

RESPONSES FROM U.S. BUREAU OF RECLAMATION
Delta Vision Blue Ribbon Task Force's Illustrative Questions to Departments
May 2008

General, to all agencies and/or departments listed below:

1. How do your department's activities contribute to achieving the co-equal values of sustaining both Delta ecosystem and water reliability functions, recognizing the California Delta as a unique and valued area warranting special legal status?

Reclamation's mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American Public. Reclamation operates the Central Valley Project (CVP) – a complex water project that encompasses the entire Delta watershed. The Delta plays a major role in CVP operations – Reclamation exports water from the Delta to serve its urban, environmental and agricultural customers in the San Joaquin Valley, Santa Clara Valley and the Bay Area. Reclamation operates the CVP in coordination with the State Water Project (SWP) which is managed by the State Department of Water Resources (DWR). Delta operations for both Projects are conducted from a Joint Operations Center.

Project operations are conducted in accordance with water right permits, State Water Resources Control Board (SWRCB) orders and Water Quality Control Plans, the Coordinated Operations Agreement (COA), all applicable environmental laws and regulations, and Biological Opinions issued by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) using the best available science.

In 1992, Congress passed the Central Valley Project Improvement Act (CVPIA), which added mitigation, protection, and restoration of fish and wildlife as an equal purpose to water and power production. Since 1993, Reclamation has dedicated a total of 18 million acre-feet of CVP water (1.2 million acre-feet of water annually) for fish and wildlife purposes, at a total estimated value of \$1.8 billion dollars. Reclamation's CVP water and power contractors make payments into a Restoration Fund, and the proceeds from this fund are used for a wide variety of environmental restoration efforts. For example, Reclamation has provided almost \$79 million from the Restoration Fund to assist the State with fish screens through fiscal year 2007. In addition to activities covered by the Restoration Fund, the Glenn-Colusa Irrigation District's diversion works received a fish screen under the authority of CVPIA, at a cost of \$76 million. A temperature control device was installed at Shasta Dam at a cost of \$80 million – this device makes it easier to provide cold water for salmonids in the Sacramento River, while reducing impacts to the generation of hydroelectric power.

The purpose of CVPIA is also to increase water-related benefits to the State of California. Provisions for water transfers allow CVP contractors to transfer water among themselves, thereby enhancing reliability to areas of greatest need.

Other efforts undertaken by Reclamation under CVPIA include restoring spawning gravel, acquiring water to improve in-stream flows, and implementing a program to eliminate, to the extent possible, losses of anadromous fish due to flow fluctuations caused by the operation of any CVP storage or re-regulating facility. During the period 1993-2008, the U.S. Congress appropriated at least \$1.36 billion dollars (Water and Related Resources, Restoration Fund, CALFED Bay-Delta funds) for use in implementing environmental actions within the Central Valley of California. (A list of CVPIA accomplishments through 2002 is attached as Table 1.)

Reclamation also plays a key role in CALFED Program implementation as one of 25 Federal and State agencies signatory to the CALFED Bay-Delta Programmatic Record of Decision—a 30-year plan to meet objectives for levee system integrity, ecosystem restoration, water supply reliability and water quality for a sustainable Delta. Reclamation and DWR have the lead implementing responsibility for the Storage and Conveyance Program studies, the Environmental Water Account, Water Use Efficiency, and Water Transfer Programs. Reclamation has also contributed to the Ecosystem Restoration Program through CVPIA activities that contribute to the goals of CALFED, along with strong leadership and financial roles in science (through the Interagency Ecological Program (IEP) and the Pelagic Organism Decline (POD) studies), the Water Quality Program, the Bay-Delta Conservation Plan, and Delta Vision. Reclamation participates in the many CALFED forums that continue to progress and contribute to the adaptive water management in the Delta—the Water Operations Management Team (WOMT), Integrated Water Operations and Fisheries Forum (IWOFF), Data Assessment Team (DAT), Salmon Decision Tree and the Delta Smelt Working Group (DSWG). The U.S. Congress has appropriated a total of \$400 million to Reclamation for the period 1998-2008 towards the goals of CALFED under the authority of the two CALFED Bay-Delta Authorization Acts (P.L. 104-333, P.L. 108-361) and Water and Related Resources In-Lieu of Bay Delta funds. Reclamation is committed to fulfilling the goals of the CALFED Program and to continuing participation in future CALFED processes towards the achievement of the two co-equal values that are the hallmark of both CALFED and Delta Vision.

