5 Conservation Strategies

The Sacramento Valley is a unique mosaic of farmlands, NWRs and managed wetlands, and high-quality rivers and streams that support waterfowl, provide spawning grounds for salmon and steelhead trout, and provide habitat for numerous other species. This natural and working landscape between the crests of the Sierra Nevada and the Coast Range includes the following:

- Several million acres of family farms that provide the economic engine for the region through the production of rice, trees, and various row crops that serve as a working landscape and pastoral setting and provide valuable habitat for waterfowl along the Pacific Flyway.

- Habitat for 50 percent of the threatened and endangered species in California, including the winter- and spring-run salmon, steelhead, and many other fish species.

- Six NWRs, more than 50 state wildlife areas, and other privately managed wetlands that support the annual migration of waterfowl, geese, and water birds in the Pacific Flyway. These seasonal and permanent wetlands support 60 percent of wintering and migratory waterfowl on the Pacific Flyway.

- The small towns and rural communities that form the backbone of the region.

- The forests, meadows, and canyons in the numerous watersheds of the Sierra Nevada and Coast Range.

The Sacramento Valley IRWMP is designed to conserve this broad mosaic by protecting and strengthening the water rights and water supplies necessary to meet various regional water needs, both now and into the future. This includes the rural working landscape and the important fish and wildlife resources in the region. The Sacramento Valley IRWMP focuses on water management (see Section 5, Conservation Strategies) and land use (see Section 6, Land and Water Use/Development Trends) strategies that are designed to meet these needs and to conserve habitat for species throughout the region.

During the past couple of decades, Sacramento Valley water suppliers and landowners have partnered with conservation organizations and state and federal agencies to resolve many long-standing endangered species problems by constructing fish screens, fish ladders, and siphons, and remanaging water supplies. Water suppliers have also partnered with agencies to deliver water to wildlife refuges and other managed wetlands.

These regional partnerships, which are described here in detail, have already shown dividends with respect to fish and wildlife in the region. For example, in 2005, DFG estimated that the number of salmon returning to the Sacramento Valley was the highest since 1981 (see DFG release, November 15, 2005). The DFG has also found that the breeding population of ducks has been increasing over the past several years (see DFG release, June 9, 2006). In addition, other waterfowl and raptor numbers have been increasing in the Sacramento Valley over the past decade, as well as the numbers of shorebirds seeking refuge in the valley during winter months.

This conservation strategy will build on these successful partnerships as described in the public process in Section 3.3, Stakeholder/Public Involvement Process for Sacramento Valley IRWMP, and will employ a variety of water management, water quality, and land use strategies to support these working landscapes. Participants in this IRWMP seek to forge additional partnerships to protect and improve habitat for endangered species and to enhance wildlife and fishery habitat in the region. This IRWMP will serve as a road map for future actions.

5.1 Fisheries Improvement Programs

Sacramento Valley water users for the past decade have been implementing projects to provide upstream solutions to improve fish passage and habitat. The Sacramento Valley's initiative and effort to help protect salmon and other aquatic species is unprecedented and is now recognized as one of the most exciting and progressive regional voluntary salmon restoration efforts in the United States. As concerns related to ecosystem health in the Bay-Delta continue, the numerous anadromous fish passage improvement actions taken in the Sacramento Valley continue to be one of the true success stories. Water managers throughout the region remain committed to further improvements and exploring opportunities for simultaneously improving water management. The following lists efforts made to improve fisheries and potential fish passage issues to be addressed on rivers and streams in the Sacramento Valley.

5.1.1 Antelope Creek

Antelope Creek watershed drainage is approximately 123 square miles, and the average stream discharge is 107,200 af/yr. In wettest years, average flows in winter months range from 200 to 1,200 cubic feet per second (cfs). In the driest years, flows in winter average 50 cfs. In all but the wettest years, summer and early fall flows average from 20 to 50 cfs. The natural flow pattern is altered by diversions in the lower creek from spring through fall. Flows are typically diverted from April 1 through October 31.

Antelope Creek supports spring-run Chinook salmon and steelhead trout. However, seasonal low flows and fish passage impediments reduce the potential for spawning.

In 1997, the Anadromous Fish Restoration Program and local partners, including Los Molinos Mutual Water Company, upgraded and installed real-time telemetered flow monitoring devices to measure streamflows (and temperature and turbidity at certain stations) on Antelope Creek to help DFG manage passage and rearing of spring-run Chinook salmon.

Local landowners and DFG are pursuing a partnership with the Service to implement a fish passage improvement to Antelope Dam. A fish ladder has been operating at the dam since 1981. Floodwaters damaged the ladder, and a new, more technologically advanced ladder needs to be installed, and improvements need to be made to the face of the dam to promote use of the ladder. If funding is available, the project will be completed in 2007.

5.1.2 Battle Creek

The Battle Creek watershed is 360 square miles. Monthly mean flow ranges from 265 to 766 cfs, with an average flow of 516 cfs.

Battle Creek has a combination of desirable habitat features including an abundance of coldwater springs, high natural flows, and a relatively constant flow during the summer. Battle Creek supports steelhead and four runs of Chinook salmon (winter, spring, fall, and late-fall). Prior to hydroelectric development, about 53 miles of creek were accessible to steelhead and Chinook salmon. Fall- and late-fall-run Chinook salmon are now partially restricted to about 6 miles between the mouth of Battle Creek and the Coleman National Fish Hatchery barrier weir.

The following four structures on the Battle Creek mainstem impede anadromous fish migration:

- The Coleman National Fish Hatchery that diverts returning hatchery fish into the hatchery for broodstock
- The Coleman National Fish Hatchery Intake 3 diversion weir that diverts water for the hatchery
- The Orwick seasonal gravel diversion dam, which diverts up to 50 cfs into an irrigation canal
- The tailrace from Pacific Gas and Electric Company (PG&E) Coleman Powerhouse, which attracts Chinook salmon and steelhead to the area with little spawning habitat

The North Fork Battle Creek has three dams built below a natural fish barrier: Wildcat Dam, Eagle Canyon Dam, and North Battle Creek Dam. The South Fork hosts three small hydro-electric facilities operated by PG&E: South Diversion Dam, Inskip Dam, and Coleman Dam. The South Fork's two tributaries, Ripley Creek and Soap Creek, are also navigable by anadromous fish. There is one diversion on each creek.

In 1999, the Battle Creek Salmon and Steelhead Restoration Project was developed through the establishment of an MOU among PG&E and state and federal agencies. This project could result in the reopening of 42 miles of anadromous fish habitat. It will involve removing five diversion dams, installing fish ladders at three diversion dams and screening associated diversions, increasing flow releases from the remaining diversion dams, and making other structural improvements.

Water temperatures in Battle Creek are influenced by seasonal hydrological and meteorological conditions, diversions and powerhouse discharges into the South Fork, the instream flow releases below diversion dams, and the diversion of cold spring water from the stream channel. Hydroelectric power diversions that divert relatively cool water from North Fork Battle Creek to South Fork Battle Creek might cool the South Fork, but might also disrupt the temperature continuum. Habitat within the artificially cooled areas is considered to be of lower quality during months when it is disconnected from the contiguous cool habitat. Fish residing in the artificially cooled areas are at risk of exposure to suboptimal water temperatures during disruptions to the hydropower conveyance system.

5.1.3 Big Chico Creek

The Big Chico Creek watershed drains approximately 72 square miles. The average annual discharge is 102,100 ac-ft. Summer flows drop to an average of 30 cfs, and winter flows average more than 300 cfs.

