flows. The agreement should identify water infrastructure facilities required to meet fish passage needs.	CDFG, Deer Creek Irrigation District, Stanford Vina Ranch Irrigation Company, USFWS					Adult and juvenile Spring-run Fall-run Steelhead	Deer Creek	Action 1. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to supplement instream flows in the lower ten miles of Deer Creek to ensure passage of adult and juvenile spring- and fall-run Chinook salmon and steelhead over three diversion dams.	Deer Creek Watershed Conservancy, CDFG, USFWS, USBR

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run Steelhead	Habitat degradation	1.9.3.2 Construct on Deer Creek state-of-the-art inflatable dams and install fish ladders that meet NMFS' adult fish passage criteria at the Cone-Kimball Diversion, Stanford Vina Dam, and the Deer Creek Irrigation District Dam.	CDFG, Deer Creek Irrigation District, Stanford Vina Ranch Irrigation Company, USFWS								
Spring-run Steelhead	Habitat degradation	1.9.3.3 Implement the Deer Creek Flood Improvement Project	No parties listed.					Fish resources	Deer Creek	Action 5. Plan and coordinate required flood management activities with least damage to the fishery resources and riparian habitats of lower Deer Creek; and establish, restore, and maintain riparian habitat on Deer Creek.	Tehama County Flood Control, Deer Creek Watershed Conservancy, ACOE, CDFG, USFWS, USBR
Spring-run Steelhead	Habitat degradation	1.9.3.4 Implement watershed restoration actions that reduce sedimentation and thermal loading in low gradient headwater habitats of Deer Creek Meadows and Gurnsey Creek.	CDFG, USFS, Deer Creek landowners					Chinook salmon Steelhead	Deer Creek	Action 2. Develop a watershed management plan to preserve the Chinook salmon and steelhead habitat in Deer Creek through cooperative watershed management.	Deer Creek Watershed Conservancy, CDFG, USFWS, USBR
								Fall-run Late fall-run	Deer Creek	Action 3. Improve spawning habitats in lower Deer Creek for fall- and late fall-run Chinook salmon.	Deer Creek Watershed Conservancy, CDFG, USFWS, USBR, Vina Resource Conservation district
								Not stated.	Deer Creek	Action 4. Negotiate long-term agreements to restore and preserve riparian habitats along Deer Creek.	Landowners, Deer Creek Watershed Conservancy, CDFG, USFWS, USBR, Vina Resource Conservation District

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Anadromous salmonids	Stony Creek	Evaluation 1. Determine the feasibility of restoring anadromous salmonids to Stony Creek by evaluating water releases from Black Butte Dam, water exchanges with the Tehama-Colusa Canal, interim and long-term water diversion solutions at Red Bluff Diversion Dam, water Quality improvements, spawning gravel protection and restoration, riparian habitat protection and restoration, creek channel creation, and passage improvements at water diversions.	Stony Creek Task Force, Tehama-Colusa Canal Authority, CDFG, ACOE, USFWS, USBR
				Chinook salmon Steelhead	Dams and other structures	Action 1. Repair the Iron Canyon fish ladder on Big Chico Creek.	Not stated.	Not stated.	Big Chico Creek	Action 2. Repair the Iron Canyon fish ladder on Big Chico Creek.	CDFG, USFWS, USBR, Big Chico Creek Task Force
								Not stated.	Big Chico Creek	Action 3. Replenish spawning gravel in reaches modified for flood control on Big Chico Creek.	Chico Parks Department, CDFG, DWR, ACOE, USFWS, USBR, Big Chico Creek Task Force
								Not stated.	Big Chico Creek	Action 4. Repair the Lindo Channel weir and fishway at the Lindo Channel box culvert at the Five-Mile Diversion on Big Chico Creek.	Chico Parks Department, CDFG, DWR, ACOE, USFWS, USBR, Big Chico Creek Task Force
								Not stated.	Big Chico Creek	Action 5. Improve cleaning procedures at One-Mile Pool on Big Chico Creek.	City of Chico, CDFG, USFWS, USBR
								Spring-run	Big Chico Creek	Action 6. Protect spring-run Chinook salmon summer holding pools on Big Chico Creek by obtaining from willing sellers titles or conservation easements on lands adjacent to the pools.	Landowners, CDFG, USFWS, USBR

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	Big Chico Creek	Action 7. Cooperate with local landowners to encourage revegetation of denuded stream reaches; and establish, restore, and maintain riparian habitat on Big Chico Creek.	Landowners, Sacramento River Preservation Trust, CDFG, California Department of Parks and Recreation, USFWS, USBR
								Not stated.	Big Chico Creek	Action 8. Preserve the productivity of the habitat on Big Chico Creek through cooperative watershed management and development of a watershed management plan.	USFS, CDFG, USFWS, USBR
								Not stated.	Big Chico Creek	Evaluation 1. Evaluate the water management operations between Big Chico Creek and Lindo Channel.	City of Chico, CDFG, DWR, USFWS, USBR
								Not stated.	Big Chico Creek	Evaluation 2. Evaluate the replenishment of gravel in the flood-diversion reach of Mud Creek.	Butte County, CDFG, DWR, USFWS, USBR
				Chinook salmon	Dams and other structures	Action 2. Install an adult salmon exclusion device at the Knights Landing outfall for Colusa Basin Drain as an interim action pending completion of Colusa Basin Drain Evaluation 1.	Not stated.	Chinook salmon	Colusa Basin Drain	Action 1. Install an adult exclusion device at the Knights Landing outfall for Colusa Basin Drain as an interim action pending completion of Colusa Basin Drain Evaluation 1.	CDFG, USFWS, USBR
								Anadromous fishes	Colusa Basin Drain	Evaluation 1. Investigate the feasibility of restoring the access of anadromous fish to westside tributaries through development of defined migrational routes, sufficient flows, and adequate water temperatures.	CDFG, USFWS, USBR
Spring-run Steelhead	Water management	1.9.4.1 Develop, implement and evaluate a Butte Creek flow test for the PG&E DeSabla-Centerville Hydroelectric Project to determine the flow conditions that optimize coldwater holding habitat and spawning distribution.	CDFG, PG&E					Not stated.	Butte Creek	Action 2. Maintain a minimum 40 cfs instream flow below Centerville Diversion Dam on Butte Creek.	Butte Creek Watershed Conservancy, CDFG, PG&E, USFWS, USBR