2. How do your department's activities contribute to achieving the remaining ten recommendations in the adopted vision?

Recommendation #3 (“The Delta ecosystem must function as an integral part of a healthy estuary.”): As mentioned above, Reclamation conducts its Delta operations in a manner consistent with its authorities, including CVPIA, Biological Opinions issued by NMFS and FWS, and its water rights permits. Reclamation is also a full participant in CALFED’s efforts to restore the Delta ecosystem, and is a participant in the Bay-Delta Conservation Plan process.

Recommendation #4 (“California’s water supply is limited and must be managed with significantly more efficiency to be adequate for its future population, growing economy and vital environment.”): The CVP, one of 14 Reclamation Projects within California, delivers an average of seven million acre-feet of water yearly to support an urban

population of five million, environmental needs, and three million acres of irrigated agriculture. Upon the passage of the Reclamation Reform Act (RRA) in 1982, all Reclamation contractors were required by law to develop water conservation plans in order to make the most efficient use of Reclamation water. CVPIA established an office on CVP Water Conservation Best Management Practices, and all CVP contractors are required to implement water conservation efficiency measures such as measurement of water within 6 percent degree of accuracy as a condition of receiving CVP water. In addition, Reclamation has incorporated CALFED's Water Use Efficiency Quantifiable Objectives into its water conservation planning requirement for Reclamation water service contractors. Along with addressing reducing water use, the contractors are required to analyze the Quantifiable Objectives for their area which includes implementing actions to increase stream flows and improve water quality and water reliability.

Recommendation #5 (“The foundation for policy making about California water resources must be the longstanding constitutional principles of ‘reasonable use’ and ‘public trust;’ these principles are particularly important and applicable to the Delta.”): Reclamation contributes to the principle of “reasonable use” by requiring its contractors to justify the need for the amount of water they receive during the recent contract renewal process, by contractually requiring its contractors to develop water efficiency measures in their water conservation plans and by requiring such water efficiency measures be implemented as a condition of continuing to receive water under their contracts. Reclamation has reduced and will continue to reduce the amount of water contractors may receive under their contracts if and when contractors cannot demonstrate a need for the original contract amount.

Public trust values include navigation, commerce, water supply for federally recognized tribes, wildlife habitat, fishing, boating, and other water-related recreation. CVP supports a wide variety of commercial activities and a large number of wildlife refuges throughout the Sacramento and San Joaquin Valleys. Water released from Reclamation reservoirs for water quality purposes also promotes navigation in the Delta and lower Sacramento River. Reclamation reservoirs provide opportunities for fishing, boating and other water-based recreation opportunities.

Recommendation #6 (“The goals of conservation, efficiency and sustainable use must drive California water policies.”): See answer to Recommendation # 4, above.

Recommendation #7 (“A revitalized Delta ecosystem will require reduced diversions, or changes in patterns and timing of those diversions, upstream, within the Delta and exported from the Delta at critical times.”): Reclamation, in collaboration and coordination with DWR, has taken measures to reduce or change patterns of diversions in response to environmental concerns. Many provisions of CVPIA give Reclamation the ability to make needed changes in diversions to protect threatened and endangered species. Under CALFED Reclamation and DWR have implemented the Environmental Water Account, which is an additional method of making needed changes in diversions.

In addition, Reclamation participates in pilot programs such as the Vernalis Adaptive Management Plan (VAMP).