Big Chico Creek historically and today has 24 creek miles accessible to Chinook salmon. Big Chico Creek supports three runs of salmon including spring- and fall-run spawning and spring-, fall-, and winter-run rearing. Chinook salmon spawn between Salmon Hole and Higgins Hole, although the health of the population is compromised by natural barriers, spawning gravel availability, temperature, and siltation.

The Service has issued a Request for Proposals to replace the Iron Canyon fish ladder to improve its ability to help fish pass over a natural barrier in Big Chico Creek. In addition, partial funding has been secured for an inflatable dam on the creek that would enhance flood protection for the City of Chico while allowing for downstream gravel migration to increase anadromous fish habitat. In addition, some of the flood protection projects along Big Chico Creek also provide habitat benefits to juvenile salmon, including the Lindo Channel (Sandy Gulch) floodplain management and riparian habitat project and a streambank stabilization project.

5.1.4 Butte Creek

The Butte Creek watershed is 809 square miles. Butte Creek varies dramatically from its origin as a clear water stream in Butte Meadows at the base of Mount Lassen, through the confined stream near Chico, to the flat-water portion consisting of wetland areas in the Butte Sink and the east and west borrow channels of the Sutter Bypass. During winter and spring of

wet years, the Butte Sink and Sutter Bypass are flooded most of the time. During the summer, water flows are low. Water imported from the Sacramento and Feather Rivers through irrigation diversions substantially augments natural flows via tailwater. The mean monthly flow for period of record at a gage station near Chico is 417 cfs. Peak flow occurs during mid-February at 826 cfs, with the lowest flows in September at 119 cfs. Below Chico, instream flows downstream of Gorrill Dam during irrigation season, between mid-July and September, range from 5 to 25 cfs in most years.

Butte Creek is one of the most productive spring-run salmon streams in the Sacramento Valley. The creek has rebounded from extremely low returns in the 1980s to record numbers of spawning fish (15,000 to 20,000) in recent years. In fact, Butte Creek is one of only three Sacramento River tributaries with sustainable populations of spring-run Chinook salmon. Today, about 53 miles of the creek are accessible to fall-, late-fall-, and spring-run Chinook salmon and Central Valley steelhead. Spring-run Chinook salmon ascend to Centerville Head Dam near DeSabla. Steelhead are restricted to the lower reaches of the canyon and tributaries such as Dry Creek. Historically, a portion of the spring-run and Central Valley steelhead might have spawned in reaches farther upstream.

Lower Butte Creek consists of three subareas: the Sutter Bypass, Butte Slough, and Butte Sink. The adult spring-run fish migrate up the Sutter Bypass, through Butte Slough and into Butte Creek, navigating past numerous diversions to spawning areas in the upper Butte Creek system. There are seven migration impediments in the Sutter Bypass and eight in the Butte Sink area, including two in Butte Creek, four in Cherokee Canal, and two in Sanborn Slough.

Efforts are being made on Butte Creek to restore spring-run Chinook salmon and steelhead populations through a comprehensive program consisting of improving fish passage, increasing and improving streamflow during certain periods, consolidating and screening diversions, and protecting and restoring the riparian corridor. Since 1992, five dams on the mid-section of Butte Creek have been removed, and the four remaining dams now have state-of-the-art fish ladders and screens.

PG&E, which operates numerous small hydroelectric facilities on upper Butte Creek, is studying the effect flow timing will have on improving water temperature to further promote spawning fish survivability in the upper reaches of the creek.

The M&T Chico Ranch (M&T) completed construction of a fish screen on its Butte Creek diversion in 1995. In addition, creek flows were augmented by relocating 40 cfs of M&T's Butte Creek water right to the Sacramento River, thereby providing an additional 40 cfs to the system. The 40 cfs on Butte Creek is managed by DFG through a recordable contract that assigns the flows to the system between September 1 and June 30.

Fish screens and ladders were constructed during 1998 and 1999, at the diversion dams operated by Durham-Mutual, Rancho Esquon (Adams Diversion Dam), and Gorrill Land Company (Gorrill Diversion Dam).

The removal of four of the five dams was facilitated through the construction of a siphon under Butte Creek in 1997, to deliver water to Western Canal Water District's Main Canal without impacting migrating salmon, including the spring-run Chinook salmon. In addition, Western Canal Water District also facilitated the elimination of 12 unscreened diversions and installation of 7 new check structures. As a direct result of this work, over 20 miles of new spring-run habitat have been opened up to migrating fish.

The Lower Butte Project in the Sutter Bypass, a partnership of local water users, resource agencies, and environmental organizations, is currently involved in the design and implementation of fish passage and water delivery alternatives for the remaining structures and diversions impairing migrating fish passage on the reach of Butte Creek downstream from Butte Sink. Specifically, the partnership is attempting to improve fish passage over five water control structures and 50 small pumping plants, which is expected to bolster the long-term sustainability of production of anadromous fish populations, in particular, spring-run Chinook salmon and steelhead trout.

In addition to addressing diversion structures and systems, Ducks Unlimited is coordinating an effort to develop a regional water management plan that will address irrigation flows, drainage issues, and fisheries and wildlife needs in the Meridian Basin and Butte Slough areas.

5.1.5 Clear Creek

The Lower Clear Creek watershed (below Whiskeytown Dam) is 49 square miles. The recommended releases from Whiskeytown Dam to Clear Creek are 200 cfs from October to April, and 150 cfs for the remainder of the year, varying in the spring depending on water-year type.

After construction of Whiskeytown Dam and Saeltzer Dams, only 6 of 25 miles of creek remained accessible to fall- and late-fall-run Chinook salmon and Central Valley steelhead. With the removal of Saeltzer Dam in November 2000, an additional 10 miles were again made available.

Since 1995, the Clear Creek Coordinated Resource Management Planning Group, which consists of stakeholders and local landowners and the Clear Creek Technical Team, have been involved in planning, implementing, and monitoring multi-disciplinary restoration projects to promote anadromous salmonids. Activities on Clear Creek to benefit the salmon populations that have been performed or that are in the process of being implemented include increasing water releases from Whiskeytown Dam, improving upstream passage for migrating Chinook salmon and steelhead to historical habitat, augmenting spawning gravel, restoring sediment transport, and reducing sediment input from upland erosion.

A gravel recruitment/replenishment program has been implemented by the Western Shasta Resource Conservation District to replace the lost recruitment and removed spawning gravel. A total of 85,000 tons of gravel have been injected into Clear Creek since 1996.

Coordinated efforts to restore a mined area on public lands within the lower Clear Creek watershed have been implemented through the Hubbard Mine Reclamation Project. The purpose of this project is to increase healthy spawning areas for salmonids by reducing sedimentation.

If releases from Whiskeytown Dam drop to 50 cfs, water temperatures can exceed 75 degrees Fahrenheit, which is lethal to salmonids. Under the interim biological opinion for spring-run Chinook salmon and steelhead, Reclamation operates Whiskeytown Dam to meet summer water temperature requirements to support steelhead and spring-run Chinook (60 degrees Fahrenheit from June through September 15, and 56 degrees Fahrenheit from September 15 through October 30).

5.1.6 Deer Creek

The Deer Creek watershed drains 200 square miles and is 60 miles long. The lower 10 miles flow through the valley floor where most of the flow is diverted. Peak monthly flows in wet winters reach up to 2,600 cfs. In the driest years, winter flows reach only 90 to 110 cfs. Minimum summer and fall base flows are 60 to 80 cfs.

Since 1990, the local irrigation districts, with assistance from DFG and the Department, have voluntarily provided fish passage flows at critical times. All of the diversions on Deer Creek have fish ladders and screens.