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Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run Steelhead	Habitat degradation and loss	1.9.4.2 Install state-of-the-art fish ladders at DWR Weir 2 and Willow Slough Weir on Butte Creek.	DWR					Not stated.	Butte Creek	Evaluation 3. Evaluate operational alternatives and establish operational criteria for Sutter Bypass Weir #2 on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 8. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #2 on Butte Creek.	Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
Spring-run Steelhead	Habitat degradation and loss	1.9.4.3 Maintain state-of-the art fish passage facilities at diversions on Butte Creek to meet NMFS's passage criteria.	No parties listed.	Salmonids	Dams and other structures	Action 3. Remove any remaining physical barriers that impede access for salmonid fish on Butte Creek.	Not stated.	Not stated.	Butte Creek	Action 4. Build a new high water volume fish ladder at Durham Mutual Dam on Butte Creek.	Durham Mutual Water Company, Butte Creek Watershed Conservancy, CDFG, The Nature Conservancy, USFWS, USBR
								Not stated.	Butte Creek	Action 4. Install fish screens on both diversions at Durham Mutual Dam on Butte Creek.	Diverters, Durham Mutual Water Company, The Nature Conservancy, USFWS, USBR, NMFS, CDFG, DWR
								Not stated.	Butte Creek	Action 10. Build a new high water volume fish ladder at Adams Dam on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 11. Install fish screens on both diversions at Adams Dam on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, DWR, NMFS, USFWS, USBR
								Not stated.	Butte Creek	Action 12. Build a new high water volume fish ladder at Gorrill Dam on Butte Creek.	Diverters, CDFG, USFWS, USBR

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Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	Butte Creek	Action 13. Install a fish screen on the Gorrill Dam diversion on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, DWR, NMFS, USFWS, USBR
								Not stated.	Butte Creek	Action 14. Install a fish screen at White Mallard Dam on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, DWR, NMFS, USFWS, USBR
								Not stated.	Butte Creek	Action 18. Install a high water volume fish ladder at White Mallard Dam on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 20. Install fish screens and fish ladder at Parrott-Phelan Diversion Dam on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 2. Evaluate alternatives or build a new high water volume fish ladder at East-West Diversion Weir on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 5. Evaluate alternatives to help fish passage, including the installation of a fish screen, at Sanborn Slough Bifurcation Structure on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, DWR, NMFS, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 6. Evaluate alternatives to help fish passage, including the installation of fish screens, within Sutter Bypass where necessary.	Diverters, Butte Creek Watershed Conservancy, CDFG, DWR, NMFS, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 9. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #1 on Butte Creek.	Butte Creek Watershed Conservancy, CDFG, USFWS, USBR

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Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	Butte Creek	Evaluation 10. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #5 on Butte Creek.	Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 11. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #3 on Butte Creek.	Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 1. Obtain additional instream flows from Parrott-Phelan Diversion on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 3. Purchase existing wat4er rights for Butte Creek from willing sellers.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR, SWRCB
								Anadromous salmonids	Butte Creek	Action 6. Remove the Western Canal Damon Butte Creek and construct the Western Canal Siphon.	Western Canal Water District, Butte Creek Watershed Conservancy, The Nature Conservancy, CDFG, USFWS, USBR
								Anadromous salmonids	Butte Creek	Action 7. Remove McPherrin and McGowan dams on Butte Creek and provide an alternate source of water as part of the Western Canal Dam removal and siphon construction.	Diverters, Western Canal Water District, Butte Creek Watershed Conservancy, CDFG, USBR, USFWS
								Not stated.	Butte Creek	Action 8. As available, acquire water rights in Butte Creek as a part of the Western Canal Siphon project.	Western Canal Water District, Butte Creek Watershed Conservancy, CDFG, SWRCB, USBR

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Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	Butte Creek	Action 9. Adjudicate water rights on Butte Creek and provide water master service for the entire creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, SWRCB, USFWS, USBR
								Chinook salmon	Butte Creek	Action 15. Eliminate Chinook salmon stranding at White Mallard Duck Club outfall on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 16. Rebuild and maintain existing culvert and riser at Drumheller Slough outfall on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 17. Install screened portable pumps in Butte Creek as an alternative to the Little Dry Creek diversion.	Diverters, Butte Creek Watershed Conservancy, CDFG, DWR, NMFS, USFWS, USBR
								Spring-run	Butte Creek	Action 19. Develop land use plans that create buffer zones between Butte Creek and agricultural, urban, and industrial developments; and restore, maintain, and protect riparian and spring-run Chinook salmon summer-holding habitat along Butte Creek.	City and county government agencies, Conservation groups, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 21. Develop a watershed management program for Butte Creek.	Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 22. Establish operational criteria for Sanborn Slough Bifurcation on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR

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NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	Butte Creek	Action 23. Establish operational criteria for the East Barrow pit and West barrow pit on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Action 24. Establish operational criteria for Nelson Slough tributary to Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 1. Develop and evaluate operational criteria and potential modifications to Butte Slough outfall on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 4. Evaluate operational alternatives and establish operational criteria for Sutter Bypass Weir #1 on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Not stated.	Butte Creek	Evaluation 7. Evaluate operational alternatives and establish operational criteria for Sutter Bypass Weir #5 on Butte Creek.	Diverters, Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
								Spring-run	Butte Creek	Evaluation 12. Evaluate enhancement of fish passage at a natural barrier below the Centerville Diversion Dam on Butte Creek.	Butte Creek Watershed Conservancy, PG&E, CDFG, USFWS, USBR
								Spring-run	Butte Creek	Evaluation 13. Evaluate fish passage enhancements at PG&E diversion dams and other barriers above Centerville Diversion Dam on Butte Creek.	Butte Creek Watershed Conservancy, Spring-run Chinook Salmon Workgroup, PG&E, CDFG, USFWS, USBR
								Juvenile Spring-run	Butte Creek	Evaluation 14. Evaluate the juvenile life history of spring-run Chinook salmon in Butte Creek.	Butte Creek Watershed Conservancy, CDFG, USFWS, USBR

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Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Juvenile and adult Chinook salmon	Butte Creek	Evaluation 15. Evaluate juvenile and adult Chinook salmon stranding in Sutter Bypass and behind Tisdale, Moulton, and Colusa weirs during periods of receding flows on the upper mainstem Sacramento River.	Butte Creek Watershed Conservancy, CDFG, USFWS, USBR
				Not stated.	Central Valley streamflows	Action 1. Encourage partner agency continuation of existing stream gages/real-time flow monitoring on Big Chico Creek, Butte Creek, Deer Creek, and Mill Creek.	Not stated.				
				Spring-run Steelhead	Central Valley hydrodynamics	Action 1. Continue to prioritize fish habitat and fish passage restoration projects particularly for spring-run Chinook salmon and steelhead trout (CALFED 2001a). No specific streams noted.	Not stated.				
				Not stated.	Central Valley hydrodynamics	Action 2. Continue to conduct adaptive management experiments in regards to natural and modified flow regimes to promote ecosystem functions or otherwise support restoration actions (CALFED 2001a). No specific streams noted.					
				Chinook salmon Steelhead	Central Valley hydrodynamics	Action 3. Continue to improve process understanding and support the development of ecologically-based plans to restore conditions in the rivers, sloughs and floodplains sufficient to meet restoration targets for Chinook salmon, steelhead, sturgeon, and splittail (CALFED 2001a). No specific streams noted.					
								Juvenile Winter-run Spring-run Fall-run Late fall-run Steelhead	Small Sacramento River Tributaries	Evaluation 1. Evaluate the contribution of small Sacramento River tributaries as rearing areas of juvenile Chinook salmon and steelhead.	CDFG, USFWS, USBR, Chico State University

