

California Bay-Delta Program

Science Program Multi-Year Program Plan (Years 5 – 8)

Implementing Agencies:

California Bay-Delta Authority

July 2004



Goals, Objectives and Targets

Goals and Objectives:

The collaborative process that characterizes the CALFED Bay-Delta Program requires transparency, open recognition of scientific uncertainties, and open discussion and publication of scientific findings. As described in the Record of Decision (ROD), it is expected that the Science Program will develop and provide the best scientific information possible to guide decisions regarding CALFED actions and to evaluate the results of the implemented actions. However, unlike other CALFED programs, the ROD establishes only broad policy objectives for Science, with few discrete tasks or milestones. Guided by the ROD, the Lead Scientist designed an organizational strategy for implementing program objectives that included identification of priority issue areas and discrete element tasks.

- **Water Operations and Environmental Resources:** There are a number of key technical uncertainties associated with the balance between ecosystem protection and water supply reliability for which the Delta is a focal point. The interactions between water management activities and sensitive species recovery provide much of the impetus for many planned CALFED actions and occur at scales ranging from specific sites like salmon spawning grounds below reservoirs and improving the efficacy of salvage at diversion facilities to systemwide operations that cover the net timing and movement of water from upstream areas into rivers and statewide diversion systems.
- **Cross-Program Integration:** Documenting what works at a regional or watershed scale where multiple CALFED activities occur requires more than routine monitoring. Necessary ingredients include interdisciplinary study of existing efforts, creative retrospective approaches, development of new knowledge about how projects affect ecosystems at multiple levels, and a high degree of collaboration with local and regional partners. Integrated, cross-program approaches for strategic adaptive management projects have already been initiated in Battle Creek, the Yolo Bypass/ Lower Consumnes, the Tuolumne, the Merced, and Suisun Marsh. The Science Program's priority for the next three years will be to focus on cross-program interactions in the Delta area and at the system-wide scale.
- **Performance Assessment:** Understanding the integrated influences of all actions on systemwide response measures (e.g. populations of key species or water supply network flexibility) is a unique responsibility of the CALFED-wide Science Program. Core objectives for years 5-8 include: facilitating program reviews including systemwide salmonid monitoring, funding studies and monitoring that fills key information gaps needed to help the CBDA understand how the net effect of program activities are influencing the accomplishment of program goals, and providing ongoing technical assistance to individual programs to help evaluate the impacts of individual projects and classes of projects.

The above priority issue areas have been identified through a significant amount of input from the CALFED agencies, staff, and the stakeholder community. These were strategically designed to provide information on the major decisions that the California Bay-Delta Authority (CBDA) must make in the near future on water operations, conveyance, flow management, restoration and storage. The Science Program staff has used these priority issue areas not only as a programmatic guide to effectively address the main ROD objectives, but also to articulate the breadth of the CALFED-wide Science Program where tasks description alone would be inadequate. These priorities were adopted by the Authority in 2003 as part of the Science Program's Multi-Year Program Plan. Since the plan's adoption, however, the program has received numerous suggestions for clarification of program goals and priorities, and has subsequently modified the priorities issue areas in description, though not in substance.

The following on-going tasks supporting these objectives include the following discrete element tasks:

- Oversight and coordination of program-wide science to respond to emerging questions relevant to the four interconnected CALFED goals.
- Investment in data analysis and identification of critical unknowns and knowledge gaps.
- Integrate use of best available scientific understandings and practices throughout CALFED by organizing Science Boards, Expert Panels, and facilitating collaborative efforts.
- Provide authoritative and unbiased descriptions of the state of scientific knowledge by convening issue workshops and preparing white papers.
- Evaluate the technical performance of CALFED Programs and help craft program specific performance measures.
- Establish and improve communication pathways between science, management, and public communities.

