


CVPIA

ANNUAL REPORT FOR FISCAL YEAR 2005

Implementation of the Central Valley Project Improvement Act

Annual Report for Fiscal Year 2005

U.S. Department of the Interior
Fish and Wildlife Service
Bureau of Reclamation

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INTRODUCTION

In one of its last actions of the session, the 102nd Congress in 1992 passed, and the President signed, the multi-purpose water legislation known as the Central Valley Project Improvement Act (CVPIA or Act). Officially designated Title 34 of Public Law 102-575, this landmark piece of legislation mandates changes in the purposes and management of the Bureau of Reclamation's (Reclamation) Central Valley Project (CVP) and specifically focused the Secretary of the Department of the Interior (Interior) on the protection, restoration and enhancement of fish and wildlife associated with the CVP. The Secretary, in turn, assigned primary responsibility for implementing CVPIA's many provisions to Reclamation and the U.S. Fish and Wildlife Service (Service), both agencies of Interior.

Since 1992, Reclamation and the Service have worked to meet the challenges that the CVPIA presents. Its implementation has been afforded highest priority and major strides have been made in accomplishing the mandate that Congress provided. Many of the Act's provisions have been completed and most of the others are well under way. More than $831.2 million of Federal, State, and private funds have been obligated in accomplishing the CVPIA's mandates.

This report is a summary of the actions taken by Reclamation and Service personnel, working with other Federal agencies, the State of California (State), and numerous partners and stakeholders during fiscal year (FY) 2005.

If greater detail on the programs and projects described in this report or on the progress towards achieving the Act's goals and objectives is desired, please directly contact either Reclamation or the Service, or the individual CVPIA project and program managers.

The Central Valley Project's Role in California's Water Resources

For 72 years, California has depended on the CVP for a large part of its water needs, particularly for agriculture. With a climate typified by extremely variable precipitation, both temporally and regionally, the State relies heavily on dams and reservoirs to balance and manage its water resources, and on an extensive distribution system to convey water supplies for regional needs.

Much of the State's water originates in the north and is conveyed southward, primarily through the Sacramento River system. Some water is diverted along the way, and the rest flows into the Sacramento-San Joaquin River Delta (Delta), where CVP water co-mingles with other supplies such as those of the State Water Project (SWP). A portion of the water entering the Delta is pumped south: the remainder discharges to the San Francisco Bay and Pacific Ocean. Because of the way water is captured and moved through the Central Valley system, the CVP affects, and is affected by, many unresolved water issues involving ecosystem balance in California's river systems and the Delta.

The sensitive ecosystems of the Central Valley, Delta estuary, San Francisco Bay, and Trinity River are affected by water diversions, particularly in drought years, so much so that the courts have intervened to ensure that adequate fresh water enters these systems. Compliance with the Endangered Species Act (ESA) and water quality mandates requires water releases from CVP dams to regulate water temperatures, salinity, and instream flows, and limits water diversions to protect listed fish from the effects of pumping water at the Tracy Pumping Plant in the Delta.

These factors have greatly increased the competition for existing water supplies and have focused scrutiny on the ways that water resources are being used.

Environmental conditions have greatly changed since the CVP was authorized in 1935. Population growth and development have increased farm, urban, and industrial water demands. Concurrently, populations of fish and wildlife have declined, resulting in some species being listed as endangered or threatened due to severe habitat loss. In response, a new imperative for resource management and ecological stewardship has evolved.

The CVPIA Mandate

The intent of Congress in passing the CVPIA is provided in Section 3402. Congress, recognizing the importance of the CVP in California's water resources picture, made significant changes in the policies and administration of the project – more than any other legislation in the CVP's 70+-year history. The Act also redefined the CVP's purposes and identified several specific goals and objectives for Interior.

Purposes of the CVPIA (Section 3402)

(a) to protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California;

(b) to address impacts of the Central Valley Project on fish, wildlife, and associated habitats;

(c) to improve the operational flexibility of the Central Valley Project;

(d) to increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation;

(e) to contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and

(f) to achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial, and power contractors

To achieve the CVPIA's purposes, a large number of provisions were incorporated into the statute. These include specific programs, measures, and operational and management directives, all to be implemented consistent with the requirements of California and Federal law. These provisions deal with water contracts, improved water management, restoration of anadromous fish populations, water supplies for State and Federal refuges and wildlife habitat areas, mitigation for other CVP-impacted fish and wildlife, and retirement of drainage-impaired agricultural lands. They also provide for system-wide modeling, numerous investigations and studies, and monitoring to assess the biological results and effectiveness of CVPIA actions. To help implement these measures, the Act provided for a Restoration Fund, established from fees paid by those who have benefited from the CVP's water and power supplies.

The CVP and other water projects have helped make the Central Valley the richest agricultural region in the nation and support the largest population of any state in the nation. California leads the nation in water use, both surface water and groundwater. The ability to develop and use this precious resource has been a boon to the economy of the State, but has also come at a great price to the natural environment. The CVPIA has afforded Interior a prime opportunity to help restore conditions favorable for fish and wildlife in the Central Valley, while providing for the continuation of its rich agricultural heritage and service to municipal and industrial users throughout the State.

IMPLEMENTING THE CVPIA

Process

Upon the CVPIA's passage, Reclamation and the Service immediately focused on three main fish and wildlife restoration initiatives identified in the Act. One of the most ambitious of these was to "… implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991…" (anadromous fish doubling goal). The anadromous fish doubling goal pertains to Chinook salmon, steelhead, striped bass, American shad, and sturgeon, which are believed to have been affected by CVP construction and operation. The process to identify reasonable anadromous fish restoration actions was defined by the Anadromous Fish Restoration Program (AFRP) in the *Final Restoration Plan for the Anadromous Fish Restoration Program* (USFWS 2001) (AFRP Restoration Plan).

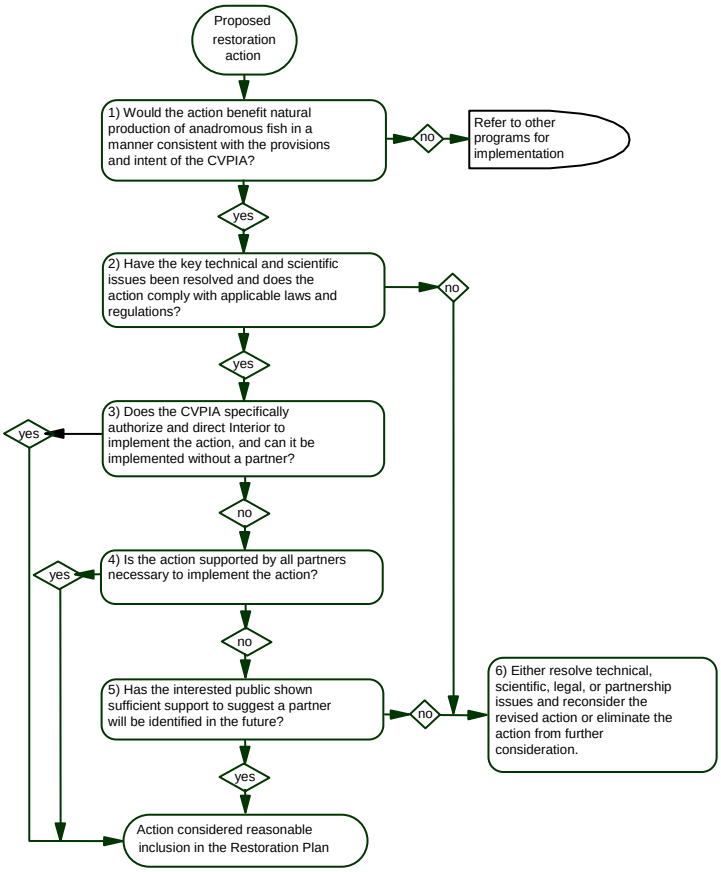


Figure 1. Process to identify reasonable restoration actions.

Actions contained within the AFRP Restoration Plan were determined to be reasonable given numerous technical, legal, and implementation considerations. The diagrammatic explanation (Figure 1) is excerpted from the AFRP Restoration Plan and depicts the process used to determine if actions were reasonable.

Another restoration initiative was to supply much-needed water to Federal and State refuges and other migratory waterfowl habitats in the Central Valley. The third was to address other adverse environmental impacts of the CVP – impacts not previously offset or specifically covered in other provisions of the Act. At the same time, Interior reaffirmed its commitment to improving the operational flexibility of the CVP in order to more effectively balance and meet the many competing demands for project water supplies, including environmental, agricultural, municipal and industrial, and power generation needs.

Procedural policies and guidelines also were developed for implementing the Act's specific provisions. Actions proposed for implementation under the CVPIA are prioritized on an annual basis. Any action undertaken to implement the Act must be designed to contribute to the attainment of CVPIA goals, while providing the greatest public benefit and minimizing adverse impacts to other CVP beneficial uses. Great emphasis is placed on forming partnerships and coordinating with other restoration efforts planned or already underway throughout the Central

Valley. Stakeholders and the public are to be fully involved and kept informed. Another key procedural objective is to use the funds available in a cost-effective manner.

Most of the programs established to address specific CVPIA provisions had the same initial steps in common. All required an administrative structure, opportunity for public and stakeholder involvement, and coordination with potential partners to develop program plans. Compliance with applicable State and Federal laws before initiating action was essential. There were large differences in the amount of time and effort required to complete these steps for the various programs, primarily dependent upon the relative complexity of issues and degree of public interest or controversy. For some provisions of the Act, plans were developed and implemented within the first year while, for others, plans are still being completed.

For planning and budgeting purposes, we have classified all CVPIA actions into one of eight action categories. These categories are used to summarize our activities in CVPIA reports, in discussions with the public and stakeholders, many who are interested in only certain facets of CVPIA implementation, and in coordinating with potential partners with interests in specific topic areas. Most of these eight categories involve several individual programs and related actions.

CVPIA Action Categories

- Administrative Processes
- Contracting and Improved Water Management
- Anadromous Fish – Habitat Restoration
- Anadromous Fish – Structural Measures
- Refuges and Waterfowl
- Other Fish and Wildlife Resources
- Studies, Investigations, and Modeling
- Monitoring

Priorities

Several factors are considered in establishing priorities for CVPIA actions. These include the importance of the action to achieving CVPIA program goals; its readiness or the amount of additional planning needed to implement the action; its cost effectiveness; and the availability of funding. Many provisions of the Act require plans or studies prior to taking action. In addition, administrative requirements, such as compliance with various State and Federal laws, must be undertaken before measures can be implemented. Finally, because the Act had specific compliance dates for some provisions, implementation was responsive to the prescribed dates.

Most of the CVPIA's provisions, however, have allowed us the discretion to implement in a purposeful, proactive manner those measures and programs deemed most important, most urgent, or that would result in the greatest or most immediate benefit. This is especially true for the Act's fish and wildlife provisions. To help prioritize our efforts for fish and wildlife over the short-term, we have used a biological "focus area" approach that takes into account three parameters:

1. Species or populations of greatest concern;

2. Controllable factors that have the greatest influence on these species or populations; and

3. Geographic areas or habitats in most critical need of help for the priority species and/or for the greatest number of species.

Other biological considerations and principles applied in our implementation of the CVPIA include the emphasis in the Act itself on restoration of natural habitat components and ecosystem function and viability. Another is the emphasis on "focused packages" (suites of actions similar

in nature in a specific geographic area) of projects to maximize and accelerate biological benefits in key geographic areas or watersheds instead of implementing measures in a scattered fashion over a wide geographic area. Critical non-biological principles include the technical feasibility and readiness of measures for implementation, and the support and availability of partners and funding to implement certain measures.

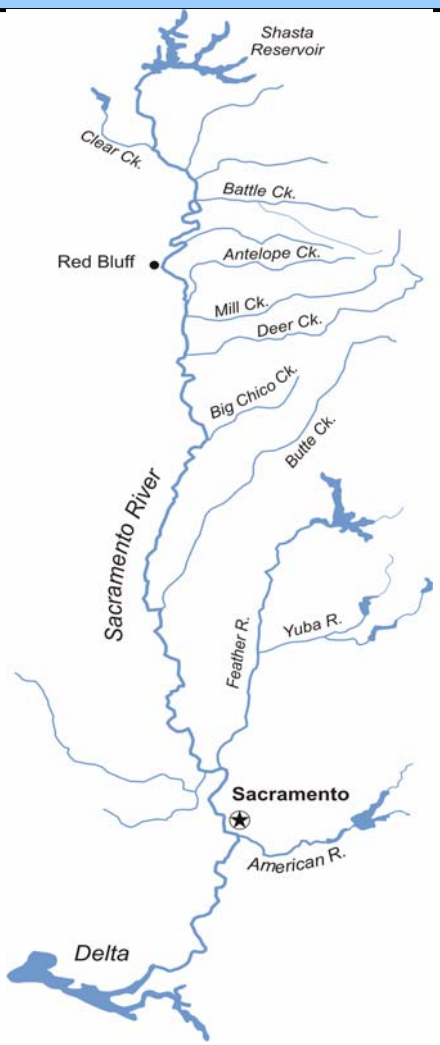
The Focus and Priorities for Anadromous Fish

Species of Anadromous Fish to be Restored Under CVPIA

- Chinook salmon (all races)
- Steelhead
- Striped bass
- American shad
- White sturgeon
- Green sturgeon

The CVPIA [Section 3406(b)(1)] directed us to develop and implement a program that makes all reasonable efforts to double, by the year 2002, the "natural" production of six species of anadromous fish in Central Valley rivers and streams over average levels that existed between 1967 and 1991. The majority of the other measures and programs in Section 3406(b) were intended to contribute to that effort.

Using the biological focus approach, the Delta has been determined to be one of the highest priority geographical areas for anadromous fish. The Delta has been highly altered by water resource development projects and operations. Still, all species and races of anadromous fish must pass through the Delta, both as adults moving upstream and as juveniles on their way to San Francisco Bay and the open ocean. In doing so, they pass close to, and are greatly affected by, the operation of water supply project facilities. The opportunity for implementing measures in the Delta with widespread beneficial effects for all anadromous fish is tremendous. Emphasis there has been on increasing streamflows and reducing water diversions during peak periods in the out-migration of juvenile anadromous salmonids and when other threatened or endangered species, such as the delta smelt, are in the vicinity of the diversion pumps. Other operational changes and structural measures to enhance conditions during out-migration are also being employed.



The east-side tributaries of the Sacramento River are another major focus area for anadromous fish, in particular, Butte, Deer, and Mill Creeks and, to a lesser extent, Big Chico Creek. These streams support the last significant runs of the threatened spring-run Chinook salmon. Once the most numerous race in the valley, the spring-run had dwindled to less than 2,000 fish in 1991. Dams have blocked access to the headwater areas of streams that once constituted their natural habitats, and flows needed to provide pools of cool water for them to survive over the summer have been diverted (they migrate into the streams in spring and delay spawning until the fall). Restoration actions on these streams have emphasized the acquisition of water for instream

flow, laddering or removal of dams and other impediments to migration, screening or removal of diversions, and acquisition and restoration of riparian habitats that shade the stream channel from solar heating and provide woody debris and nutrients to the aquatic ecosystem.

Other Sacramento River tributaries, most notably Battle Creek, Clear Creek, Antelope Creek, and the Yuba River, have also been targeted for restoration efforts. Along with Deer, Mill, and Butte Creeks, these streams support naturally spawning populations of steelhead, another listed threatened species. Juveniles of this species generally spend a year or more in their natal streams. Consequently, they are subject to many of the same limiting factors as the spring-run Chinook salmon, most notably the need to access the cooler upper reaches of streams and adequate supplies of water during the summer. Restoration efforts on these streams have focused on the same types of measures as for the spring-run Chinook on Butte, Deer, and Mill Creeks.

The Focus and Priorities for Refuges and Waterfowl

With the decline of natural wetlands in the Central Valley, wildlife specialists have been forced to intensively manage the remaining 300-400 thousand acres of wetlands to accommodate the millions of wintering waterfowl, shorebirds, and other wildlife that depend on wetlands for survival. This has entailed careful management of limited and uncertain water supplies to provide for only the most critical of needs for a limited number of species. Some very difficult trade-offs of one species for another was the rule rather than the exception.

Central Valley Refuge Areas Receiving CVPIA Water

- Sacramento National Wildlife Refuge
- Delevan National Wildlife Refuge
- Colusa National Wildlife Refuge
- Sutter National Wildlife Refuge
- Gray Lodge Wildlife Area
- North Grasslands Wildlife Area
- San Luis National Wildlife Refuge
- Volta Wildlife Area
- Merced National Wildlife Refuge
- Los Banos Wildlife Area
- Grassland Resource Conservation District
- Mendota Wildlife Area
- Pixley National Wildlife Refuge
- Kern National Wildlife Refuge

With the CVPIA's passage, we were directed to make available the water supply needed for full habitat development at specific Central Valley State and Federal refuges and private wetland areas. A base level of supply (referred to as Level 2 supplies) was made available immediately; the remaining portions of their full supply (referred to as Level 4 supplies) were to be made available in 10 percent increments over 10 years. The total amount of water to be supplied annually to the 14 refuge units is approximately 560,000 acre-feet (af), with limited reductions under certain hydrologic circumstances. CVPIA's increased refuge water supplies will enable managers to enhance existing habitats, expand their wetland base, and provide increased benefits to a greater number of wetland-dependent species.

The amounts of water to be supplied and the schedule for delivery were prescribed in the Act. In several instances, however, facilities to convey the requisite water supplies to the various wetland units were not in place. Consequently, the primary focus in the Refuge Water Supply Program has been to develop the necessary conveyance capacity, independently or through agreements

with other parties, and to acquire the water to meet the prescribed needs.

In addition, a program was implemented to provide incentives to farmers to keep agricultural fields flooded during the winter months to provide greater amounts of habitat and increased food availability. Dubbed the Agricultural Waterfowl Incentives Program, it provided tremendous benefits at relatively low costs per acre by providing supplemental habitat and an expanded food base, helping to reduce disease by spreading birds out over a wider area. The primary focus was on fields with crops leaving waste grain, primarily in the Sacramento Valley. Unfortunately, this program, with its conjunctive use of lands for agriculture and waterfowl, has expired.

The Focus and Priorities for Other Fish and Wildlife and Associated Habitats

The CVPIA directs us to make all reasonable efforts to address the environmental impacts of the CVP that are not specifically dealt with in other provisions of the Act. However, identifying the impacts of the CVP some 50 years after it was initiated is problematic at best, especially for those indirect effects that were realized in the CVP service area. Our approach has been to initiate a habitat trends analysis to be used as one of several tools to determine what habitats, and consequently what species, experienced the greatest reductions over the last half-century in areas affected by CVP operations or water service. In the interim, while the data are gathered and analyzed, the focus of our efforts has been on habitat protection and restoration for those species in the CVP operations and service area that are in greatest need of assistance, primarily species listed as threatened or endangered that are not addressed in other provisions of the CVPIA, some of which are on the verge of extinction. Emphasis has been on habitat acquisition for protection and restoration of species such as the riparian brush rabbit, giant garter snake, vernal pool invertebrates, and San Joaquin Valley floor species like the San Joaquin kit fox, blunt-nosed leopard lizard, and several listed species of kangaroo rats. Concurrently, the CVPIA Land Retirement Program is acquiring land which, when retired from irrigated agriculture and restored or allowed to revert to natural conditions, will provide habitat for many of these same species.

Coordination

Cooperation through partnerships with others is essential to the CVPIA's success. We have developed many partnerships and extensive coordination linkages with local, State, and Federal agencies and private groups. These partnerships are with many previously existing programs, as well as with programs and groups formed specifically to carry out CVPIA mandates. CVPIA implementation is closely coordinated with existing and ongoing restoration efforts such as the State of California's efforts to restore salmon and steelhead populations, the State Water Resources Control Board's (SWRCB) Water Quality Control Plan for the Delta, and the CALFED Bay-Delta Program's (CALFED) Ecosystem Restoration Program (ERP). In addition, most CVPIA restoration actions are developed and/or implemented in conjunction with local interest groups, many formed specifically for the purpose.

Coordination with the ERP is particularly important. Many of their actions have the same or similar objectives and address the same natural resource and water management problems as the

CVPIA. Close coordination and a focus on functional integration of both programs have helped us to achieve common goals and avoid duplication. An example of this coordination is Interior's willingness and effort to have ERP scientists provide "expert level" review and comment on proposed CVPIA programs and actions. This review is expected to lead to a more broad-based ecosystem management strategy that more effectively addresses fish and wildlife mitigation, restoration, and enhancement, and assists in the selection of worthy projects

We have also encouraged the ERP and other potential partners to enter into cooperative relationships to implement appropriate CVPIA measures or to help achieve CVPIA goals and objectives through their own programs. Frequently, Interior will provide funds and services to these partners for them to undertake pre-approved restoration actions that help to attain CVPIA goals. At other times, funds from these other programs or partners are used to implement measures identified by CVPIA. Regardless of who implements which measures, Interior first assures that CVPIA funds are used only to meet CVPIA goals and objectives. Additionally, implementation of the CVPIA has routinely involved the CVP water and power users and other interested parties, including the discussion of priorities and efficient use of funds.

Funding Sources

Implementation of the prescribed actions and programs of the CVPIA through the first 13 years (1993–2005) has cost approximately $831.2 million. Many of the measures implemented pursuant to the CVPIA were already being planned or in progress at the time the Act was passed and a large portion of these expenditures would have occurred even in the absence of the CVPIA. These include the Shasta Temperature Control Device ($84 million to implement, but saving $5 million per year in lost power generation), Glenn-Colusa Irrigation District Fish Screen Project ($43 million), rehabilitation of Coleman National Fish Hatchery ($22 million), and fixing the fish passage problems at Red Bluff Diversion Dam (RBDD) ($42 million) and Tracy and Contra Costa Canal Pumping plants ($22 million). Other efforts, however, such as the AFRP, Clear Creek Restoration Program, Spawning Gravel Replenishment Program, Anadromous Fish Screen Program (AFSP), Refuge Water Supply Program, and the Comprehensive Assessment and Monitoring Program (CAMP) became realities only because of CVPIA-provided funding.

Most of the $831.2 million spent thus far has come from the Restoration Fund that was established in accordance with CVPIA Section 3407. These funds are derived from fees paid by the beneficiaries of the CVP's water and power supplies. The rest of the monies came from Reclamation's Water and Related Resources appropriations, from contributions provided by the State of California, and from donated funds.

For FY 2005, $54.6 million was appropriated in the Restoration Fund for the various CVPIA programs and actions.

Since its inception more than eight years ago, the ERP facilitated funding for a variety of projects contributing to ecosystem restoration within its geographic scope. The ERP is designed to maintain, improve, and increase aquatic and terrestrial habitats and improve ecological functions in the San Francisco Bay and Sacramento-San Joaquin Delta (Bay-Delta) to support sustainable populations of diverse and valuable plant and animal species. Most of the ERP's goals and geographic scope overlap with CVPIA goals. Thus, CALFED agencies have established a "Single Blueprint" for restoration and species recovery within the geographic scope of the ERP.

The Single Blueprint requires CALFED to integrate with numerous programs. With respect to CVPIA, there is much coordination amongst the Anadromous Fish Restoration Program, Anadromous Fish Screen Program, Dedicated CVP Water for Environmental Purposes, Clear

Creek Program, Gravel Replenishment Program, and to a lesser extent, the Habitat Restoration Program. The Single Blueprint approach helps ensure coordination and integration, not only within the Bay-Delta Program, but between all resource management, conservation, and regulatory activities affecting the Bay-Delta system. As a result, many CVPIA projects receive leverage funding from the ERP program.

Figures 2 and 3 show the obligations by fund source; Figure 2 for FY 2005 and Figure 3 for the 13-year period since FY 1993. The largest portion of the monies obligated since 1993 have been spent on anadromous fish restoration-related structural measures, such as the Shasta Temperature Control Device and the Glenn-Colusa Irrigation District Fish Screen Project. These projects benefit the water and power users as well as anadromous fish. Large amounts were also obligated to habitat restoration measures for anadromous fish, measures believed necessary to help achieve our anadromous fish doubling goal, and on acquiring and providing water for refuges. Figures 4 and 5, respectively, show the total distribution of these obligations among action categories for FY 2005 and the entire FY 1993-2005 periods.