Recommendation #8 (“New facilities for conveyance and storage, and better linkage between the two, are needed to better manage California’s water resources the estuary and exports.”): Reclamation is currently performing studies on four new storage facilities—Shasta Enlargement, North of Delta Offstream Storage (Sites), Los Vaqueros Expansion, and a new storage facility on the San Joaquin River above Millerton Reservoir. All of these studies are being done in partnership with DWR (except for the Shasta Enlargement Study due to the State’s restriction on the Wild and Scenic River issue). In addition, Reclamation is participating in the Bay-Delta Conservation Plan effort, which includes a study of Delta Conveyance Alternatives.

Recommendation #9 (“Major investments in the California Delta and the statewide water management system must be consistent with, and integrate specific policies in this vision. In particular, these strategic investments must strengthen selected levees, improve floodplain management and improve water circulation and quality.”): Reclamation, in partnership with DWR, has several on-going studies/activities to determine potential improvement to water quality and circulation in the Delta. Reclamation has used its facilities in the Delta to conduct pilot studies on the recirculation of water diverted from the Delta down the San Joaquin River to assist with improving water quality in the San Joaquin River and the southern Delta.

Reclamation is working with DWR and the Central Valley Regional Water Quality Control Board in laying the foundation of a stakeholder driven Real Time Water Quality Monitoring and Management Program. This program is still in the scoping phase. The goal is to identify and install the monitoring sites needed for this program by the end of 2008.

Reclamation is working with both State and Federal wildlife refuges that receive Federal water and discharge to the San Joaquin River to finalize their Best Management Practice Plans and identify potential pilot studies needed to determine potential impacts due to operational changes.

Reclamation is currently funding a portion of the Westside Regional Drainage Plan under the CALFED Water Quality Program. The objective of the plan is to reduce and manage salt, selenium, and boron discharges to the San Joaquin River.

Recommendation #10 (“The current boundaries and governance system of the Delta must be changed. It is essential to have an independent body with authority to achieve the co-equal goals of ecosystem revitalization and adequate water supply for California while also recognizing the importance of the Delta as a unique and valued area. This body must have secure funding and the ability to approve spending, planning and water export levels.”): Reclamation defers to the State of California on the need for a new organization.

Recommendation #11 (“Discouraging inappropriate urbanization of the Delta is critical both to preserve the Delta’s unique character and to ensure adequate public safety.”): This is a land use issue—Reclamation, as a federal agency, has no role in this activity.

Recommendation #12 (“Institutions and policies for the Delta should be designed for resiliency and adaptation.”): Reclamation’s Delta operations are governed by the Coordinated Operations Agreement (COA)—an agreement enacted in 1986 between Reclamation and DWR. The COA defines the CVP and SWP facilities and their water supplies, sets forth procedures for coordination of operations, identifies formulas for sharing joint responsibilities for meeting Delta standards (as defined in SWRCB Decision 1485) and other legal uses of water, identifies how unstored flow will be shared, sets up a framework for exchange of water and services between the Projects, and provides for periodic review of the agreement. COA has provided both Reclamation and DWR with some operational resiliency and flexibility. Over the years this operational resiliency and flexibility has diminished due to events such as the passage of CVPIA and listing of species under ESA.

Resiliency is also provided by the use of a variety of sources of water for export. Releases are made from upstream reservoirs as needed to meet water quality requirements—for example, releases from Folsom Reservoir reach the Delta more quickly than releases from Shasta Dam—therefore, Folsom is used when changes in Delta water quality or increased export demands require a quick response. Again, the resiliency and flexibility afforded by use of a variety of sources of water have been lessened by changing circumstances.

Reclamation has also consolidated its water rights place of use to allow delivery of CVP water from any source to any destination within this place of use. This gives Reclamation some flexibility to meet requirements anywhere in the CVP without depending upon a specific source of water. In addition, Reclamation and the SWP are now able to use each other’s points of diversion in the Delta subject to SWRCB conditions, which provides some additional flexibility and resiliency to each project.