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run	Habitat loss	1.9.5.1 Implement the use of a weir in the Feather River to spatially segregate spring-run Chinook salmon and fall-run Chinook salmon during their spawning migrations.	DWR								
Spring-run Steelhead	Hatchery effects	1.9.5.2 Develop a hatchery genetic management plan for the Feather River Fish Hatchery, including specific criteria for operating as either an integrated or segregated hatchery	CDFG, DWR					Chinook salmon	Feather River	Evaluation 3. Evaluate the distribution of Feather River Fish Hatchery Chinook salmon in Central Valley stocks and determine the genetic integrity of Feather River spring-run Chinook salmon.	DWR, CDFG
Spring-run Steelhead	Water management	1.9.5.3 Develop and implement a spring-run pulse flow schedule for the Feather River that is coordinated with Yuba River operations for dry and critically dry years.	DWR, YCWA								
Spring-run Steelhead	Habitat degradation and loss	1.9.5.4 Develop a spawning gravel budget, identify gravel depleted areas, and implement an augmentation plan in the Feather River.	DWR					Chinook salmon	Feather River	Evaluation 2. Evaluate the quality of spawning gravel in the Feather River in areas used by Chinook salmon, and if indicated, consider gravel renovation or supplementation to enhance substrate quality.	DWR
Steelhead	Habitat degradation and loss	1.9.5.5 Construct steelhead side channel habitats using carrying capacity models sufficient to support a viable naturally spawning population of steelhead in the lower Feather River.	DWR								
Spring-run Steelhead	Water temperature	1.9.5.6 Implement facilities modifications to achieve Feather River water temperatures at least as protective as those specified in Table 2 of the Settlement Agreement For Licensing of the Oroville Facilities (March 2006).	DWR, FERC, SWRCB					Fall-run Spring-run Steelhead	Feather River	Action 1. Supplement flows in the Feather River with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of fall- and spring-run Chinook salmon and steelhead.	DWR, CDFG, USFWS, USBR

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	Feather River	Action 3. Develop and utilize a temperature model for the Feather River as a tool for river management.	DWR
								Salmonids	Feather River	Evaluation 1. Evaluate the response of spawning salmonids to increased flows in the low-flow channel of the Feather River.	DWR CDFG
Spring-run Steelhead	Habitat degradation and loss	1.9.6.1 Develop and implement a salmon reintroduction plan to re-colonize historic habitats above Englebright Dam on the Yuba River. Implement actions to: (1) enhance habitat conditions including providing flows and suitable water temperatures for successful upstream and downstream passage, holding, spawning and rearing; and (2) improve access within the area above Englebright Dam, including increasing minimum flows, providing passage at Our House, New Bullards Bar, and Log Cabin dams, and assessing feasibility of passage improvement at natural barriers. ► Conduct feasibility study ► Conduct habitat evaluation ► Conduct 3-5 year pilot testing program ► Implement long-term fish passage program	CDFG, NMFS, PG&E, USFWS, YCWA	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted.	Not stated.				
Spring-run Steelhead	Habitat degradation	1.9.6.2 Improve spawning habitat in the lower Yuba River by gravel restoration program below Englebright Dam and improve rearing habitat by increasing floodplain availability.	CDFG, NMFS, PG&E, USFWS, YCWA					Chinook salmon Steelhead	Yuba River	Action 1. Supplement flows in the Yuba River with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of Chinook salmon and steelhead.	Yuba County Water Agency, SWRCB, CDFG, USFWS, USBR

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Juvenile salmonids	Yuba River	Action 3. Reduce and control flow fluctuations in the Yuba River to avoid and minimize adverse effects to juvenile salmonids.	Yuba County Water Agency, PG&E, SWRCB, CDFG
								Juvenile salmonids	Yuba River	Evaluation 1. Evaluate the effectiveness of pulse flows to facilitate successful juvenile salmonid emigration from the Yuba River.	Yuba County Water Agency, CDFG, USFWS, USBR
								Not stated.	Yuba River	Action 4. Maintain adequate instream flows in the Yuba River for temperature control.	Yuba County Water Agency, CDFG, USFWS, USBR
				Various native fishes	Water diversions	Action 2. Improve the efficiency of screening devices on the Yuba River at Hallwood-Cordua and Brophy-South Yuba diversions, and construct screens at Brown's Valley water diversion and other unscreened diversions.	Not stated.	Not stated.	Yuba River	Action 5. Improve efficiency of screening devices at Hallwood-Cordua and Brophy-South Yuba water diversions, and construct screens at the Browns Valley water diversion and other unscreened diversions on the Yuba River.	Diverters, SWRCB, USFWS, USBR, NMFS, CDFG, DWR
				Various native fishes	Water diversions	Action 3. Construct or improve the fish bypasses at Hallwood-Cordua and Brophy-South Yuba water diversions on the Yuba River.	Not stated.	Not stated.	Yuba River	Action 6. Construct or improve the fish bypasses and Hallwood-Cordua and Brophy-South Yuba water diversion on the Yuba River.	Diverters, SWRCB, USFWS, USBR, NMFS, CDFG, DWR
				Juvenile salmonids	Dams and other structures	Action 4. Facilitate passage of juvenile salmonids by modifying the dam face of Daguerre Point Dam on the Yuba River.	Not stated.	Juvenile salmonids	Yuba River	Action 9. Facilitate passage of juvenile salmonids by modifying the dam face of Daguerre Point Dam on the Yuba River.	Yuba County Water Agency, CDFG, ACOE
								Adult salmonids	Yuba River	Action 7. Facilitate passage of spawning adult salmonids by maintaining appropriate flows through the fish ladders, or by modifying the fish ladders at Daguerre Point Dam on the Yuba River.	Yuba County Water Agency, CDFG, ACOE, USFWS, USBR
								Anadromous fish	Yuba River	Action 10. Operate reservoirs to provide adequate water temperatures for anadromous fish in the Yuba River.	Yuba River Water Temperature Advisory Committee, SWRCB