FIGURE 2
CVPIA OBLIGATIONS BY FUND SOURCE
Fiscal Year 2005

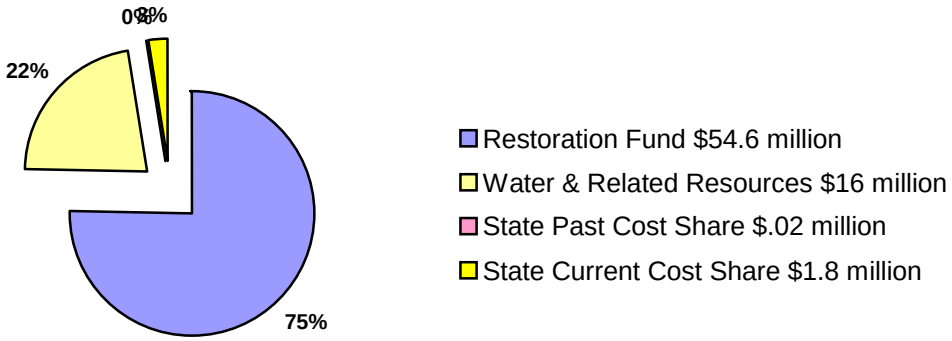


FIGURE 3
CVPIA OBLIGATIONS BY FUND SOURCE
Fiscal Years 1993-2005

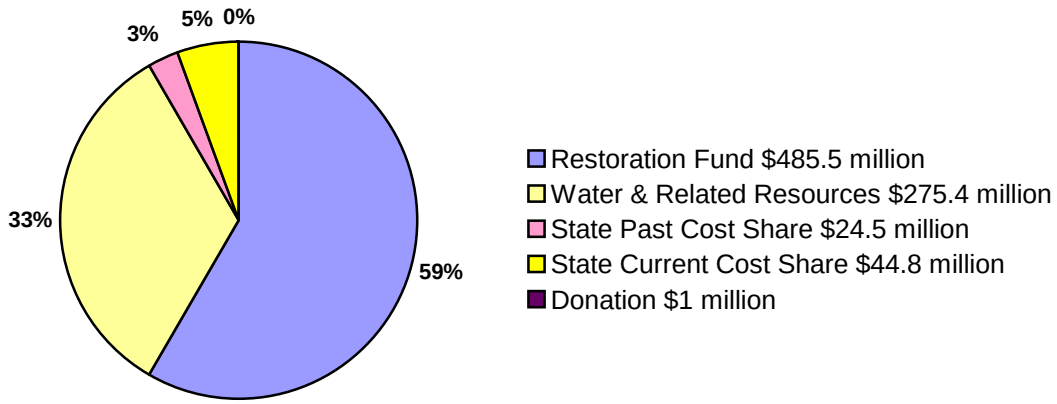


FIGURE 4
CVPIA OBLIGATIONS BY ACTION CATEGORY
Fiscal Year 2005

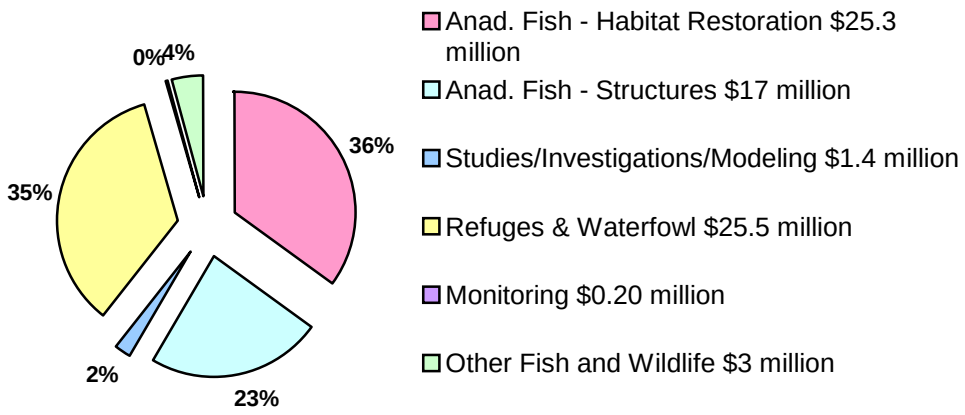
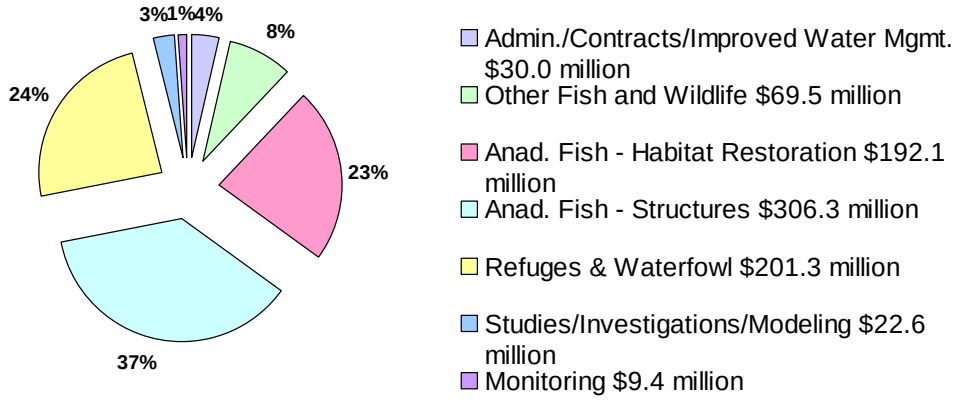


FIGURE 5
TOTAL CVPIA OBLIGATIONS BY ACTION CATEGORY
Fiscal Years 1993-2005



FISCAL YEAR 2005 ACCOMPLISHMENTS AND RESTORATION FUND DOLLARS OBLIGATED

Since passage of the CVPIA, Reclamation and the Service, with assistance of the State and the cooperation of many partners, have completed many of the provisions of the Act, including many of the administrative requirements, water management and operational changes, and contracting and water conservation measures. Many studies and investigations have been undertaken and completed, and hundreds of measures to benefit fish and wildlife resources and improve water project operations have been implemented. The following provides a brief discussion of the status of CVPIA programs and a general overview of our activities and accomplishments specifically in FY 2005.

Project Title: Anadromous Fish Restoration Program
CVPIA Section 3406(b)(1)
FY 2005 Funding: $ 3,722,303
FY 2005 Accomplishments (AFRP Program Overview):

Passage of the CVPIA led to establishment of the Anadromous Fish Restoration Program (AFRP) and directed Interior to include all reasonable efforts to at least double the natural production, on a sustainable long-term basis, of six species of anadromous fish in Central Valley rivers and streams over levels that existed during the 1967-1991 period. Anadromous fish are those species that are born in freshwater but migrate to saline waters as juveniles, where they spend a large portion of their lives before returning to freshwater as adults to spawn. The six species targeted by the CVPIA are Chinook salmon (four distinct races or runs), steelhead, striped bass, American shad, white sturgeon, and green sturgeon.

All actions to achieve the anadromous fish doubling goal were guided by the AFRP Restoration Plan developed by AFRP staff in coordination with experts from many agencies and stakeholder groups. The AFRP Restoration Plan, finalized in 2001 after extensive input and public review, identified six general objectives necessary to achieve the anadromous fish doubling goal:

1. Improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat;

2. Improve survival rates by reducing or eliminating entrainment of juveniles at diversions;

3. Improve the opportunity for adult fish to reach their spawning habitats in a timely manner;

4. Collect fish population, health, and habitat data to facilitate evaluation of restoration actions;

5. Integrate habitat restoration efforts with harvest and hatchery management; and

6. Involve partners in the implementation and evaluation of restoration actions.

Summary of AFRP Biological Benefits Since 1995

Environmental limiting factors

AFRP projects implemented since 1995 have addressed eight major categories of limiting factors, as identified in AFRP's *Working Paper on Restoration Needs, Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California* (AFRP Working Paper) (USFWS 1995a). The projects were defined in the AFRP Restoration Plan as reasonable (USFWS 2001:11-12) restoration actions and evaluations necessary to address limiting factors associated with anadromous fish restoration in Central Valley watersheds.

Table 1 shows the numbers and percentages of Central Valley watersheds where actions were taken and which AFRP objectives were addressed. Insufficient flow (Objective 1) is a limiting factor category associated with all Central Valley watersheds (27 CVPIA identified watersheds) (USFWS 2001) and has been partially addressed in about 41 percent of the watersheds. Adult and juvenile salmon and steelhead entrainment and passage, and stream habitat restoration are also important limiting factor categories for adult and juvenile salmon and steelhead, and were partially addressed in about 23 percent of the Central Valley watersheds. Measures that addressed limiting factor categories for insufficient flow, stream habitat restoration, spawning habitat, and erosion and sediment control are helping to meet AFRP Objective 1. Measures that addressed the adult and juvenile entrainment limiting factor category are helping to meet Objective 2. All measures that addressed the fish passage limiting factor category are helping to meet Objective 3. Measures that evaluate or improve survival, assess effects of hatchery fish on natural production, and involve partners in watershed planning are helping meet Objectives 4-6.

Project categories

The AFRP has implemented more than 150 restoration projects in nine categories, as mentioned on Table 2, in 27 watersheds, including the mainstem Sacramento and San Joaquin Rivers. Along with the Category descriptions, Table 2 also contains the percentage of watersheds where projects occurred, percentage of all projects occurring in each category, and which AFRP objectives were addressed. For example, 50 percent of the 27 watersheds have had restoration planning, 17 percent of all projects implemented to date are planning projects, and these projects addressed Objectives 1-6. The AFRP supported fish screen projects where fish screens were integrated in the fish ladder structures (mostly on the Lower Butte Creek Project).

Table 1. Numbers and percentages of Central Valley watersheds in which AFRP limiting factors have been addressed with AFRP funding, and AFRP Objectives (1-6) that were supported by the projects, since 1995.

AFRP limiting factor categories	**Number (and percent) of watersheds where actions were taken**	**AFRP objectives addressed (1-6)**
Insufficient flow	11 (41)	1
Adult and juvenile entrainment	7 (26)	2
Stream habitat restoration	6 (22)	1
Fish passage	6 (22)	3
Predation	4 (15)	1, 4
Spawning habitat	4 (15)	1, 4

Effects of hatchery fish on natural stocks	3 (11)	5
Erosion and sediment control	2 (7)	1

Overall progress toward salmon production goals in Central Valley watersheds

Progress toward addressing environmental limiting factors identified in the AFRP Working Paper and implementation of restoration actions in the AFRP Plan are summarized in Table 3. About 26 percent of all limiting factors identified in the AFRP Working Paper were addressed, and about 26 percent of AFRP Plan actions and evaluations were implemented during 1995-2005. Several restoration actions will continue in perpetuity and must be renewed seasonally (e.g., instream flows and spawning gravel), due to such things as geomorphological impediments, including high dams that intercept natural gravel recruitment.

The total estimated natural production of Central Valley Chinook salmon increased about 5 percent from the 1967-1991 baseline period (Table 3), well below the doubling goal established by CVPIA. Central Valley streams where most environmental limiting factors have been improved and restoration actions implemented, salmon production has increased about two, or more, times beyond the CVPIA doubling goal (e.g., Butte and Clear Creeks). Uncertainty remains, however, whether this short-term increase is sustainable in either creek.

With the exception of streams with hatcheries (Table 3, Column 1, footnote "i"), streams having less than or equal to 70 percent of their limiting factors addressed and less than or equal to 60 percent of their restoration actions implemented, show negative production averaging 28 percent during the 1992-2005 period.

Table 2. Relationship of AFRP funded projects to Central Valley watersheds, restoration categories, and AFRP objectives during the 1995-2005 periods.

AFRP Restoration Project Categories	Percent watersheds where projects occurred	Percent of all projects	AFRP objectives addressed (1-6)
Watershed planning	50	17	1-6
Fish passage	35	14	3
Education	25	4	6
Riparian easement acquisition and restoration	55	19	1, 5
Life-history evaluations	35	14	4
Gravel restoration	25	7	1
Predator mine-pit isolation	10	4	1
Hydrological modeling, fluvial geomorphology	60	13	1
Anadromous fish monitoring	35	8	4, 5

Table 3. Percent of AFRP watershed limiting factors addressed and AFRP projects implemented, related to Chinook salmon production during the 1967-1991 and 1992-2005 periods.

AFRP Central Valley Watersheds	Percent Limiting Factors Addressed[a]	Percent AFRP Projects Implemented[b]	Salmon Natural Production Doubling Goal[c]	1967-1991 Average Natural Salmon Production[d]	1992-2005 Average Natural Salmon Production[d]	Percent Natural Production Relative To 1967-1991 Baseline[e]
All AFRP Central Valley watersheds	**26**	**27**	**990,000**[f]	**496,393**	**521,110**[i]	**5**
Upper Mainstem Sacramento River and Tributaries						
Upper mainstem Sacramento River	67	59	477,022[f]	235,000	105,273	-55
Clear Creek	95	95	7,100[g]	3,600	12,000	233
Butte Creek	85	80	3,500[g,h]	1,800	14,000	678
Big Chico Creek	40	40	800[g,h]	650	130	-80
Mill Creek	60	40	8,600[g,h]	4,300	3,900	-9
Deer Creek	60	60	8,000[g,h]	4,100	3,300	-24
Cow Creek	0	0	4,600[g]	2,400	Data n.a.	
Battle Creek[i]	20	25	10,550[f]	5,300	23,200	338
Antelope Creek	50	0	720[g]	400	Data n.a.	
Bear Creek	0	0	Data n.a.	Data n.a.	Data n.a.	
Paynes	0	0	330[g]	170	Data n.a.	
Stoney Creek	0	0	Not set	Data n.a.	Data n.a.	
Cottonwood Creek	0	0	5,900[g]	3,000	4,000	33

Table 3. Percent of AFRP watershed limiting factors addressed and AFRP projects implemented, related to Chinook salmon production during the 1967-1991 and 1992-2005 periods.

AFRP Central Valley Watersheds	**Percent Limiting Factors Addressed[a]**	**Percent AFRP Projects Implemented[b]**	**Salmon Natural Production Doubling Goal[c]**	**1967-1991 Average Natural Salmon Production[d]**	**1992-2005 Average Natural Salmon Production[d]**	**Percent Natural Production Relative To 1967-1991 Baseline[e]**
Thomes Creek	0	0	Not set	Data n.a.	Data n.a.	
Elder Creek	0	0	Not set	Data n.a.	Data n.a.	
Miscellaneous small tributaries[j]	0	0	1,100[g]	552	Data n.a.	
Lower Sacramento River and Delta Tributaries						
Feather River[i]	0	8	170,000[g]	87,000	133,000	53
Yuba River	43	36	66,000[g]	34,000	43,000	27
Bear River	0	0	450[g]	636	Data n.a.	
American River[i]	29	15	160,000[g]	81,200	153,000	88
Cosumnes River	50	33	3,300[g]	1,700	650	-62
Mokelumne River[i]	25	31	9,300[g]	4,700	9,200	96
Calaveras River	40	33	2,200[g]	800	Data n.a.	
San Joaquin River and Tributaries						
San Joaquin River	10	15	Not set	38,500	27,600	-28
Stanislaus River	40	33	22,000[g]	11,000	7,200	-35

Table 3. Percent of AFRP watershed limiting factors addressed and AFRP projects implemented, related to Chinook salmon production during the 1967-1991 and 1992-2005 periods.

AFRP Central Valley Watersheds	Percent Limiting Factors Addressed[a]	Percent AFRP Projects Implemented[b]	Salmon Natural Production Doubling Goal[c]	1967-1991 Average Natural Salmon Production[d]	1992-2005 Average Natural Salmon Production[d]	Percent Natural Production Relative To 1967-1991 Baseline[e]
Tuolumne River	55	40	38,000[g]	19,000	10,300	-46
Merced River[i]	42	50	18,000[g]	9,000	9,800	9

a Limiting factors identified in USFWS (1995). This column includes limiting factors partially addressed; does not consider relative significance of actions or limiting factors.

b Projects identified in USFWS (2001). Percentages represent restoration actions implemented and does not imply that all actions to address the limiting factors are completed; e.g., actions such as replenishing gravel or restoring riparian habitat are general in nature and, as stated in the AFRP Restoration Plan, these types of actions must be repeated in perpetuity (gravel replenishment) for that watershed, or repeated for different sections of the watershed (riparian restoration).

c Chinook salmon doubling goals from USFWS (2001).

d Natural production numbers for 1967-1991 and 1992-2005 from California Department of Fish and Game (CDFG -- 2005). May vary from half the USFWS, 2001, numeric goals due to subsequent recalculations and corrections. Methods to calculate natural production from USFWS (1995a:2-IX-5-18).

e Percent change in natural production calculated by subtracting natural production for 1967-1991 from natural production for 1992-2005, and dividing by natural production for 1967-1991.

f All Chinook salmon races.

g Fall-run Chinook salmon.

h Spring-run Chinook salmon.

i Hatchery supported Chinook salmon production.

j Miscellaneous streams include production estimates of fall-run Chinook salmon in streams above RBDD and between Princeton and RBDD.

FY 2005 Funded Projects
During FY 2005, the AFRP was limited to funding mostly ongoing projects due to a limited budget.

Upper Mainstem Sacramento River and Tributaries

Upper Mainstem Sacramento River
Since 1995, 25 AFRP funded projects have been implemented in the upper mainstem Sacramento River watershed, including: (1) fish inventories/monitoring; (2) riparian restoration, acquisition, and/or easements; (3) genetic maintenance and hatchery-related studies; (4) instream flow studies; project-related environmental compliance (La Barranca project); (5) Sacramento River Conservation Area support; (6) assessment of public ownership impacts; and (7) law enforcement support. In addition to habitat degradation, another aspect being carefully researched is the incidence of anadromous fish phenotypic sex reversal; i.e. the fish looks female, but genetically is male (U.C. Davis, sex reversal study). No new AFRP funded projects were initiated or completed in FY 2005.

AFRP projects have gathered information needed to help meet AFRP Program Objectives 1 through 4 (e.g., information from genetics studies and other fisheries monitoring efforts, and habitat restoration). Objective 6 (involving partners) is being addressed through active collaboration with the Sacramento River Conservation Area Forum, natural resource agencies, and other parties.

Natural production of Chinook salmon in the upper mainstem Sacramento River is approximately 55 percent below (-55) the 1967-1991 baseline period. On the mainstem Sacramento River and upper Sacramento River tributaries (excluding Clear Creek), AFRP funded restoration efforts have addressed many of the AFRP Restoration Plan actions and evaluations (Table 3), but a considerable number of restoration projects (e.g., fish passage, riparian easement acquisition and restoration, and anadromous fish monitoring) remain to be implemented to attain the anadromous fish doubling goal.

Cow Creek
To contribute to meeting AFRP objectives on Cow Creek, AFRP projects have collected information needed to help meet objectives 1 through 4 (e.g., information from Cow Creek Watershed Assessment and Plan, and water quality data collection). Objective 6 is being addressed through active collaboration with the local resource conservation district, watershed group, and natural resource agencies, including CALFED efforts.

The Cow Creek Watershed Management Group received a 2005 demonstration project grant from CALFED, which explores the use of holding ponds to address water quality, as well as repairing a diversion to provide improved fish passage. A watershed assessment was completed with CALFED funding in 2002. Technical support to maintain open space via land acquisition and/or conservation easements is also a priority for local State and Federal agencies, as well as conservation groups. Cow Creek is also a third tier priority CALFED Environmental Water Program stream, but no actions have been initiated to date with this program.

Other than watershed planning, there have been no AFRP restoration projects implemented on Cow Creek (Table 3). It has been determined that several limiting factors involving riparian habitat conditions could best be addressed by developing a comprehensive map of riparian habitat within the watershed.

Battle Creek
In 2005, one of AFRP's limiting factors for Battle Creek was resolved when a tailrace barrier was constructed by Pacific Gas and Electric (PG&E) on their Coleman Powerhouse tailrace. Ongoing AFRP

projects include the multi-agency/private diverter effort to make the Orwick diversion fish-friendly by constructing a headgate structure to ensure that the CDFG fish screen operates properly.

Chinook salmon natural production in Battle Creek is 338 percent over the 1967-91 baseline period (note Battle Creek is a hatchery supported stream). These numbers exceed the stream specific target, but contribute to the Central Valley-wide doubling goal of 990,000 adults. Although Battle Creek AFRP funded restoration efforts have addressed about 25 percent of AFRP Restoration Plan actions and evaluations (Table 3), a considerable number of restoration projects remain to be implemented to attain the anadromous fish doubling goal. About 20 percent of Battle Creek limiting factors have been addressed (Table 3). Several data gaps need to be addressed to better deal with fish passage, instream flow, and fish entrainment limiting factors. An upcoming project will include the environmental documentation for screening the Coleman National Fish Hatchery intakes. The Battle Creek Watershed Conservancy's watershed management strategy document (originally funded by AFRP) is being considered for revisions and updates.

Other limiting factors for anadromous fish in Battle Creek are being addressed with other sources of funding, including CALFED. These activities include increasing the instream flows to provide near-optimum transportation, spawning, and rearing flows; ensuring upstream passage for adults at hydropower facilities (e.g., PG&E diversion dams); screening Orwick and PG&E diversions to prevent entrainment of juveniles; preventing straying of adult fish by building a barrier at the Gover Diversion, and building tailrace connectors at PG&E powerhouses to prevent mixing of North Fork and South Fork water upstream of their confluence.

Deer, Bear, and Antelope Creeks

An Antelope and Deer creek fish passage project was competitively bid and a Cooperative Agreement to carry out the work in FY 2006 is underway. On Deer Creek, a structure will be built below Stanford Vina Dam to raise the pool water elevation and enhance fish ladder access for Chinook salmon and steelhead. CALFED funds were used to pay for the "Antelope/Deer/Mill Creeks Watershed Assessment" (prepared by the U.S. Forest Service), as well as road inventories in the upper portions of Antelope Creek.

To contribute to the watersheds' AFRP objectives, information has been collected on Bear Creek to help meet objectives 1 through 4 (e.g., information from the draft Bear Creek Watershed Assessment). Objective 3 is also being addressed through the Antelope and Deer Creeks fish passage project. Objective 6 is being addressed on all three watersheds through active collaboration with the local resource conservation district, watershed groups, natural resource agencies, and other parties.

The CDFG will be constructing two fish passage projects on Antelope and Deer Creeks in 2006. Several data gaps need to be addressed to better deal with passage, flow, and entrainment limiting factors caused by agricultural diversions, including a map and information on all diversions in all three watersheds.

Cottonwood Creek

Information gathered by the Cottonwood Creek Watershed Assessment (2001) has better defined data gaps, contributing to the ongoing development of a CALFED funded watershed management strategy, a watershed management plan, a geomorphological analysis of portions of the lower watershed, and an environmental education grant.

The watershed's contribution to addressing AFRP program objectives (through outside funding) includes information being collected on Cottonwood Creek to help meet Objectives 1 through 4 (e.g., info from the watershed assessment and strategy). Objective 6 is being addressed through active collaboration with the watershed group, natural resource agencies, and other parties.

Several data gaps need to be addressed to better assess straying and stranding of anadromous fish, water quality, erosion, and habitat conditions caused by land management practices (e.g., gravel mining, agriculture, and land development). Limiting factors involving habitat conditions (spawning gravel and channel structure) have not been addressed to a large extent. For example, there is a growing concern about bank stability in the lower watershed; many acres of established riparian forest and managed pasture have been washed away in the last 20 years as the creek is attempting to stabilize itself from natural and human-caused events. Land development is also a growing issue and fish population information is limited and sporadic. Mapping the riparian habitat would be the most useful way to identify and prioritize riparian habitat restoration and conservation.

Thomes and Elder Creeks

CALFED funds have been used to identify and control noxious weeds in the area (demonstration project); as well as educate landowners on best management practices for various land management activities. Tehama County Resource Conservation District, with input on natural resource values from technical advisors, is also actively involved in the update of the Tehama County Management Plan, which is under development. Timber harvest impacts are currently being addressed through newer regulations on timber harvest being implemented by the State (Timber Harvest Plan review) and the Federal government (U.S. Forest Service's Northwest Forest Plan), which have improved protection of riparian and aquatic habitats since the mid-1990s.

The watersheds' contribution to addressing AFRP program objectives (through outside funding) includes information being collected to help meet Objectives 1 through 4 (e.g., information from the draft West Tehama Watershed Assessment). Objective 6 is being addressed through active collaboration with the local resource conservation district, natural resource agencies, and other parties.

No work to address Thomes and Elder Creeks' limiting factors and to implement watershed actions has been completed; however, with funding from other sources, potential solutions to limiting factors have been addressed. Several data gaps need to be addressed to better deal with fish passage, instream flow, and fish entrainment limiting factors. A map is needed, along with information on all diversions and land uses (e.g., gravel mining, grazing, and upper watershed activities, such as timber harvest). General information on soil erosion and water quality also lacking in the watersheds. No AFRP funded projects were completed this fiscal year.

Mill Creek

A Mill Creek hydro acoustic study was competitively bid, and a Cooperative Agreement to carry out the work in FY 2006 is under development. Beginning in fall, 2006, a pilot study will examine the usefulness of hydro acoustics to count adult salmonid escapement in Mill Creek. Once results are available, recommendations will be made on the feasibility of using hydro acoustics for this purpose. Most limiting factors involving fish passage, instream habitat conditions in the valley floor and diversion impacts are currently being addressed to some degree through a water efficiency/fish passage grant, which the Mill Creek Conservancy received in 2003 from Reclamation. In addition to Reclamation's grant, various CALFED grants have been obtained to complete an upper watershed assessment by the U.S. Forest Service, including road erosion inventory, road improvements, and restoration.

The watershed's contribution to addressing AFRP program objectives includes AFRP projects that have collected information to help meet Objectives 1 through 4 (e.g., information from Mill Creek Watershed Management Strategy and water quality data). Objective 6 is being addressed through active collaboration with the Mill Creek Watershed Conservancy, natural resource agencies, and other parties. Mill Creek projects have also addressed AFRP Objective 1 by improving riparian habitat conditions.

Natural production of Chinook salmon in Mill Creek is 9 percent below (-9) the 1967-1991 baseline period (Table 3). Although Mill Creek AFRP restoration efforts have addressed about 40 percent of the AFRP Restoration Plan actions and evaluations (Table 3), a considerable number of restoration projects remain to be implemented toward attaining the anadromous fish doubling goal. About 60 percent of Mill Creek limiting factors have been addressed (Table 3). While a watershed management plan has already been completed, it is five years old and needs updating.

Deer Creek

CALFED grants were used to complete an upper watershed assessment (completed by the U.S. Forest Service), road erosion inventory and road-related restoration projects, meadow restoration, conservation easements, noxious weed (*Arrundo donax*) removal, and environmental education. Funding from the Delta Pumping Plant Fish Protection Agreement (Four Pumps Agreement) was used for part of a water exchange agreement and was used to purchase, install, and monitor a groundwater well. Deer Creek Irrigation District also received a water use efficiency grant in 2005 to assess the irrigation system and install improvements (to be initiated in 2006). Contributions to water savings via the efficiency grant will also contribute to the water made available for fish passage in the water exchange agreement.

The Deer Creek Watershed Conservancy has three grants for conducting a floodplain feasibility study to determine how to best manage large flood events from a cultural and ecosystem perspective, a grant to update the watershed management strategy, and a water monitoring and education grant to be used watershed-wide. The California Department of Water Resources (CDWR) and CDFG are working on a water exchange agreement with the Deer Creek Irrigation Company to better ensure fish passage flows. Two AFRP projects to improve fish passage at two diversion sites will be implemented within the next year. Two fish passage projects at diversion dams were funded by the AFRP in FY 2004 and FY 2005, but are not yet implemented.

The watershed's contribution to addressing AFRP program objectives includes AFRP projects that have collected information to help meet Objectives 1 through 4 (e.g., information from Deer Creek Watershed Management Strategy and water quality data). Objective 6 is being addressed through active collaboration with the Deer Creek Watershed Conservancy, natural resource agencies, and other parties. Deer Creek implementation projects have also addressed AFRP Program Objective 1 by improving riparian habitat conditions and fish passage.

Natural production of Chinook salmon in Deer Creek is 24 percent below (-24) the 1967-1991 baseline period (Table 3). Although AFRP restoration efforts on Deer Creek have addressed about 60 percent of the AFRP Restoration Plan actions and evaluations (Table 3), a considerable number of restoration projects remain to be implemented toward attaining the anadromous fish doubling goal. About 60 percent of Deer Creek limiting factors have been addressed (Table 3).