Again it must be emphasized that the ability of Reclamation and DWR to respond to changes has been steadily diminished over the years. The projects originally had a great deal of flexibility and resiliency; now they have very little ability to respond to the ever-increasing changes imposed upon them. This loss of capacity to respond to changes is one of the greatest challenges faced by the projects.

Department of Water Resources and U.S. Bureau of Reclamation:

1. *Water resources in California are developed (captured, stored, conveyed and treated) by many different entities (local districts, the federal government, the state). What are the advantages and disadvantages of such a system? In particular, how does integration of policy and operations occur?*

Water service and supply organizations vary widely in terms of mission, formation, and authority. This diversity resulted from local, state-wide and national interests and to satisfy specific needs. Smaller entities provide water service to meet local needs; irrigation districts that provide water for agriculture don't need to provide the same types of services that an urban water supplier provide, and the large projects can act as a "wholesaler" of water to smaller entities. This variety allows each type of entity to determine the best way to administer the way it develops and delivers water, including how best to raise the revenue necessary to provide its services. This water system evolved over time and as more and more demands are placed on the water system without increases in water supplies, conflicts will increase until the original system is modified to meet California's changing priorities in managing its scarce water supplies.

Reclamation's perspective on the advantages and disadvantages of such a system is that of the manager of the largest water project in the State with senior water right permits and licenses. The water right seniority of the existing system and storage capability within the project facilities generally allow Reclamation to achieve its statutory directed responsibilities. The disadvantages of the present system experienced by Reclamation are related to impediments to achieving these responsibilities. Notably, optimizing the existing systems within the State could reduce environmental impacts and improve the amount and timing of water delivered in a more cost-effective manner.

2. What water uses do you project by region of California for the year 2030? For 2070? For 2100?

Reclamation is providing Supply-Demand Gap Tables (attached as Table 2) for the year 2030 for both dry year and average year conditions. These tables were developed as part of a Water Supply and Yield Study directed by CVPIA. The 2030 projections were derived from information provided in DWR's California Water Plan 2005 update. Additional sources of information included Reclamation planning studies, Title 16, Integrated Resource Management Plans, other special studies and the CALFED Programmatic Record of Decision and Program Plans. The Tables evaluated the 2005 update scenario for urban, agricultural, and environmental water use in an average and dry year to ensure that full future demands were reflected.

Reclamation has not developed water supply or demand estimates past 2030. Historically, Reclamation has assisted DWR in their Water Plan Update process and will continue to do so in the future. It is our understanding that DWR will be estimating water supply and use beyond 2030 as part of the current Water Plan Update process and other funding agreements.

3. If charged with achieving 20 percent additional efficiencies in water use in California by 2020, what would the Department do? List the actions proposed with costs and time to achieve effects. How will the efficiencies achieved vary by region and by sector?

Reclamation has had an active water conservation program in the Mid-Pacific Region since the inception of the RRA in 1982. In 1992, CVPIA directed Reclamation to

develop criteria to evaluate water conservation plans required by the RRA in 1982. The CVPIA also provided additional authority to implement water conservation measures. CVPIA requires Reclamation contractors to prepare and implement water management plans that address specific Best Management Practices. On the urban side, all contractors receiving more than 2,000 acre-feet of water are required to follow the California Urban Water Conservation Council's planning process. In addition, measuring by customer and pricing by volume of water received is required.

Reclamation also has financial assistance programs to assist contractors and others with the implementation of water conservation projects. Reclamation provides funds to various universities, councils and consultants to provide water conservation technical assistance throughout the Region. Reclamation has regularly consulted with, and where appropriate, partnered with DWR on developing and implementing these assistance programs.

Reclamation has already factored in increased water use efficiency by its water contractors through the CVP long-term contract renewal process. In October 1998, Reclamation began performing water needs assessments for each contractor as part of this process. Each assessment assumed that the contractor would continue to implement water use efficiency measures between now and the year 2025. These measures would further reduce the unit amount of water needed for future agricultural and urban uses. The agricultural water needs assessments assumed that each contractor would achieve the 85 percent irrigation efficiency goal outlined in DWR's Bulletin 160 by the year 2025. Urban assessments assumed a lower landscape ET factor of .8, and a per capita urban water use projection based upon State Water Plan Year 2020 criteria.