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	Yuba River	Evaluation 2. Evaluate whether enhancement of water temperature control via shutter configuration and present management of the cold water pool at New Bullards Bar Dam if effective, and modify the water release outlets at Englebright Dam if enhancement of water temperature control via shutter configuration is effective.	Yuba County Water Agency, CDFG, PG&E, USFWS, USBR
								Salmonids	Yuba River	Evaluation 4. Evaluate the benefits of restoring stream channel and riparian habitats of the Yuba River, including the creation of side channels for spawning and rearing habitats for salmonids.	Yuba County Water Agency, CDFG, PG&E, USFWS
				Not stated.	Riparian and riverine aquatic habitat	Action 3. Remove small, non-essential dams on gravel-rich streams. No specific streams noted.					
				Salmonids	Riparian and riverine aquatic habitat	Action 2. Purchase streambank conservation easements from willing sellers or establish voluntary incentive programs to improve salmonid habitat and instream cover along the Yuba River, Feather River, and Bear River.	Not stated.	Salmonids	Yuba River	Action 8. Purchase streambank conservation easements along the Yuba River to improve salmonid habitat and instream cover.	Landowners, Yuba County Water Agency, BLM, USFWS, USBR
				Anadromous fish	Water diversions	Action 1. Screen all diversions to protect all life history stages of anadromous fish on Bear River.	Not stated.	Anadromous fish	Bear River	Action 3. Screen all diversions on the Bear River to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, DWR
								Chinook salmon Steelhead	Bear River	Action 1. Supplement flows in the Bear River with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of Chinook salmon and steelhead.	South Sutter Water District, SWRCB, CDFG, USFWS, USBR
								Chinook salmon Steelhead	Bear River	Action 2. Provide adequate water temperatures in the Bear River for all life-stages of Chinook salmon and steelhead.	South Sutter Water District, SWRCB, CDFG

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Anadromous fish	Bear River	Action 4. Negotiate removal or modification of the culvert crossing at Patterson Sand and Gravel and other physical chemical barriers impeding anadromous fish migration on the Bear River.	Patterson Sand and Gravel, CDFG, USFWS, USBR
								Salmonids	Bear River	Evaluation 1. Determine and evaluate instream flow requirements for the Bear River that ensure adequate flows for all life stages of all salmonids.	South Sutter Water District, CDFG, USFWS, USBR
								Anadromous fish	Bear River	Evaluation 3. Monitor water quality in the Bear River, particularly at agricultural return outfalls, and evaluate potential effects on anadromous fish.	Diverters, CDFG
				Salmonids	Dams and other structures	Action 3. Remove any remaining physical barriers that impede access for salmonid fish on Dry Creek, Auburn Ravine, and Miner's Ravine.	Not stated.				
				Not stated.	Dams and other structures	Action 6. Reestablish the natural stream corridor of Miner's Ravine through the Hidden Valley Estates subdivision in Granite Bay; primarily through dam removal, sediment stabilization/removal and re-engineering of the natural stream corridor and ancillary features.	Not stated.				
				Anadromous fish	Dams and other structures	Action 7. Removal or modification of culvert crossings and other physical and chemical barriers impeding anadromous fish migration. No specific streams/sites noted.					
Steelhead	Habitat degradation and loss	1.9.7.1 Develop and implement a steelhead reintroduction plan to re-colonize historic habitats in the American River watershed above Nimbus and Folsom dams. ► Conduct feasibility study ► Conduct habitat evaluation ► Conduct 3-5 year pilot testing program ► Implement long-term fish passage program	CDFG, NMFS, Reclamation, USFWS	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted.	Not stated.				

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Steelhead	Water temperature	1.9.7.2 Implement physical and structural modifications to the American River Division of the CVP in order to improve water temperature management.	ACOE, CDFG,NMFS, Reclamation, USFWS					Not stated.	American River	Action 4. Reconfigure Folsom Dam shutters for improved management of Folsom Reservoir's cold water pool and better control over the temperature of water released downstream to the American River.	County of Sacramento, Sacramento Area Flood Control Agency, USFWS, USBR, CDFG
				Not stated.	Central Valley streamflows	Action 3. Increase flow by purchasing water from willing sellers or providing alternative sources of water to diverters during important fish passage periods in spring and fall on the American and Bear rivers.	Not stated.	Anadromous fish	American River	Action 1. Develop and implement a river regulation plan the meets American River minimum flow objectives for different water year types by modifying CVP operations, using (b)(2) water, and acquiring water from willing sellers as needed.	Sacramento Area Water Forum, CDFG, USBR, USFWS
								Not stated.	American River	Action 2. Develop a long-term water allocation plan for the American River watershed.	Sacramento Area Water Forum, CDFG, Other water users, USFWS, USBR
								Juvenile salmonids	American River	Action 3. Reduce and control flow fluctuations to avoid and minimize adverse effects on juvenile salmonids in the American River.	USFWS, USSBR, CDFG
								Salmonids	American River	Action 5. Replenish spawning gravel and restore existing spawning grounds in the American River.	USFWS, USBR, CDFG
								Not stated.	American River	Action 6. Improve the fish screen at Fairbairn Water Treatment Plant on the American River.	City of Sacramento, USFWS, USBR, NMFS, CDFG, DWR
								Juvenile salmonids	American River	Action 7. Modify the timing and rate of water diverted from the American River annually to reduce entrainment losses of juvenile salmonids.	City of Sacramento, Other water users, CDFG, USFWS, USBR
								Not stated.	American River	Action 8. Develop a riparian corridor management plan to improve and protect riparian habitat and instream cover in the American River.	Sacramento Area Flood Control Agency, ACOE, USFWS, USBR, CDFG

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Not stated.	American River	Action 9. Terminate current programs that remove woody debris from the American River channel.	County of Sacramento, City of Sacramento, Sacramento Area Flood Control Agency, ACOE, USFWS, USBR, CDFG
								Juvenile salmonids	American River	Evaluation 1. Evaluate the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids in the American River.	USFWS, USBR, CDFG
								Anadromous fish	American River	Evaluation 2. Evaluate and refine a river regulation plan that provides flows to protect all life stages of anadromous fish based on water storage at Folsom Reservoir and predicted hydrological conditions in the American River watershed.	Sacramento Area Water Forum, CDFG, USFWS, USBR
				Not stated.	Central Valley hydrodynamics	Action 4. Continue to support projects to: ► develop ecological and hydrodynamic modeling tools and conceptual models that describe ecological attributes, processes, habitats, and outflow/fish population relationships ► develop ecological and biological criteria for water acquisitions ► evaluate previous water acquisition strategies and their biological and ecological benefits No specific streams noted.	Not stated.				
Spring-run Steelhead	Habitat degradation and loss	1.9.8.1 Evaluate and, if feasible, develop and implement a fish passage program for Camanche and Pardee dams on the Mokelumne River. ► Conduct feasibility study ► Conduct habitat evaluation ► Conduct 3-5 year pilot testing program ► Implement long-term fish passage program	CDFG, NMFS, Reclamation, USFWS EBMUD not listed.	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted.	Not stated.				