Big Chico Creek

Erosion control efforts are underway on selected rural roads. A newsletter and website (http://www.bigchicocreek.org/) are maintained to keep people informed. The recently completed Existing Conditions report for the creek is available on the website. An upcoming effort involving the Big Chico Creek Watershed Alliance, California State University at Chico, and fisheries agencies includes design and construction of a fish ladder at Iron Canyon Dam. Initial designs were completed, and final decisions to proceed with construction, based on nearly-completed geological risk evaluation of the construction site, are under development.

Natural production of Chinook salmon in Big Chico Creek is 80 percent below (-80) the 1967-1991 baseline period (Table 3). Although AFRP restoration efforts on Big Chico Creek have addressed about 40 percent of the AFRP Restoration Plan actions and evaluations (Table 3), a number of restoration

projects remain to be implemented to attain the anadromous fish doubling goal. About 40 percent of Big Chico Creek limiting factors have been addressed (Table 3). No AFRP funded projects were completed this fiscal year.

Butte Creek

The AFRP provided $582,000 for Butte Creek restoration projects in FY 2005. Regarding the three Lower Butte Creek Project phases, for all approved projects: (1) Phase I (Existing Conditions) is 100 percent complete, (2) Phase II (Engineering Design/Environmental Documentation/Permits) is 80 percent complete, and (3) Phase III (Construction) is 60 percent complete. Additional Phase II non-structural projects are under way in the Sutter Bypass through a memorandum of understanding for the east side of the Sutter Bypass, which will result in development of a fish passage restoration plan that will review the small pumping plants and establish minimum flows for fish passage for both borrow channels of the Sutter Bypass.

Projects recently completed in Phase III are Sutter Bypass E-W Diversion Dam, Weir 5, Weir 3, Butte Sink Weir, North Weir, End Weir, Morton Weir, Field and Tule Turnout, Mile Canal Turnout, Drivers Cut Adult Fish Barrier and Reclamation District 833 Adult Fish Barrier, West of Butte Creek Bifurcation Dam, Drumheller Slough Adult Fish Barrier, and the White Mallard Duck Club Adult Fish Barrier. An additional Phase III construction project, the White Mallard Dam and Fish Ladder Project, has been approved, funded, and is underway.

The Lower Butte Creek Project meets three AFRP objectives: (1) improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity and timing and improved physical habitat (the Giusti water right purchase agreement has nearly completed purchase of 21 cubic feet per second (cfs) of in-stream flows); (2) improve survival rates by reducing or eliminating entrainment of juveniles at diversions (the Lower Butte Creek Project has constructed fish screens in the Sutter Bypass and adult fish barriers in the Butte Sink); and, (3) improve the opportunity for adult fish to reach their spawning habitats in a timely manner (fish ladders have been constructed in the Sutter Bypass and Butte Sink, and construction of a fish ladder at the White Mallard Dam site is underway).

Natural production of Chinook salmon in Butte Creek is 678 percent over the 1967-1991 baseline periods (Table 3). These numbers exceed the stream specific target, but contribute to the Central Valley-wide doubling goal of 990,000 adults. Although Butte Creek AFRP restoration efforts have addressed about 80 percent of the AFRP Restoration Plan actions and evaluations (Table 3), a smaller number of restoration projects remain to be implemented to attain the anadromous fish doubling goal. About 85 percent of Butte Creek limiting factors have been addressed (Table 3). There are two Phase II projects remaining to be completed. Preliminary plans and environmental documentation are underway for the Five Points Fish screen and water conveyance system associated with the White Mallard Dam and conceptual plans for Weir 2, the Willow Slough Fish Ladder and CDWR Pumping Plants 1, 2, and 3 on the east side of the Sutter Bypass. Under Phase III, these same projects remain to be funded and constructed.

Miscellaneous Small Tributaries

AFRP program objectives are being addressed and information is being collected from West Tehama, Shasta West and Churn/Stillwater/Clover creeks watershed assessments to help meet objectives 1 through 4. Objective 6 is being addressed through active collaboration with the local resource conservation district, natural resource agencies, and other parties.

There has been minimal AFRP funding of restoration projects on miscellaneous small tributaries (Table 3). A considerable number of restoration projects remain to be implemented toward the anadromous fish doubling goal. Several data gaps need to be addressed to better deal with impacts to habitat (particularly fish rearing), water quality, fish passage, and instream flow limiting factors. A map is needed, along with

information on all diversions, siphons/canal crossings, and other land use impacts (e.g., land development and vegetation removal). Some of these streams may have many more urban-related impacts (e.g., land development near the stream, water discharge, flood management, etc.) than those in a more rural setting. General information on soil erosion and water quality also is lacking in the watersheds. Concerns regarding riparian habitat conditions are best addressed with comprehensive watershed maps of riparian habitat, which currently do not exist for most small tributaries. No AFRP funded projects were completed this fiscal year.

Lower Sacramento River and Delta Tributaries

This region includes the Feather, Yuba, Bear, and American Rivers in the Lower Sacramento region, and the Cosumnes, Mokelumne, and Calaveras Rivers in the Delta tributaries region. There are currently three AFRP Habitat Restoration Coordinators (HRCs) and one assistant HRC for the Lower Sacramento River and Delta, charged with implementing restoration actions and evaluations that improve anadromous fisheries, as described in section 3406 (b)(1) of the CVPIA.

The HRCs assigned to the Lower Sacramento River and Delta tributaries serve as technical advisors on watershed work groups, including the Oroville Federal Energy Regulatory Commission (FERC) Relicensing Technical Working Groups, Feather River Technical Team, Yuba/Feather Work Group, Agency Team and River Team for the Upper Yuba River Studies Program, Lower Yuba River Technical Working Group, Lower Yuba River Management Team, South Yuba Screen Work Group, Yuba River Modeling Forum, American River Operations Group, American River Fish Working Group, American River Gravel Study Advisory Team, Lower American River Science Conference Planning Committee, Dry Creek Conservancy, Bear River Watershed Group, and the Cosumnes Water Acquisition Team.

Feather River

Some progress has been made on AFRP Program Objective 1 by implementing gravel augmentation and riparian enhancement. The Feather River does not have significant issues with large unscreened diversions below Oroville Dam, so progress on Objective 2 is not of major concern. But, there are many issues that need to be addressed relative to Objective 3, such as hazards of mined areas adjacent to the river channel that are inundated during high water events. Relative to Objective 4, fish population health and habitat data are being collected to facilitate evaluation of restoration actions through the FERC relicensing process. The ongoing FERC collaborative process is making significant progress towards AFRP Objective 5. Toward Objective 6, the AFRP regularly involves partners in the implementation and evaluation of restoration actions.

Natural production of Chinook salmon in the Feather River is 53 percent over the 1967-1991 baseline period (Table 3) (note the Feather River is a hatchery supported stream). Although Feather River AFRP restoration efforts have addressed about 8 percent of the AFRP Restoration Plan actions and evaluations, a considerable number of restoration projects remain to be implemented to attain the anadromous fish doubling goal. In particular, additional projects to improve instream, riparian, flood plain, and side channel habitat need to be implemented. No AFRP funded projects were completed this fiscal year.

Yuba River

The Spawning Habitat Integrated Rehabilitation Approach-Based River Analysis and Sediment Transport Study is improving our understanding of how gravel resources (i.e., spawning habitat) respond to changes in flow. Preliminary results of this study reveal a very high correlation between those areas the model predicted would be good spawning habitat, and actual redd locations. Data collected to date includes sampling tracer gravel cores, locating Chinook salmon redds, and conducting a bathymetric survey of a spawning reach at the University of California property at flows of 600 cfs, 12,000 cfs, and 45,000 cfs.
Three separate studies on the Yuba River address the AFRP Program goal of collecting fish population, health, and habitat data to facilitate evaluation of restoration actions. A Chinook salmon and steelhead

life history evaluation was completed. The purpose of this study was to determine the timing, abundance, and distribution of adult Chinook salmon in the lower river using VAKI Riverwatchers (infrared detection devices) installed in both fish ladders at Daguerre Point Dam. The Juvenile Life History Evaluation on the Yuba River project is trapping, tagging, and releasing wild juvenile Chinook salmon, and recapturing them as adults 3-5 years later in carcass surveys. The steelhead scale and otolith analyses project is entering its second year of sampling, and investigates the suite of life history strategies expressed by Central Valley steelhead by analyzing scale and otolith annuli. The Yuba Goldfields Barrier was constructed in the outfall of waterway 13 in August, 2003, and eliminated entrainment of adult anadromous fish into the Goldfields. However, the high flows in May 2004, which exceeded 45,000 cfs, breached this structure. As a result, the AFRP provided funds in FY 2005 to repair this damage.

Natural production of Chinook salmon, in three separate studies on the Yuba River, was 27 percent over the 1967-1991 baseline periods (Table 3). Although AFRP restoration efforts on the Yuba River have addressed about 36 percent of AFRP Restoration Plan actions and evaluations, considerable restoration projects remain to be implemented until a natural production doubling target can be accomplished. About 43 percent of Yuba River limiting factors have been addressed (Table 3).

Bear River

On the Bear River, tributary to the Feather River, CALFED's Watershed Program funded the development of a watershed restoration plan, but this effort is focused primarily on the upper Bear River above Camp Farwest Reservoir.

None of the limiting factors or AFRP program objectives identified in the AFRP Restoration Plan have been implemented or initiated. This lack of accomplishment on the Bear River stems from the paucity of existing fish and habitat data, and the perceived lack of habitat below Camp Farwest Reservoir.

A considerable number of restoration projects remain to be implemented to attain the anadromous fish doubling goal. An initial project, a baseline conditions CALFED Request For Proposals (RFP), was developed in 2005 for the lower Bear River and is ready to be submitted for FY 2006 funding. In addition, an RFP was developed in coordination with Beale Air Force Base personnel and other stakeholders for making improvements to the existing fish ladder on Dry Creek, a tributary to the Bear River. This RFP will be ready for FY 2006. No AFRP funded projects were completed this fiscal year.

American River

Some progress has been made on AFRP Program Objective 1, such as evaluating benefits of increased instream flow, Folsom Dam operations to improve water temperature conditions, and effects of pulse flows on outmigration of juvenile salmonids and returning adults.

There are many issues to be addressed for AFRP Program Objective 3, such as dewatering of steelhead side-channel spawning habitats and providing appropriate temperatures for spawning. Relative to AFRP Program Objective 4, fish population, health, and habitat data are being collected in collaboration with CDFG and Reclamation to facilitate the evaluation of restoration actions. Significant progress is also being made on AFRP Objective 5, integrating habitat restoration efforts with harvest and hatchery management. Toward AFRP Objective 6, the AFRP regularly involves partners in the implementation and evaluation of restoration actions. To meet anadromous fish doubling goals, additional projects to improve instream, riparian, floodplain, and side-channel habitat need to be implemented. Based on

current levels of funding, it is anticipated that it will take well beyond 10 years to complete all of the AFRP actions and evaluations for the American River.

Natural production of Chinook salmon in the American River is 88 percent over the 1967-1991 baseline periods (Table 3). Although American River AFRP restoration efforts have addressed about 15 percent of the AFRP Restoration Plan actions and evaluations, a considerable number of restoration projects remain to be implemented to attain the anadromous fish doubling goal. About 29 percent of American River limiting factors have been addressed (Table 3). AFRP watershed projects yet to be addressed on the American River include improving flows, reconfiguring Folsom Dam shutters for improved management of Folsom Reservoir's cold water pool, replenishing spawning gravel and restoring existing spawning grounds, developing a riparian corridor management plan to improve and protect riparian habitat and instream cover, assessing the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids, and assessing and refining a river regulation plan that provides flows to protect all the life stages of anadromous fishes.

The AFRP continues to work closely with other American River stakeholders to address AFRP objectives. Actions to reduce and control flow fluctuations and modify CVP operations to reduce entrainment losses are discussed and determined by the American River Operations work group, and implemented by Reclamation. In addition, the AFRP is working with the City and County of Sacramento, Sacramento Area Flood Control Agency (SAFCA) and other stakeholders to formally terminate current programs that remove woody debris from the river channel. While this action has not been formally implemented, stakeholders in the lower river have taken the position that woody debris should be moved or removed only if it posses a danger to human health. The AFRP routinely works with the Water Forum, SAFCA, CDFG, Reclamation and other stakeholders to develop and implement watershed restoration actions on the American River.

Cosumnes River

The AFRP provided funding to complete construction of fish passage barriers on the Cosumnes River in FY 2005. To date, the AFRP has rectified all but one of the major barriers on the Cosumnes River, the Rooney Brothers Dam at River Mile 25, which will be rectified through construction in fall 2005 or fall 2006. The AFRP is also funding an effort to identify water supply resources so that the lower river does not go dry in the early fall when adults are returning to the river to spawn. However, progress on this project is slow because of negotiations to obtain water resources from outside the Cosumnes River basin. The AFRP has funded two separate studies to investigate steelhead distribution, habitat utilization, and food habits. Both studies have been completed and final reports submitted. The reports provide information on floodplain use, stranding, interspecific competition, and distribution of non-native exotic species, such as red-eye bass (*Micropterus coosae*).

Minimal progress has been made on AFRP Program Objective 1 by implementing gravel augmentation and riparian enhancement. The Cosumnes River does not have significant issues with large unscreened diversions, so progress on Objective 2 is not of major concern. However, the Cosumnes River has issues that need to be addressed relative to Objective 3. For instance, sections of the river go dry during the summer and early fall as a result of ground water pumping. Relative to Objective 4, fish population, health, and habitat data have been and are continuing to be collected to facilitate evaluation of restoration actions. In reference to Objective 5, the Cosumnes River likely has issues with Mokelumne River hatchery strays, but the significance of this issue is unclear. The AFRP and other stakeholders in the basin are working to address this issue. Toward Objective 6, the AFRP regularly involves partners in the implementation and evaluation of restoration actions. Additional projects to improve instream, riparian, flood plain and side channel habitat need to be implemented to meet CVPIA fish doubling goals.

Natural production of Chinook salmon in the Cosumnes River is 62 percent below (-62) the 1967-1991 baseline period (Table 3). Although Cosumnes River AFRP restoration efforts have addressed about 33 percent of AFRP Restoration Plan actions and evaluations (Table 3), a considerable number of restoration projects remain to be implemented to attain the anadromous fish doubling goal. About 50 percent of the Cosumnes River limiting factors have been addressed (Table 3). The AFRP is working closely with the Nature Conservancy, University of California at Davis, the Fishery Foundation, Reclamation, CDFG, and others to coordinate and plan restoration actions to address insufficient instream flow, stream habitat restoration, spawning habitat, rearing habitat, predation of juveniles, fish passage, effects of hatchery fish on natural stocks, and erosion and sediment control.

Mokelumne River

Riparian restoration on Murphy Creek, a tributary to the Mokelumne River, was completed and cattle exclusion fences await lower water levels for completion this fiscal year. By the end of the fiscal year, 2,300 additional tons of spawning gravel will be added to the river channel, increasing spawning, incubation, and rearing habitat for salmonids. Two side-channel restoration projects should be completed during this fiscal year as part of the Mokelumne River Partnership. Biological benefits of these projects include reduced fine sediments and cattle waste, reduced water temperatures, additional rearing habitat, increased habitat complexity, and additional food resources. Monitoring gravel augmentation has occurred and will continue in order to document utilization of added gravel and habitat variables associated with preferred spawning sites. The above projects address limiting factors of insufficient spawning and rearing habitat and sediment and erosion control. Existing added gravels have been heavily utilized according to recent redd surveys.

The Mokelumne River Spawning Improvement Project has improved spawning habitat through gravel augmentation and is an ongoing cost-share effort with East Bay Municipal Utility District (EBMUD). In association with this project, the "Demonstration Project to Test a New Interdisciplinary Approach to Rehabilitating Salmon Spawning in the Central Valley" has focused on small scale monitoring to identify preferred spawning habitat and aid design of gravel augmentation projects within, and beyond, the Central Valley. The nearly complete Mokelumne River Streambank Improvement Project provides fencing and off-channel watering for livestock in conjunction with a co-funded revegetation project designed to improve riparian conditions and reduce livestock waste.

Minimal progress has been made on AFRP Program Objectives 1 and 2. Reconstruction of Woodbridge Dam should benefit Objective 3 and improve the opportunity for adult fish to reach their spawning habitats in a timely manner (instream flow enhancement is ongoing). Relative to Objective 4, fish population, health, and habitat data are being collected to facilitate evaluation of restoration actions both by AFRP and others. Some progress is being made towards Objective 5. AFRP restoration efforts contribute continuously to Objective 6, regularly involving partners in the implementation and evaluation of restoration actions.

Natural production of Chinook salmon in the Mokelumne River is 96 percent over the 1967-1991 baseline period (Table 3) (note the Mokelumne River is a hatchery supported stream). Mokelumne River restoration efforts have addressed 31 percent of the AFRP Restoration Plan actions and evaluations, and about 25 percent of limiting factors have been addressed (Table 3). To meet anadromous fish doubling goals, additional projects to improve instream, riparian, flood plain, and side channel habitat need to be implemented, and many unscreened diversions need to be screened. The most significant limiting factors for salmonids on the Mokelumne River include spawning habitat, rearing habitat, predation on juveniles below Woodbridge Dam, adult passage at Woodbridge Dam, invasive aquatic plant species, adverse impacts of hatchery origin salmon, and the use of Feather River steelhead broodstock. Assuming current levels of funding, completion of the AFRP actions and evaluations will likely take beyond 10 years to complete.

Calaveras River

Biological benefits from AFRP-funded projects include improvements to the operation and efficiency of the Bellota Weir fish ladder, allowing more steelhead and salmon to reach spawning grounds. The Habitat Conservation Plan (in preparation) identifies passage of both adult and juvenile fish as the major limiting factor on the Calaveras River while entrainment into water diversions is the next most limiting factor. Entrainment of juvenile salmonids will continue to occur until diversions are screened, most notably, the Stockton East Water District (SEWD) diversion at Bellota. Monitoring continues to document stranding, and should continue to provide a baseline until improvements are made and monitoring can verify the reduction in stranding and entrainment.

A fish ladder has been retrofitted at Bellota Weir and is currently undergoing evaluation. Stranding and carcass surveys are being conducted along with an analysis of factors limiting salmonid populations. A flow modeling study conducted by CDWR to prioritize passage improvements is nearly complete. The AFRP is participating in the Habitat Conservation Plan workgroup for steelhead, along with other State and Federal agencies. CALFED has funded a preliminary engineering study to replace Bellota Weir, screen the diversion and provide fish ladders.

Some progress has been made on AFRP Program Objective 1 by coordinating flow releases from New Hogan Dam. Little progress has been made on Objective 2, though monitoring has documented the occurrence of stranding. Retrofitting the Bellota Weir fish ladder will benefit Objective 3 through improved opportunity for adult fish to reach their spawning habitats in a timely manner, although ladder and flashboard dam problems still exist. Relative to Objective 4, fish population, health, and habitat data is being collected to facilitate evaluation of restoration actions both by AFRP and others. No progress has been made towards Objective 5. AFRP restoration efforts contribute continuously to Objective 6 by regularly involving partners in the implementation and evaluation of restoration actions through the Calaveras River Fish Group and the Habitat Conservation Plan Workgroup.

Calaveras River restoration efforts have addressed about 33 percent of the AFRP Restoration Plan actions and evaluations, with the majority of current efforts focused on building consensus and partnerships between the SEWD, natural resources agencies, and environmental groups.

About 40 percent of the Cosumnes River limiting factors have been addressed (Table 3). To meet fish doubling goals, physical improvements to flashboard dams and Bellota Weir must be constructed, then additional projects to improve instream, riparian, flood plain, and side channel habitat need to be implemented. Unscreened diversions need to be screened and water needs to be set aside for dedicated fisheries flows. Plans are underway to fund additional passage improvements (AFRP) and reduce entrainment by SEWD. Once these issues have been resolved, restoration of habitat above Bellota can commence. Since little or no restoration has occurred to date, and with current funding and activity levels, completion of AFRP actions and evaluations will likely take beyond 10 years to complete.

San Joaquin Basin Tributaries and Mainstem San Joaquin River

This AFRP geographic area includes the Stanislaus, Tuolumne, and Merced Rivers, including the mainstem San Joaquin River. Each watershed within this region has unique characteristics and environmental limiting factors. There are currently two HRCs, one Federal assistant HRC, and one State HRC, dedicated to the implementation of restoration actions in the San Joaquin Basin tributaries and the mainstem San Joaquin River.

AFRP duties in this geographic region are expanding, as new watershed and stakeholder groups become organized, restoration plans are developed, and large-scale restoration projects and greater numbers of

restoration activities are implemented. HRCs served as technical advisors to watershed related groups, such as the Stanislaus River Temperature Modeling Group, San Joaquin Basin Temperature Modeling Group, Stanislaus River Fish Group, Tuolumne River Technical Advisory Committee, Merced River Technical Advisory Committee, Merced River Stakeholder Group, Western Stones Planning Group, Delta Pumping Plant Fish Protection Agreement Advisory Committee, the Dredge Tailings Workgroup, State Taskforce on Rivers and the Effects of Aggregate Mining (STREAM), the Vernalis Adaptive Management Program (VAMP), and the San Joaquin River Management Program. Natural production of Chinook salmon in the San Joaquin River is 28 percent below (-28) the 1967-1991 baseline period (Table 3).

Stanislaus River

A fish counting weir with an infrared fish counter and digital camera was operated and tested in the Stanislaus River and the first year of egg survival studies to evaluate gravel augmentation projects was completed. A fisheries summary has been completed and conceptual models are in preparation as part of the Stanislaus River Restoration Plan. Implementation of gravel augmentation and side channel/floodplain restoration continued with planning and permitting. Results of these projects include accurate enumeration of Chinook salmon escapement, documentation of steelhead passage, and analysis of the size composition of added gravel for optimum spawning success. The above projects addressed limiting factors of stream habitat restoration, spawning habitat, and watershed planning. Monitoring results from the Knights Ferry Gravel Replenishment Project, Phase 2, have shown significant use of spawning gravels by adult salmonids, and poor survival of eggs within gravel with insufficient smaller size fractions (missing gravel less than 0.5 inch in diameter). Optimal size composition of gravel will be better understood in future studies planned by both the AFRP and Reclamation, and have implications for other gravel augmentation projects within the Central Valley.

Accurate and standardized escapement data are necessary to evaluate program progress toward anadromous fish doubling. The AFRP is currently funding the "Test and Demonstrate a Portable Alaskan Weir to Count and Characterize Runs of Anadromous Salmonids in the Stanislaus River Project" as a demonstration of new technology (VAKI Riverwatchers infrared detection devices and digital photography). This project provides an accurate and standardized assessment of escapement and can potentially be used on other Central Valley streams. Also, the AFRP manages a juvenile Chinook salmon monitoring project and a rotary screw trapping contract funded mostly through Reclamation and water programs under section 3406(b)(2) of CVPIA. This project helps correlate flow with juvenile mortality.

A restoration plan is being prepared for the Stanislaus River, containing a summary of existing fisheries information that will result in a set of conceptual models to address watershed limiting factors. Future efforts of this project will focus on prioritizing restoration actions. The most significant limiting factors on the Stanislaus River include spawning and rearing habitat, insufficient flows, and predation. According to a recent study (Kondolf et al. 2001); approximately 20,000 cubic yards of gravel are lost annually due to dams blocking recruitment. Approximately 1 million cubic yards were removed from the river channel through mining, with an additional 5.2 million cubic yards mined from the floodplain.

Little progress has been made on AFRP Program Objectives 1 or 2, although Objective 2 appears minor in this watershed. Improving the opportunity for adult fish to reach their spawning habitats in a timely manner (Objective 3) has been partially achieved through the use of fall pulse flows, though dissolved oxygen, temperature and export problems continue. Relative to Objective 4, data on fish population, health, and habitat are being collected to facilitate evaluation of restoration actions, both by AFRP and others, although funding of monitoring is increasingly difficult (ongoing). Little progress is being made towards Objective 5. AFRP restoration efforts contribute continuously to AFRP Program Objective 6, by regularly involving partners in the implementation and evaluation of restoration actions through the Stanislaus River Fish Group.

Natural production of Chinook salmon in the Stanislaus River is 35 percent below (-35) the 1967-1991 baseline period (Table 3). Stanislaus River restoration efforts have addressed about 33 percent of AFRP Restoration Plan actions and evaluations. About 40 percent of limiting factors have been addressed (Table 3). To meet anadromous fish doubling goals, additional projects to improve instream, riparian, flood plain, and side channel habitats need to be implemented, and many unscreened diversions need to be screened. Completely replacing the 20,000-cubic yard annual gravel deficit resulting from blockage by dams could cost roughly $10 million per year (at $50 per cubic yard, including monitoring), assuming gravel costs do not escalate as gravel supplies are reduced.

Tuolumne River

Ongoing projects to restore spawning, rearing, and floodplain habitats in the Tuolumne River include: (1) continuing monitoring at the 7/11 materials restoration site (CALFED funded); (2) revising the appraisals for the MJ Ruddy restoration project by Interior; (3) completing preliminary design engineering and environmental permitting on the Warner-Deardorff channel and floodplain restoration project (AFRP; CALFED Phase II construction on hold until MJ Ruddy appraisal has been completed); (4) continuing the environmental permitting, design engineering, and pre-project monitoring (Phase I) at the Tuolumne Special Run Pool 10 site (AFRP funded); (5) continuing post-project monitoring of the Grayson River Ranch floodplain restoration project (CALFED funded); (6) completing design and permitting for the Gravel Transfusion Project (CALFED funded), which is on hold pending review by the CALFED Science Panel; (7) continuing Stillwater Science's Fall Attraction Flow Study (AFRP funded); (8) initiating the planning for the Fine Sediment Management Project (CALFED); and, (9) completing the design and permitting for Bobcat Flat RM 43 Project (CALFED and Four Pumps Agreement funded).

The AFRP and stakeholders have identified four significant limiting factors on the Tuolumne River: (1) insufficient flows, (2) degraded spawning, rearing, and floodplain habitats, (3) predation, and (4) excessive sedimentation (Tuolumne River Habitat Restoration Plan). Perhaps the most severe limiting factor for the Tuolumne River is insufficient flows.