Reclamation will continue to work closely with DWR in its development of an action plan to attain an additional 20 percent efficiency by 2020. As part of this effort, Reclamation will continue to consult with DWR during the routine revisions of water conservation planning criteria. In addition Reclamation will continue to coordinate closely with DWR in the development of Reclamation's water conservation financial assistance solicitations to optimize funding resources in an effort to meet the 20 percent goal.

*4. What provisions (performance metrics) would be available and used to document compliance with achieving a 20 percent additional water efficiency charge? **Response provided by DWR.***

5. If a major seismic event occurred in the second quarter of 2008 and most levees in the western and central Delta collapsed, what would be the effects on water supply? What is the distribution of those effects, geographically and by sector of the California economy? What responses are expected? Provide any plans that describe the specific actions that would be taken and any information regarding time sequence of actions. How much time and money would be required to return to pre-event operations? To 50 percent of the level of reliable water supply?

Reclamation and DWR would conduct their response to a major seismic event affecting the Delta from the Joint Operations Center. In addition, Reclamation has an Emergency Operations Center (and Plan) that would be activated under these circumstances.

A complete answer to these questions would require numerous assumptions and a detailed study. The effects of a major seismic event in the western or central Delta would vary depending upon the severity of the event. If one assumes that the event occurred in the second quarter of 2008, the south of Delta projects of the CVP and SWP would be near the peak storage for the year. The south of Delta users would probably feel most of the water supply impacts, but north of Delta users could be affected if release from storage is used to flush the Delta to speed a return to normal operations.

The effects, recovery time, costs and extent of agency response would all depend on the extent and location of damage and other factors such as:

- Impact on Delta hydrodynamics and water quality.
- Resources available for levee repair.
- Priorities of water uses and evaluation of water quality standards, e.g., health and safety needs over other demands and uses. In an emergency the SWRCB may have to evaluate priorities across normal water rights boundaries. Would a senior water rights holder provide water for others for the good of the State and at what compensation?
- Condition of other project facilities such as pumping plants, conveyance facilities, power lines, etc.

Depending on the damages, hydrology and response of the various regulatory agencies, it could take months or year(s) to fully recover from a major event. Possible water supply impacts at Jones Pumping Plant alone could range from a few hundred thousand acre-feet to millions of acre-feet.

In 2007 and 2008, DWR sponsored a detailed study about the effects of a major levee failure in the Delta and potential responses. We recommend this study as a reference.

*6. How are relationships among surface water and ground water managed? In your response include consideration of both adjudicated and non-adjudicated ground water basins, conjunctive use, water transfers and other factors of importance. What could be done to manage these relationships more effectively? **Joint question with SWRCB.***

Reclamation currently does not utilize groundwater as an additional source of project water and does not own groundwater storage or recharge facilities. Reclamation does understand the interaction of surface and groundwater and has developed its operations around optimizing the conjunctive use of water in the CVP place of use. For example, the Friant Division provides surface water supplies to areas that rely on groundwater and are operated to support conjunctive water management to reduce groundwater use in the eastern San Joaquin Valley.

Reclamation also encourages the banking of water outside of a contractor's service area for return during dry years, and has also required contractors to consider conjunctive use within its boundaries if groundwater resources are also available.

Water Banking

In addition to encouraging the conjunctive use of water resources within a contractor's service boundaries, Reclamation also supports banking surface water in groundwater basins outside of contractors' boundaries to facilitate better management of CVP water supplies. Language in all CVP water service contracts states that "Groundwater recharge programs, groundwater banking programs, surface water storage programs and other similar programs utilizing Project Water or other water furnished pursuant to the Contract conducted outside the Contractor's Service Area may be permitted upon written approval of the Contracting Officer, which approval will be based upon environmental documentation, Project Water rights, and Project operational concerns." Reclamation is in the process of developing guidelines for the banking of CVP water supplies to help streamline the approval process while ensuring the protection of third party interests and the environment.