The Deer Creek Watershed Conservancy, a group of stakeholders, landowners, and local government representatives, is involved in a collaborative stakeholder effort to foster conservation, restoration, and sound resource management in the Deer Creek watershed. Fish passage improvements being implemented on Deer Creek include a water exchange program to augment fish transportation flows; monitor and maintain existing fish screens and ladders; and protect anadromous fish spawning, rearing, and holding habitat. In addition, the Deer Creek Watershed Conservancy is involved in a project to determine the need to upgrade existing ladders and screens at three water diversions that are currently using perforated flat screens developed in the 1950s.

5.1.7 Mill Creek

Mill Creek flows for 60 miles draining a 134-square-mile watershed. From 1929 to 1994, Mill Creek had an average annual runoff of 215,000 ac-ft, equivalent to a mean annual flow of 297 cfs, and a median flow of 175 cfs. There are no storage dams or reservoirs on Mill Creek; however, there are several diversion dams, including Ward Dam and Upper Diversion Dam. Because of flood damage, the Ward Dam was rebuilt in 1997, along with a modified

pool and chute ladder. The fish ladder provides passage at lower flow conditions. The Los Molinos Mutual Water Company completed a fish screen on its relocated diversion in 2000.

The Clough Dam Siphon and Fish Screen Project, which began in 1998, was completed in 2003. This project included removing the remains of Clough Dam, constructing an inverted siphon under Mill Creek, and screening a diversion in the creek to improve upstream fish passage for adult salmon and steelhead.

The Mill Creek watershed supports spring-, fall-, and winter-run Chinook salmon and Central Valley steelhead. Over 44 miles of the creek are accessible to these species. Winter-run salmon have been observed spawning in the lower reaches of Mill Creek, and spring-run salmon have been observed spawning at an elevation of 5,300 feet, the highest known spawning activity in California.

Mill Creek differs from other eastside streams because of its high silt load and turbidity during the spring snowmelt. Much of this silt originates from naturally occurring volcanic ash in Lassen Volcanic National Park. Siltation in upstream spawning and rearing areas between Highway 36 and Big Bend has become severe enough to adversely affect salmonid production.

In dry years, when natural streamflows are low and diversions are operating, increased water temperatures resulting from lower and slower flows can create a thermal barrier, delaying or even preventing salmonid migration.

5.1.8 Sacramento River

Numerous programs have been undertaken or are now underway to promote fish passage and survivability on the Sacramento River.

In 2000, 32,000 tons of gravel were placed in the Sacramento River as part of a spawning gravel program authorized through the CVPIA of 1992. In 2002, an additional 15,000 tons of gravel were placed in the upper Sacramento River, and 8,800 tons more in 2003. The gravel was added to the river in an effort to restore riparian habitat. It is expected that the gravel will erode downstream and become future salmon spawning habitat. Sonic tags were placed in selected pieces of gravel to track the downstream movement.

The temperature control device at Shasta Dam, which was completed in March 1997, was constructed to enhance fish habitat by releasing colder water into the upper reaches of the Sacramento River without losing power revenue. The temperature control device and associated low-level intake structure are intended to help mitigate the declines in population of threatened winter-run Chinook salmon. It was determined that one of the major causes of the decline is the high loss of eggs and fry during the later summer and fall spawning season in the upper Sacramento River because of elevated water temperatures.

The 250-foot-wide by 300-foot-high steel facility consists of a shutter structure and a 130-foot-wide by 170-foot-high low-level intake structure attached to the upstream face of Shasta Dam, which encloses all five existing power penstock intakes and regulates water temperature through selective level withdrawal of reservoir water.

The Red Bluff Diversion Dam (RBDD) is a key component of the CVP and is owned and operated by Reclamation to deliver water to the TCCA's 18 water districts. It also provides a backup means for delivery of water to several federal wildlife refuges in the Sacramento Valley. It is one of the most important remaining structures identified by fishery agencies as a place where further gains are possible to improve fish passage on the Sacramento River. The dam has a series of spillway bays, each 60 feet wide, separated by eight-foot-wide piers. When the spillway gates are fully open, no significant head differential occurs from headwater to tailwater at the dam. When the dam gates are closed, an artificial lake is formed, extending approximately 6 miles upstream through the City of Red Bluff. RBDD raises the elevation of water in the river so that a portion of the flows can be diverted to the Tehama-Colusa Canal through a headworks structure consisting of six radial gates and drum-type fish screens.

A majority of Sacramento River spawning habitat for listed fish occurs upstream of RBDD, and fishery agencies believe the dam impedes fish passage both upstream and downstream. A biological opinion for endangered winter-run Chinook salmon issued in 1993 by National Marine Fisheries Service requires that the dam gates be kept in a raised (nondiverting) position (gates out) 8 months of the year. The only time that the gates can be in, to make maximum use of RBDD diversion capability, is May 15 until September 15 each year. At this time, National Marine Fisheries Service is finalizing the first stage of a listing of the green sturgeon as a threatened species, placing added emphasis on the requirement for an alternative means of diversion at Red Bluff, because the green sturgeon is incapable of using the dam's fish ladders.

The water users that make up TCCA and Reclamation have been addressing fish passage problems at RBDD since 1985, by modifying dam operations. The installation of rotary drum screens in 1990, and the Research Pumping Plant in 1995, furthered these efforts. The TCCA is also exploring plans for improving fish passage at RBDD. The TCCA investigated the feasibility of numerous different alternatives to the current RBDD gravity intake system, including installing a state-of-the-art screening and pumping facility at Red Bluff, altering the operation schedule for the diversion dam, constructing a fish bypass facility, or implementing a mixture of new facilities construction and altered dam operation. The water users have selected a preferred alternative that involves the construction of an improved positive barrier fish screen and pumping facility. Reclamation has yet to agree to a preferred alternative.

The RBDD is located approximately 60 miles downstream from Shasta and Keswick Dams. The reach of the Sacramento River upstream of RBDD is the primary spawning habitat for the endangered winter-run Chinook and the fall- and late-fall-run Chinook salmon.

GCID operates a state-of-the-art fish screening facility, the largest of its kind in the world. GCID diverts a maximum of 3,000 cfs from the Sacramento River, with the peak demand occurring during spring months at the same time as the peak outmigration of juvenile salmon. Key components of GCID's fish screen facility include a 600-foot extension to GCID's pre-existing fish screen and a stabilizing gradient facility in the Sacramento River mainstem. This project is designed and operated to minimize losses of all fish near the pumping plant diversion, including endangered winter-run Chinook salmon, while maximizing GCID's capability to divert the full quantity of water it is entitled to use to meet its water supply delivery obligations. The total capital cost of GCID's fish screening project is approximately $76 million.

M&T environmental restoration activities included relocating the M&T Pumping Station from the mouth of Big Chico Creek to the Sacramento River and screening the new diversion. M&T intends to complete this project by installing a remaining pump behind the screens. This project ensures a guaranteed water supply to over 8,000 acres of permanent wetlands and over 1,500 acres of seasonal wetlands. Additionally, it also protects habitat for migrating spring-run Chinook salmon. One other important benefit of this project is M&T's agreement to provide fish flows in the amount of 40 cfs in Butte Creek, one of the most important and last remaining spawning areas for spring-run salmon. Currently, a gravel bar is threatening the pumping station.

A pumping plant maintenance and channel alignment project has been proposed. It involves the placement of 700 feet of rock toe and tree revetment on the west side of the Sacramento River at River Mile 192.5 on land that is owned and managed by the Service as part of the Capay Unit of the Sacramento River NWR. This project would stabilize the bank for a period of 5 years. River meander and sediment deposition jeopardizes the continued operation of the M&T Llano Seco Rancho pumping facility. The pumping facility was relocated from Big Chico Creek to the present location in 1997, to reduce impacts on spring- and winter-run Chinook salmon, with funds made available pursuant to the CVPIA, Bay-Delta Accord Category III, Wildlife funds, Wildlife Conservation Board funds, and Ducks Unlimited funds.