In spite of the combined AFRP, CALFED, and Four Pumps Agreement restoration efforts, fall-run Chinook salmon populations have declined by about 46 percent (-46) from the 1967-1991 baseline period (Table 3). Tuolumne River restoration efforts have addressed about 40 percent of the AFRP Restoration Plan actions and evaluations. About 55 percent of limiting factors have been addressed (Table 3). Although there are many elements to the fisheries research program, it's not clear why the anadromous fish population did not respond favorably to the implemented restoration projects or the revised minimum instream flow schedule implemented in 1996. The following actions are being taken to help address this decline: (1) the AFRP has recommended a new flow regime and an adaptive management study program to amend the FERC license for the New Don Pedro Project; (2) CALFED is funding a water temperature model; (3) the AFRP is funding new studies to assess salmon egg survival in different sizes of restoration gravel; and (4) CALFED has selected a multi-million dollar monitoring project to fund in 2006. However, additional stream channel, riparian, floodplain, and gravel restoration is needed to restore the watershed. Additional studies are needed for assessing the effectiveness of restoration efforts to reduce predation of juvenile salmonids, conducting annual surveys of adult Central Valley steelhead abundance, and assessing the effects of flow on juvenile health. To meet anadromous fish doubling goals, additional projects to improve and evaluate instream flows, instream habitats, and floodplain habitats need to be implemented. McBain and Trush estimates that the total volume of sediment needed to restore the degraded habitats is approximately 2.6 million cubic yards of gravel, plus an additional 1,000 to 2,500 cubic yards each year for maintenance.

Merced River

Ongoing projects to restore spawning, rearing, and floodplain habitats in the Merced River are all in the conceptual stage, and include the Upper Western Stones Project (Four Pumps Agreement-funded) and Merced River Dredger Tailings Reach Phase I Project (CALFED funded). Several of the funded projects, such as the Merced Dredger Tailing Reach Phase I and the Upper Western Stones Phases of the Merced River Salmon Habitat Enhancement Project, are reconstructing riffle-pool sequences and floodplain habitats to provide spawning and rearing habitats in areas degraded by past aggregate mining operations. The Wing Dam Gravel Projects and 4-Pumps Gravel Maintenance Projects are helping supply spawning-sized gravel to the river near Crocker-Huffman Dam. The AFRP funded study, "A Feasibility Investigation of Reintroduction of Anadromous Salmonids Above Crocker-Huffman Dam on the Merced River," is still ongoing. CALFED has funded development of restoration plans for the Merced River that the AFRP uses to estimate funding needed to implement the remaining high priority projects.

The ongoing studies indicate that in response to the gravel restoration at the "Assess the Spawning Habitat on the Robinson Reach on the Merced River Project," Chinook salmon spawning was restored to pre-1997 flood damage levels immediately following construction. It is anticipated that biological benefits at Robinson Ranch will gradually increase, as pool depth and riparian vegetation increase. The Physical Habitat Simulation studies at Robinson Ranch were useful for comparing the amount of spawning and rearing habitat between pre- and post-project conditions, but not for predicting actual use by salmonids.

The effectiveness of the past Magneson and Ratzlaff projects to reduce predation on juvenile salmonids has not been studied. Studies are also needed to assess the impacts of creating spawning beds with the abnormally porous dredger tailings at the Merced River Dredger Tailing Reach Phase I and II sites on incubating salmonid eggs. Sediment transport studies by Stillwater Sciences indicated that 2,600 cubic yards of gravel should be added each year to maintain habitat quality.

AFRP objectives include: (1) supplementing the existing minimum flow schedule by acquiring water from willing sellers; (2) improving watershed management to restore and protect instream and riparian habitat; (3) screening diversions; and (4) evaluating the influence of water temperature on all life stages of anadromous fish, predation on juvenile fish, and fall pulse flows on adult attraction.

The fall-run Chinook salmon population has increased by about 9 percent from the 1967-1991 baseline periods (Table 3). Merced River restoration efforts have addressed about 50 percent of the AFRP Restoration Plan actions and evaluations, and about 42 percent of limiting factors have been addressed (Table 3).

Another high priority objective for the Merced River is to adequately assess habitat restoration efforts. CALFED is funding a $1.4 million, 3-year study to assess effectiveness of the Robinson Ranch Project, as well as a water temperature model. Studies are also needed to assess impacts of creating spawning beds with the abnormally porous dredger tailings at the Merced River Dredger Tailing Reach Phase I and II sites on incubating salmonid eggs. To meet the anadromous fish doubling goal of CVPIA, additional projects to improve and evaluate instream flows, instream habitats, and floodplain habitats need to be implemented.

Project Title: Evaluation of Anadromous Fish Instream Flow Needs CVPIA Section 3406(b)(1)(B)
FY 2005 Funding: $395,725
FY 2005 Accomplishments:

In directing Interior to make all reasonable efforts to at least double the natural production of anadromous fish, Congress recognized the need for flows of suitable quality, quantity, and timing in those streams that

support these species. It specifically directed that the instream flow necessary to protect all life stages of anadromous fish on CVP-controlled streams be determined by the Service after consultation with CDFG. However, to achieve the goal of doubling the natural production of anadromous fish throughout the Central Valley, the flow needs of these species on other Central Valley streams and rivers must also be ascertained so that actions may be taken to provide for those needs. Instream flow studies had already been conducted on several streams. With the passage of the CVPIA, those previous evaluations are being reviewed and additional studies conducted. These efforts have been under way for several years and will continue for several more.

Biological benefits of activities since 1992 include identifying flow-habitat relationships for anadromous salmonids in the following: Merced, American, and Sacramento Rivers, and Butte Creek. Notably in 1995, the flow-habitat relationship for spring-run Chinook salmon spawning in Butte Creek was used to increase the spawning flows in the bypass reach of Butte Creek, resulting in reduced redd superposition and greater survival of eggs and larvae. Monitoring of these results includes screw-trapping in Butte Creek. Also in 1995, the results of our flow-habitat relationships for the American River were used to develop a new flow regime for the river, which will result in improved conditions for anadromous salmonids.

FY 2005 accomplishments were documented in the annual status report entitled "Identification of the Instream Flow Requirements for Anadromous Fish in the Streams within the Central Valley of California" for seven tasks. Task 1 addressed Chinook salmon and steelhead rearing in the Yuba River; Task 2 addressed Chinook salmon and steelhead rearing in Clear Creek; Tasks 3 and 4 addressed Chinook salmon and steelhead rearing in the Yuba River, and Chinook salmon and steelhead spawning and rearing in Clear Creek; and Tasks 5 and 6 addressed Chinook salmon spawning in the Sacramento River between Battle and Deer Ceeks, and juvenile Chinook salmon rearing in the Sacramento River between Keswick Dam and Battle Creek.

1. Habitat Suitability Criteria (HSC) Development - Completed collection of rearing HSC data for fry and juvenile fall/spring run Chinook salmon and steelhead/rainbow trout in FY 2005. Rearing HSC data collection is 100 percent complete.

2. Habitat Mapping - Habitat mapping for Clear Creek was conducted in FY 2005. Habitat mapping is 100 percent complete.
3. Field Reconnaissance and Study Site Selection - Established six study sites for Chinook salmon and steelhead/rainbow trout rearing in Clear Creek. The above activities are 100 percent complete.

4. Hydraulic Data Collection – Completed hydraulic data collection for Chinook salmon and steelhead/rainbow trout spawning sites on Clear Creek, continued hydraulic data collection for Chinook salmon and steelhead/rainbow trout fry and juvenile rearing sites on the Yuba River, and started hydraulic data collection for Chinook salmon and steelhead/rainbow trout rearing sites on Clear Creek. All of the above hydraulic data collection should be completed in FY 2006. Hydraulic data collection is 95 percent complete for Yuba River rearing, 100 percent complete for Clear Creek spawning, and 10 percent complete for Clear Creek rearing.

5. Modeling of Spawning and Rearing Habitat in Study Streams – Final reports were issued for modeling of fall-run Chinook salmon spawning habitat in the Sacramento River between Battle and Deer Creeks and modeling of rearing habitat in the Sacramento River between Keswick Dam and Battle Creek in FY 2005. These tasks are 100 percent completed. These studies resulted in the establishment of flow-habitat relationships for spawning and rearing salmonids and identified

the importance of integrating spawning and rearing habitat with water temperature in a single model such as SALMOD.

6. Peer Review - The reports for rearing habitat in the Sacramento River between Keswick Dam and Battle Creek and for spawning habitat in the Sacramento River between Battle and Deer Creeks were peer reviewed in FY 2005. These tasks are 100 percent complete.

7. Program Management - Project coordination meetings were held and a project progress report was prepared in FY 2005. This activity is 70 percent complete.

Project Title: Habitat Restoration Program
CVPIA Section 3406(b)(1) "Other"
FY 2005 Funding: $1,472,069
FY 2005 Accomplishments:

The Habitat Restoration Program (HRP) was established to protect and restore habitats impacted by the CVP that were not specifically addressed elsewhere in the CVPIA, and to stabilize and improve populations of native species that relied on those habitats. The program's initial focus was on those habitats known to have experienced the greatest decline in habitat quantity and quality and on species that were listed, proposed, or candidates for listing under the ESA or were non-listed State or Federal species of special concern.

The program began in FY 1996 and has funded 67 new projects located throughout the Central Valley. About 98,000 acres of habitat for listed, proposed, and candidate species and species of special concern have been protected, often through partnerships with others in fee title acquisitions or conservation easements. Habitats protected include serpentine soils and associated habitats, vernal pool, aquatic, alkali sink and alkali scrub, foothill chaparral, valley-foothill hardwood, riparian woodland, and grassland.

In FY 2005, nine conservation actions were funded. Two of these actions provided additional funding to continue projects that were initiated in previous years. These are: (1) continued monitoring for giant garter snakes within the habitat restoration site the program funded at the Colusa National Wildlife Refuge in Colusa County, and (2) the second and third year of a study to assess grazing impacts on native serpentine plant species on Coyote Ridge in Santa Clara County.

FY 2005 accomplishments include the following:

1. Funds were provided to the San Luis National Wildlife Refuge Complex for the planning phase to restore floodplain and vernal pool habitat on the 1,905-acre refuge-owned Sno-bird Ranch in Merced County. Species that would benefit include the vernal pool tadpole shrimp, vernal pool fairy shrimp, and Colusa grass.

2. Funds were provided to Entrix, Inc., to obtain distribution information on Sierra Nevada populations of the California red-legged frog; obtain DNA for downstream studies of Sierra Nevada red-legged frog genetics in the context of the role of the Central Valley Project Folsom Dam Pond facility in species recovery; and obtain distribution information on other special status species such as the yellow-legged frog and western pond turtle in Placer and El Dorado Counties.

3. Funds were provided to the University of California, Davis, to complete a characterization of vernal pool vegetation in relation to habitats; documentation of the affiliation of special status species to particular plant communities; and creation of guidelines for the conservation and

restoration of vernal pool diversity. Various vernal pool species would benefit from this project throughout the Sacramento Valley.

4. Funds were provided to the Wildlife Conservation Board for the fee title acquisition of 796 acres vernal pools and Butte County meadowfoam on the Stone Ridge Ranch property in Butte County. The species to be benefited include vernal pool invertebrates, Butte County meadowfoam, and bald eagle.

5. Funds were provided to Ducks Unlimited in Glenn County for restoration of the natural hydrology to support vernal pool and vernal pool-alkali meadow complex habitats and their associated special-status species on about 755 acres in Tracts A, B and C of the Sacramento National Wildlife Refuge. Species to be benefited include Hoover's spurge, palmate-bracted bird's beak, vernal pool fairy shrimp, and vernal pool tadpole shrimp.

6. Funds were provided to the Sequoia Riverlands Trust for a project on the James K. Herbert Wetland Prairie Preserve in Tulare County that would establish a rotational system of prescribed burning and livestock grazing; continue wetland and upland restoration; evaluate hydrology and soils to assess the feasibility of a vernal pool/grassland community mosaic; establish trial plantings of native bunchgrasses; provide systematic monitoring of restoration and management effects on plant and animal communities; and provide a 2-year study of effects of prescribed fire and grazing on vernal pool/grassland flora and fauna. Species to be benefited include the vernal pool fairy shrimp, Swainson's hawk, and western spadefoot toad.

7. Funds were provided to the Tuolumne River Trust for the first two phases (planning/surveying/appraisal) of the project pursuant to acquisition of a conservation easement on the 1,766-acre Dos Rios Ranch in Stanislaus County. The project would protect the riparian corridor; establish a riparian brush rabbit colony on site; provide habitat for the riparian woodrat; and protect floodplain values and compatible agricultural uses.

Project Title: San Joaquin River Riparian Habitat Restoration Program
CVPIA Section 3406(b)(1) "Other"
FY 2005 Funding: $19,700
FY 2005 Accomplishments:

In late 1997, as an outcome of the CVPIA Administrative Proposal process to help resolve issues related to restoration on the San Joaquin River, a Program Manager position was established in Reclamation's South-Central California Area Office (SCCAO) in Fresno to facilitate a San Joaquin River Riparian Habitat Restoration Program (SJRRHRP). Reclamation and the Service, in cooperation with the Natural Resources Defense Council (NRDC), Pacific Coast Federation of Fishermen's Association (PCFFA), and Friant Water Users Authority (FWUA), created a SJRRHRP Management Team to bring together diverse interest groups and promote riparian restoration on the San Joaquin River below Friant Dam. The San Joaquin River Exchange Contractors Water Authority was also added as a member of the SJRRHRP Management Team, and the 6 representatives functioned to request the implementation of projects of mutual interest. SJRRHRP efforts were funded under authority of the CVPIA, because the results would assist development of a San Joaquin River Comprehensive Plan (Comprehensive Plan), as required under Section 3406(c)(1) of the CVPIA. In response to a joint letter from the NRDC and FWUA, CVPIA Restoration Funds were provided in October, 1999, to assist NRDC and the FWUA in restoration planning activities as part of their *Natural Resources Defense Council (NRDC) v. Rodgers* lawsuit settlement discussions. Concurrent with FWUA/NRDC planning activities, the SJRRHRP had a focus in FY 2004 to provide:

1. Program Management and Technical Support: Continue program administration and efforts to centralize and provide availability of data, reports, maps, etc., developed under this program. Provide technical support, funding, and/or liaison coordination for other San Joaquin River related activities and programs that support restoration.

2. Resource Management: Plan and implement activities, studies, programs, and all associated environmental compliance activities that would be beneficial to long-term San Joaquin River restoration.

When the NRDC v. Rodgers litigation resumed Reclamation reassessed the best method for gathering the data needed to develop the Comprehensive Plan. While that reassessment was occurring, the following on-going activities previously approved by the SJRRHRP Management Team continued, and new activities deemed critical to the development of a Comprehensive Plan were initiated by Reclamation in FY 2005:

1. CDFG continued to work the CDWR to develop their internal agreement on conducting the 4-year Milburn-Hansen Restoration Planning Project (Reclamation obligated funds to CDFG for this effort). Since CDFG needs CDWR to conduct the modeling, pre-design, and engineering activities necessary to outline a restoration plan for the abandoned aggregate mining pit areas in the Milburn Unit and the state-owned lands adjacent to Hansen Farm property, the progress, to date, has been on the respective State agencies agreeing on terms on how to administratively organize and implement the project.

2. The CDFG continued the Fishery and Aquatic Resources Inventory. The CDFG has continually inventoried and documented the present-day status, distribution, and condition of aquatic fauna and flora between Friant Dam and the confluence of the Merced River. The documentation will include water condition information pertinent to interpretation of the inventory results. A final report of this 'point in time' inventory is expected by the first quarter of FY 2006.

3. The Point Reyes Bird Observatory (PRBO) continued their monitoring program efforts. PRBO has been funded from 2003 through 2006 to annually provide baseline information on riparian songbird communities, including presence-absence, habitat associations, density (birds per acre), and some demographic indices (fidelity, productivity, and survivorship) to measure population health along the mainstem of the San Joaquin River from Friant Dam to the confluence of the Merced River. This effort builds upon the bird monitoring activities PRBO conducted for SJRRHRP in 2002.

4. The U.S. Department of Energy's Lawrence Berkeley National Laboratories (LBNL) designed and installed six additional water quality monitoring systems at various points along the San Joaquin River. LBNL will also make recommendations on a water quality monitoring and decision support system for the San Joaquin River between Friant Dam and the confluence of the Merced River. Four of the six new monitoring locations are real time. The last 2 locations will be converted to real time in FY 2006.

5. The California State University's Stanislaus Foundation continued conducting surveys for the valley elderberry longhorn beetle and its habitat through the Endangered Species Recovery Program (ESRP), created to address endangered species needs in the San Joaquin Valley. Quarterly reports for their surveys will be provided to Reclamation in FY 2006.

6. To assist Reclamation in meeting the minimum flow requirements at Gravely Ford, funds have been provided to cover the materials and trash and tire disposal fees for a San Joaquin River cleanup effort that occurred in September 2005. This effort is coordinated by Rivertree

Volunteers, Inc., in partnership with Reclamation, in recognition of the "Keep California Beautiful" campaign, California Coastal Commission's "Coastal Clean Up Day," and Federal "Take Pride in America" and "National Public Lands Day" events. By partnering with community and volunteer organizations on these types of 'Take Pride in America' activities, Reclamation's ability to meet the Gravelly Ford flow requirements is further enhanced and the fish and wildlife habitat along the riparian corridor is improved.

Anticipated Activities for FY 2006 and Beyond

Because Reclamation and the Service want all San Joaquin River restoration planning efforts to clearly reflect the purpose of programs like SJRRHRP. Funding for the SJRRHRP will no longer occur under section 3406(b)(1) of the CVPIA. Instead, FY 2006 funding for SJRRHRP will be applied to the Comprehensive Program, so that all San Joaquin River riparian restoration issues will be addressed in a comprehensive approach, inclusive of any riparian issues. In FY 2007, and beyond, programs and funding that support the Comprehensive Plan will occur under section 3406(c)(1) of the CVPIA.

Project Title: Management of Dedicated CVP Water for Environmental Purposes
CVPIA Section 3406(b)(2)

FY 2005 Funding: $882,463

FY 2005 Accomplishments:

On May 9, 2003, Interior released its "Final Decision on Implementation of Section 3406 (b)(2)" (Final Decision), in response to a ruling in March, 2002, by the Federal District Court. The Final Decision provided a calculation of CVP water, identified the method of accounting for use of the dedicated CVP yield [(b)(2) water] pursuant to the CVPIA, set out procedures for management of the water, and listed potential measures that may be prescribed by the Service for use of the dedicated water. The Final Decision was implemented beginning October, 2003, and was further clarified by a Department of the Interior memorandum, "Guidance for Implementation of Section 3406(b)(2) of the CVPIA," dated December 17, 2003.

Reclamation, Service, National Oceanographic and Atmospheric Administration Fisheries Service (NOAA Fisheries), CDWR, and CDFG established an Environmental Water Account (EWA) to provide protection (supplemental to a baseline level of protection) to the fish of the Bay-Delta estuary. The management of (b)(2) water is part of that baseline and is closely coordinated with management of the EWA.

Both (b)(2) water and the EWA contribute to the anadromous fish doubling goal, and provide concurrent benefits to other fish and wildlife, including threatened and endangered species. Monitoring and evaluation to assess the effectiveness of implemented environmental measures under section 3406 (b)(2) of the CVPIA continues.

FY 2005 accomplishments include the following:

1. Prepared annual operations forecast representing 1992 baseline conditions and 1995 WQCP conditions. An annual fishery action plan was prepared based upon the operations forecast and consultation with other Federal and State agencies. A final operations forecast was then developed, and the forecast was updated on a monthly basis.

2. Developed a preliminary accounting of (b)(2) water on the 15th day of each month, showing the current accounting for the accounting year, as of the end of the previous month. Final accounting for all (b)(2) water actions for the entire water year was calculated by October 31.

3. Included stakeholders and public input on the annual fishery action plan and how the plan was integrated into the operations forecast.

4. Continued monitoring and evaluation of the effectiveness of (b)(2) water actions.

5. Augmented base flows in Clear Creek throughout the year to improve habitat conditions for anadromous fish; including benefits to Chinook salmon and steelhead upstream migration, spawning, egg incubation, rearing, and downstream migration.

6. Augmented base flows in the American and Sacramento Rivers in the fall and early winter of 2005 to improve habitat conditions for Chinook salmon and steelhead upstream migration, spawning, egg incubation, and rearing.

7. Augmented base flows in the Stanislaus River in winter and spring to improve habitat conditions for Chinook salmon and steelhead upstream migration, spawning, egg incubation, and rearing, and provided a pulse flow from May 1-31, 2005 [in coordination with the VAMP to assist juvenile salmon downstream migration.

8. Closed Delta Cross Channel gates December 5, 2004, to protect emigrating juvenile salmonids from the Sacramento basin, including listed Chinook salmon and steelhead.

9. Reduced Delta exports December 6-15 to facilitate "Delta Action 8", which helps protect emigrating juvenile Chinook salmon from the Sacramento basin and examines the relationship between export pumping and juvenile salmon survival in the Delta during winter months.

10. Reduced Delta exports in February to protect pre-spawning adult delta smelt, which were exposed to excessive levels of risk, as assessed by the Delta Smelt Risk Assessment Matrix, prior to export curtailment.

11. Reduced Delta exports April 17-May 1, 2005, to protect delta smelt (prior to the VAMP implementation period), and San Joaquin River emigrating salmonids.

12. Reduced Delta exports May 1-31 to protect emigrating salmonids, delta smelt, and to facilitate VAMP in San Joaquin basin streams.

Since 1993, (b)(2) water has been dedicated and managed annually for fish, wildlife, and habitat restoration purposes; to assist the State of California in its efforts to protect the waters of the San Francisco Bay/Sacramento-San Joaquin Delta estuary; and to help meet post-1992 ESA requirements.

In general, (b)(2) water actions have included: (1) instream flow augmentations on CVP-controlled streams to protect salmon and steelhead and contribute toward meeting AFRP flow objectives; (2) increased releases from New Melones Reservoir to help meet Delta WQCP requirements for San Joaquin River flows at Vernalis; (3) increased releases from Shasta and/or Folsom reservoirs to help meet outflow requirements for the Delta WQCP; and (4) export reductions at the Central Valley Project's Tracy Pumping plant to protect at-risk fish species (notably salmon, steelhead, and delta smelt).

Many factors have contributed to the decline of anadromous fish in Central Valley rivers and streams. Pursuant to CVPIA and AFRP numerous restoration efforts have been implemented that are intended to positively affect more than one stressor, including the use of (b)(2) water to help meet AFRP flow objectives. Consequently, assessing the biological benefits of (b)(2) water actions in isolation from other

restoration activities is very difficult. However, the Service believes increased instream flows, in particular, have helped maintain or improve salmon and steelhead habitat and populations in CVP-controlled streams. The Service also believes that export reductions at critical times have helped protect delta smelt as well as salmon and steelhead in the Delta.

The (b)(2) water is just one of the environmental tools created by the CVPIA to achieve the AFRP anadromous fish doubling goal. The AFRP Restoration Plan establishes Chinook salmon doubling targets for each of the main rivers and streams in the Central Valley. On the CVP-controlled streams, where (b)(2) water is available, only Clear Creek appears to be meeting the doubling goal for fall run Chinook. The Service is still evaluating whether the doubling of natural production will be sustainable on a long-term basis. Table 4 describes recent adult salmonid escapement trends on CVP-controlled streams relative to the anadromous fish doubling goal.

Real-time fish monitoring helps inform (b)(2) water decisions on when and where actions should be taken. On a weekly basis, biologists from the Sacramento, San Joaquin, and Delta update the Data Assessment Team on fish movements. The sites sampled include the mainstem Sacramento and San Joaquin rivers, their major tributaries, and various locations in the Delta, including the export facilities.

Table 4. Recent salmon and steelhead escapement trends in CVP-controlled streams, relative to the anadromous fish doubling goal. A "Yes" indicates that recent escapement trends meet or exceed the numeric doubling goal; however, sustainability of these escapement numbers is yet unknown. A blank field indicates that a specific goal has not been established. Note that striped bass, green sturgeon, white sturgeon, and American shad estimates are not included, and non-CVP controlled streams are not included.

Table 4. Adult Salmonid Escapement Trends on CVP-Controlled Streams (anadromous fish doubling goal)

	Fall-Run Chinook Salmon	Late Fall-Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead
Clear Creek	Yes				unknown
Sacramento River	No	No	No, but population increasing	No	unknown
American River	No, but population increasing				
Stanislaus River	No				

Project Title: **Water Acquisition Program**
CVPIA Section 3406(b)(3)
FY 2005 Funding: **$20,368,733**
FY 2005 Accomplishments:

The CVPIA Water Acquisition Program is charged with the responsibility of obtaining, by various means, water to supplement the 800,000 af of dedicated CVP water and to assist in meeting the CVPIA

requirements for refuge water needs (approximately 159,000 af for Level 4 refuge water supplies). In FY 2005, the Water Acquisition Program continued efforts to:

1. Provide supplemental water supplies for refuges, referred to as Incremental Level 4, for critical wetland habitat supporting resident and migratory waterfowl, threatened and endangered species, and wetland dependent aquatic biota.

2. Investigate the potential of using groundwater resources, including conjunctive use, to augment Incremental Level 4 supplies.

3. Acquire instream flows in support of the VAMP and the San Joaquin River Agreement (SJRA).

4. Acquire water to improve spawning and rearing habitat and increase migration flows for fall-, winter- and spring-run Chinook Salmon and steelhead, in support of the AFRP Restoration Plan and in coordination with the CALFED Environmental Water Program and Environmental Water Account

Outstanding issues that need to be addressed include financial constraints on the acquisition of 100 percent of Incremental Level 4 supplies, because of the increasing price of water and inadequate funding limits of the Restoration Fund. A summary of water purchases and executed agreements for FY 2005 is provided in Table 5.

Table 5. Summary of water purchases and executed agreements for the Water Acquisition Program in FY 2005. Total cost for Fiscal Year 2005 includes funds obligated in FY 2004.