Groundwater Substitution

Reclamation worked cooperatively with DWR in the development and use of the "White Paper for Groundwater Substitution Transfers in the Sacramento Valley." In dry years, Reclamation has approved the transfer of CVP contract surface water supplies based on the White Paper guidelines. The guidelines were intended to expand the use of groundwater resources in dry years while ensuring the protection of environmental and third party interests. Reclamation has also used guidelines similar to those developed for the Sacramento Valley to allow for groundwater substitution transfers and water exchanges in other areas of the CVP.

Conjunctive Use Investigations

Reclamation is aiding several conjunctive use planning and demonstration efforts by providing funding and technical assistance as authorized by Congress. These efforts include the Semi-Tropic water bank expansion, the Conjunctive Management Opportunities Study in the San Joaquin and Tulare Lake watersheds, and the Stoney Creek Fan Lower Tuscan Conjunctive Use Investigation. All of these efforts require environmental documentation and monitoring to determine if there is any significant environmental or other third party impacts related to conjunctive use of the groundwater resource.

TABLE 1
CVPIA ACCOMPLISHMENTS (Through 2002)

PROGRAM OR PROJECT	STATUS
Anadromous Fish – Habitat Restoration	
Anadromous Fish Restoration Program (AFRP)	Established AFRP, developed Restoration Plan to guide implementation of efforts, partnered with local watershed groups, acquired over 8,200 acres and enhanced over 1,000 acres of riparian habitat, restored over 5.6 miles of stream channel and placed 62,300 tons of spawning gravels, eliminated predator habitat in San Joaquin River tributaries, and provided for fish protective devices at 7 diversion structures on Butte Creek.
Dedicated CVP Yield	Implemented management of 800,000 acre-feet of water each year dedicated to CVPIA purposes; ongoing.
Water Acquisition Program (Anadromous Fish Focus)	Acquired 913,952 acre-feet of water for anadromous fish from 1993 to 2002.
Clear Creek Fishery Restoration	Removed Saeltzer Dam and diversion, increased flows, restored 2 miles of stream channel and 68 acres of floodplain, added 54,000 tons of spawning gravel, constructed 152 acres of shaded fuelbreak, and treated 12 miles of roadway for control erosion.
Gravel Replenishment and Riparian Habitat Protection	Developed long-term plans for CVP streams; placed 111,488 tons of gravel in Sacramento, American and Stanislaus rivers.
Trinity River Fishery Flow Evaluation Program	Conducted flow evaluation studies; completed environmental impact report/environmental impact statement (EIR/EIS) to analyze range of alternatives for restoring and maintaining fish populations downstream from Lewiston Dam; Record of Decision signed December 2000; construction underway on improvements to infrastructure to accommodate increased streamflows.
Anadromous Fish – Structural Measures	
Tracy Pumping Plant Mitigation	Improved predator removal; increased biological oversight of pumping; developed better research program, including a new lab and aquaculture facilities; improved and modified existing facilities.
Contra Costa Canal Pumping Plant Mitigation	Established cooperative program for fish screen project for Rock Slough intake of Contra Costa Canal (CCC); 90% designs and environmental evaluation completed. New short-term, low-cost mitigation measures are being developed to allow for an extension of the construction completion date; final design and construction pending results of CALFED Stage 1 and other studies.
Shasta Temperature Control Device (TCD)	Completed 2/28/97; since operated to reduce river temperatures without stopping power generation operations (cost \$80 million; loss in power generation pre-TCD was \$35 million over 7 years).
Red Bluff Dam Fish Passage Program	Completed interim actions and modification of Red Bluff Diversion Dam to meet needs of fish and water users; studies of fish passage alternatives is ongoing.