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run Steelhead	Water temperature	1.9.8.2 Manage cold water pools in Camanche and Pardee reservoirs on the Mokelumne River to provide suitable water temperatures for all downstream life stages.	CDFG, EBMUD, NMFS, Reclamation, USFWS					Salmonids	Mokelumne River	Action 6. Maintain suitable water temperatures in the Mokelumne River for all salmonid life stages.	EBMUD, CDFG
								Chinook salmon Steelhead	Mokelumne River	Action 1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of Chinook salmon and steelhead in the Mokelumne River.	EBMUD, SWRCB, Woodbridge Irrigation District, FERC, CDFG, USFWS
								Salmonids	Mokelumne River	Action 2. Replenish gravel suitable for salmonid spawning habitat in the Mokelumne River.	CDFG, EBMUD
								Salmonids	Mokelumne River	Action 3. Cleasne spawning gravel in the Mokelumne River of fine sediments and prevent sedimentation of spawning gravel.	CDFG, EBMUD
								Juvenile salmonids	Mokelumne River	Action 4. Reduce and control flow fluctuations in the Mokelumne River to avoid and minimize adverse effects to juvenile salmonids.	
								Anadromous fish	Mokelumne River	Action 5. Screen all diversions on the Mokelumne River to protect all life history stages of anadromous fish.	Diverters, CDFG, DWR, USFWS, USBR, NMFS
								Juvenile salmonids	Mokelumne River	Action 7. Enhance and maintain the riparian corridor along the Mokelumne River to improve streambank and channel rearing habitat for juvenile salmonids.	Landowners, CDFG
								Salmonids	Mokelumne River	Action 8. Establish and enforce water quality standards for the Mokelumne River to provide optimal water quality for all life history stages of salmonids.	CDFG
								Salmonids	Mokelumne River	Action 9. Eliminate or restrict gravel mining operations in the Mokelumne River floodplain to prevent damage to potential spawning areas and encroachment of vegetation.	Gravel miners, CDFG

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Juvenile salmonids	Mokelumne River	Evaluation 1. Evaluate the effectiveness of pulse flows in the Mokelumne River to facilitate successful emigration of juvenile salmonids in the spring, and determine the efficacy in all water year types.	EBMUD, CDFG, USFWS, USBR
								Juvenile and adult salmonids	Mokelumne River	Evaluate 2. Evaluate and facilitate passage of spawning adult salmonids in the fall and juvenile salmonids in the spring past Woodbridge Dam and Lodi Lake on the Mokelumne River.	Woodbridge Irrigation District, City of Lodi, EBMUD, CDFG, USFWS
								Juvenile salmonids	Mokelumne River	Evaluation 3. Evaluate the incidence of predation on juvenile salmonids emigrating past Woodbridge Dam on the Mokelumne River, and investigate potential remedial actions if necessary.	Woodbridge Irrigation District, EB MUD, CDFG, USFWS, USBR
								Juvenile salmonids Adult steelhead	Mokelumne River	Evaluation 4. Evaluate the effects of extending the closure of the fishing season on the Mokelumne River from 31 December to 31 March (and possible to 1 June) to protect juvenile salmonids and adult steelhead and prevent anglers from wading on redds.	CDFG
								Salmonids	Cosumnes River	Action 1. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to reduce water diversions or augment instream flows on the Cosumnes River during critical periods for salmonids.	Diverters, CDFG, USFWS, USBR
								Salmonids	Cosumnes River	Action 2. Pursue opportunities to purchase existing water rights from will sellers consistent with applicable guidelines to ensure adequate flows for all life stages of salmonids in the Cosumnes River.	CDFG, The Nature Conservancy, USFWS, USBR
								Not stated.	Cosumnes River	Action 3. Enforce Fish and Game Code sections that prohibit construction of unlicensed dams on the Cosumnes River.	CDFG

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Anadromous fish	Cosumnes River	Action 4. Screen all diversions on the Cosumnes River to protect all life history stages of anadromous fish.	Diverters, CDFG, DWR, USFWS, USBR, NMFS, The Nature Conservancy
								Not stated.	Cosumnes River	Action 5. Establish a riparian corridor protection zone along the Cosumnes River.	The Nature Conservancy, Landowners, CDFG
								Not stated.	Cosumnes River	Action 6. Rehabilitate damaged areas and remedy incompatible land practices to reduce sedimentation and instream water temperatures in the Cosumnes River.	The Nature Conservancy, Landowners, CDFG
								Salmonids	Cosumnes River	Evaluation 1. Determine and evaluate instream flow requirements that ensure adequate flows in the Cosumnes River for all life stages of all salmonids	Diverters, The Nature Conservancy, CDFG, USFWS, USBR
								Adult and juvenile salmonids	Cosumnes River	Evaluation 2. Evaluate and facilitate passage of adult and juvenile salmonids at existing diversion dams and barriers on the Cosumnes River.	Diverters and dam builders, The Nature Conservancy, CDFG, USBR, USFWS
								Salmonids	Cosumnes River	Evaluation 3. Evaluate the feasibility of restoring and increasing available spawning and rearing habitat in the Cosumnes River for salmonids.	The Nature Conservancy, CDFG, USBR, USFWS
				Not stated.	Non-native invasive species	Action 2. Continue research and monitoring programs to increase understanding of the invasion process and the role of established NIS in the Sacramento Valley ecosystem. No specifics given.					
				Chinook salmon	Chinook salmon	Action 2. Continue monitoring individual species' status and trends using new and existing data sets. No specific streams noted.					

Appendix D
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the Sacramento River watershed (i.e., headwaters to Collinsville).

NMFS (2009)				CDFG (2011)				USFWS (2001)			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
				Chinook salmon	Chinook salmon	Action 3. To the extent possible, limit interaction between wild and hatchery-reared fish. No specifics noted.					

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APPENDIX E

Comparison of Actions for the San Joaquin Valley Watershed

Appendix E
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the San Joaquin River watershed (i.e., headwaters to Mokelumne River confluence).