Delivery Period	Seller	Quantity (AF)	Cost	Cost per AF	Purpose
Oct 04	SJR Group Authority/ Merced I.D.	12,500	$822,125	$66	Fall attraction flows and habitat improvement in Merced River and lower San Joaquin River (SJR) per SJRA. (FY04 and FY05 Funds)
May-Jun 05	SJR Group Authority	110,000	$4,529,484	N/A	Pulse Flows per SJRA/VAMP (FY04 and FY05 funds and state cost share)
Apr-Sep 05	SJR Group Authority/ Oakdale I.D.	15,000	$900,000	$60	Flow for habitat improvement in Stanislaus and lower San Joaquin Rivers
Jun - Sep 05	SJR Group Authority/ Oakdale I.D	11,000	$660,000	$60	Oakdale I.D. difference water from VAMP 2005 (per SJRA).
May – Jun 05	N/A	N/A	$290,290	N/A	VAMP monitoring
Jul 05- Feb 06	Banta Carbona Water District	4,000	$520,000	$130	Level 4 refuge water, contract year 2005
Jun 05-Feb 06	Byron Bethany Irrigation District	5,700	$798,000	$140	Level 4 refuge water, contract year 2005
Jul 05-Feb 06	Del Puerto Irrigation District	10,000	$1,200,000	$120	Level 4 refuge water, contract year 2005
Jun 05-Feb 06	Fresno Slough Water District	700	$98,000	$140	Level 4 refuge water, contract year 2005
Jul 05-Feb 06	Kern-Tulare	20,000	$2,800,000	$140	Level 4 refuge water, contract year

Table 5. Summary of water purchases and executed agreements for the Water Acquisition Program in FY 2005. Total cost for Fiscal Year 2005 includes funds obligated in FY 2004.

Delivery Period	Seller	Quantity (AF)	Cost	Cost per AF	Purpose
	Water District				2005
Jul 05-Feb 06	Lower Tule River Irrigation District	5,000	$650,000	$130	Level 4 refuge water, contract year 2005
Jun 05-Feb 06	Patterson Irrigation District	2,075	$269,750	$130	Level 4 refuge water, contract year 2005
Jul 05-Feb 06	Pixley Irrigation District	5,000	$650,000	$130	Level 4 refuge water, contract year 2005
Jul 05-Feb 06	San Joaquin River Exchange Contractors Water Authority	7,800	$936,000	$120	Level 4 refuge water, contract year 2005
Jun 05-Feb 06	San Benito County Water District	1,200	$168,000	$140	Level 4 refuge water, contract year 2005
Jul 05-Feb 06	Santa Clara Valley Water District	10,000	$1,500,000	$150	Level 4 refuge water, contract year 2005
Jun 05-Feb 06	Tranquillity Irrigation District	1,549	$216,860	$140	Level 4 refuge water, contract year 2005
TOTALS		221,524	$17,008,509		

Refuge Benefits

Prior to CVPIA, refuge management priorities were fall flood-up and maintenance of adequate pond levels throughout the winter. Since 1992, supplemental refuge water supplies acquired by the Water Acquisition Program have provided a more consistent, reliable year round water supply to certain Central Valley refuges. Some of the benefits include:

1. Increased frequency and acreage of irrigated moist soil food plants. The result has been a doubling in desirable plant biomass, which equates to more high-quality, high energy food available to waterfowl.

2. Improved maintenance water flows through refuge ponds to improve water quality and reduce avian disease.

3. Increased critical deepwater habitat within existing riparian zones. An example of biological benefits is establishment of a great blue heron rookery at Kern National Wildlife Refuge (NWR) in 1998. By 2001 there were 53 nests counted, inhabited by numerous nesting herons, egrets, cormorants and night-herons.

4. Increased spring and summer habitat to benefit water dependent wildlife such as the giant garter snake. An example of habitat improvements occurred within Grassland Resource Conservation District (GRCD) consisting of 14,000 acres of additional spring habitat between 1991 and 2003 and 2,400 acres of additional summer habitat between 1991 and 1998.

5. Increased critical spring and summer breeding habitat for the white-faced ibis which is a "species of special concern." At Sutter NWR the population of this species has increased from 50 in 1992 to more than 15,000 in 2004, and at Kern NWR the population increased from 50 in 1992 more than 8,000 in 2005.

6. Increased early fall habitat for over-wintering migrants. Between GRCD, Kern NWR and Pixley NWR, there has been an increase in overall early fall habitat of 2,300 acres in 2003 for the benefit of the northern pintail and other early migrants which arrive in August to over-winter.

Ground Water Investigations

Groundwater investigations are being conducted by the Water Acquisition Program to lower the costs of providing supplemental refuge water supplies and to increase the reliability of these water supplies. In 2004, initial ground water investigations were completed which identified groundwater data needs for the Central Valley Refuges that receive Incremental Level 4 water supplies. In 2005, the Water Acquisition Program initiated follow-up ground water studies at Pixley NWR, East Bear NWR and Los Banos Wildlife Area to determine the potential for sustained use of ground water resources on these refuges to meet Incremental Level 4 needs. Additional ground water investigations will be conducted over the next several years at other refuges receiving water supplies pursuant to CVPIA.

Instream Flows for SJRA and VAMP

The Water Acquisition Program has acquired water from the San Joaquin River Group Authority (SJRGA) and its member agencies to provide spring and fall fishery flows on the Stanislaus, Tuolumne, Merced, and lower San Joaquin rivers. The water is acquired in support of the SJRA and VAMP, which is a scientifically based fishery management plan to determine the relationships between flows, exports, and other factors on fish survival in the Sacramento-San Joaquin Delta. The increased flows benefit numerous resident and anadromous fish species but are acquired primarily to benefit Chinook salmon. Central Valley Chinook salmon constitute the majority of salmon produced in California, and at times have accounted for 70 percent or more of the statewide commercial harvest. The SJRA and VAMP will continue as an on-going requirement until at least 2011.

Instream Flows for AFRP

The AFRP identified the need to augment stream flows on some tributaries to the Sacramento and San Joaquin rivers to help meet a doubling goal of Central Valley anadromous fish identified in Section 3406 (b)(1) of CVPIA. In recent years, the Service has led a planning effort to determine which tributaries should receive priority for instream acquisition efforts. A key product of this effort is a Draft Decision Support Model (DSM). The DSM evaluates key factors including potential biological benefits, availability of water rights, cost of water, and impacts, in order to assess water acquisition priorities. A monitoring component will be built into future instream acquisitions to assure flow requirements are met and biological benefits are quantified. A specific timeline for implementation of instream acquisitions in support of AFRP has not yet been established.

Project Title: Tracy Pumping Plant Mitigation Program
CVPIA Section 3406(b)(4)
FY 2005 Funding: $638,652
FY 2005 Accomplishments:

The goal of the Tracy Pumping Plant Mitigation Program (TPPMP) is to mitigate for impacts associated with the operation of the Federal Tracy Pumping Plant in the south Delta. Included within the scope of the TPPMP are research activities to determine improved methods of screening and salvaging fish at the Tracy Fish Collection Facility (TFCF), payments to the CDFG for direct losses of fish experienced as a

result of the TPP and TFCF operations, and implementation of operational and maintenance changes at the TFCF to provide improvements in salvage efficiencies.

The previous Direct Loss Agreement with CDFG expired in 2002 and is presently being renegotiated. No payments were made to CDFG in FY 2005.

The current objectives of the research activities are to improve fish protection and fish salvage at the facility in the short-term, while determining the best practical fish protection technology for incorporation into long-term improvements at the facility. To help accomplish this, the CALFED South Delta Fish Facility forum (SDFF) has been meeting and establishing guidelines during these tight fiscal times to determine how best to accomplish these goals and objectives.

The SDFF recommended to suspend the construction of a large scale test facility (TFTF) at Tracy at this time and to, instead, focus on improving existing fish salvaging facilities in the south Delta, while implementing other less costly alternatives to fish protection at the same time.

FY 2005 accomplishments include the following:

1. Evaluation of the existing facility for Chinook salmon and Delta smelt salvage efficiencies.

2. Evaluation of the Tracy mitten crab traveling screen as a potential device for continuous woody and leafy debris removal.

3. Studies on tracking predator fish movements inside fish salvage facilities using remote telemetry.

4. Continuation of swirl tests to assess stress levels of salvaged fish held in recessed collections tanks.

5. Evaluation of stress on winter-run Chinook salmon associated with fish holding.

6. Evaluation of above ground holding tank.

7. Evaluation of dual frequency identification sonar (DIDSON) for underwater observation of fish movement.

8. Fish taxonomic refinement and external assessment of test fish.

9. Maintenance and updating of a technical web site.

10. Publication of Tracy Volume Series Nos. 24 and 30.

FY 2005 the improvement activities were:

1. Hydraulic evaluation of new primary bypass transition boxes.

2. Evaluation and design of improved trash rack cleaning device.

3. Evaluation and design of improved primary louver cleaning system.

4. Installation of new 15 kV power cable to provide upgraded power service to the facility.

5. Biological surveys of abandoned intake channel.

It is difficult to summarize biological benefits of the TPPMP since 1992 due to uncertainty about how best to proceed in the south Delta to improve fish protection at both the Federal TFCF and State J.F. Skinner Fish Facility. Originally the plan was to construct a full scale (i.e. 2,500 cfs) TFTF as one-half of the eventual replacement of the existing TFCF and phase in construction of several 2,500 cfs modules at the Skinner facility. However, due primarily to exorbitant construction cost, the CALFED SDFF recommended focusing more on improving existing fish facilities and returning the existing facility to its original operation criteria as best as possible, while implementing other less costly fish protection measures elsewhere within the state.

The research activities noted above provide valuable information towards these improvements in fish protection at the South Delta fish facilities (both the CVP and SWP).

Once present research efforts are completed, or as they are being completed, physical changes will be made at the existing facilities to improve efficiency of the fish salvage process. At that time, field tests can be conducted to assess the effectiveness of these changes.

It is anticipated that at least three more years of intensive field and lab testing is required to determine best methods of salvaging fish at the TFCF under the current conditions. Some improvements can be implemented sooner than others.

As determined by internal Reclamation engineering studies, the overall efficiency of the federal TFCF has lessened by as much as 60 percent over the past 40+ years.

Project Title: Contra Costa Canal Pumping Plant Fish Screen Project
CVPIA Section 3406(b)(5)
FY 2005 Funding: $246,605
FY 2005 Accomplishments:

The Program focus is to mitigate for fishery impacts resulting from operations of the Contra Costa Canal Pumping Plant. In order to achieve the requirements of this section, it is needed to provide for construction and operation of new fish screen and recovery facilities and for modification of operations and practices at the Contra Costa Canal Pumping Plant. This is consistent with and supports the Service's biological opinion for the delta smelt that was issued for the Los Vaqueros Project.

In 1996, the Contra Costa Fish Screen Management Team and the Contra Costa Technical Advisory Committee were established, consisting of representatives from CDFG, CDWR, the Service, Reclamation, NOAA Fisheries Service, and the Contra Costa Water District. These two groups have been assisting in planning and developing a fish screen project for the Rock Slough intake of the Contra Costa Canal. In addition, there is a Peer Review Team that has helped review planning and design documents and a Value Engineering Team that explored cost saving alternatives.

An extension was made to the Los Vaqueros biological opinion for delta smelt to allow for a later date for the construction of a fish screen. There is also the possibility of re-initiating formal consultation and adding mitigation requirements.

Final design and construction of a major project at the Contra Costa Canal Pumping Plant will await the results of further studies by the Contra Costa Water District and responses from the fishery and regulatory agencies on an amendment to the biological opinion.

Project Title: **Flow Fluctuation/Reservoir Storage Management Program**
CVPIA Section 3406(b)(9) and (19)
FY 2005 Funding: **$ 17,526**
FY 2005 Accomplishments:

CVPIA Section 3406(b)(9) requires development and implementation of a program to eliminate, to the extent possible, losses of anadromous fish due to flow fluctuations caused by operation of any CVP storage or re-regulating facility. This program is to be patterned, where appropriate, after the agreement between CDFG and CDWR on the operation of the SWP's Oroville Dam complex. Closely related to this charge to reduce the impacts of flow fluctuations, CVPIA Section 3406(b)(19) calls for the re-evaluation of reservoir storage criteria in order to maintain minimum carryover storage in Shasta and Trinity Reservoirs to benefit anadromous fish, with full regard to the Secretary's responsibility to fulfill all project purposes, including agricultural water delivery. Interior's efforts on both of these directives are generally handled as a single program. Although no funding specifically allocated for section (b)(19), reservoir storage was studied under 3406(b)(2) in FY 2005.

The American River Operations Work Group met monthly throughout FY 2005 to discuss American River operations and to determine threshold flows and ramping rates required to protect Lower American River fishery resources. In addition, Reclamation conducted monthly temperature modeling of the flows of the American River.

The Stanislaus River flow fluctuation study was started in 1999 and is still ongoing. An early draft report of that study was released in July, 2004. More regular discussions of the Operations

Group are held in the April/May period when the pulse flows for VAMP are being planned and implemented. These pulse flows include releases from New Melones Reservoir on the Stanislaus River.

Project Title: **Red Bluff Diversion Dam Fish Passage Program**
CVPIA Section 3406(b)(10)
FY 2005 Funding: **$827,234**
FY 2005 Accomplishments:

CVPIA Section 3406(b)(10) requires the development and implementation of measures to minimize fish passage problems for adult and juvenile anadromous fish at the Red Bluff Diversion Dam (RBDD) in a manner that provides for the use of associated CVP conveyance facilities for delivery of water to the Sacramento National Wildlife Refuge Complex (SNWR).

Fish passage was substantially improved through compliance with NOAA Fisheries' 1993 biological opinion for the winter-run Chinook salmon, which requires lifting of gates on RBDD between September 15 and May 15. The second objective, reliable delivery of water to the SNWR complex, was subsequently addressed by installation of new fish screens at the Glenn Colusa Irrigation District's (GCID) diversion in Hamilton City, and installation of a siphon on the GCID canal under Stony Creek.

Consequently, the analysis of alternatives for infrastructural changes at the Red Bluff Research Pumping Plant led to the general recognition that operations, as directed in the 1993 biological opinion for winter-run Chinook salmon, were very effective in improving passage of anadromous fish, with the possible exceptions of adult spring-run Chinook and green sturgeon. The increased duration of gate removal at RBDD, prompted by the biological opinion, dramatically improved baseline passage conditions for both juvenile and adult Chinook salmon and changed the standard against which additional measures to minimize fish passage problems would be measured. Although further fish passage improvement analyses have shown the greatest potential for spring-run Chinook salmon, the amount and certainty of those benefits remain unclear for a variety of reasons. Benefits with respect to the green sturgeon appear uncertain also, but less confidence can be placed in assertions of either harm or benefit from RBDD operations given the limited data on this species in the Sacramento River.

A year-round pumping plant to support off-stream storage under CALFED would lead to elimination of fish passage issues at RBDD through construction of a pumping plant capable of year-round operation. However, without such a storage-related facility or an alternative funding source, major structural changes at the RBDD would be difficult to finance.

Formal decisions are still pending completion of an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) and Record of Decision for the RBDD Fish Passage Program Improvement Project. The draft EIS/EIR, which focused on structural alternatives to resolve fish passage problems at RBDD, was made available for public review in 2002. Work was then suspended pending, first, completion of ESA section 7 consultation for the Central Valley Project Operations Criteria and Plan (OCAP) and, second, completion of the Long Term Water Contract Renewal process. Completion is now on hold pending completion of the NOAA Fisheries' decision on whether to list the green sturgeon as threatened, and an assessment of whether recent research warrants revision of the EIS/EIR. It is clear, however, that removal of passage impediments to both Chinook salmon and sturgeon at RBDD, and the provision of water supply reliability would cost on the order of $80-100 million.

In the meantime, substantial progress was made in 2005 on the installation of additional pumping capacity at the Red Bluff Pumping Plant, and that capacity is expected to come on line for the 2006 irrigation season.

No new benefits accrued in FY 2005.

Project Title: Coleman National Fish Hatchery
CVPIA Section 3406(b)(11)
FY 2005 Funding: $287,155
FY 2005 Accomplishments:

Section 3406(b)(11) of the CVPIA states that the Secretary is authorized and directed to rehabilitate and expand the Coleman National Fish Hatchery (NFH) by implementing the Service's Coleman National Fish Hatchery Station Development Plan, and modify the Keswick Dam Fish Trap to provide for its efficient operation at all project flow release levels and modify the basin below the Keswick Dam spillway to prevent the trapping of fish. Coleman NFH was originally constructed in 1942 to offset fish habitat losses resulting from the construction of Shasta and Keswick dams (the cornerstone of the CVP).

Disease and sediment problems associated with the water supply have confounded fish culture programs at Coleman NFH since its inception, and have caused mortality of juvenile and adult salmonids at the hatchery. To reduce sediment in the hatchery water supply and to alleviate recurrent disease problems, a water treatment facility capable of filtering 45,000 gallons per minute (gpm) and ozonating 30,000 gpm has been constructed at Coleman NFH. Operation of the ozone water treatment facility substantially

lessens occurrence of disease in hatchery production and reduces potential for disease transmission to naturally-produced stocks. Since the ozone facility reached full capacity in 2000, juvenile fall Chinook from brood years 1999-2004 have been reared and released with no incidence of infectious haematopoietic necrosis virus (IHNV). This is a first in the history of the hatchery. It is also extremely significant that the water treatment facility alleviates concerns of passage by anadromous salmonids above the hatchery's water source. This action, therefore, ties directly with efforts of the CALFED funded Salmon and Steelhead Restoration Project to restore 42 miles of habitat in upper Battle Creek.

Other projects implemented at Coleman since enactment of the CVPIA include rehabilitation of 28 badly deteriorated rearing ponds, interim improvements to the hatchery's water intake on Battle Creek, and initiation of planning and environmental compliance for a permanent solution for the water intake that will comply with National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).

Design modifications of the Keswick Dam Fish Trap on the Sacramento River were completed in 1996. The fish trap at Keswick Dam is used to collect broodstock for production at both the Coleman and Livingston Stone hatcheries. Historically, the trap has failed to efficiently trap and maintain fish at higher flows or provide a safe work environment for collecting fish and making repairs. Section 3406(b)(11) of the CVPIA allowed for modification of the trap at Keswick to make it more efficient and safe at all flows. Modifications have reduced loss of smaller fish and have helped reduce fish injury in general. New controls on the elevator allow increased flexibility and safety for the operator. Construction of an escape channel has eliminated trapping and stranding issues associated with the stilling basin.

In 1997, the CVPIA provided more than $1 million to establish the Livingston Stone Fish Hatchery on the Sacramento River. The hatchery allows for rearing of winter Chinook salmon in a Sacramento River water supply. The construction of the Livingston Stone NFH assures that the hatchery-origin adults will return to spawning grounds in the upper Sacramento River, rather than Battle Creek, to better assist in the recovery of this endangered species.

The hatchery building at Coleman NFH was reconstructed in FY 2003. The hatchery building, constructed in the early 1940s, is a significant component at the hatchery, as incubation and early rearing of all stocks is accomplished in the building. In March of 2000, a Federal Emergency Management Agency (FEMA) 310 structural, non-structural, and geotechnical evaluation identified a number of deficiencies, which resulted in the building failing to meet current California Zone 2 seismic requirements. Following completion of the Coleman NFH Hatchery Building Renovation Report and subsequent discussions and analyses, renovation/rehabilitation of the structure was deemed more cost effective and feasible than demolition and new construction. Renovation was accomplished with funds secured in FY 2000, FY 2001 and FY 2002. Total project cost was approximately $1.4 million.

Program Objectives for FY 2005 are to continue rehabilitation/expansion of the Coleman National Fish Hatchery (NFH) by implementing the Service's 1987 Coleman NFH Station Development Plan. Funding pursuant to CVPIA section 3406(b)(11) FY 2005 was used to complete required construction and modification of the domestic water system. The project as described is considered a component of Phase Two of the Station Development Plan.

Visitor use at Coleman NFH numbers tens of thousands. A safety/environmental compliance review of the Coleman NFH complex identified a potential health and human safety concern related to the station's drinking water system. Safe drinking water is achieved on-station through a well and storage tank and application of an Ultra Violet (UV) sterilization system. However, as currently configured, the station's fire suppression system utilizes common lines with the drinking water system. Use of the fire suppression system could result in the contamination of the drinking water system through the cross-piping

connections. This situation could result in the complete unavailability of potable water on station until the drinking water lines were flushed and UV treated water again recharged in the system. A complete separation of the two systems has been identified to rectify this situation and ensure the availability of high quality treated drinking water to station staff and the visiting public.

In addition, the casing for the main well (drilled in 1942) was found to be heavily deteriorated. Code changes adopted by the Department of Public Health preclude efforts to modify the

existing well and have required the development of a new well. Funding provided in FY 2005 augmented previously received funding to complete the development of a new domestic water system.

Project Title: **Clear Creek Restoration Program**
CVPIA Section 3406(b)(12)
FY 2005 Funding: **$953,371**
FY 2005 Accomplishments:

This section of the Act requires restoration of Clear Creek, construction of a new fish ladder at the McCormick-Saeltzer Dam, and the development and implementation of a comprehensive program to provide flows from Whiskeytown Dam to allow sufficient spawning, incubation, rearing, and outmigration for salmon and steelhead.

Since the removal of McCormick-Saeltzer Dam and its diversion from Clear Creek in 2000, efforts on Clear Creek have been re-focused to improve instream habitat conditions for anadromous salmonids. FY 2005 accomplishments include the following:

1. Implementation of the Clear Creek Stream channel restoration project. This project is restoring natural geomorphic form and process to a 2-mile section of the creek degraded by instream gold and aggregate mining. The project is currently 50 percent complete. In FY 2005, a funding proposal was prepared and submitted to CALFED for implementation and post-construction monitoring of Phase 3B, with implementation expected to begin in summer, 2006. The need to implement the last phase, Phase 3C, is being evaluated. Fisheries monitoring showed a 363 percent increase in Chinook salmon spawning density in the newly completed Phase 3A. In addition, migratory songbird diversity and population sizes are increasing in the restoration area. Topographic surveys and mercury characterization were conducted for Phase 3B. Mercury characterizations conducted by the University of Montana and the U.S. Geological Survey indicated that the project had no adverse impacts on mobilizing or increasing mercury concentrations in the creek.

2. Implementation of salmon-friendly flows. In accordance with the mandate of this section of the Act and in concurrence with the AFRP's restoration plan, increased flows will continue indefinitely. This project element is 14 percent complete. From October 1, 2004, to June 3, 2005, water releases were maintained at 200 cfs to provide spawning and rearing habitat for Chinook salmon and steelhead. Begun in 1995, these increased flows have resulted in a 5-fold increase in fall-run Chinook salmon escapement. During the summer months, water releases of 90-200 cfs were provided to create cool water temperatures and habitat for threatened spring-run Chinook salmon and steelhead. Spring-run Chinook salmon and steelhead adult abundance indices continued to increase to 98 and 288, respectively. To satisfy the requirements of Section 3406 (b)(12), an Instream Flow Incremental Flow Methodology (IFIM) study is continuing. This study will assist in determining long-term salmon and steelhead spawning and rearing flows. The IFIM study is expected to be completed in FY 2008. The Clear Creek Decision Analysis and

Adaptive Management Model, designed to evaluate power, sediment, riparian, and salmonid impacts from large managed releases of water, was improved.

3. Implementation of the spawning gravel augmentation and monitoring program. This program element is approximately 21 percent complete, but the addition of spawning gravel to the channel is expected to continue in perpetuity. Approximately 2,000 tons of spawning gravel were injected below Whiskeytown Dam, and 1,000 tons were injected at the NEED Camp site. In addition, designs continued on a new gravel augmentation project at Dog Gulch. Work continues on revision of the Gravel Management Plan to refine and determine long-term spawning gravel addition needs for the creek. Monitoring indicated that spring-run Chinook salmon and steelhead were utilizing injected gravel for spawning areas.

4. Clear Creek monitoring efforts. Monitoring included juvenile salmonid use of restored habitats, fish stranding, adult population estimates, and redd mapping. Stream flows, water temperatures, spawning gravel, and stream substrate quality were also monitored in FY 2005. CALFED approved funding for two major monitoring efforts by the Service and Western Shasta Resource Conservation District on Clear Creek, including most fisheries, geomorphology, riparian vegetation and songbird monitoring needs for three years.

Project Title: **Spawning Gravel Replenishment Program**
CVPIA Section 3406(b)(13)
FY 2005 Funding: **$589,900**
FY 2005 Accomplishments:

The CVPIA directs that a program be established to replenish anadromous fish spawning gravel that has been lost as a result of the construction and operation of the CVP, bank protection projects, and other activities on the Sacramento, American, and Stanislaus Rivers. Since 1997, the gravel replenishment program mandated in section 3406(b)(13) of the CVPIA has implemented actions that placed almost 166,000 tons of spawning gravel in these rivers to increase the availability of spawning and rearing habitat for Chinook salmon and steelhead. In addition, existing gravel substrates on the American River have been ripped and manipulated to make them more usable for these purposes.

Nearly 152,000 tons of spawning gravel has been placed in the upper Sacramento River since 1997. A total of 32,500 tons of gravel has been placed at a site on the west bank, immediately downriver from Keswick Dam, during the years 1997, 1998, 2000, 2004, and 2005; 96,300 tons at a site on the west bank, immediately downstream from the confluence with Salt Creek, during the years 1997, 1998, 1999, 2002, 2003, 2004, and 2005; and 23,000 tons on the east bank on the Tobiasson property toward the southern extent of the Redding city limits in 2000. These introductions have occurred in anticipation that subsequent high river flows will disperse the gravel downriver. In every case the gravel has been dispersed.

The substrate at three riffles on the lower American River was manipulated and 6,000 tons of spawning gravel was subsequently placed at these sites according to specifications in 1999.

A total of 8,000 tons of spawning gravel has been placed in the Stanislaus River since 1997 at several sites immediately downriver from Goodwin Dam. On two occasions, helicopters were used to deposit the gravel directly into the channel. Gravel was also delivered by truck to areas adjacent to the channel, and pushed into the river channel. Gravel was deposited into the river channel in 2004 by means of a sluice delivery system. The introduced gravel was subsequently dispersed downriver by streamflow.

Selected cobble at the Upper Sacramento River placement site in the vicinity of Salt Creek was implanted with electronic monitors to follow the downriver movement of gravel. Monitoring was conducted for one season. Field observations indicated the cobble moved varying distances downriver, with the farthest movement reaching to just above Anderson Cottonwood Irrigation District Diversion Dam at the City of Redding. No report on this monitoring was generated. Visual anecdotal observations have similarly been reported for adult salmon spawning in the vicinity of the gravel and for large numbers of juvenile salmon adjacent to the gravel placement sites. Aerial redd surveys unrelated to this program have indicated that winter-run Chinook salmon spawning distribution has shifted upstream since gravel introductions began in the upper river near Keswick Dam.