In 1999, Princeton-Codora-Glenn Irrigation District and Provident Irrigation District completed the fourth largest fish screen on the Sacramento River. The completed facility replaces three major diversions on the Sacramento River with a consolidated, screened pumping plant. In addition to the fishery benefits, the project also provides reliable water supplies for nearly 30,000 acres of farmland and thousands of acres of seasonal wetlands for migrating waterfowl in Princeton-Codora-Glenn Irrigation District and Provident Irrigation District. Currently, these districts are working in collaboration with the Service and the

conservation non-profit River Partners on a joint project that investigates how to restore the wildlife refuge area and protect the river bank on the Butte County side of the river from erosion to prevent the river from meandering away from the fish screen and pumping facility.

RD 1004 completed construction on its screen in 1998. In addition to construction of a positive barrier fish screen, this project relocated the Princeton Pumping Plant and necessary conveyance facilities to a more stable location along the Sacramento River.

Maxwell Irrigation District operates a state-of-the-art positive barrier fish screen, one of the first of its kind installed on the Sacramento River. Completed in 1994, the new pumping plant and screen facility protects threatened steelhead and spring-run Chinook salmon, and endangered winter-run Chinook salmon. In 2002, Maxwell Irrigation District incorporated a neighboring diversion into the existing project, thereby eliminating another unscreened diversion on the Sacramento River.

RD 108 is currently developing a new fish screen project that will consolidate its three largest unscreened river diversions into one pumping plant with a new fish protection screen facility. This project is scheduled to enter its construction phase in 2006, if it receives adequate funding. In 2000, RD 108 completed construction of a positive barrier fish screen on the Sacramento River. The project, located at the district's Wilkins Slough diversion, protects migrating endangered winter-run Chinook salmon, and threatened spring-run Chinook and steelhead trout. The design for the new screen facility was chosen after several years were spent examining the performance of alternate screen technologies.

In 1994, Pelger Mutual Water Company completed construction of its new pumping station and positive barrier fish screen in the Sacramento River near Knights Landing. This facility includes pumps with a discharge capacity of 60 cfs. The screen protects spring and winter runs of Chinook salmon and steelhead trout.

In 2005, Sutter Mutual Water Company began construction on the fish screen project for its diversion on the Sacramento River just downstream from the Tisdale Weir. The Tisdale Pumping Plant is the largest remaining unscreened diversion on the Sacramento River.

The Richter Brothers diversion on the Sacramento River near Knights Landing is located along a reach of the river that hosts several species of salmon, steelhead trout, and the Sacramento splittail minnow. Construction is expected to begin on the fish screen in 2007, as part of the the Family Water Alliance Small Diversion Fish Screen Program.

Natomas Central Mutual Water Company has completed the feasibility, preliminary design, and environmental evaluation work associated with consolidation of five Sacramento River diversions (with a combined capacity of about 630 cfs) into two screened facilities. The project will remove pumping from an area (Natomas Cross Canal Channel) that can be preserved for fish passage and provide new protections for terrestrial species by preserving and enhancing important habitat.

In addition to the fish screens installed on larger diversions, the Family Water Alliance Small Diversion Fish Screen Program, in collaboration with state and federal resource agencies and private landowners, developed a program that has researched, developed, and resulted in the installation and monitoring of 24 fish screens projects, focusing on diversions under 100 cfs. This innovative technology has resulted in the cumulative screening of over 563 cfs, resulting in over 21,600 private acres of land that are irrigated in a fish-friendly manner. This program serves to protect these water rights and the fishery resource by assuring compliance with the mandates of the federal Endangered Species Act. Currently, this program is completing a 100-cfs screen for Reclamation District 999, and will be installing a fish screen for the Richter Brothers in Knights Landing next year.

5.1.9 Stony Creek

Three storage reservoirs are located on Stony Creek that in tandem provide flood control and water supply benefits. Opportunities exist to reoperate Orland Project reservoirs in conjunction with that of other downstream supplies that can result in increased yield of the presently underused Orland Project reservoir system. Yields resulting from reoperation of the Stony Creek Reservoir system have not been determined; however, in 2003, a CALFED-funded feasibility study was completed for the OUWUA in cooperation with TCCA titled *OUWUA and the TCCA Regional Water Use Efficiency Project*. One conclusion in the study stated, "Regional supplemental supplies of 40,000 to 120,000 [ac-ft] may be possible during dry years, depending on the timing and quantity of Stony Creek runoff." The study was based on aggressive institutional assumptions that combined the operation of the Orland Project with the improvements and development of groundwater wells to extract an average of 30,000 ac-ft annually. The study also supported that winter seasonal runoff that must be spilled from Black Butte Dam could be rediverted through an enlarged Orland Project conveyance connecting Black Butte Dam with the Tehama-Colusa Canal. It indicated that such a new conveyance "could convey up to 100,000 [ac-ft] during a 4-month runoff period."

A 2003 report titled, *Stony Creek Alternative for Conveyance to Sites Reservoir North-of the-Delta Storage Evaluations,* was completed for the Department to provide alternative conveyance routes to deliver water to a future Sites Reservoir. Such routing could also serve to accommodate direct or substitution water transfers, whereby Stony Creek supplies diverted into the Tehama-Colusa Canal are offset by other Sacramento River supplies made available to others. Further investigation into reoperating the Stony Creek Reservoir system and Black Butte-Tehama-Colusa conveyance intertie are needed. Diversions from Stony Creek are currently permitted for two 45-day period periods between April 1 and May 15, and between September 15 and October 29. The Stony Diversion depends on the U.S. Army Corps of Engineers' operation of Black Butte Reservoir. TCCA must annually supplement its water supply during the times that gravity diversion at RBDD is not available. During these times, TCCA obtains water, when it is available, from Black Butte Reservoir via a diversion from Stony Creek.

In 2004, Reclamation completed the third and final year of a monitoring program on Stony Creek in Glenn and Tehama Counties. The purpose of the monitoring program was primarily to determine if steelhead trout were present in the creek. During the 3-year program, no steelhead trout were found in Stony Creek. This information should allow the state and federal fishery agencies to concentrate their steelhead restoration activities on other rivers and streams on the east side of the Sacramento Valley where steelhead are present.

5.1.10 Yuba River

The Yuba River drains about 1,339 square miles with a total storage capacity of 1,377,000 ac-ft. The monthly mean flow for the gage station in Marysville on the Yuba River is 2,341 cfs. Flows range from 833 cfs during the summer to 4,740 cfs during the winter and spring. If fall flows in the lower Yuba River drop below 600 cfs, spawning habitat becomes limited.

Local agencies on the Yuba River have been implementing numerous projects and activities to benefit the passage and survivability of anadromous and other fish species.

In late 1999, Browns Valley Irrigation District completed construction of its Yuba River Diversion Fish Screen. This project protects salmon in the Yuba River, and because Browns Valley Irrigation District relied heavily on local and in-house construction services, came in below budget. The final project was funded with Browns Valley Irrigation District's own resources, and assistance was provided by the YCWA, Yuba River PG&E Mitigation Account, Category III, CVPIA Restoration Fund, and Tracy Pumps Mitigation Fund.