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run Steelhead	Habitat degradation and loss; Water quality	1.10.1 Develop and implement a suite of actions to improve salmon and steelhead outmigration survival through the mainstem San Joaquin River downstream of the Merced River by: ► Restoring floodplain habitat, and implementing ecological flow schedules to create frequently activated floodplain ► Reducing contaminants ► Implementing remedies for the biological oxygen demand and low dissolved oxygen levels in the Stockton Deep Water Ship Channel that impede fish migration.	CDFG, DWR. NMFS, Reclamation, SWRCB, USFWS, water districts	Fish	Dissolved oxygen	Action 1. Maintain dissolved oxygen levels in the San Joaquin River that meet SWRCB water quality objectives for the protection of fish and wildlife beneficial uses. No specific streams/sites noted.	SWRCB	Not stated.	San Joaquin River	Action 5. Maintain the 6 mg/L dissolved oxygen standard during September through November in the San Joaquin River between Turner Cut and Stockton, as described in the SWRCB's 1995 Water Quality Control Plan.	CDFG, DWR, ACOE, City of Stockton, Port of Stockton
				Aquatic biota	Contaminants	Action 1. Continue coordination and support for the TMDL and associated implementation to address dissolved oxygen depletion in the lower San Joaquin River. Listed in the Delta narrative.	SWRCB				
Spring-run Steelhead	Water management	1.10.2 Implement Action IV.2.1 (San Joaquin River Inflow to Export Ratio) of the Reasonable and Prudent Alternative described in the NMFS BO on the long-term operation of the CVP/SWP (NMFS 2009) to improve juvenile outmigration for steelhead and future spring-run Chinook salmon in the mainstem San Joaquin River downstream from the Merced River.	CDFG, DWR. NMFS, Reclamation, SWRCB, USFWS, water districts	Aquatic species	Water diversions	Further investigate the role of E/I ratio as dominant factor in particle fate, in relation to entrainment of pelagic organisms (including eggs and larvae) in SWP and CVP pumps and other diversions.	Not stated.	Not stated.	San Joaquin River	Action 2. Develop an equitable, integrated San Joaquin Basin plan that will meet outflow:export objectives identified under Sacramento-San Joaquin Delta Operational Target 4 and Supplemental Actions Requiring Water 7, 8, and 9.	River and tributary water managers and diverters, CDFG, SWRCB, DWR, USFWS, USBR
Spring-run Steelhead	Habitat loss	1.11.1.1 Evaluate and, if feasible, develop and implement a fish passage program for Goodwin, New Melones, and Tulloch dams on the Stanislaus River. ► Conduct feasibility study ► Conduct habitat evaluations ► Conduct 3-5 year pilot testing program ► Implement long-term fish passage program	CDFG, NMFS, Reclamation, USFWS	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted. No mention of steelhead.	Not stated.				

Appendix E
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the San Joaquin River watershed (i.e., headwaters to Mokelumne River confluence).

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run Steelhead	Water temperature	1.11.1.2 Manage cold water pools behind Goodwin, New Melones and Tulloch dams to provide suitable water temperatures for all downstream life stages in the Stanislaus River.	CDFG, NMFS, Reclamation, USFWS	Salmonids	Water temperature	Action 3. Manage storage of and release from San Joaquin river tributaries to ensure the duration of cool temperatures are supportive of spawning, egg survival, and rearing of juvenile salmonids. No specific streams/reservoirs noted.	Not stated.	Anadromous fish	Stanislaus River	Evaluation 3. Evaluate and refine a Stanislaus River regulation plan that provides adequate flows to protect all life stages of anadromous fish based on water storage at New Melones Reservoir, predicted hydrologic conditions, and current aquatic habitat conditions.	USFWS, USBR, CDFG, ACOE
Steelhead	Water management	1.11.2.1 Develop and implement long-term instream flow schedules and requirements for the Calaveras River based on physical habitat modeling and critical riffle analysis.	CDFG, NMFS, USFWS					Fish	Calaveras River	Evaluation 2. Evaluate instream flow, water temperature and fish habitat use in the Calaveras River to develop a real-time management program so that reservoir operations can maintain suitable habitat when fish are present.	CDFG, Diverters, USFWS
Steelhead	Water management	1.11.2.2 Establish a minimum carryover storage level at New Hogan Reservoir that meets the instream flow and water temperature requirements in the lower Calaveras River.	ACOE, CDFG, NMFS, USFWS	Salmonids	Water temperature	Action 3. Manage storage of and release from San Joaquin river tributaries to ensure the duration of cool temperatures are supportive of spawning, egg survival, and rearing of juvenile salmonids. No specific streams/reservoirs noted.	Not stated.	Salmonids	Calaveras River	Action 2. Provide flows in the Calaveras River of suitable water temperature for all salmonid life stages.	CDFG,USFWS, USBR
Steelhead	Habitat degradation and loss	1.11.2.3 Remove or modify all fish passage impediments in the lower Calaveras River to meet NMFS fish passage criteria.	ACOE, CDFG, NMFS, USFWS					Anadromous fish Salmonids	Calaveras River Calaveras River	Action 3. Facilitate passage of adult and juvenile salmonids at existing diversion dams and barriers on the Calaveras River. Evaluation 1. Monitor sport fishing on the Calaveras River and evaluate the need for regulations to protect salmonids.	Diverters, CDFG CDFG
Spring-run Steelhead	Habitat loss	1.11.3.1 Evaluate and, if feasible, develop and implement a fish passage program for LaGrange and Don Pedro dams on the Tuolumne River. ► Conduct feasibility study ► Conduct habitat evaluations ► Conduct 3-5 year pilot testing program ► Implement long-term fish passage program	CDFG, NMFS, USFWS, Modesto Irrigation District, Turlock Irrigation District	Chinook salmon	Chinook salmon	Action 1. Investigate whether individual species' respective range of distribution can be extended or changed, so they may persist in changing future conditions. No specific streams noted. No mention of steelhead.	Not stated.				

Appendix E
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the San Joaquin River watershed (i.e., headwaters to Mokelumne River confluence).

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
Spring-run Steelhead	Water temperatures	1.11.3.2 Manage cold water pools behind LaGrange and Don Pedro dams to provide suitable water temperatures for all downstream life stages in the Tuolumne River.	CDFG, NMFS, USFWS, Modesto Irrigation District, Turlock Irrigation District	Salmonids	Water temperature	Action 3. Manage storage of and release from San Joaquin river tributaries to ensure the duration of cool temperatures are supportive of spawning, egg survival, and rearing of juvenile salmonids. No specific streams/reservoirs noted.	Not stated.				
Spring-run	Habitat degradation and loss	1.11.4.1 Implement the San Joaquin Settlement Agreement (San Joaquin River from Friant Dam to confluence with Merced River). ► Implement interim and long-term settlement flows ► Develop and implement a spring-run Chinook salmon reintroduction strategy ► Construct channel modifications to increase the channel capacity from 475 cfs to 4,500 cfs ► Minimize entrainment and fish losses to non-viable migration pathways: • Screen Arroyo Canal • Retrofit Sack Dam to ensure unimpeded fish passage • Construct Mendota Pool Bypass • Fill and isolate high priority gravel pits • Implement temporary barriers at Mud and Salt sloughs	CDFG, DWR, NMFS, Reclamation, USFWS	Salmonids	Water diversions	Action 2. Screen all diversions to protect all life history stages of anadromous fish on the San Joaquin River system including Merced, Tuolumne, and Stanislaus rivers. No specific sites noted.	Not stated.	Chinook salmon	San Joaquin River	Action 1. Coordinate with CDFG and others and acquire water from willing sellers consistent with applicable guidelines as needed to implement a flow schedule that improves conditions for all life history stages of Chinook salmon migrating through, or rearing in the San Joaquin River.	River and tributary water managers and diverters, CDFG, SWRCB, USFWS, USBR
								Anadromous fish	Calaveras River	Action 4. Screen all diversions on the Calaveras River to protect all life history stages of anadromous fish.	Diverters, CDFG, DWR, USFWS, NMFS, USBR
								Anadromous fish	Merced River	Action 4. Screen all diversions on the Merced River to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, DWR
								Anadromous fish	Tuolumne River	Action 4. Screen all diversions on the Tuolumne River to protect all life history stages of anadromous fish.	Diverters, Lower Tuolumne River TAC, USFWS, USBR, NMFS, CDFG, DWR
								Anadromous fish	Stanislaus River	Action 4. Screen all diversions on the Stanislaus River to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, DWR

Appendix E
Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the San Joaquin River watershed (i.e., headwaters to Mokelumne River confluence).