Gravel placement in the American River occurred in 1999, and monitoring has been conducted since then as a part of the 1999 plan to evaluate the project before designing new gravel enhancement projects in the river. The monitoring has shown that Chinook salmon spawning has occurred each year on the gravel placement sites at Sailor Bar and Sacramento Bar. Spawning at the Sunrise site occurs primarily during higher flows than are typical during the Chinook salmon spawning period; however, steelhead has spawned on the gravel at Sunrise during higher flow periods. The average Chinook salmon escapement from 2001 through 2005 (148,000) was more than triple the average escapement prior to that period (42,000). Although the increase in escapement has been substantial following the project, the increase cannot be attributed wholly to the gravel project. The hatchery contributes a large, unknown portion of Chinook salmon production, and favorable ocean conditions enhanced marine survival over the period since gravel placement. Monitoring of adult Chinook salmon spawning activity during 2005 showed that fish densities during the peak spawning period in the upper river are higher than needed to fully utilize the existing spawning habitat. Many of the 'extra' salmon died prior to spawning, likely due to competition with fish that successfully defended favorable spawning sites and spawned. An interagency group is currently examining new gravel replenishment projects in the upper river.

Prior to gravel placement in Goodwin Canyon, spawning habitat was extremely limited in the upper four miles of the Stanislaus River, and little spawning occurred there. Since gravel placement began, over 149 female Chinook have spawned in Goodwin Canyon each year on the new gravel. This number of Chinook salmon spawners should produce about 745,000 eggs, which in turn should produce about 400,000 adult Chinook salmon, annually in the Stanislaus River. The area of the Stanislaus River near Goodwin Canyon contains the best water quality year-round for salmonids because the water is cooler than that farther downstream. In addition, steep sections of river prevent predatory fish from migrating to Goodwin Canyon. Because of the cooler temperatures and lack of predation, salmonids that spawn in the upper river, where the gravel enhancement has occurred, likely produce more outmigrating smolts per spawner than those that spawn lower in the river. In addition to spawning habitat values, gravel placement enhances rearing habitat conditions for salmonids. Juvenile rearing densities on the new gravel are roughly double that of other rearing habitat in close proximity.

FY 2005 accomplishments include the following:

1. Delivered spawning gravel to two river bank sites on the upper Sacramento River and let river flow subsequently disperse the material downstream. A total of 8,500 tons of spawning gravel was placed in the river—4,250 tons at the Keswick Dam site and 4,250 tons at the Salt Creek site. Entered into a contract to evaluate the benefits of gravel placement in the Upper Sacramento River, which includes an examination of the geomorphic environmental baseline.

2. Continued the spawning gravel monitoring program on the lower American River. The spawning gravel monitoring program on the lower American River included two items: (1) aerial photo documentation of Chinook spawning locations and redd densities relative to gravel placement sites on three dates throughout the spawning period; and (2) spawning gravel condition

monitoring to assess suitability of spawning gravels in the gravel placement sites and in other high use spawning areas, compared to low use and unused habitats.

3. Placed 2,500 tons of spawning gravel at two sites in Goodwin Canyon on the Stanislaus River—1,500 tons at an in-channel stockpile location for flows to distribute the gravel downstream over time, and the remaining 1,000 tons at an experimental site. An adaptive management experiment is being conducted at the experimental site to ascertain gravel size criteria that will provide the best survival for incubating eggs. A peak count of 65 Chinook redds occurred on the site where gravel was placed in 2004 and a peak of 84 redds were counted at the 2002 placement sites. Redds were also mapped at these two sites. Underwater observations verified that fry emergence occurred from the placed gravels, and rearing densities were high. Post-project streambed topography was mapped at the 2004 placement location and pre-project topography was mapped at the 2005 placement sites.

The vision for this program is to replenish gravel in the three designated rivers to maintain sufficient salmon and steelhead spawning habitat in support of CVPIA goals. The dams on these rivers have created a permanent block to gravel recruitment downstream of the dams, and the remaining sources of gravel are limited to tributary inputs and side-bank erosion downstream of the dams, both of which cannot replenish these losses on their own. Consequently, it is anticipated that the gravel replenishment requirements of the Gravel Replenishment Program will remain in place into the future, for as long as gravel recruitment is curtailed.

Project Title: **Comprehensive Assessment and Monitoring Program**
CVPIA Section 3406(b)(16)
FY 2005 Funding: **$203,493**
FY 2005 Accomplishments:

The CVPIA calls for a comprehensive program to assess the biological results and effectiveness of CVPIA actions undertaken pursuant to section 3406(b) of the statute. CAMP is the vehicle developed to comprehensively assess the effects of all actions under section 3406(b) of the CVPIA. The program will provide information on long-term changes at the population and landscape levels that accrue as a result of restoration actions, suites of actions, and programs. The program has two main objectives:

1. Assess the overall (cumulative) effectiveness of actions implemented under Section 3406(b) of the CVPIA so that progress toward restoration goals can be ascertained.

2. Assess the relative effectiveness of categories of actions under Section 3406(b) of the CVPIA so restoration can proceed in the most effective manner through adaptive management.

One major CVPIA restoration goal being assessed by CAMP is the AFRP goal to make all reasonable efforts to ensure that natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991. Another major CVPIA restoration goal being assessed by CAMP is that for the Habitat Restoration Program (HRP; also known as the "b1 other" Program). Its goal is to protect and restore native habitats and to stabilize and improve populations of native species impacted by the CVP and not specifically addressed in section 3406(b) of the CVPIA.

FY 2005 accomplishments include the following:

1. Estimates of Central Valley Chinook salmon adult production were updated, covering the years 1952 through 2003. These data were submitted in support of the State Water Resources Control Board hearings on the Implementation and Monitoring of the San Joaquin River Agreement and the VAMP. The pertinent documents comprised Exhibit 17 for the hearings include:

    (a) Adult Chinook salmon escapement and natural production estimates for the Sacramento and San Joaquin River systems (PowerPoint presentation)

    (b) Spreadsheet, used to generate adult Chinook salmon production estimates using both in-river and hatchery escapement numbers from Grand Tab (Lotus 123 spreadsheet)

    (c) Notes and Caveats for Exhibit 17 Figures (MS Word document)

2. Completed a third year of visual monitoring for Chinook salmon and steelhead on the lower American River. These data provides information for evaluating and adjusting Folsom Dam operations and will contribute to baseline data for planning future restoration projects on the lower American River.

Between the years 1992 and 2005, CAMP recorded several other accomplishments. In 1996, CAMP developed a Conceptual Plan for evaluating the overall success of various actions for fisheries and, in 1997, an Implementation Plan was created describing in detail how fisheries monitoring would be accomplished and how fisheries data would be processed and evaluated.

Data collection under CAMP began in 1995 and has continued each year insofar as funding has allowed. CAMP has provided funding to CDFG to perform a variety of monitoring efforts, including a summer Delta tow-net survey to provide information on American shad; elements of an adult striped bass monitoring program; juvenile salmonid out-migration monitoring on the Yuba, Merced, and Tuolumne rivers; and a Central Valley angler survey that focused on catches of Chinook salmon and steelhead to gauge numbers being caught in the inland recreational fisheries. The latter is a necessary component of salmonid stock monitoring, along with spawning population surveys and ocean catch estimates provided by CDFG. Since 2002, CAMP has funded an annual fish population monitoring program on the American River using visual observation to help provide a baseline for future restoration projects.

Annual findings of CAMP-funded monitoring activities and other available monitoring data are reported by the program. These reports have provided insight into changes in salmonid population levels since the start of CVPIA restoration activities. Thus far, results are mixed, with apparent population increases reported on Clear Creek, Butte Creek, and Battle Creek, and declines reported in other areas, such as San Joaquin River tributaries.

Data generated by CAMP is also provided to the Interagency Ecological Program (IEP) for management and to be shared with others working on related activities, and CAMP has provided funding to help maintain the IEP database (the IEP was established to provide information on factors that affect ecological resources associated with the Sacramento-San Joaquin Delta).

CAMP is investigating methods to ascertain sustainability of observed population levels, as required to meet program objective 1. In 2004, CAMP funded a report on statistical procedures for assessing progress toward the AFRP Chinook salmon production doubling goal and determining sustainability of production increases. The report is to be used in further development of methods to assess population changes. Preliminary conclusions cite a need for better data, including watershed specific escapement

estimates for naturally spawned and hatchery fish; watershed specific juvenile production; and ocean, mainstem, and tributary catches.

Other accomplishments of CAMP include funding of a hatchery marking program and development of a plan for constant fractional marking of hatchery salmonids, development and implementation of a fish screen evaluation program, and completion of a riparian mapping program for the Sacramento River and its tributaries.

The lack of consistent monitoring over time has hindered the progress of CAMP in achieving its objectives. Because the Service and Reclamation believe reinvigoration and expansion of CAMP is necessary to effectively and efficiently implement many provisions of the CVPIA, CAMP is undergoing reevaluation. Monitoring and assessment needs are also being identified to evaluate the effectiveness of restoration actions for CVP impacts not specifically enumerated in CVPIA section 3406(b), including those being addressed by the HRP.

Certain monitoring activities of interest to CAMP may be conducted under the CALFED Bay-Delta Program. Coordination with CALFED Bay-Delta Program monitoring activities will be necessary to most efficiently meet the monitoring needs of both programs.

Project Title: Glenn-Colusa Irrigation District Fish Screen Replacement Project
CVPIA Section 3406(b)(20)
FY 2005 Funding: $2,045,590
FY 2005 Accomplishments:

The CVPIA calls for elimination of loss or damage to fish in the Sacramento River from the water diversion at Glenn-Colusa Irrigation District's (GCID) Hamilton City Pumping Plant (HCPP). The plant diverts up to 3,000 cfs from the river, and past losses of fish at the facility have ranged from 10 to 21 million per year, depending on the weather, flow in the river, fry survival and other factors. An eight-agency/stakeholder effort to correct the problems has been under way since 1992.

The objectives of the project, as stated in the 1997 EIR/EIS, are to construct a project that: (1) provides state-of-the-art fish screen protection that is reliable, cost-effective, and minimizes all fish losses, including endangered winter-run Chinook salmon, while minimizing adverse impacts to other environmental resources; (2) enables GCID to meet instantaneous (Peak) demands (within the existing capacity of the HCPP) and provides long-term reliability for GCID water deliveries through the HCPP; and (3) minimizes the potential risk of screen performance failure due to local changes in river gradient and alignment over the project's 50-year life. Overall, at the end of FY 2005, the project planned funding and expenditures will be 99.5 percent complete and the schedule will be 82 percent accomplished.

Construction of all components of a state-of-the-art fish protection facility was completed in the spring of 2001 at a cost of $48 million. The components of the system consist of a flat-plate wedge-wire 1,114-foot long, 28-foot high fish screen structure, with three 54-inch diameter fish bypass pipes and a 1,200 cfs open channel to return fish to the river. The system also includes a 1,000 foot long Gradient Restoration Facility in the main stem of the Sacramento River, and various appurtenant structures.

A fish screen system testing/operation optimization program was initiated in the summer of 2001. Up to 20 hydraulic and biological parameters were identified for testing, with at least three years of acceptable data required for each parameter. Transfer of the project to operations and maintenance status is scheduled for October, 2008, provided the testing program finds the facility to be operating as designed.

FY 2005 accomplishments include the following:

1. Completed the second year of biological testing of the fish bypass system with suitable fry-size Chinook salmon. Results will be available after October 2005.

2. Completed the report titled *2004 Biological Evaluation of the Fish screens at the Glenn-Colusa Irrigation District's Sacramento River Pump Station*, May 2005. This report presents the 73 mark/recapture tests conducted from May 6 to September 14, 2004. Overall fish survival for the 2004 tests was found to range from 58 to 100 percent, with an average of 81 percent.

3. Completed the report titled *2003 Biological Evaluation of the Fish Screens at the Glenn-Colusa Irrigation District's Sacramento River Pump Station*, January 2005. This report presents the 74 mark/recapture tests conducted from March 25 to September 4, 2003. Overall fish survival for the 2003 tests was found to range from 56 to 100 percent, with an average of 86 percent.

4. Completed the first tests for determining the effect of predation on the survival of test fish at the fish screen.

5. Completed the second year of sturgeon radio tagging and gradient facility passage tests. No sturgeon testing was completed in 2004.

6. Completed the report titled *Evaluation of Adult Sturgeon Migration at the Glenn-Colusa Irrigation District Gradient Facility on the Sacramento River during 2003*, May 2005. The report concluded that 11 sturgeons passed through the Gradient Restoration Facility.

7. Completed a fully executed modification to extend the Cooperative Agreement to 2008 to allow for complete biological and hydraulic testing of the system.

8. Completed a fully executed modification to extend the Grant Agreement and add funds to address reimbursement of early planning efforts.

Project Title: **Anadromous Fish Screen Program**
CVPIA Section 3406(b)(21)
FY 2005 Funding: **$12,476,090**
FY 2005 Accomplishments:

The Anadromous Fish Screen Program (AFSP) serves two functions in its efforts to protect juvenile anadromous fish from the effects of unscreened or inadequately screened water diversions. First, it is a potential source of cost-share type funding for diverters to install fish screens or other protective devices at their facilities. As a matter of policy, cost-share funding is only provided for features of approved projects that are required for screening and protecting fish. Up to 50 percent of the funding for qualified features can be provided by the AFSP. The AFSP funds are expended on a biological priority basis that is closely coordinated with the CALFED Environmental Restoration Program (ERP), a potential source of additional funds for fish screen projects.

Second, the AFSP Technical Team, with screen experts from various Federal and State resource and regulatory agencies, provides fish screen development guidance to participating diverters throughout various phases of project planning and implementation.

The overall benefits of screening diversions as carried out by the AFSP include the following:

1. Prevents entrainment of important fish species including steelhead and Chinook salmon.
2. Compliments other fish habitat restoration efforts for anadromous fish.
3. Benefits other native aquatic organisms of importance by effectively keeping them out of the diversions.
4. Meets legal requirements under the ESA to avoid or limit take of listed fish.

The AFSP has funded fish screen projects at water diversions ranging from 17 to 1,000 cfs. Every project funded by the Program is a multi-year effort, with funds being provided for feasibility studies, engineering and design, construction, and start-up testing. Consequently, accomplishments reported in any given year may be the result of funding provided several years earlier. Through FY 2005, the AFSP has been responsible for the construction of 21 screens. Approximately 3,200 cfs of diverted water in Central Valley streams is now fish-safe as a result. Currently, the Program is involved with seven applicants, each in various phases of project development.

FY 2005 accomplishments include the continued support to screen design and environmental compliance activities for:

1. Natomas Mutual Water Company (NMWC) Fish Screen located in Sacramento County, to screen diversions totaling approximately 630 cfs on the Sacramento River.
2. Meridian Farms Water Company (MFWC) Fish Screen in Sutter County for existing diversions on the Sacramento River.
3. Reclamation District 2035 Fish Screen located north of the City of Sacramento to screen diversions totaling approximately 400 cfs on the Sacramento River.
4. Patterson Irrigation District Fish Screen to screen diversions totaling 190 cfs on the San Joaquin River.

In addition to the above noted accomplishments, the project continued to support screen design and purchased sheet pile for the Sutter Mutual Water Company Tisdale Pumping Plant Fish Screen in Sutter County to screen diversions totaling 960 cfs on the Sacramento River. Initiation of construction is underway.

A Fish Screen Evaluation Committee (FSEC) was initiated in 2004 to refine common interagency goals and priorities for future fish screen projects. The FSEC has members representing

Reclamation, NOAA Fisheries, CDFG, USFWS and CDWR with participation from CALFED.

The FSEC is currently investigating the following methodologies for assessing the benefits of fish screens:

1. Monitoring assessments. Investigate entrainment correlations relative to diversion location and orientation and relative to percentage of flow diverted.

2. Fish loss criteria. Develop acceptable cumulative fish loss criteria and establish a cumulative percent mortality threshold.

3. Quantitative assessments. Couple quantitative assessment of fish losses with mortality thresholds and develop models to assess and predict the effects of diversions.

As a means of quantifying the benefits of fish screens to fisheries, the AFSP provided funds in FY 2005 to initiate a three year program (2005-2008) to monitor fish losses at selected unscreened diversions. This monitoring program was developed with the assistance of the FSEC. Information developed by the FSEC and the AFSP monitoring program will be used to determine when AFSP screening efforts should be concluded.

Project Title: **Trinity River Restoration Program**
CVPIA Section 3406(b)(23)
FY 2005 Funding: **$8,295,551**
FY 2005 Accomplishments:

The Trinity River Basin Fish and Wildlife Management Program was established by an act of Congress in 1984 to restore the fish and wildlife stocks in the Trinity River Basin that were adversely affected by the construction and operation of the CVP's Trinity River Division. This program was fully functional until 1998 when Federal authorization and funding to develop and construct restoration measures expired.

When the CVPIA was passed in 1992, section 3406(b)(23) directed Interior to complete the Trinity River Flow Evaluation Study mandated in 1981 and, under certain conditions, to implement the flows determined necessary for fishery restoration. The CVPIA, in Section 3406 (b)(1), also directed the Secretary to address other identified CVP adverse environmental impacts, which includes the Trinity River Division.

The Trinity River Fishery Flow Evaluation Study report was completed in spring 1999 and an EIS/EIR was completed in October, 2000, which analyzed a range of alternatives for restoring and maintaining the natural production of anadromous fish populations of the mainstem Trinity River downstream of Lewiston Dam. A final Record of Decision (ROD) was signed in December, 2000. The decision called for a range of flows from 369,000 acre-feet in critically dry years to 815,000 acre-feet in wet years to be released down the Trinity River. It also called for physical channel rehabilitation and coarse sediment augmentation to work in concert with the increased flows to restore habitat. Litigation that constrained Lewiston Dam releases since the signing of the ROD has been resolved and full implementation of the program is now underway. Dam releases for fishery purposes have increased from 340,000 acre-feet when the ROD was signed in 2000, to 647,000 acre-feet in 2005.

In order to implement the increased dam releases, at risk manmade structures in the floodplain needed to be addressed. Modifications to four river crossings and the removal of at least one house were identified. In FY 2004 construction contracts were awarded for all four bridge projects with the new crossings opened to traffic early in Calendar Year 2005. The home at risk was purchased in March 2005 to allow for the largest fishery release (7,000 cfs) since construction of the Trinity River Division.

FY 2005 accomplishments include the following:

1. Release of the first unconstrained fishery restoration flow since litigation was resolved in favor of Interior in November 2004. Normal water year volume of 647,000 af was released with a four-day peak of 7,000 cfs. This 1,000 cfs increase above the normal year peak of 6,000 cfs was designed to calibrate and improve accuracy of the predictive hydraulic models.

2. Contract awarded for construction of the program's first channel rehabilitation project at Hocker Flat. Over 80,000 cubic yards of material were excavated along a 1-mile section of the Trinity River near Junction City, California. This will provide increased geomorphic and hydraulic complexity to this area of the river and provide greater diversity of fish habitats supporting a wide range of life history stages.

3. Initiation of environmental documentation and preliminary designs for construction of four other channel rehabilitation sites downstream of Canyon Creek. Preliminary research suggests that a three to four-fold increase in rearing habitat is necessary to observe in the summer and fall of 2006 a doubling in juvenile fish populations. In all, 47 separate channel rehabilitation projects are scheduled for construction by 2012.

4. Revegetation of native riparian habitat adjacent to bridges to fulfill mitigation requirements and improve plant diversity.

5. Completion of inundation mapping to inventory and analyze floodplain structures potentially at risk between Lewiston Dam and the North Fork Trinity River.

6. Award of a 5-year sediment monitoring contract to quantify mainstem and tributary sediment transport, overall sediment budget, bed scour, and substrate quality.

7. Consolidation of the stream gagging network on the Trinity River under the responsibility of the U.S. Geological Survey to ensure all flow data meets quality standards and is publicly accessible.

In general, program activities have resulted in improvements in juvenile and adult fish health since 1992. Increasing summer baseflows from 300 cfs to 450 cfs has improved temperature characteristics for juvenile steelhead, increasing overall health and reducing mortality as evidenced by data from outmigrant traps and estuary seining. Spring bench flows of 2,000 cfs have resulted in spring Chinook salmon migrating upriver faster, according to weir and hatchery data, improving fish health and spawning success. The spring bench flows also provide increased rearing habit for steelhead juveniles, which are expected to result in increases in the number of returning adults. Coho salmon populations in the Klamath/Trinity system have remained steady, as compared to other river systems along the California/Oregon coast that have experienced declines.

Project Title: San Joaquin River Comprehensive Plan CVPIA Section 3406(c)(1)
FY 2005 Funding: $891,993
FY 2005 Accomplishments:

In November 1989, Reclamation was directed by the Secretary of the Interior to explore opportunities for environmental restoration in the San Joaquin River Basin, as described in the San Joaquin River Basin Resource Management Initiative (Initiative). In November 13, 1991, Reclamation and the State of California's Resource Agency (Agency) entered into a Memorandum of Agreement for "Sharing of the Cost of the San Joaquin River Basin Resource Management Initiative." Among other things, the study activities described in the Memorandum of Understanding (MOU) stated "Reclamation and the Agency shall develop a mutually acceptable plan of study for the Initiative which is consistent with the work activities underway in the California Department of Water Resources' San Joaquin River Management Program (SJRMP) effort." It also stated the Initiative "…shall focus primarily on Chinook salmon, water quality conditions, wetlands for waterfowl, wildlife, reservoir fishery, and recreation…"

Subsequently, in 1992, section 3406(c)(1) of the CVPIA mandated the preparation of a "reasonable, prudent, and feasible" comprehensive plan (Comprehensive Plan) to "address fish, wildlife, and habitat concerns on the San Joaquin River, including but not limited to the streamflow, channel, riparian habitat, and water quality improvements that would be needed to reestablish where necessary and to naturally reproducing anadromous fisheries from Friant Dam to its confluence with the San Francisco Bay/Sacramento-San Joaquin Delta Estuary." Work under the scope of the Initiative was halted and

efforts to develop a plan of action to develop the Comprehensive Plan were initiated by Reclamation and the Service. The CVPIA requires that "…Such plan shall be developed in cooperation with the California Department of Fish and Game and in coordination with the San Joaquin River Management Program [SJRMP] under development by the State of California; shall comply with and contain any documents required by the National Environmental Policy Act and contain findings setting forth the basis for the Secretary's decision to adopt and implement the plan as recommendations concerning the need for subsequent Congressional action, if any…"

In 1998, the Natural Resources Defense Council (NRDC) sued Reclamation (NRDC v. Rodgers, *No. CIV. S-88-1658 LKK/GGH*) over the renewals of long-term water service contracts in the Friant Division of the CVP. The Friant Water Users Authority (FWUA) intervened in the suit. In an effort to settle this litigation, on October 25, 1999, in response to a jointly signed letter from the NRDC and FWUA, CVPIA Restoration Funds were provided to assist NRDC and the FWUA in their San Joaquin River restoration planning activities. Thus, the Reclamation and Service led effort to develop a Comprehensive Plan was re-focused to support the FWUA/NRDC approach. Their efforts were funded in a large part from CVPIA Restoration funds and California Proposition 13 funds. Restoration funds were provided for this purpose since the information developed would assist Interior in the development of the required Comprehensive Plan.

Although the San Joaquin River Riparian Habitat Restoration Program (SJRRHRP) was established in 1997 and functioned as a six-party, consensus-based management team directing short-term projects that would provide useful baseline data for Interior's overall efforts to gather existing conditions data on the San Joaquin River, it became a complimentary program for specifically defined demonstration efforts, programs, and studies the FWUA and NRDC restoration planning also requested.

When FWUA and NRDC ended their restoration planning efforts in 2004, the approach to develop a Comprehensive Plan was re-directed again to have Reclamation and the Service lead the effort in FY 2005. To administratively reflect the continuing Interior focus to develop a Comprehensive Plan, $1 million of the $1.5 million provided under Section 3406(b)(1) was provided to Section 3406(c)(1) to clearly convey that all San Joaquin River restoration planning efforts are for the Comprehensive Plan development process.

In FY 2005, a unique opportunity presented itself on the San Joaquin River below Friant Dam. An unusually large snow pack required substantial flood releases to the San Joaquin River below Friant Dam. A multi-agency coordination team effort was established and a Technical Data Collection Group was formed to obtain field data potentially useful to anadromous fish restoration planning, where historically limited information has been available. The data collected are intended to benefit the further development of Reclamation's temperature, hydraulic, and operational models for Millerton Reservoir and the San Joaquin River, downstream to the Merced River confluence.

The primary goals during the duration of flood releases were to:

1. Obtain hydraulic information pertaining to the reach of river between Friant Dam and Mendota Pool, including stage-discharge data and inundation patterns for improvement of hydraulic model representation.

2. Collect ground water data from existing monitoring wells to conduct a preliminary assessment, in conjunction with stage-discharge measurements, of the effects of surface water groundwater interactions in the reach between Gravelly Ford and Mendota Pool.

3. Collect temperature data for use in the development of an improved river temperature model.

4. Obtain channel morphology information in targeted reaches to assist in assessing the limitations of boundary assumptions associated with hydraulic and sediment transport modeling.

FY 2005 accomplishments include the following:

1. Hydraulic information. Stage and discharge measurements were collected at various locations between Friant Dam and the Chowchilla Bifurcation Structure using an acoustic Doppler current profiler (ADCP). As part of collecting supplemental stage data, Solinst Leveloggers were installed to collect continuous stage readings. Reclamation has the lead in documenting the ADCP and temporary stage recorder data collected during the first quarter of FY 2006. A survey grade, real-time kinetic (RTK) global positioning system was employed to measure water surface elevations along the San Joaquin River. Base station elevations and locations were surveyed to tie all the water surface and bathymetry data into the appropriate local datum. Work continues on developing ortho-rectified aerial survey imagery of the San Joaquin River between Friant Dam and the Merced River confluence. The aerial imagery project is expected to be completed in FY 2006.

2. Ground water. In order to understand surface and groundwater interactions on a 'localized' level, alluvial wells adjacent to the San Joaquin River were fitted with Global Logger pressure transducers to measure changes in groundwater. Hourly measurements continue to be made in these wells. Due to higher than expected water levels, some transducers in wells were removed during the flood release period to keep their electronic logging device from saturation.