Prior to the 2001 irrigation season, work was completed on a 600-cfs fish screen for the diversion on the north side of the Yuba River at Daguerre, which serves Cordua Irrigation District, Hallwood Irrigation District, and Ramirez Water District. This screen was constructed in cooperation with YCWA, National Marine Fisheries Service, DFG, and the Service, and replaced an obsolete screen that was owned and operated by DFG. The DFG screen was not operated on a continuous basis, and about 1 million juvenile fish were estimated to be entrained in the diversion each year. Funding for the screen came from the irrigation districts and YCWA.

The YCWA has performed numerous activities promoting Yuba River fish recovery, including partnering with the fishery agencies and other stakeholders in reviewing studies and making decisions on the lower Yuba River; conducting an annual Chinook salmon escapement survey after DFG discontinued the survey in 1990, because of a lack of funding; including fishery conditions into water management decisions; scheduling water transfers in a fish-friendly manner; and improving the reliability of its Narrows 2 Powerhouse to be less susceptible to PG&E transmission line outages that can result in flow reductions out of Englebright Reservoir.

The YCWA has also been actively partnering with CALFED to develop additional fishery improvements on the Yuba River. The agency has received CALFED funding for two ongoing steelhead studies and one study to further enhance the Yuba fishery. The YCWA is currently working to help several small diverters screen their pump facilities and received a grant to install a full-flow bypass to further reduce the possibility for flow reductions on the lower Yuba River. In addition, YCWA received a grant to install an intake extension on its Narrows 2 Powerhouse to further reduce temperatures on the Yuba by up to 6 degrees Fahrenheit.

The YCWA is working with the Service and the U.S. Army Corps Engineers to evaluate options to improve fish passage upstream and downstream of Daguerre Point Dam on the Yuba River. Although the existing fish ladders appear to be working properly, a study will assess whether the facilities can be further improved. The YCWA has partnered with CALFED and the Service to study the life history and stock composition of steelhead trout on the Yuba River. The YCWA is also planning to install a new turbine shutoff valve and a new flow bypass valve that would be synchronized to maintain constant flow to the Yuba River to permit a smooth transfer of flow.

Water has also been acquired on the Yuba River to benefit the Delta and anadromous fish species. Many of the recent acquisitions have been targeted primarily for the benefit of fisheries in the Bay-Delta watershed. In 2001, 80,000 ac-ft of water were acquired for the Environmental Water Account. This exceeded the 35,000 ac-ft called for in the CALFED Record of Decision. In 2002 and 2003, 142,000 and 70,000 ac-ft, respectively, were acquired upstream of the Delta for the Environmental Water Account.

In 2005, the YCWA and 16 partners signed the Lower Yuba River Accord to proceed with three separate but related agreements to resolve nearly 15 years of controversy and litigation over instream flow requirements for the lower Yuba River. The Fisheries Agreement would provide higher instream flows for Yuba River Chinook salmon, steelhead, and other fish species, ranging from 260,000 ac-ft in a dry year to more than 574,000 ac-ft in a wet year. The Water Purchase Agreement would provide 60,000 af/yr for the Environmental Water Account and up to 140,000 ac-ft in dry years for the CVP and the SWP. The Conjunctive Use Agreement would call for YCWA and seven of the local irrigation districts and mutual water companies it serves in Yuba County to implement conjunctive use measures to help meet local water supply needs in dry years, facilitating YCWA's operation of its storage facilities to meet the new, higher instream flow requirements in the lower Yuba River, as called for in the Fisheries Agreement.

5.1.11 Future Actions

To build on these successful partnerships, the Sacramento Valley IRWMP will help advance the following measures to further improve fisheries:

- Fish Screens

  Sacramento Valley water users are working with the Anadromous Fish Screen Program to identify and prioritize future fish screen projects. Currently, all large diversions (>250 cfs) are either screened or in the process of being screened.

  The next step for the fish screen program is screening smaller diversions. A technical team has been established to determine the diversions on which screening will provide the greatest benefit to fish passage. The purpose of prioritization is to determine where to direct limited state and federal resources. This process will build on efforts that already have been established in the valley. Since 1997, The Family Water Alliance has administered its Small Screen Program, an effort to enhance fish passage on the Sacramento River and its tributaries by identifying, prioritizing, and screening small agricultural diversions in cooperation with local landowners.

  In the future, the technical team and a science advisory panel are hoping to determine which remaining diversions do not need to be screened because of the limited impact they would have on migrating fish.

- Water Acquisitions

  Water suppliers and other water right holders in the Sacramento Valley are interested in furthering an environmental water program to provide flows for key fishery and other environmental needs in the Sacramento River and its tributaries. Sacramento Valley water users are investigating the benefits that can be provided through voluntary transfers in a flexible manner to enhance streamflows for fisheries and their habitat. These Sacramento Valley interests will work with the state and federal fishery agencies to further develop this program. In January 2002, CALFED released Environmental Water Program Pilot Acquisitions-Stream Selection Recommendations, an evaluation and prioritization of 12 streams that it determined would benefit the most from transfers. The stream selection process began by evaluating 12 streams identified by the Service as "having the highest biological priorities for flow augmentation." The 12 streams were divided into three tiers. Streams recommended for the first tier were (1) Butte Creek, (2) Clear Creek, (3) Deer Creek, (4) Mill Creek, and (5) Tuolumne River. Streams in the second tier are (1) Battle Creek, (2) Big Chico Creek, (3) Calaveras River, (4) Stanislaus River, and (5) Yuba River. Streams in the third tier are (1) Antelope Creek and (2) Cow Creek.

- Reoperation of Facilities

  a. Rerouting of Flows to Meet TBs

     The Department has developed a number of TBs to enhance streamflow and water quality on rivers and streams in the Sacramento Valley. Many of the TBs will increase the quantity of water in certain reaches of rivers and streams during specific times of the year. These TBs can be addressed through a number of water management tools, including conjunctive management and system improvements. Each method of developing water or affecting flows will rely on a scheduling of flows to achieve the TB. The Sacramento Valley IRWMP will continue to focus on efforts to improve water use efficiency and to promote system improvement projects to meet the TBs and to help fisheries in the region.

  b. CVPIA

     Water that originates from the Sacramento Valley will continue to be used to help meet commitments in the CVPIA, including the 800,000 ac-ft dedicated to fish and wildlife purposes, Level 4 refuge water supplies, and the Anadromous Fish Restoration Program.

  c. Reservoir Reoperation

     The potential to reoperate major reservoirs in the region to achieve Sacramento River system fishery and riparian ecosystem benefits continues to be analyzed. Sacramento Valley water users will work with Reclamation and the Department to evaluate the potential to coordinate CVP and SWP operations to maximize water supply benefits for this conservation strategy and broader purposes.

- Environmental Monitoring Program

  An environmental monitoring program will be conducted in various parts of the valley to estimate the ecosystem water demands and to monitor the health of aquatic and terrestrial habitats under changing land and water use. This effort will begin with the Butte County Environmental Monitoring Program and expand from that effort. The monitoring program will focus on efforts to maintain riparian habitat and flows to support fisheries.

- Improve Water Quality

  The Coalition and the California Rice Commission have a strong program to improve water quality as part of the Sacramento Valley IRWMP. Many of the measures taken by the Coalition and the California Rice Commission have and will continue to improve fishery habitat by addressing water quality problems as they arise in the Sacramento Valley. The Coalition or California Rice Commission will coordinate with municipalities

in the region, as effluent dischargers and stormwater managers, to help address any water quality concerns.

5.2 Waterfowl and Wildlife Improvement Programs

The Sacramento Valley serves as a vital part of the Pacific Flyway, which is the habitat corridor for the annual migration of waterfowl, geese, and water birds. The Sacramento Valley also provides habitat for 50 percent of the threatened and endangered species in California. This habitat varies from riparian zones and wetlands along the Sacramento River and other significant tributaries and agricultural drains, wildlife refuges, and rice fields that provide food sources and habitat for a variety of species.