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Juvenile Chinook salmon	San Joaquin River	Action 3. Reduce or eliminate entrainment of juvenile Chinook salmon at Banta-Carbona, West Stanislaus, Patterson, and El Soyo diversions on the San Joaquin River by implementing the Anadromous Fish Screen Program in conjunction with other programs.	Diverters, USFWS, USBR, NMFS, CDFG, DWR
								Juvenile Chinook salmon	San Joaquin River	Action 4. Reduce or eliminate entrainment of juvenile Chinook salmon at smaller riparian umps and diversions on the mainstem San Joaquin River.	Diverters, USFWS, USBR, NMFS, CDFG, DWR
				Chinook salmon Steelhead	Streamflows	Action 1. Continue stream gages/real-time flow monitoring with the San Joaquin River system including Merced, Tuolumne, and Stanislaus rivers.	Not stated.				
				Fall-run	Streamflows	Action 2. Continue to assist the SWRCB to develop flow standards that allow adequate and consistent instream flows within the San Joaquin River watershed including Merced, Tuolumne, and Stanislaus rivers during key fall-run Chinook salmon life stages.	SWRCB Other parties not stated.				
				Chinook salmon Steelhead	Streamflows	Action 3. Increase instream flow by purchasing water from willing sellers or providing alternative sources of water to diverters during important fish passage periods in spring and fall. No specific streams noted.	Not stated.	Chinook salmon	Calaveras River	Action 1. Supplement flows in the Calaveras River with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of Chinook salmon.	Calaveras County Water District, Stockton East Water District, CDFG, ACOE, USFWS, USBR
								Chinook salmon	Merced River	Action 1. In the Merced River supplement flows provided pursuant to the Davis-Grunsky Contract Number D-GGR17 and FERC License Number 2179 with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life history stages of Chinook salmon.	Merced Irrigation District, Diverters, CDFG, DWR, USFWS, USBR

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Comparison of actions identified by federal and state agencies to recover listed Central Valley salmonids in the San Joaquin River watershed (i.e., headwaters to Mokelumne River confluence).

NMFS (2009)				CDFG (2011)				USFWS			
Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Chinook salmon	Tuolumne River	Action 1. Implement a flow schedule for the Tuolumne River as specified in the terms of the FERC order for the New Don Pedro Project. Supplement FERC agreement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life history stages of Chinook salmon.	City and County of San Francisco, Turlock Irrigation District, Modesto Irrigation District, Lower Tuolumne River TAC, FERC, USFWS, USBR
								Not stated.	Stanislaus River	Action 1. Implement an interim Stanislaus River regulation plan that meets the [flow scheduled listed] by supplementing the 1987 agreement between USBR and CDFG, through reoperation of New Melones Dam, use of (b)(2) water, and acquisition of water from willing sellers as needed.	CDFG, USFWS, USBR, Oakdale Irrigation District, South San Joaquin Irrigation District, Stockton East Water District, Central San Joaquin Water Conservation District, South Delta Water Agency, ACOE
								Not stated.	Merced River	Action 2. Reduce adverse effects of rapid flow fluctuations in the Merced River.	Merced Irrigation District, CDFG, USFWS, USBR
								Salmonids	Merced River	Action 3. Improve Merced River watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel.	Landowners, Merced County, NRCS, CDFG, USFWS, USBR
								Not stated.	Merced River	Action 5. Establish a streamwatch program for the Merced River to increase public participation in river management.	Public, CDFG, USFWS
								Juvenile Chinook	Merced River	Evaluation 2. Evaluate and implement actions to reduce predation on juvenile Chinook salmon, including actions to isolate ponded sections of the Merced River.	CDFG, USFWS, USBR

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Chinook salmon Steelhead	Merced River	Evaluation 3. Evaluate fall pulse flows in the Merced River for attraction and passage benefits to Chinook salmon and steelhead.	Dam operators, CDFG, USFWS, USBR
								Salmonids	Tuolumne River	Action 2. Improve Tuolumne River watershed management and restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel and performing an integrated evaluation of biological and geomorphic processes.	Landowners, NRCS, CDFG, USFWS, USBR, Lower Tuolumne River TAC
								Noted stated.	Tuolumne River	Action 5. Establish a streamwatch program for the Tuolumne River to increase public participation in river management.	Public, Lower Tuolumne River RAC, CDFG, USFWS
								Not stated.	Tuolumne River	Action 6. Coordinate the AFRP with appropriate activities supported by the Riparian and Recreation Improvement Fund that was established by the New Don Pedro Settlement Agreement.	Lower Tuolumne River TAC, USFWS, USBR
								Juvenile Chinook	Tuolumne River	Evaluation 2. Evaluate and implement actions to reduce predation on juvenile Chinook salmon, including actions to isolate ponded sections of the Tuolumne River.	TID, MID, Lower Tuolumne River TAC, CDFG, USFWS, USBR
								Chinook salmon	Tuolumne River	Evaluation 3. Evaluate the effects of flow fluctuations in the Tuolumne River established by the guidelines of the FERC Settlement Agreement on spawning, incubation, and rearing of Chinook salmon, and if substantial adverse effects are indicated, modify guidelines to reduce effects.	Diverters, Hydropower operators, Lower Tuolumne River TAC, CDFG, USFWS, USBR
								Chinook salmon Steelhead	Tuolumne River	Evaluation 4. Evaluate fall pulse flows in the Tuolumne River for attraction and passage benefits to Chinook salmon and steelhead.	Diverters, Hydropower operators, Lower Tuolumne River TAC, CDFG, USFWS, USBR
								Salmonids	Stanislaus River	Action 2. Improve Stanislaus River watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel.	Landowners, CDFG, NRCS, ACOE, USFWS, USBR