PROGRAM OR PROJECT	STATUS
Coleman National Fish Hatchery Restoration and Keswick Fish Trap Modification	Installed ozone water treatment system, installed fish trap improvements, improved raceways and barrier weir and ladders, installed interim screens at intakes, established Livingston Stone National Fish Hatchery.
Anderson-Cottonwood Irrigation District (ID) Fish Passage	Modified dam and operations to improve fish passage; designed new fish ladders and screens.
Glenn-Colusa ID Pumping Plant	Constructed fish screen for 3,000 cubic feet per second (cfs) diversion, completed water control structure and access bridge, completed improvements on side channel.
Anadromous Fish Screen Program	Assist the State in implementing the program, installed 17 screens and 3 fish ladders at diversions totaling 3,200 cfs capacity, removed 4 dams and 14 diversions; three screens under construction: others in design.
Other Fish and Wildlife	
Habitat Restoration Program	Established Habitat Restoration Program and San Joaquin River Riparian Habitat Restoration Program, helped acquire 88,364 acres of native habitat and restore 1,111 acres.
Land Retirement Program	Established land retirement program to decrease drainage problems in San Joaquin Valley, enhanced wildlife habitat and recovery of endangered species, acquired over 10,000 acres from willing sellers; demonstration project underway with various land treatments applied on over 2,200 acres of retired lands to date.
Monitoring	
Comprehensive Assessment and Monitoring Program	Established program to evaluate success of restoration efforts; ongoing.
Studies, Investigations, and Modeling	
Flow Fluctuation	Coordinated management of CVP facilities and developed standards to minimize fishery impacts from flow fluctuation; studies on American and Stanislaus Rivers are ongoing.
Shasta and Trinity Reservoir Carryover Storage Studies	Ongoing studies [related studies funded under 3406(b)(9)].
San Joaquin River Comprehensive Plan	Initiated evaluation to re-establish anadromous fish from Friant Dam to Bay-Delta Estuary; Congress dropped funding because of public opposition to continued study.
Stanislaus River Basin Water Needs	Prepared Stanislaus and Calaveras river water use program and Federal Endangered Species Act (ESA) report; additional studies ongoing concurrent with development of Stanislaus River long-term management plans.
Central Valley Wetlands Water Supply Investigations	Report completed that identified private wetlands and water needs, alternative supplies, and potential water supplies for supplemental wetlands. Developed geographic information system (GIS) database to identify potential water supply sources.
Investigation on Maintaining Temperatures for Anadromous Fish	Completed field investigations on interaction between riparian forests and river water temperatures and on the general effects on water temperature of vegetation, irrigation return flow, and sewage effluent discharge; ongoing.

PROGRAM OR PROJECT	STATUS
Investigations on Tributary Enhancement	Completed report in 1998 on investigations to eliminate fish barriers and improve habitat on all Central Valley tributary streams.
Report on Fishery Impacts	Completed report in 1995 describing major impacts of CVP reservoir facilities and operations on anadromous fish.
Ecological and Hydrologic Models	Developing models and data to evaluate effects of various operations of water facilities and systems in Sacramento, San Joaquin, and Trinity river watersheds (to evaluate potential impacts of various CVP actions; cooperative effort with DWR, USGS, and others; ongoing).
Project Yield Increase (Water Augmentation Program)	Developed least-cost plan considering supply increase and demand reduction opportunities.

TABLE 2
SUPPLY DEMAND GAP TABLES

Future Dry Year Supplies, Demands, and Gaps by Hydrologic Region and Statewide (2030 Conditions)