The NWRs, state WMAs, and private areas are important contributors to habitat in Northern California; and they play a crucial role in the Sacramento Valley IRWMP. Partnerships among agricultural landowners, water users, wetlands, and waterfowl interests, including the NWRs and WMAs, have been developed over years and will continue to play a critical role to assure good water quality, the protection of a broad array of aquatic and terrestrial species, and reliable and affordable water supplies for agriculture and waterfowl purposes. Sacramento Valley water users supplement water for NWRs by 107,600 to 179,000 ac-ft of water annually.

The Sacramento Valley lies near the southern end of the Pacific Flyway migratory route and is one of the most prominent wintering sites for waterfowl, attracting from 1 to 3 million ducks and 750,000 geese to its seasonal marshes. Sacramento Valley habitat supports approximately 44 percent of wintering waterfowl using the Pacific Flyway. The NWRs were created to provide habitat for migratory waterfowl using the Pacific Flyway and serve a variety of wildlife and conservation objectives. Other key species benefiting from the NWRs include the bald eagle, giant garter snake, and valley elderberry longhorn beetle.

The acquisition of water for protecting, restoring, and enhancing fish and wildlife populations has been facilitated through implementation of the CVPIA of 1992. First, the Central Valley NWR and Wildlife Habitat Areas section of the CVPIA (Sec. 3406 (d)) directs the Secretary of the Interior to provide dependable water supplies of appropriate quality to maintain and improve the Central Valley wetlands habitat on NWRs and state WMAs and lands within the Grassland Resource Conservation District.

Other sections of the CVPIA help to secure reliable supplies of water through infrastructure improvements that increase system flexibility and provide protections to prevent take of listed fish species. Improvements that have been authorized by CVPIA include the GCID Fish Screen Project and other fish screen projects constructed under the 3406(b)(21) program that allow water to be diverted year-round (which is critical to the water supply timing needs of NWRs and the flooding of rice fields in the winter to provide waterfowl habitat).

The CVPIA also includes the Refuge Water Supply Long-term Construction Project. The objective of this program is to provide infrastructure to support delivery of long-term, firm, reliable water to specific federal and state NWRs, state WMAs, and the Grassland Resource Conservation District. The working plan is to modify existing facilities and/or construct new facilities to provide infrastructure to support refuge water deliveries. The water is acquired by the Water Acquisition Program from willing sellers of water, i.e., water districts or other entities that hold water rights and are willing to transfer their water rights (either temporarily or permanently) to the U.S. Department of the Interior.

The *Refuge Water Supply Report* describes the following four refuge water supply levels:

- Level 1 = Existing firm water supply
- Level 2 = Current average annual water deliveries
- Level 3 = Full use of existing development
- Level 4 = Optimum management

The overall goal for the program is to achieve an ecosystem management approach that strives to maintain multiple habitats that support and maintain diversity of wildlife species. In the past, incremental Level 4 needs have not been fulfilled because of lack of water supply on a year-round basis. Increases in water to fulfill Level 4 supplies are being sought to meet CVPIA obligations, boost habitat, decrease waterfowl overcrowding, and decrease waterfowl diseases. Realization of Level 4 supplies is often only achievable upon construction of additional water supply infrastructure. Any additional water supplies will also benefit populations of endangered and threatened species that use the habitat provided by the NWRs, WMAs, and designated private wetlands.

A list of water supplies and additional water needs (if any) for state and federal NWRs in the Sacramento Valley follows.

5.2.1 Sacramento National Wildlife Refuge

The Sacramento NWR extends into both Glenn and Colusa Counties covering 10,776 acres. The refuge contains permanent ponds, seasonal wetlands, irrigated moist soil units, and uplands. These areas contain invertebrate populations and plant species that serve as a food source for migratory waterfowl as well as other sensitive-status and common terrestrial species.

The Sacramento NWR water supplies consist of the appropriative water rights on Logan Creek and water supplies provided for in the CVPIA. In regards to the water supply from Logan Creek, the rights are subject to depletion by other water rights with higher priorities, so it is not considered a dependable water supply. An MOU entered into between Reclamation and the Service provides for CVP and acquired water supplies to the refuge from March 1, 2006 through February 28, 2026. The GCID conveys Level 2 CVP water and acquired Level 4 water supplies to the refuge pursuant to Cooperative Agreement No. 1425-

98-FC-20-17620 between Reclamation and GCID. Cooperative Agreement 17620 provides for payment for conveyance services of Level 2 and Level 4 water supplies on a year-round basis. Before Cooperative Agreement 17620, GCID only conveyed water to the refuge from April through November, and, as a result, the refuge had to stockpile water during the winter months. Now, as a result of Cooperative Agreement 17620 and Cooperative Agreement 1425-98-FC-17630, which provided for construction of improvements to GCID's conveyance system, including the Stony Creek Siphon located south of Hamilton City, GCID is able to convey Level 2 and Level 4 water supplies on a year-round basis.

5.2.2 Delevan National Wildlife Refuge

The Delevan NWR, which covers 5,663 acres in Colusa County, was authorized in 1962, under the Migratory Bird Conservation Commission. The refuge provides numerous habitat improvements including permanent ponds, seasonal wetlands, water grass, and invertebrate populations. It provides habitat for geese, birds, and other wildlife species.

The Delevan NWR receives surplus CVP water via GCID facilities. This water is agricultural return flows conveyed by the GCID. With the completion of the GCID fish screen facilities modification, which was dedicated in 2002, GCID conveys water from the GCID Hamilton City Pumps through the GCID main canal to the refuge. When GCID dewaters its system in the winter, CVP water is transported through the Tehama-Colusa Canal to the Wasteway Cross Channel. The Wasteway Cross Channel is used to direct water to the GCID facilities that serve the refuge. No wells currently exist on the refuge. An MOU entered into between Reclamation and the Service provides for CVP and acquired water supplies to the refuge from March 1, 2006 through February 28, 2026. The GCID conveys Level 2 CVP water and acquired Level 4 water supplies to the refuge pursuant to Cooperative Agreement No. 1425-98-FC-20-17620 between Reclamation and GCID. Cooperative Agreement 17620 provides for payment for conveyance services of Level 2 and Level 4 water supplies on a year-round basis. Before Cooperative Agreement 17620, GCID only conveyed water to the refuge from April through November. Now, as a result of Cooperative Agreement 17620 and Cooperative Agreement 1425-98-FC-17630, which provided for construction of improvements to GCID's conveyance system, including the Stony Creek Siphon located south of Hamilton City, GCID is able to convey Level 2 and Level 4 water supplies on a year-round basis.

5.2.3 Colusa National Wildlife Refuge

The Colusa NWR was established in 1944, and currently occupies 4,956 acres. The refuge is approximately southwest of the Town of Colusa in Colusa County.

Existing water supplies consist of the refuge's appropriative water rights on RD 2047's drain, agricultural return flows, and water supplies provided for in the CVPIA. Level 2 water supplies have been met through a combining of existing water supplies and CVP water delivered by GCID year-round. An MOU entered into between Reclamation and the Service provides for CVP and acquired water supplies to the refuge from March 1, 2006 through

February 28, 2026. The GCID conveys Level 2 CVP water to the refuge pursuant to Cooperative Agreement No. 1425-98-FC-20-17620 between Reclamation and GCID. Cooperative Agreement 17620 provides for payment for conveyance services of Level 2 water supplies on a year-round basis. Before Cooperative Agreement 17620, GCID only conveyed water to the refuge from April through November. Now, as a result of Cooperative Agreement 17620 and Cooperative Agreement 1425-98-FC-17630, which provided for construction of improvements to GCID's conveyance system, including the Stony Creek Siphon located south of Hamilton City, GCID is able to convey Level 2 water supplies on a year-round basis.