3. Temperature/Water Quality. Where possible, during this flood event, Reclamation and DFG provided instrumentation to obtain hourly temperature readings in strategic locations in both the Chowchilla and Eastside Bypass, as well as between Friant Dam and the Merced River confluence. Reclamation will be including these readings in the report of this effort.

4. Channel Morphology. Coordinated efforts between CDFG, Friant, and Reclamation continued to collect channel bathymetry data at strategic locations between Friant Dam and the Chowchilla Bifurcation Structure.

5. Aquatic Inventory. CDFG used the funding under the existing agreement with Reclamation to take additional "point in time" inventories of the aquatic species in the San Joaquin River. Discussions were initiated between Reclamation and CDFG to consider conducting a post-assessment "point in time" inventory for comparison purposes in FY 2006.

6. Vegetation Sampling Target Data Set Group (VS). As a part of a post-assessment, the Technical Data Collection Group and the Interagency Group recommended to Reclamation that a vegetation sampling be designed and implemented to document conditions after the flood release event. This effort is being considered for FY 2006.

Reclamation and the Service will continue their efforts to partner with San Joaquin River water system operators, and State and other Federal agencies, to gather data and develop a suite of modeling tools for alternative development. It is anticipated that a San Joaquin River Comprehensive Plan interagency, interdisciplinary team will be established in FY 2006 to review all existing data developed under the Initiative, the early 1990's Reclamation/Service Comprehensive Plan effort, the FWUA/NRDC effort, and the SJRRHRP, before designing a plan of action to ultimately develop a Comprehensive Plan.

Project Title: Refuge Water Supply Program – Water Conveyance Component
CVPIA Section 3406(d)(1-5)

FY 2005 Funding: $5,948,815

FY 2005 Accomplishments:

The CVPIA directs Interior to provide long-term, reliable water supplies to Central Valley State and Federal refuges, to the Grassland Resource Conservation District, and to certain lands identified in the "San Joaquin Basin Action Plan/Kesterson Mitigation Action Plan Report" (referred to as the San Joaquin Basin Action Plan lands). The CVPIA authorized such water to be provided from CVP supplies and from water acquired by the Water Acquisition Program established pursuant to section 3406(b)(3). The CVPIA also authorized Interior to construct facilities as necessary to deliver the water to the various refuge units and/or acquire the conveyance capacity from non-Federal entities for them to convey the water to the refuge areas.

The Refuge Water Supply Program consists of three separate, but highly coordinated, components to deliver the water supplies to the identified refuges. These are the Water Conveyance "Wheeling" Component to acquire conveyance capacity from non-Federal entities and two construction components. The Facilities Construction Component constructs facilities needed to deliver water to the State and Federal refuges, and the San Joaquin Basin Action Plan Construction Component constructs the facilities necessary to deliver water supplies to the San Joaquin Basin Action Plan lands.

The Water Conveyance "Wheeling" Component conveys prescribed quantities to refuge areas not having their own delivery facilities through cooperative agreements with wheeling entities that have conveyance capability. As of the end of FY 2005, 10 long-term (7-50 years) conveyance cooperative agreements (wheeling agreements) were in place and being used to deliver water to certain refuges. These long-term agreements are with San Luis Canal Company (two agreements), Biggs-West Gridley Water District, Central California Irrigation District, Grassland Water District, San Luis Delta Mendota Water Authority, Buena Vista Water Storage District, Tehama-Colusa Canal Authority, and the GCID.

FY 2005 funds were primarily expended for the conveyance of water to specific refuges, including implementation of wheeling agreements; coordination for the overall Refuge Water Supply Program; and staff participation in the Load Reduction Monitoring Study at Grassland Wetlands.

FY 2005 accomplishments include the following:

1. Worked with the Interagency Refuge Water Management Team to develop Level 2 and Level 4 water delivery schedules.
2. Conveyed full Level 2 water supplies to refuges in the Sacramento and San Joaquin Valleys with conveyance capacity to accept full deliveries. For Level 4 water, the program conveyed approximately 6,300 af in the Sacramento Valley and approximately 72,000 af in the San Joaquin Valley.
3. Transitioned from fiscal year funding periods (October through September of following year) to contract water year funding periods (March through February of following year) on all Reclamation conveyance agreements.
4. Coordinated with Reclamation's Central Valley Operations (CVO), the Water Acquisition Program, and the refuges on water needs and delivery schedules to ensure the contract obligations were met. CVO was responsible for providing Level 2 water supplies and the Water Acquisition Program component was responsible for acquiring Incremental Level 4 supplies.

5. New 7-year contract was executed with CDWR for conveying water to the Kern NWR.
6. Negotiated a second ground water pumping reimbursement agreement with CDFG to supplement Level 2 surface water supplies up to full Level 2 allocation for the Gray Lodge Wildlife Area. Additionally, negotiated an amendment to extend the performance period, with further extensions expected through contract water year 2008, after which the facilities construction should be completed and utilized by Biggs-West Gridley Water District for full conveyance of Level 2 and Level 4.
7. Continued development of an integrated database for refuge water supply accounting, delivery scheduling, tracking and invoicing. The Refuge Water Database is expected to be operational in calendar year 2006 for internal Reclamation use, with projected integration with internet by FY 2007 to extend access to various stakeholders, including refuge managers.
8. Supported start-up work on the Load Reduction Monitoring Study at Grassland Wetlands. This action involves wildlife studies related to modified management of Grassland Resource Conservation District wetlands to minimize San Joaquin River water quality impacts. These efforts have potential application for development of water quality Best Management Practices for various wildlife refuges in the San Joaquin River Basin.
9. The Water Conveyance "Wheeling" component of the Refuge Water Supply Program is an on-going program required to deliver Level 2 and Incremental Level 4 supplies to Central Valley refuges pursuant to Section 3406 (d) of the CVPIA. The biological benefits that have occurred from deliveries of this water are discussed under accomplishments of the Water Acquisition Program.

Project Title: Refuge Water Supply Program - Facilities Construction Component
CVPIA Section 3406(d)(1-5)

FY 2005 Funding: $34,000

FY 2005 Accomplishments:

The facilities construction component of the Refuge Water Supply Program was developed to provide the necessary infrastructure to support the long-term delivery of firm, reliable water supplies to specific State and Federal refuges in the Central Valley. These refuge units are Sacramento, Delevan, Colusa, Sutter, Kern, and Pixley NWRs and the State's Mendota and Gray Lodge Wildlife Areas.

To date, construction of the necessary facilities to transport water supplies to the Sacramento, Delevan, Colusa, and Kern National Wildlife Refuges have been completed. This effort includes negotiating and awarding Facilities Construction Agreements with water purveyors to design and construct approximately 150 facilities. Also included in this effort was the fulfillment of environmental commitments pursuant to the Service's biological opinion for construction of conveyance facilities for the West Sacramento Valley Study Area (Sacramento, Delevan, and Colusa NWRs), East Sacramento Valley Study Area (Sutter NWR and the Gray Lodge Wildlife Area), the South San Joaquin Valley Study Area (Kern and Pixley NWRs), and the Mendota Wildlife Area.

FY 2005 accomplishments include the following:

1. Continued development of environmental documentation for Mendota NWR. Negotiations of the Facilities Construction Agreement for Mendota infrastructure will be initiated and finalized in FY 2005.

2. Completed designs/specifications and construction activities pursuant to provisions in the Facilities Construction Agreement with Buena Vista Water Storage District to provide infrastructure to Kern NWR.

3. Initiated the Facilities Construction Agreement with Biggs-West Gridley Water District to provide infrastructure to Gray Lodge Wildlife Area. The Facilities Construction Agreement (designs/specifications and construction) is expected to be completed in FY 2008.

Project Title: **Refuge Water Supply Program – San Joaquin Basin Action Plan Component**
CVPIA Section 3406(d)(1-5)
FY 2005 Funding: **$9,587,055**
FY 2005 Accomplishments:

Environmental documentation for implementation of the San Joaquin Basin Action Plan was completed in 1997. An Implementation Plan was completed in April 1998, and cooperative agreements with the San Luis Canal Company, Grassland Water District, and Central California Irrigation District to convey water to the Action Plan lands were completed in summer 1998. Reclamation is currently administering the cooperative agreements, which include construction and rehabilitation of facilities to accommodate the needs of the refuges within San Joaquin Basin Action Plan area. Reclamation is completing design and construction work for the remaining facilities identified in the Implementation Plan. Construction of these facilities is ongoing and is expected to continue through FY 2006 and beyond, depending on the level of future funding.

As part of these efforts, the Grassland Water District's San Luis Spillway Ditch was increased from its previous capacity of 300 cfs to 350 cfs to accommodate the delivery of water to wetland habitat in the Grassland Resource Conservation District and portions of the San Luis NWR. The San Luis Spillway Headworks also required modification to accommodate the additional flows through the District's canal.

As the result of SJBAP projects, substantial improvements in both the reliability and timing of water delivery to wetland habitat will occur. A conveyance system that provides year-round water to meet the delivery schedule for wetland management in the Grassland Ecological Area will have the following benefits:

1. Earlier fall flood-up schedule. Water made available to flood seasonal wetland habitat in the early fall, during the months of August and early September. An earlier fall flood-up schedule for seasonal marsh will make habitat available for early migrant waterfowl and shorebirds. In addition, early water will provide habitat necessary for resident wildlife and their young during a critical time of the year when wetland habitat is particularly limiting.

2. Increased Acreage of semi-permanent and permanent wetland habitat. Additional acres of semi-permanent and permanent wetland habitat will be available to provide resident and wintering habitat for wildlife. Resident wildlife has benefited by having a reliable source of water for breeding and foraging. The availability of summer water is particularly important and may directly benefit the recovery of special status species such as the giant garter snake, white-faced ibis, and tricolored blackbirds. Wintering wildlife will benefit because this habitat type provides increased diversity in a landscape dominated by shallow seasonal wetland habitat.

3. Ability to maintain seasonal wetlands for longer durations during the spring. With a reliable, year-round water supply, seasonal wetlands can be maintained and de-watered to coincide with peak migration times of shorebirds and waterfowl, making invertebrates available for forage. Moreover, by holding water longer during the spring, wetland managers can specifically time draw-downs to germinate important moist-soil forage plants, such as swamp timothy grass or watergrass. In the past, when water delivery was unreliable or unavailable, numerous wetland managers drained their wetlands immediately following waterfowl season.

4. Increased water for canal habitat. As seasonal wetland habitat dries during the spring and wetland habitat becomes scarcer during the summer, canals provide important linkages to remaining semi-permanent and permanent wetlands. During the summer, the canals, themselves, also provide habitat for wetland dependent mammals, breeding wildlife, and special status species such as the giant garter snake.

5. Increased frequency of spring irrigation to improve moist-soil plant production. Moist-soil plants are an important forage item for wintering and migrating waterfowl. These plants provide a high-energy food source through both their seeds and associated invertebrate communities. Spring and summer irrigation increases the plant biomass and results in greater quantities of seed being produced.

6. Ability to manage for disease outbreaks. Often a manager's best strategy to battle disease outbreaks, such as avian botulism and cholera, is to apply additional water and create a "flow through" system of water delivery and drainage. A flow through system decreases the potential of disease outbreaks in wildlife species commonly affected by disease.

7. Ability to manage wetlands for optimum foraging depths. Shorebirds and waterfowl require depths of less than 12 inches to optimize foraging efficiency. Increased availability of maintenance water and improvements in delivery timing allow wetland managers to lower water depths to make seeds and invertebrates available without the fear of having wetlands completely evaporate.

8. Ability to improve soil quality and manage for salinity. High salinity is often a problem found in wetlands in the Grassland Ecological Area. Wetlands with high concentrations of salts are often lower in productivity and diversity. CVPIA water allows wetland managers to "flush" salts from the wetland basin and improve soil quality. Maintenance of acceptable surface salt balances is necessary to produce an optimum diversity of both emergent and submergent aquatic plants

9. Development of additional wetland habitat and riparian habitat. Water is the most important component to enhancing and restoring wetland habitat in the Grassland Ecological Area. Having a reliable, high quality source of water will and has made possible the restoration of historic wetland habitat throughout the area, including hundreds of acres of wetland and riparian restoration on the North Grasslands Wildlife Area and the San Luis NWR.

FY 2005 accomplishments include the following:

1. Continued progress on capacity and efficiency improvements to Central California Irrigation District (CCID) facilities. Under the existing cooperative agreement with CCID, the Ora Loma Weir on the Main Canal was completed. Funding was provided for the construction of the O'Banion Bypass to transfer CCID's Outside Canal water to the CCID's Main Canal.

2. Completed the environmental assessment for the proposed delivery alternatives for the East Bear Creek Unit of San Luis NWR. This effort was contracted in 2002 with CH2MHill, Sacramento, California. Design and specifications for Phase I (Bear Creek Pumping Station and Pipeline) of the East Bear Creek conveyance facilities have been completed with expected award in September 2005.

Project Title: Ecosystem/Water System Operations Models
CVPIA Section 3406(g)
FY 2005 Funding: $533,125
FY 2005 Accomplishments:

The Ecological/Water Systems Operations Models Development Program is a continuing effort initiated in 1994. The program supported:

1. The Ecosystem Modeling Consensus Project, designed to identify needed development of a credible and consistent set of tools to support management decisions involving water and biological resources.

2. Review and update of the Central Valley Ground-Surface Water Model.

3. Development of a graphical user interface and database for the PROSIM and SANJASM models (note: this effort was abandoned because the CALSIM model replaced both PROSIM and SANJASM).

4. Development of the 3-D temperature model for Whiskeytown Reservoir. Development of the CALSIM II model and hydrologic input for CALSIM.

5. Development of the CALSIM II model and hydrologic input for CALSIM.

Since 1998, this program has provided a steadily increasing level of support for development and application of CALSIM II. Reclamation and CDWR have made a major commitment to CALSIM and it is essential for Interior to participate in and guide its development and application. CALSIM II is now available for public use and has been applied to water supply improvement studies. The Ecosystem/Water System Model Development Program continued through FY 2005 to provide the basic support for continuing CALSIM II development and distribution to a wide range of users.

The Ecological/Water Systems Operations Models Development Program is also involved in the development of new reservoir and river temperature models to be used for operations and planning. Part of this effort includes ensuring that appropriate staff is capable of implementing these models. Reclamation, the Service, CDWR, and private contractors all have staff capable of applying these models that have been trained under funding from this program.

FY 2005 accomplishments include the following:

1. Continued oversight and review of CALSIM.

2. Continued review and documentation of CALSIM II code.

3. Continued hydrology documentation for the San Joaquin Valley.

4. Continued management of CALSIM II and river and reservoir water temperature simulation.

5. Supported Reclamation participation with CDWR in the joint Climate Change Work Team.

6. Supported the Service's participation in review and development of CALSIM II.

7. Participated in Professional Organizations including the California Water and Environmental Modeling Forum and conferences with organizations such as American Society of Civil Engineers and American Water Resources Association.

8. Supported external review of CALSIM II modifications related to San Joaquin hydrology and water quality. The review is co-sponsored by CALFED Science and the California Water and Environmental Modeling Forum. It consists of three workshops and a report to Reclamation.

Project Title: **Land Retirement Program**
CVPIA Section 3408(h)
FY 2005 Funding: **$1,494,552**
FY 2005 Accomplishments:

The CVPIA authorizes Interior to acquire irrigated agricultural lands that are drainage-impaired and receive CVP water. These lands are then retired them from agricultural production. The CVPIA Land Retirement Program was established to implement this provision. The main goals of the CVPIA Land Retirement Program are to:

1. Improve water conservation by district, or improve the quality of an irrigation district's agricultural wastewater.

2. Reduce drainage and improve water quality in the San Joaquin River, and to use retired lands to create additional wildlife habitat in the San Joaquin Valley.

FY 2005 accomplishments include the following:

Acquisition
As Land Retirement was identified as a means to assist in drainage impacts reduction, acquisition of lands demonstrating these characteristics was necessary. Acquisition by the Interagency Land Retirement Team prepared the necessary documents to establish the Land Retirement Demonstration Project (LRDP) in 1999 at two sites: Tranquility in Fresno County and Atwell Island in Tulare and Kings Counties. To date, 2090 acres have been retired in Fresno County. During FY 2005, the Bureau of Land Management (BLM) purchased three parcels totaling 781 acres at the Atwell Island site, bringing the project total for that area to 6,965 acres. FY 2005 acquisitions were done at a cost of $700,000 plus $3,352 in closing costs. Appraisals are currently being done on 4 parcels in Atwell Island totaling 534 acres and offers will be made on these parcels before the end of FY 2005. Twenty-one parcels, comprising 230 acres, remain to be appraised at Atwell Island.

Monitoring
At both of the Land Retirement Demonstration Project (LRDP) sites in the San Joaquin Valley, monitoring activities continued in order to meet the provisions of the 1999 biological opinion for the project. Results are indicative of those that would be expected on the majority of drainage impacted lands in the San Joaquin Valley. Monitoring activities include the following:

1. Ground water and soil monitoring continued at the Tranquility and Atwell Island Demonstration Project sites. Performance Standards for the biological opinion were met for physical parameters,

with the exception of ground water quality, which was highly saline with high concentrations of selenium. The bioavailability of the selenium was extremely low, however, due to the increased depth from surface to ground water.

2. The LRDP monitoring plots at the Atwell Island site were assessed by BLM for vegetation structure and small mammal populations.

3. At Atwell Island lands outside of LRDP plots, BLM wildlife surveys conducted for sensitive plants and animals resulted in important discoveries: (a) a population of the endangered Tipton's kangaroo rat; b) a breeding population of 29 pairs of the sensitive burrowing owl; (c) a breeding population of the sensitive coast horned lizard; (d) a population of the sensitive San Joaquin Valley coachwhip; (e) a breeding population of Swainson's hawks; and (f) a population of the sensitive plant, Hoover's woolystar.

4. At Atwell Island, BLM continued development of a wildlife sighting database, which now contains 9,500 observations.

5. BLM developed plant and animal lists for the Atwell Island project area. The plant list now contains 135 species from 43 families. The animal list includes 185 bird, 22 mammal, 9 reptile, 4 amphibian, and 23 butterfly species.

6. A photo-illustrated flora of Atwell Island was developed by BLM.

Reports

The biological opinion for the LRDP required 5 years of monitoring and annual reports. The Endangered Species Recovery Program (ESRP) has performed the monitoring, analysis, and report writing for 5 years of the project at Tranquility and 3 years of selenium monitoring at Atwell Island. The research findings regarding soil and ground water responses to land retirement were done by Reclamation. The *Five-Year Report for the Land Retirement Demonstration Project* will be published and available on the Reclamation South Central California Area Office website in FY 2005. The report contains the results of the 5-year Habitat Restoration Study at Tranquility, 5-years of selenium monitoring at Tranquility and 3 years at Atwell Island, and the results of the physical impacts study of land retirement at both Tranquility and Atwell Island.

Restoration

Lands that have been retired by the Land Retirement Program are to be restored to upland habitat to meet one of the program goals. Methods for performing this task have been tried at both sites. Complete restoration to upland habitats found in the San Joaquin Valley could take many years to achieve, but the program's work has restored portions of the land and continues to adapt techniques to achieve desired habitat values. Sharing the results of this work is the basis for most of the Partnership and Outreach Land Retirement Program efforts. Restoration activities include the following:

1. At Atwell Island, BLM has performed restoration activities on 1,119 acres and 119.5 miles of hedgerows. In FY 2005, the restored area totaled 345 acres, including: (a) the establishment of 8 miles (about 80 acres) of hedgerows with native shrubs; (b) seeding of 40 acres of fallow land (fallow for 5 years) with a mix of native annuals and perennial seed after burning, using Range Drill seeder; (c) seeding of 40 acres of fallow land (fallow for 2 years) with a mix of native annuals and perennial seed after burning and disking, using Trillion seeder; (d) planting of 40 acres of recently farmed land (oats) with a mix of native annuals and perennial seed after disking, using Trillion seeder; (e) planting of 40 acres of land just being taken out of alfalfa with a mix of

native annuals and perennial seed after disking, using Trillion seeder; (f) planting of 6 acres of the sump with iodine bush and suaeda seed; (g) planting of 200 trees in riparian-canal areas using hydro-planter; and (h) planting of 150 potted trees and shrub in riparian-canal areas.

2. The BLM established a wildlife farming demonstration area with 40 acres of native shrub plantings interspersed with 45 acres of crops, including 15 acres of safflower, 10 acres of lespedeza, 10 acres of milo maze, and 10 acres of wheat.

3. The BLM developed a native seed source by increasing seed collection activities (about 8,000 pounds) utilizing seed collecting contracts.

4. The BLM established a 1.5-acre grow-out area for native grass seed under contract.

5. The BLM managed an existing 10-acre wetland for breeding season waterfowl and shorebirds.

6. The BLM managed an existing 20 acres of wetland for wintering waterfowl and planted 2 acres of native forb seed around the edge of the pond.

7. The BLM planted 2 acres of perennial grass seed along ditch banks. Planted sites are currently being monitored by BLM to determine the planting success. The prolonged rainy season in 2005 produced the most prominent floral displays observed to date.

8. At Tranquility, ESRP continued to maintain a 4-acre native plant nursery. Seed was harvested from 64 native plant species in summer and fall, 2004. After the harvest, planting beds for annual species were re-formed and replanted with 100 native species. High rainfall required extensive weeding in the nursery during the 2005 growing season. On an additional 4 acres, 8 species were grown using mechanized production and harvesting methods. Due to the high weed load that resulted from 2005 high rainfall, harvesting of this part of the nursery was not feasible.

9. The seed collecting, cleaning and storage activities performed by ESRP during FY 2005 were done on 46 native plant species collected from 17 off-site locations. The seed cleaning facility was upgraded with an approved dust collection system and desktop seed cleaner. Seed cleaned totaled 710 pounds from 89 different species. Additional seed from 58 species remains to be cleaned. A private seed collector/grower was contracted to augment the seed inventory, collect and clean 629 pounds of 15 species and grow and clean 209 pounds of three species. The seed inventory was thus increased by 1550 pounds, representing over 100 species. Seed will continue to be collected and processed during the remainder of the year. In early FY 2006, most of the available seed will be planted during research trials and on-site restoration efforts, and in the nursery.

10. The ESRP planted 50 acres with native plants in association with various research trials and 1 acre as a restoration demonstration area.

11. The ESRP conducted site management at Tranquility with the assistance of a local farmer. To inhibit weed establishment on the site, and to reduce erosion and dust, 600 acres of barley were maintained in the primary study area. Access roads were graded, fire control measures established, and irrigation ditches maintained. Sheep grazing was initiated on a limited basis to control weeds and reduce fire damage. In late FY 2005 and 2006, research on the grazing effects on native species and its potential use as a management tool in restored areas will be investigated.

12. The ESRP established a number of replicated research trials for weed control at Tranquility, and sampled previously installed trials, as weed control continues to be the primary challenge in restoration efforts. These efforts include:

    (a) The Herbicide and Charcoal Treatment Trial established in cooperation with a Reclamation restoration botanist focused on the responses of native and non-native plants to five pre-emergent herbicides and the potential for activated charcoal to decrease the damage caused by herbicides to the target species. Preliminary results from this trial warrant an expanded version in FY 2006.

    (b) The Native Release Trial examined on 40 plots the possibility of promoting germination of native seed in the seed bank by reducing competition from weeds. Four weed-control methods were compared, including agricultural flaming, mowing, spraying with a grass-specific herbicide, and spraying with a broad-spectrum herbicide. Results indicated that the weed seed bank overtook what few natives were left in the soil.

    (c) In FY 2005, the second year of the Planting Techniques Trial was conducted by a California State University, Fullerton (CSUF) graduate student. Three planting methods on 90 plots were compared in the second year's trial using six native species. Data collected and analysis will be presented in the students Master's thesis in FY 2006.

    (d) In the Seed Delivery and Competition Trial, ESRP tested two seed delivery methods on 40 acres where previous restoration efforts had established native shrub vegetation on the berm (http//esrp.csustan.edu/projects/rldp/trials/ SDCT/index.php#fig_1). An additional treatment factor, seed mixture, was incorporated into the trial. Sampling was planned, but abundant rainfall during the growing season promoted weed growth to the exclusion of most native species; hence, sampling was not warranted.

Partnerships

Because of funding constraints, developing partnerships with farmers, NGOs, and other agencies and educational groups has been pursued from the beginning of the Land Retirement Program. FY 2005 continued this endeavor, perhaps to new levels, as the partnership established with the AmeriCorps National Civilian Community Corps (NCCC) demonstrates. Partnership activities include:

1. The BLM coordinated with cooperating farmers to carry out restoration activities.

2. The BLM Site Coordinator continued to work as part of the Interagency Land Retirement Team.

3. The BLM cooperated with a Reclamation scientist to study restoration with native species following alfalfa plantings on 20 acres.

4. The BLM established a partnership with AmeriCorp NCCC which provided a crew of 10 to work on numerous projects including construction of 0.5 mile of nature trail, reforestation of 3 miles of ditch and pond banks, and general cleanup and maintenance of the administrative site. The crew also worked on a greenhouse at the Alpaugh School, as a first step to get students involved in the restoration project. The crew also conducted a major cleanup event and removed more than 45 tons of garbage from the community, much of which might otherwise have been dumped on the project area.

5. The BLM continued to work with the Tulare Lake Basin Working Group.

6. The BLM helped to establish Tulare Basin Wildlife Partners, an NGO that will be a cooperator on the project.

7. The BLM worked to develop partnerships with Tulare County Audubon Society, Alpaugh School District, Citizens for a Better Alpaugh, State Park Service–Allensworth State Historic Park, U.S. Natural Resources Conservation Service, U.S. Forest Service (Trails Unlimited), and the Service.

8. The ESRP applied for three grants to further research partnerships at the Tranquillest site.

9. A grant proposal was submitted to the Oracle Giving Program for funds to purchase and install irrigation equipment and to construct permanent retaining walls for the beds in the Native Plant Nursery. Unfortunately, this proposal was not funded.

10. A grant proposal was submitted to the California State University (CSU) Applied Research Initiative program. This project, "Restoration of Retired Agricultural Land in the San Joaquin Valley: Use of Simulated Fire and Mycorrhizae to Maximize Native Species Establishment," represents a collaboration between ESRP and CSU, Fresno biologist Dr. John Constable. The potential for using commercial smoke products to enhance germination of a suite of native species and the potential for growth improvement and establishment by the addition of mycorrhizal innoculum will be evaluated. A decision on funding for this proposal is anticipated in August, 2005.