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Juvenile Chinook	Stanislaus River	Evaluation 2. Evaluate and implement actions to reduce predation on juvenile Chinook salmon, including actions to isolate ponded sections of the Stanislaus River.	CDFG, USFWS, USBR, ACOE
								Chinook salmon	Stanislaus River	Evaluation 4. Develop a carryover storage target for New Melones Reservoir to ensure Vernalis flow standards are met during the 30-day pulse flow period during the third year of a dry or critical period.	USFWS, USBR, CDFG, Stockton East Water District
								Chinook salmon Steelhead	Stanislaus River	Evaluation 6. Evaluate fall pulse flows in the Stanislaus River for attraction and passage benefits to Chinook salmon and steelhead.	USFWS, USBR, CDFG, ACOE, Stockton East Water District
								Not stated.	San Joaquin River	Action 6. Establish a San Joaquin River basin-wide conjunctive use program.	River and tributary water managers and diverters, CDFG, DWR, USBR, USFWS
								Not stated.	San Joaquin River	Evaluation 1. Identify and implement actions to improve watershed management in the San Joaquin River watershed to restore and protect instream and riparian habitat.	Landowners, CDFG
								Chinook salmon	San Joaquin River and Delta	Evaluation 2. Identify and implement actions to maintain suitable water temperatures or minimize length of exposure to unsuitable water temperatures for all life stages of Chinook salmon in the San Joaquin River and Delta.	River and tributary water managers and diverters, CDFG,USFWS, USBR
								Juvenile Chinook salmon	San Joaquin River	Evaluation 3. Identify and implement actions to reduce predation on juvenile Chinook salmon in the San Joaquin River.	CDFG, USFWS

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Anadromous fish	San Joaquin River	Evaluation 6. Evaluate the potential to develop and implement a strategy of coordinating a variety of specific actions, such as coincident pulse flows on San Joaquin River tributaries, reduced Delta exports, hatchery releases, and gravel cleaning to stimulate outmigration and reduce predation and entrainment.	River and tributary water managers and diverters, CDFG,USFWS, USBR
								Steelhead	San Joaquin River	Evaluation 7. Identify, evaluate the need for, and, if needed, attempt to maintain adequate flows in the San Joaquin River for migration of steelhead, consistent with efforts to maintain adequate flows for Chinook salmon.	River and tributary water managers and diverters, CDFG,USFWS, USBR
				Native fishes	Natural floodplains and flood processes	Action 1. Support SWRCB's efforts to establish flow requirements that provide sufficient flows to inundate floodplains during critical later winter and early spring periods. No specific streams/sites noted.	SWRCB Other parties not stated.				
				Native fishes	Natural floodplains and flood processes	Action 2. Floodplains should be reestablished by settling flow requirements, constructing setback levees, and removing other obstacles. No specific streams/sites noted.	Not stated.				
				Native fishes	Natural floodplains and flood processes	Action 3. Pursue opportunities to allow reconnection of historic floodplain, with minimal impacts to private property. No specific streams/sites noted.	Not stated.				
				Salmonids	Riparian and riverine aquatic habitat	Action 1. Coordinate with other programs such as San Joaquin River Restoration Program and DWR's FloodSafe program to aide in the restoration of functional riparian corridors and to reestablished floodplains. Presumably the San Joaquin River. Other streams not noted.	DWR Other parities not stated.				

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
				Salmonids	Riparian and riverine aquatic habitat	Action 2. Acquire title or easements for river corridor meander zones on appropriate rivers and streams. No specific streams noted.	Not stated.				
				Salmonids	Riparian and riverine aquatic habitat	Action 3. Purchase streambank conservation easements from willing sellers or establish voluntary incentive programs to improve salmonid habitat and instream cover. No specific streams noted.	Not stated.				
				Salmonids	Riparian and riverine aquatic habitat	Action 4. Remove small, non-essential dams on gravel-rich streams. No specifics noted.	Not stated.				
				Salmonids	Water diversions	Action 1. Identify diversions within the San Joaquin River system in need of improved screens. No specifics noted.	Not stated.				
				Salmonids	Water diversions	Action 2. Screen all diversions to protect all life history stages of anadromous fish on the San Joaquin River system including Merced, Tuolumne, and Stanislaus rivers. No specific sites noted.	Not stated.				
				Salmonids	Water diversions	Action 3. Fund studies determining the effectiveness of different mechanical and operational solutions of screened diversions. No specific streams/sites noted.	Not stated.				
				Salmonids	Water diversions	Action 4. Construct or improve the fish bypasses at identified water diversions. No specific streams/sites noted.	Not stated.				
				Anadromous fishes	Water temperature	Action 1. Maintain water temperatures in the San Joaquin River and its tributaries that are beneficial to anadromous fish species. No specific streams/sites noted. Actions 1 and 2 duplicate the more specific Action 3.	Not stated.	Chinook salmon	Merced River	Evaluation 1. Identify and implement actions to provide suitable water temperatures in the Merced River for all life stages of Chinook salmon; establish maximum temperature objectives of 56°F from October 15 to February 15 for incubation and 65°F from April 1 to May 31 for juvenile emigration.	Dam operators, CDFG, USFWS, USBR

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Species Benefited	**Threat Category**	**Priority 1 Recovery Actions**	**Involved Parties**	**Species Benefited**	**Ecosystem Processes**	**Stage 2 Actions**	**Involved Parties**	**Species Benefited**	**Geographic Location**	**Restoration Actions/Evaluations**	**Involved Parties**
								Chinook salmon	Tuolumne River	Evaluation 1. Identify and implement actions to provide suitable water temperatures in the Tuolumne River for all life stages of Chinook salmon; establish maximum temperature objectives of 56°F from October 15 to February 15 for incubation and 65°F from April 1 to May 31 for juvenile emigration.	Dam operators, CDFG, USFWS, USBR, Lower Tuolumne River TAC
								Chinook salmon	Stanislaus River	Evaluation 1. Identify and implement actions to provide suitable water temperatures in the Tuolumne River for all life stages of Chinook salmon; establish maximum temperature objectives of 56°F from October 15 to February 15 for incubation and 65°F from April 1 to May 31 for juvenile emigration.	Dam operators, CDFG, USFWS, USBR, ACOE
				Steelhead	Steelhead	Action 1. Identify and fund projects increasing the understanding of the status of steelhead within the San Joaquin River watershed. No specific projects noted.	Not stated.				
				Steelhead	Steelhead	Action 2. Identify and fund projects monitoring steelhead population trends within the San Joaquin River watershed. No specific projects noted.	Not stated.				
				Chinook salmon	Chinook salmon	Action 2. Continue monitoring individual species' status and trends using new and existing data sets. No streams/sites noted.	Not stated.				
				Chinook salmon	Chinook salmon	Action 3. To the extent possible, limit interaction between wild and hatchery-reared fish. No specifics provided.	Not stated.				