5.2.4 Sutter National Wildlife Refuge

The Sutter NWR, established in 1944, covers 2,591 acres in Sutter County, southwest of Yuba City (Water Acquisition Program). The refuge is the only publicly owned wetlands habitat in the Sutter Basin. In the winter, flood flows from the Sacramento River, Butte Sink, and the Feather River cover large portions of the Sutter Basin. Levees were put up on most of the land to promote flood protection and agricultural production. Water is used on the refuge to maintain ponds and seasonal wetlands. The wetlands support waterfowl food sources such as swamp timothy, millet, and invertebrate populations. About 500 acres provide wetlands habitat for geese, upland birds, and other wildlife species.

Reclamation does not presently have a cooperative agreement for conveyance services with Sutter Extension Water District; and therefore, any water diverted by Sutter NWR is a result of being a landholder within the district's boundary for those lands located outside the Sutter Bypass, or any water to which there is a right to divert from the East Borrow Ditch for use on refuge lands within the Sutter Bypass. An MOU entered into between Reclamation and the Service provides for CVP and acquired water supplies to the refuge from March 1, 2006 through February 28, 2026. The GCID conveys Level 2 CVP water and acquired Level 4 water supplies to the refuge pursuant to Cooperative Agreement No. 1425-98-FC-20-17620 between Reclamation and GCID. Cooperative Agreement 17620 provides for payment for conveyance services of Level 2 and Level 4 water supplies on a year-round basis. Before Cooperative Agreement 17620, GCID only conveyed water to the refuge from April through November. Now, as a result of Cooperative Agreement 17620 and Cooperative Agreement 1425-98-FC-17630, which provided for construction of improvements to GCID's conveyance system, including the Stony Creek Siphon located south of Hamilton City, GCID is able to convey Level 2 and Level 4 water supplies on a year-round basis.

5.2.5 Sacramento River National Wildlife Refuge

The Sacramento River NWR is located along the Sacramento River for 90 miles between Red Bluff and Princeton and is composed of 22 units or small properties. The 11,000 acres of riparian habitat provided by the refuge includes wetlands, uplands, and almond and prune orchards. The 22 units have riparian water rights. The only unit open to the public with a

visitor facility is the Llano Seco Unit 2/3-mile walking trail. The Llano Seco encompasses 700 acres in Butte County.

The Llano Seco's existing water supplies consist of riparian water rights and the purchase of an annual average of 5,000 ac-ft of water from Perrott Ranch, which is pumped through M&T's pumps. The Sacramento NWR Complex pays for Sacramento River NWR water supply because it is not covered under the CVPIA.

5.2.6 Gray Lodge Wildlife Management Area

The Gray Lodge WMA was established in 1931, and encompasses 9,180 acres in Sutter and Butte Counties. Only 8,400 acres of the refuge were considered in and covered by the *1989 Report on Refuge Water Supply Investigation*. In 1997, the refuge added 800 acres; 163 acres consisted of rice fields, and the remainder consisted of irrigation pasture. The CVPIA Water Acquisition Program provides water to 8,400 acres of the WMA.

The DFG manages the wildlife area. Gray Lodge WMA is located adjacent to the Butte Sink, an overflow of Butte Creek and the Sacramento River, and supports ponds, wetlands, crops, and pastures. The refuge wetlands areas support waterfowl food sources such as swamp timothy and invertebrate populations; and upland areas support habitat for geese, upland birds, and other wildlife species.

Gray Lodge WMA receives water from a combination of surface water and groundwater sources. Pursuant to Section 3406(d) of the CVPIA, Reclamation and DFG entered into a contract that provides for a water supply to Gray Lodge WMA from March 1, 2006 through February 28, 2026. The contract can be renewed for successive periods of 25 years each, subject to terms and conditions mutually agreeable to the parties.

Also pursuant to Section 3406(d) of the CVPIA, Reclamation entered into a Cooperative Agreement, No. 03-FC-202049, with BWGWD, which provides for funding for the district's cost of constructing facilities improvements and paying for conveyance services of Level 2 and Level 4 water supplies to the wildlife area. The wildlife area, as a landholder in the district, receives an allocation of water from the district for their primary and secondary lands for the April through October irrigation season, and an additional allocation from the district for their primary and secondary lands from the November 1 through shutdown period (usually middle of January). The Level 2 provided by CVP supplements the wildlife area's allocation as a landholder up to full Level 2. No Level 4 water has been acquired because the district's distribution system is unable to convey the additional water at this time.

Reclamation also entered into an agreement with DFG to reimburse the state for deep well pumping of groundwater, considered Level 2 water, until such time as construction begins and the improvements are completed on the district's distribution system.

Before construction can begin, a seepage study is being conducted to ensure that increased use of the district's laterals to convey water to the wildlife area will not negatively impact adjacent landowners by raising the water table.

5.2.7 Future Actions

The Sacramento Valley IRWMP will help advance the following measures to further improve waterfowl, wetlands, and wildlife environment:

1. Continue Partnerships

   Water suppliers and landowners have been working closely with the conservation community, including Ducks Unlimited and California Waterfowl Association, to improve habitat for wetlands-dependent species. Continuing these partnerships is a central part of the Sacramento Valley IRWMP. These partnerships have included the Coalition and efforts to improve water quality and avoid conflicts between water users and NWR and managed wetlands in the valley.

2. Promote Joint Habitat Venture

   The Sacramento Valley IRWMP seeks to help achieve the goals established by the Central Valley Joint Habitat Venture to protect, restore, and enhance wetlands and associated habitats necessary to sustain migratory bird populations in perpetuity for the benefit of those species, resident wildlife, and the public. See www.centralvalleyjointventure.org.

3. Seek Level 4 CVPIA Supplies

   Sacramento Valley water users will continue to work with the Service to determine the potential to assist in establishing Level 4 water supplies for the refuges in the Sacramento Valley.

4. Explore Groundwater

   Numerous NWRs and WMAs currently augment their water supplies with groundwater from wells located within the boundaries of the refuge. Reclamation and the Service have also initiated a study to evaluate the potential of using groundwater, including locally managed conjunctive use projects, to supplement Level 4 water supplies for Central Valley federal and state wildlife refuges, including the WMAs. The study will analyze the availability of groundwater supplies near the Central Valley refuges. This information will be used to develop options to secure short- and long-term supplemental sources of refuge water supplies through the Water Acquisition Program, and will avoid conflict over groundwater resources.

5.3 Ricelands Habitat

Ricelands make up a significant portion of the Northern California Working Landscape. California ricelands have become important surrogate wetlands habitats for many wildlife species. In fact, 235 species are known to use California ricelands. With the extensive loss of about 95 percent of the native wetlands habitats in the Central Valley, riceland habitats have become essential to the management of certain wildlife groups, such as waterfowl and shorebirds. Moreover, many special-status species have also successfully adapted to cultivated ricelands. For some wetlands-dependent species, ricelands provide essential wetlands-like habitat that has contributed to the stability of populations. In some cases, habitat provided by ricelands has helped to support population increases. Additionally, agricultural drains that run to, from, and through riceland areas can provide important habitat for sensitive and common terrestrial species.