11. A grant proposal was submitted to the CSU, Stanislaus Biology Program in order to secure funds for additional seed processing equipment. Funds were requested for the purchase of equipment that is specifically designed for efficient handling of small seed lots.

Outreach

Outreach in the form of presentations, tours and classes are important means to disseminate information from the Land Retirement Demonstration Project to other agencies, individuals, and interested parties. FY 2005 had a variety of outreach efforts performed by all associated with the project. Outreach efforts include:

1. A Reclamation hydrologist and soil scientist presented research findings on soil and ground water responses to land retirement in western San Joaquin Valley at the International Salinity Conference held at Riverside, California in April 2005.

2. The BLM held a workshop on recreation and tourism potential for Atwell Island and the Tulare Basin.

3. The ESRP gave a tour of the Tranquility site, including the nursery and seed cleaning facility, to the Clovis Botanical Garden staff and volunteers.

4. The ESRP gave a day-long tour to the coordinators and nursery staff from the five native plant nurseries of the Golden Gate National Recreation Area.

5. The ESRP gave one poster presentation entitled "Raptor Occurrences, Incidence of Nesting, and an Assessment of Prey Availability on Retired Agricultural Lands in the San Joaquin Valley, California" at the Raptor Research Foundation's annual meeting in Visalia, California.

6. The ESRP had one poster abstract and three oral presentations accepted by the Society for Ecological Restoration, California Chapter, for the annual meeting at Bass Lake, California.

Another abstract has been accepted for a presentation in September, 2005, at the annual international meeting of the Society for Ecological Restoration that will be conducted by BLM and the Service.

7. The ESRP developed a web site that makes information on the Land Retirement Demonstration Project and research results available to the public and cooperating agencies. Links are provided to various annual reports and 5-year report. The ESRP web site can be accessed at: http://esrp.csustan.edu/projects/lrdp/.

8. The ESRP developed workshops on land retirement that included classroom and on-site field work. These workshops were presented to several local high school science classes and science clubs.

9. The ESRP worked with the Clovis Botanical Gardens to assist with public education, outreach, and construction of a wildlife component for the Clovis Community Trail. We designed and helped install a self-guided nature trail, assisted with planting native species along the trail, and acquired a substantial donation from Home Depot for materials to construct bat roosting boxes, bee boxes, and raptor perches for the trail.

10. The ESRP had a volunteer day at the native plant nursery in observance of Earth Day.

11. The ESRP sponsored a booth and gave presentations to 100 under-privileged school children at the U.S. Forest Service's Central California Consortium event held at Grizzlies Stadium, Fresno, California.

The ESRP is assisting with the support of two CS Fresno graduate students who are conducting research at the Tranquility site. One student is investigating the population structure of native plant pollinators in the native plant nursery and on nearby Ecological Preserves owned by CDFG. The other student is investigating seed delivery methods for seven native plant species.

DISCUSSION OF CVPIA IMPLEMENTATION AND RESULTS

Reclamation and the Service have attempted to implement, in a purposeful, proactive manner, the fish and wildlife provisions of the Act believed to be the most important, most urgent, or that would result in the greatest or most immediate contribution to attainment of its three primary fish and wildlife restoration goals: (1) sustainable doubling the natural production of anadromous fish, (2) providing water to refuges, and (3) mitigating for other CVP impacts.

Measuring progress towards attaining the goals and objectives of CVPIA has been a challenging task. The long-term, system-wide results of implementing individual actions, or of multiple actions within any single year, may not be seen for many years, and when apparent, may not be directly attributable to any particular action, but rather to a suite of actions taken by multiple programs over a long period of time. Consequently, reporting the response of the ecosystem to actions implemented in any particular year, and then separating that response from results of work done in previous years, is not practical. This is as true for FY 2005 as it has been for any of the prior 13 years of CVPIA implementation.

Nevertheless, we believe target fish and wildlife resources are responding to CVPIA measures. Implementation of long-term CVPIA programs and plans appears to be gradually realizing its goals and objectives: the number of salmon returning to the Central Valley is increasing, spawning in areas where they have not been seen for many years; hundreds of thousands of ducks, geese and other migratory birds are using wetland areas newly created or greatly enhanced under the Act; avail diseases are declining

throughout the valley; tens of thousands of acres of habitat have been acquired to protect threatened and endangered species; and thousands of acres have been restored and/or enhanced to benefit species on the brink of extinction, increasing their chances for recovery.

To better identify progress towards meeting CVPIA goals, the Restoration Fund Roundtable tasked a subcommittee to engage with Reclamation and the Service in an effort to evaluate CVPIA programs. The resulting "Program Evaluation" process includes identifying objectives of CVPIA programs, clarifying measurable outcomes, and evaluating progress. Thus far, Reclamation and the Service have focused on four programs as a pilot to test this process: the Clear Creek Restoration Program, Spawning Gravel Replenishment Program, AFRP, and AFSP. For the Clear Creek Restoration and Spawning Gravel Replenishment programs, draft documents have been produced that detail objectives, outcomes, and progress. The Restoration Fund Roundtable has provided feedback, and the documents are continually improving. Finally, to identify the extent that screening diversions is necessary in the Central Valley, the AFSP has convened a Fish Screen Program Evaluation Committee. This committee meets monthly, and is comprised of representatives from the Service, Reclamation, CDWR, CDFG, NOAA Fisheries, ERP, and the ERP Science Board. Through the use of models and monitoring of juvenile anadromous fish loss in diversions, this committee hopes to gain an understanding of the impact that diversions have on anadromous fish populations, and use the information to develop screening criteria to minimize diversion impacts.

Anadromous Fish - Biological Response

Chinook salmon continue to be a high priority for CVPIA restoration efforts. A majority of implemented measures and the $498.4 million obligated over the past 13 years has been focused on this species. While the overall number of salmon along the West coast has declined, adult returns to the Central Valley and catch off the California coast have increased, correlating well with implementation of the CVPIA, which began in 1993. While other factors such as hydrology, ocean conditions, and fishing regulations have undoubtedly contributed to these increases, the declining West coast salmon fishery has also been subject to these factors and shows a different population trend.

Clear Creek provides a good example of positive biological gains correlating closely with CVPIA-related efforts. On Clear Creek, streamflows were increased during critical periods for fall-run Chinook salmon; spawning gravel was added to the stream; degraded portions of the stream channel, floodplain, and adjacent riparian habitats were restored; and erosion and sedimentation from sources within the watershed were controlled. McCormick-Saeltzer Dam, a major impediment to upstream passage of salmon and steelhead, and an associated unscreened diversion that reduced flows in the lower portions of the creek, have been removed.

Clear Creek
Removal of McCormick - Saeltzer Dam

Before

After

The fall-run Chinook salmon population in Clear Creek has increased greatly following implementation of these measures. Spawning production of fall-run Chinook salmon in Clear Creek, which averaged 4,641 fish during 1967-1991, increased to an average of 12,508 fish during 1992-2005. Furthermore, the improvement in flows and removal of McCormick-Saeltzer Dam opened Clear Creek to use by steelhead and spring-run Chinook salmon, both threatened species. Adult returns over the next several years should indicate whether there will be significant increases in numbers of these special status species, and whether the fall-run response is a long-term upward trend induced by CVPIA actions, or just a temporary or cyclical increase resulting from other factors. At this time, the results are very encouraging.

Very positive biological gains have occurred on several other streams where CVPIA efforts have been focused. Notable among these is Butte Creek, where spring-run Chinook salmon returns have been steadily improving. Natural production of Butte Creek Chinook salmon, which averaged only 1,800 fish during 1967-1991, increased to an average of 14,000 fish during 1992–2005 (Table 3).

In some years, natural production of salmon on several Central Valley streams has reached or exceeded population *numbers* set by the Anadromous Fish Restoration Plan (USFWS 2001) (numeric doubling goals), but has not yet been determined to be *sustainable* as required by the CVPIA. To determine if increased natural production is sustainable on a long-term basis, several life cycles (3 to 5 years per cycle) of continued monitoring is necessary under a variety of environmental conditions (USFWS 1995a:2-IX-5-18). A statistical process is being developed to assist in determining the sustainability of increased population levels. Conversely, there are many other streams where the production of salmon and other anadromous fish have declined (e.g., Table 3, pages 20-22).

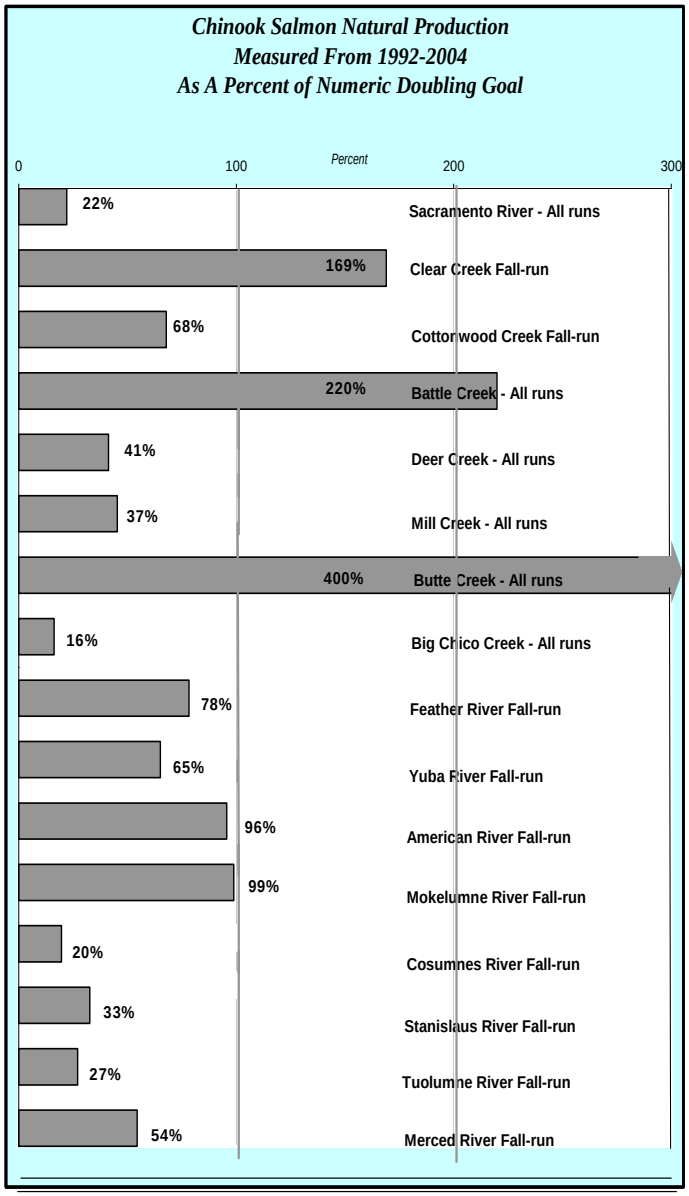


Figure 6. Natural production of Chinook salmon for the period 1992-2004, as a percentage of numeric doubling goals (sustainability of numbers not considered).

[a/] Natural production was calculated from salmon escapement data (CDFG 2005) using methods developed by the AFRP (USFWS 2001: Appendix A).

[b/] Methods include estimates from sample data and are subject to sampling errors.

In Central Valley rivers and streams with sufficient data, Figure 6 presents natural production of Chinook salmon for the period of CVPIA implementation (1992-2004), as a percentage of the appropriate numeric doubling goal.

For example, Figure 6 shows natural production of Clear Creek fall-run Chinook salmon to be 69 percent greater than the numeric doubling goal. If Clear Creek fall-run Chinook salmon numbers were shown to be sustainable, the anadromous fish doubling goal for this run on Clear Creek could have been exceeded by 69 percent.

In contrast, production for Yuba River fall-run Chinook salmon in Figure 6 is 65 percent of the numeric doubling goal; 35 percent below this level, and production for Tuolumne River fall-run is 27 percent of the numeric doubling goal; 73 percent below this level.

Several small streams and two rivers identified in the AFRP Restoration Plan (Cow, Paynes, Antelope, and Big Chico Creeks; miscellaneous small creeks, and Bear and Calaveras rivers) are not included in this figure due to insufficient data.

Three of the 16 Chinook salmon populations in Figure 6 have exceeded their CVPIA numeric doubling goals, and nine populations, including these three have exceeded baseline 1967-1991 production (50% on Figure 6). As stated earlier, to determine progress toward anadromous fish doubling goals (as opposed to just numeric doubling goals), will require continued monitoring to determine if these production levels are sustainable on a long-term basis.

Refuges and Waterfowl - Biological Response

With the passage of the CVPIA, a firm and reliable water supply was made available to Central Valley State and Federal refuges and private wetland areas. Flooding agricultural fields containing waste grain during winter provided new seasonal habitats for waterfowl. Waterfowl, shorebirds, and other wetland-dependent wildlife benefited from expansion and enhancement of habitat. Central Valley refuges reported increases of thousands of acres of new wetland habitats and tens of thousands of acres of enhanced habitats as a result of CVPIA water supplies. These refuges provided habitat for longer periods during the year, and refuge managers with the ability to manage a much more diverse mix of habitat types that more fully satisfied year-round environmental requirements of many wildlife species. Before the CVPIA, refuge managers had to concentrate the vast majority of water use in fall and early winter months, when Central Valley waterfowl numbers peaked. With passage of CVPIA, the habitat calendar was expanded to the full year. Under CVPIA programs, moist soil food plant irrigations are carried out, water is made available during August and September to satisfy needs of the first wintering ducks and geese that arrive in the Central Valley, maintenance flows are applied throughout the winter months to improve water quality and decrease avian disease outbreaks, and spring and summer water provides critical nesting habitat for waterfowl and colonial birds.

Water availability also enhances refuge managers' ability to provide a food supply for winter migrants. Waterfowl food production increased tenfold in some refuge areas. The Grasslands Resource Conservation District (RCD) increased its acreage of enhanced seed production from 4,000 acres in 1991-1992 to an average of 26,000 acres during 1993-2005. In that same time period, per acre plant biomass doubled.

Waterfowl use increased nearly as much. In the Grasslands RCD, waterfowl use in early fall increased by 300 percent. Other areas recorded increases of 800 percent, from 2 million to over 18 million waterfowl use-days per year. Not only has waterfowl use increased, but visits to these areas by the public have increased as well, drawn by the prospect of seeing hundreds of thousands of birds of many species at one time in a far more natural setting than was previously possible.

Additional refuge water supplies provided by the CVPIA have helped alleviate waterfowl overcrowding, particularly in the Sacramento Valley. Waterfowl disease-related mortality, usually caused by overcrowding and stagnant water, decreased markedly in the Sacramento Valley, as birds took advantage of increased habitat and improved water quality. Cholera outbreaks, once frequent and widespread in the Sacramento Valley, have been reduced to only one major incident since passage of the CVPIA. Similarly, the Sacramento NWR complex reported a nearly 89 percent decline in botulism since 1992, compared to the decade prior to availability of CVPIA water supplies.

Species other than waterfowl also benefited from CVPIA water. Sacramento Valley refuges reported an increased presence of western pond turtles and colonial nesting birds, such as the tricolored blackbird. In fact, the largest tricolored blackbird colony documented in California in 2004 occurred at Delevan NWR, a population of more than 75,000 individuals. In addition, refuges in the San Joaquin Valley noted increases in populations of giant garter snakes; nesting western, Clark's, and eared grebes; black-crowned night herons; and tricolored blackbirds. Valley-wide, shorebird use on shallow wetlands increased by hundreds of thousands, as sandpipers, dunlins, yellowlegs, phalaropes, and dowitchers responded to the increased wetland acreage and subsequent invertebrate food supplies. More than 150 species of other birds, 20 species of butterflies, 15 species of dragonflies, 5 species of reptiles, 2 species of amphibians, and 10 species of mammals were reported using these enhanced habitat areas in the North Grasslands Wildlife Area alone.

White-faced ibis and sandhill cranes are excellent examples of how the availability of adequate water supplies enabled refuge managers to provide habitat for endemic species that had been in severe decline for decades. Improved water supplies first led to an increase in numbers of frogs, snails, aquatic insects, and small fish. This, in turn, provided ibis and cranes with habitat for late-spring and summer nesting, essential components for these species. Increased and improved breeding habitat resulted in a steady upswing in bird numbers. Sutter NWR, for example, hosted 100 white-faced ibis in 1991. That number increased to 1,000 birds in 2000, 7,000 in 2001, and a staggering 15,000 in 2004. Kern NWR had a similar experience, with 50 ibis in 1991, 5,600 in 2001, and more than 8,000 in 2004. Pixley NWR supported 200 sandhill cranes in 1992 when the CVPIA was passed. It received its first allocation of CVPIA water in 1993 and provided habitat for more than 2,000 sandhill cranes that year. By 2001, the number rose to 5,100 sandhill cranes and has remained over 5,000 ever since.

Other Fish and Wildlife - Accomplishments

Efforts under the CVPIA to protect and provide habitat for fish and wildlife other than anadromous fish and wetland-dependent wildlife include fee title and conservation easement acquisition of more than 98,179 acres from willing sellers at fair market prices; restoration of 1,111 acres of native habitat for special status species; and research, surveys, and planning activities that contribute to recovery of CVP impacted species. These actions were usually accomplished through partnerships with others, such as The Nature Conservancy and Trust for Public Lands. These lands are now protected from the adverse impacts that would have occurred if they had been developed.

Since 1993, 10,283 acres of drainage impaired agricultural lands have been retired from irrigated agriculture. Upland habitat restoration has occurred on about 2,719 acres. Desirable plant and animal habitats along the San Joaquin River, from Friant Dam to the river's confluence with the Merced River, are being enhanced. Over the next several years, we anticipate that populations of species associated with these habitats, and particularly those that are threatened or endangered, will increase substantially.

The CVPIA LRPDP is indicative of the benefits that we expect to achieve. Monitoring results from the Fresno County site indicate a decline in the shallow ground water table in response to land retirement, which is important, as the highly saline ground water has high concentrations of selenium and boron. Restoration of these retired lands and their use by wildlife has not resulted in increased levels of bio-accumulated selenium in any of the plants, invertebrates or mammals measured. All selenium levels measured are considered below concentrations of concern to Environmental Protection Agency and the Service.

Treating these lands has increased abundance and diversity of wildlife. Increased numbers of invertebrate species and abundance include parasites and predators of agricultural pests, as well as beneficial pollinators. Bird species diversity and abundance increased across all treatments immediately following restoration efforts. Populations of small mammals increased substantially on retired lands. Special status mammalian species observed on restored land at Atwell Island, including the San Joaquin kit fox and Tipton's Kangaroo Rat, were observed using established hedgerows and retired lands. Adequate native seed supplies necessary for successful restoration are being secured. Utilizing native plant species for upland habitat restoration has many challenges, primarily large weed load control. Irrigation in the first year has helped establish natives at Atwell Island. After 1 year, no further irrigation was necessary and the resulting vegetation was very low maintenance. Knowledge of the sensitive species habitat needs enables proper planning and planting of required vegetation for their desired structure and density.

The 5 year results of the LRDP can assist in implementation of any large-scale San Joaquin Valley land retirement. The restoration technology learned on the sites can be applied to other retired lands and assist in sensitive species recovery. The Native Plant Nursery needs to be maintained, as the plants grown there

are limited in occurrence throughout the San Joaquin Valley. The partnerships developed during the life of the program will encourage the extension of monitoring and restoration accomplishments.

CONCLUSIONS

Quantifiable Progress in 2005

In the first decade since the CVPIA was enacted, a vast amount of "foundation work" has taken place. Foundation work is essential to the final outcome, but often not highly visible. It involves many activities, such as data collection, research, development of alternative actions, alternatives analysis, feasibility studies, permitting, and design work. Adequate foundation work is critical if the desired outcomes of the CVPIA are to be achieved, including (1) fish and wildlife protection, habitat restoration and enhancement; (2) addressing CVP impacts; (3) improving CVP operational flexibility; (4) expanding water transfers; (5) protecting the Bay-Delta; and (6) achieving a reasonable balance of CVP water uses. Much of that work has been accomplished, although more must continue.

In 2005, some significant "on the ground" achievements were made toward the overall environmental goals of the CVPIA. A few examples of these achievements are the restoration of about 755 acres of vernal pool and vernal pool-alkali meadow complex habitats on the Sacramento NWR, injection of spawning gravel below Whiskeytown Dam for spring-run Chinook salmon and steelhead, and restoration of the Clear Creek stream channel to increase Chinook salmon spawning density. These achievements, and the promise for similar achievements in the future, create a level of optimism that the CVPIA can achieve its environmental goals within a reasonable period of time and with reasonable expenditures.

At the conclusion of 2005, significant progress has been made in meeting the CVPIA's fish and wildlife goals. To be sure, there is much more work to be accomplished. Challenges for anadromous fish restoration are particularly complex on rivers where the largest, most important dams prevent migration to historic headwater habitats. Even so, some improvements appear significant.

One of the most significant events through 2005 has been the increase of anadromous fish populations in five different Central Valley tributary streams (Figure 6). Most notable is Butte Creek Chinook salmon (all runs); whose population has increased to an astonishing 678 percent of its average 1967-1991 natural production (Table 3). Such increases need to be sustainable to meet the CVPIA's mandated anadromous fish doubling goal, and the outlook for meeting that mandate is very promising. In Battle Creek, a watershed where restoration efforts have been shared by both CALFED and CVPIA, natural production of all runs of Chinook salmon has increased to 338 percent of its average 1967-1991 natural production (Table 3). In Clear Creek, fall-run Chinook salmon natural production has increased to 233 percent of its average 1967-1991 production (Table 3). Chinook salmon populations in the American River (fall-run) and Mokelumne River (fall-run) also show promising trends.

Actions taken under the CVPIA and other restoration programs, such as CALFED, are believed to have greatly influenced the increasing population trends for anadromous fish in widely dispersed areas of the Central Valley. Actions have included removal of smaller old dams and barriers, reopening many miles of spawning habitat; carefully planned deposition of gravel, recreating lost spawning habitat; improvement of stream-side habitat; better management of available instream water supplies; addition of fish screens at many diversions, protecting both seaward-migrating smolt and adults returning to spawn; support for larger habitat restoration efforts in the watershed; and surveys and research work to help fishery biologists better understand workings of the Central Valley fishery and ways to re-invigorate its fish populations.

Spawning gravel replenishment has become an essential and highly effective tool to improve anadromous fish populations on many streams. Nearly 11,000 tons of gravel was placed in the Upper Sacramento and the Stanislaus rivers in 2005. Salmon use of the new spawning gravels is helping to increase fish numbers in those streams. In some streams, deeper pools that shelter predator species have been re-configured to eliminate this threat to anadromous salmonid fry.

Important achievements were also made as a result of the refuge water supply program, keystone in efforts to reinvigorate and expand imperiled bird, fish and animal populations in the Central Valley. Vital water supplies are provided to refuges in the Central Valley of California, known as Level 4, to meet optimum habitat management requirements. The Level 4 water supplies consist of "Level 2" water which is usually provided by CVP project yield, and "Incremental Level 4" water acquired through purchase from willing sellers.

In 2005, approximately 68,000 acre feet of Incremental Level 4 water supplies were acquired to allow optimum management on the refuges relating to increased habitat diversity, seasonal availability of habitat, and waterbird breeding, nesting and foraging areas. These water supplies provide critical wetland habitat supporting resident and migratory waterfowl,

threatened and endangered species, and wetland dependent biota. The increased water supplies have expanded refuge wetland habitat and resulted in larger and healthier bird populations.

The direct result of these acquisitions continues to be a much larger, healthier bird population. Kern NWR, for example, had 50 white-faced ibis the year before enactment of the CVPIA, and counted 8,000 birds in 2005. Sutter NWR counted 100 ibis in 1991 and a staggering 15,000. Another bird species showing renewed vigor is the tricolored blackbird, a species not yet listed, but which has been identified by some environmental interests as needing protection. It had an observed population of 75,000 birds at Delevan NWR in 2005.

Other types of habitat restoration also achieved significant progress in 2005. The Habitat Conservation Program participated in the acquisition and/or restoration of nearly 7,000 acres of important Central Valley habitat. Restoration included areas along the Sacramento River in Tehama County, at Drumheller Slough in Glenn County, and at several sites in Santa Clara County. Additionally, habitat was acquired along a San Joaquin River tributary in Madera County and in the Carizzo Plain in Kern County.

To Continue Progress in the Future

Reclamation and the Service are actively assessing and rating CVPIA programs to better identify and improve our performance in achieving the results of the CVPIA. More specifically, Reclamation and the Service are assessing our overall program effectiveness, spanning from how well a program is designed to how well it is implemented and what results it has and will achieve. This review will help identify a program's strengths and weaknesses, and will assist in funding and management decisions to further improve program and overall CVPIA effectiveness. All factors that may affect and reflect program performance will be assessed; for example, program purpose and design, performance measurement, evaluations, strategic planning, program management, and program results. This effort will further Reclamation and the Service's goal of completing fish, wildlife, and habitat mitigation and restoration actions mandated by the Act.

Interior is proud of its many achievements in the protection, restoration, and enhancement of fish and wildlife associated with the CVPIA. There is still much to be done to accomplish the many provisions of the CVPIA; however, Interior remains resolute in its implementation effort and dedicated to the accomplishment of CVPIA mandates.

REFERENCES

CDFG. 2005. Grand Tab. California Department of Fish and Game, Native Anadromous Fish and Watershed Branch, Stockton, CA. February 3, 2005.

Kondolf, G.M., A. Falzone, and K.S. Schneider. 2001. Reconnaissance-Level Assessment of Channel Change and Spawning Habitat on the Stanislaus River Below Goodwin Dam. Report to the U.S. Fish and Wildlife Service, Sacramento, CA. Available at http://www.delta.dfg.ca.gov/srfg/docs/Assessment_of_Channel_Change_10233-01.pdf [44mb].

USFWS. 1995a. Working paper on restoration needs habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume 2. U.S. Fish and Wildlife Service, Stockton, Anadromous Fish Restoration Program, CA.

USFWS. 1995b. Working paper on restoration needs, habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume 3. U.S. Fish and Wildlife Service, Stockton, Anadromous Fish Restoration Program, CA.

USFWS. 2001. Final restoration plan for the Anadromous Fish Restoration Program, a plan to increase natural production of anadromous fish in the Central Valley of California. Anadromous Fish Restoration Program, U.S. Fish and Wildlife Service, Stockton, CA.