Hydrologic Region	User	Supply (TAF)	Demand (TAF)	Gap (TAF)	Total Regional Gap (TAF) ¹
North Coast	Urban	150	190	40	260
	Agricultural	630	750	120	
	Environmental	1,730	1,830	100	
San Francisco Bay	Urban	1,110	1,280	170	170
	Agricultural	120	110	0	
	Environmental	30	30	0	
Central Coast	Urban	140	350	210	310
	Agricultural	760	860	100	
	Environmental	10	10	0	
South Coast	Urban	3,500	5,140	1,640	1,640
	Agricultural	760	640	0	
	Environmental	40	40	0	
Sacramento River	Urban	880	1,420	540	1,230
	Agricultural	8,570	8,540	0	
	Environmental	8,700	9,390	690	
San Joaquin River	Urban	620	1,040	420	920
	Agricultural	7,040	6,420	0	
	Environmental	1,840	2,340	500	
Tulare Lake	Urban	670	990	320	700
	Agricultural	9,420	9,800	380	
	Environmental	80	80	0	
North Lahontan	Urban	40	50	10	80
	Agricultural	430	500	70	
	Environmental	110	110	0	
South Lahontan	Urban	240	440	200	200
	Agricultural	340	310	0	
	Environmental	80	80	0	
Colorado River	Urban	610	1,110	500	540
	Agricultural	3,440	3,480	40	
	Environmental	30	30	0	
Statewide²	Urban	7,960	12,010	4,050	
	Agricultural	31,511	31,410	710	
	Environmental	12,651	13,940	1,290	
Total³		52,120	57,360	6,050	

¹ Each total regional gap is the sum of all user gaps (urban, agricultural, and environmental) for a particular hydrologic region. Statewide supplies, demands, and gaps are the sum of the supplies, demands, and gaps for each hydrologic region, respectively.

² Total supplies, demands, and gaps are the sum of statewide supplies, demands, and gaps for each user type, respectively.

³ Statewide supplies are reduced by 2 MAF in a dry year to account for Bulletin 118's maximum estimate of groundwater overdraft. It is assumed that overdraft is not a sustainable source of supply. The 2 MAF is distributed over the supplies of applicable hydrologic basins that have reported subbasins in overdraft.

 Future Average Year Supplies, Demands, and Gaps by Hydrologic Region and Statewide (2030 Conditions)

Hydrologic Region	User	Supply (TAF)	Demand (TAF)	Gap (TAF)	Total Regional Gap (TAF) ¹
North Coast	Urban	150	190	40	380
	Agricultural	810	750	0	
	Environmental	1,870	2,210	340	
San Francisco Bay	Urban	1,070	1,270	200	200
	Agricultural	110	110	0	
	Environmental	30	30	0	
Central Coast	Urban	300	350	50	170
	Agricultural	740	860	120	
	Environmental	20	20	0	
South Coast	Urban	3,790	5,120	1,330	1,330
	Agricultural	910	640	0	
	Environmental	40	40	0	
Sacramento River	Urban	860	1,390	530	940
	Agricultural	8,710	8,540	0	
	Environmental	11,46	11,870	410	
San Joaquin River	Urban	600	1,010	410	930
	Agricultural	6,910	6,420	0	
	Environmental	2,540	3,060	520	
Tulare Lake	Urban	650	970	320	320
	Agricultural	10,22	9,800	0	
	Environmental	70	70	0	
North Lahontan	Urban	40	50	10	40
	Agricultural	470	500	30	
	Environmental	110	110	0	
South Lahontan	Urban	270	430	160	160
	Agricultural	360	310	0	
	Environmental	90	90	0	
Colorado River	Urban	680	1,080	400	400
	Agricultural	3,550	3,480	0	
	Environmental	30	30	0	
Statewide²	Urban	8,410	11,860	3,450	
	Agricultural	32,79	31,410	150	
	Environmental	16,26	17,530	1,270	
Total³		57,460	60,800	4,870	

¹ Each total regional gap is the sum of all user gaps (urban, agricultural, and environmental) for a particular hydrologic region. Statewide supplies, demands, and gaps are the sum of the supplies, demands, and gaps for each hydrologic region, respectively.

² Total supplies, demands, and gaps are the sum of statewide supplies, demands, and gaps for each user type, respectively.

³ Statewide supplies are reduced by 1 MAF in an average year to account for Bulletin 118's minimum estimate of groundwater overdraft. It is assumed that overdraft is not a sustainable source of supply. The 1 MAF is distributed over the supplies of applicable hydrologic basins that have reported subbasins in overdraft.