5.3.1 Wildlife Use of Cultivated Ricelands

Early in the nineteenth century, the Central Valley was characterized by large numbers of small creeks, sloughs, oxbows, and major rivers that were subject to periodic flooding. The scouring associated with seasonal flooding created a mosaic of channels, depressions, lowland swamps, marshes, and hummocks across wide expanses of the Central Valley. An estimated 4 million acres of wetlands, together with extensive grasslands, riparian forests, and valley oak woodlands, formed a complex mosaic of habitats that supported enormous flocks of ducks, geese, swans, cranes, shorebirds, and other species.

In the mid-nineteenth century, the landscape of the Central Valley began to undergo a gradual conversion to one dominated by intensively managed agricultural lands, finally becoming one of the most productive agricultural regions in the world. This loss of habitat resulted in substantial declines in the estimated 40 million waterfowl and other waterbird populations that historically used the Central Valley. Despite this enormous habitat loss, 3 to 6 million ducks, geese, and swans continue to winter in California. During there annual cycles, large numbers of shorebirds, cranes, pelicans, egrets, herons, ibises, songbirds, and raptors use the Central Valley wetlands. The total annual waterbird count (including migrants) in the region has been estimated as high as 10 to 12 million.

With the gradual loss of wetlands in the Central Valley, wildlife has become increasingly dependent on suitable agricultural lands for food and cover. Certain types of agricultural land – chiefly rice cultivation – help to sustain remaining populations by creating valuable habitat that provides functions similar to native valley habitats. Rice cultivation has provided surrogate wetlands habitats that serve as essential breeding and wintering habitat for water-fowl, shorebirds, wading birds, and other wildlife. These habitats also provide food and cover for some reptiles, amphibians, and mammals.

Each year, approximately 500,000 acres of land, mainly in the Central Valley, are planted in rice. Rice fields are flooded during the summer growing season, and as a result of straw

burning legislation to improve air quality (Rice Straw Burning Act, 1991), many rice fields are also flooded following harvest in an effort to decompose rice straw. In total, rice fields are often flooded for up to 8 months of the year, during which time they become temporary wetlands with enormous significance to bird populations wintering and breeding in the Central Valley.

These flooded rice fields are dynamic in their attraction to wildlife and in the habitat values they provide. Habitat quality varies with rainfall, site-specific flooding cycles, management practices, and the particular habitat requirements of each species.

Although specific management practices can influence the value of ricelands, the mere presence of summer- and winter-flooded habitat has provided more then 500,000 acres of wetlands-like habitat in the Central Valley. This habitat, in conjunction with the abundant food source that remains in the rice fields after harvest, has contributed to population increases of many wetlands-dependent species. During the winter months, large flocks of water birds forage in the flooded rice fields. These shorebird and water bird concentrations in turn attract raptors, especially northern harrier, peregrine falcon, and bald eagle. When not flooded, rodent population in rice fields might also attract hundreds of raptors, such as white-tailed kites, northern harriers, red-tailed hawks, American kestrels, and short-eared owls.

The Central Valley is an essential habitat area for waterfowl (ducks, geese, and swans). It serves as part of an annual bird migration corridor known as the Pacific Flyway. During the 1880s, an estimated 4 million acres of wetlands habitat were available to waterfowl during the winter. Today, fewer than 300,000 acres of natural wetlands remain, supplemented by approximately 500,000 acres of ricelands. This additional wetlands acreage plays an enormous role in sustaining the populations of the 3 to 6 million waterfowl (approximately 60 percent of the total number of waterfowl in the Pacific Flyway) that continue to use the Central Valley during winter.

For a variety of reasons – including loss of wetlands, extended periods of drought on the breeding grounds, and loss of nesting habitat – wintering of waterfowl in California had declined dramatically in the late 1970s. Through the efforts of waterfowl conservation groups and the proactive management of both breeding and wintering waterfowl habitats by state and federal agencies, the decline in California's waterfowl population slowed, then started to reverse in the late 1980s. The winter flooding of rice fields in the Central Valley has been an important factor in this recovery. This winter flooding has resulted in an apparent dependence of some waterfowl species on flooded ricefields. For example, more then 1 million northern pintails have been counted in the recent years during January waterfowl surveys in the Central Valley.

Overall, ricelands are known to be used by 183 species of birds, 28 species of mammals, and 24 species of amphibians and reptiles. Of these, 29 are considered special-status species. In addition, 15 of the bird species are part of a specially designated habitat area that includes

rice fields and adjacent wetlands of the Sacramento Valley. For additional information, visit http://www.calrice.org/.

5.3.2 Future Actions

The Sacramento Valley IRWMP will help advance the following measures to further improve waterfowl and wildlife environment:

1. Protect Water Rights

   The key to sustainable rice practices is the protection of water rights and the ability to access affordable water supplies for rice production and the attendant values described above. The cornerstone of the Sacramento Valley IRWMP is the protection of water rights and entitlements for Northern California, including the use of water for rice.

2. Develop Garter Snake Management Practices

   The giant garter snake is a threatened species under the federal Endangered Species Act and, as the above report shows, resides in riceland habitat. Water suppliers and the California Rice Commission are working with federal and state agencies to further develop conservation measures for the giant garter snake, including best management operation and maintenance practices for lands with existing giant garter snake habitat.

3. Perpetual Protection of Rice Base in Key Areas

   The establishment of an acreage goal for perpetual rice production in the Sacramento Valley is a critical factor in the support of migratory waterfowl using the Pacific Flyway and other species dependent on ricelands for feed and habitat.

5.4 Sacramento River Conservation Area

The Sacramento River Conservation Area Advisory Council was created in 1986, with the passage of State Senator Jim Nielson's legislation, SB1086. The legislation called for the development of a management plan for the Sacramento River and its tributaries that would promote the protection, restoration, and enhancement of both fisheries and riparian habitat while ensuring that other community needs are met, including agricultural production, public safety, public and private infrastructure, economic stability, and public recreation. The *Sacramento River Conservation Area Handbook* was a result of this legislation (Conservation Area Advisory Council, 1998). The Sacramento River Conservation Area covers the reach of Sacramento River from just below Keswick Dam downstream to the confluence with the Feather River at Verona.

5.4.1 Sacramento River Conservation Area Handbook

In 1989, the Conservation Area Advisory Council published the *Upper Sacramento River Fisheries and Riparian Habitat Management Plan* to guide habitat restoration, protection, and enhancement activities. Efforts to implement activities contained in the plan led to the development of the *Sacramento River Conservation Area Handbook. The Sacramento River Conservation Area Handbook* contains a set of guiding principles and planning tools developed by the Conservation Area Advisory Council to "govern riparian habitat management along the river." The principles are categorized as follows: ecosystem management, flood management, voluntary participation, local concerns, bank protection, and information and education.

5.4.2 Sacramento River Conservation Area Forum

More recently, the riparian habitat management has been guided by two entities created through the SB1086 process: the Sacramento River Conservation Area Forum (SRCAF) and the Technical Advisory Council. Like the Conservation Area Advisory Council that preceded it, the SRCAF includes representatives from Butte, Colusa, Glenn, Tehama, Shasta, Yolo, and Sutter Counties; state and federal agencies; landowners; water users; environmental groups; and other interested parties. The SRCAF, although not regulatory, is responsible for determining whether habitat management is being conducted in accordance with the principles established in the *Sacramento River Conservation Area Handbook*. The Technical Advisory Council has similar representation to the SRCAF, and provides technical advice to the SRCAF on riparian habitat management.

5.4.3 Future Actions

The SRCAF has been faced with a number of contentious issues, many of which are still being debated, including the definition of the "Conservation Area" (lands subject to the *Sacramento River Conservation Area Handbook*), inner river zones and areas for river meander, protection of hardpoints (i.e., the fish screens described earlier) along the river, and good neighbor policy to limit or mitigate for negative impacts to landowners' adjoining habitat lands.