Targets

The ROD established the Science Program to “provide a comprehensive framework and develop new information and scientific interpretations necessary to implement, monitor, and evaluate the success of the CALFED Program (including all program components), and to communicate to managers and the public the state of knowledge of issues critical to achieving CALFED goals”. These objectives are broad and long-term in nature, and as such, require continuous efforts as identified in the priority issue areas and the supporting ongoing tasks listed above (see Goals and Objectives). Because these priorities were recently established through an open and technically credible process and because they are just beginning to be implemented, the Science Program does not intend to review/revise its targets for the next two to four years.

Accomplishments

The first 4 years of the CALFED Science Program have been marked by significant progress toward meeting ROD objectives, with focus on large-scale issues that cut across multiple program goals and regions, including:

- An intensive effort to clarify and improve the state of knowledge on a number of specific and central issues with an emphasis on water operations and environmental resources, critical fish species, water operations modeling, and restoration science.
- Establish a practice of seeking external peer review and advice and conducted external reviews of major proposals on Delta smelt salvage and south Delta diversion facility hydrodynamics.
- Initiate the use of public workshops as forums to publicly discuss complex technical issues.
- Develop a common methodology for assessing performance at different scales.
- Develop a strategy for monitoring program design and implementing a pilot monitoring program for wetlands restoration.
- Provide ongoing advice to individual CALFED programs regarding independent panels, performance assessment programs, science strategies, and peer review as part of proposal solicitation processes.
- Develop and implement a basic organizational design for integrating science throughout CALFED, including the establishment of a standing CALFED Science Board, Environmental Water Account review panel, and other ad hoc review panels such as the in-Delta Storage.

It should be noted that although significant progress was made during the first 4 years, some delays and institutional obstacles have hampered full implementation of the Science Program. The most significant delay has been caused by contracting and fiscal issues. In most cases, the time taken to process contracts with other state agencies and public entities has ranged from 16 to over 24 months. As a result, many program activities related to performance assessment, data analyses, and work conducted by standing Science Boards were delayed by approximately 1 ½ years. While work is progressing, outstanding systemic issues such as 3-year time limits to spend appropriated funds, the lack of master agreements with public entities, and the inability to fund service contracts across fiscal years will continue to hamper progress and are likely to cause additional delays in the future.

WATER OPERATIONS AND ENVIRONMENTAL RESOURCES

Investment in Data Analysis and New Scientific Information

Prepared program's first Proposal Solicitation Package (PSP) designed to fill critical information gaps in support of program-wide management (to be released July 2004).

Continued support of multidisciplinary hydrodynamic, fish, and water quality studies in the Delta, focusing on impacts related to the Delta Cross Channel.

Collaboratively, with Interagency Ecological Program (IEP), co-funded projects that addressed current information gaps and management concerns (*See Appendix for complete IEP Program Plan*).

Made recommendation to IEP on dedication of resources to monitoring program reviews and using a water quality monitoring program review as prototype for such efforts. Funded two efforts to analyze existing IEP data on benthic communities and fish distribution and trends and recommended adoption of multi-year fiscal and project plans.

Supported work that aim to increase the understanding of Delta smelt life cycle in support of actions taken in protection and recovery. Studies included a focus on the types of stressors affecting the populations, understanding the relationship between spawning and rearing habitat and the seasonal geographic population distributions, and developing population models to assess population status and trends.

Formed a team of investigators to conduct a pilot monitoring effort of tidal wetland restoration in the Bay and Delta aimed at describing the effects of restoration on ecosystem processes.

Funded a comprehensive review of Mercury that resulted in a Mercury Strategy for Bay-Delta Ecosystem. The final strategy has been peer reviewed and is available on the Science Program website: <http://science.calwater.ca.gov/>

Science Boards, Expert Panels, and Collaboration

Established an Independent Science Board to make recommendations on science issues to the Authority and Bay-Delta Public Advisory Committee. The board will help ensure that CALFED programs meet their goals by evaluating the science underlying the programs as well as the application of that science.

Continued to provide guidance on ways to build technical basis for Environmental Water Account (EWA) asset use by appointing an independent science panel and conducted three annual technical reviews of the EWA program.

Convened technical panel to review CALSIM II, the simulation model used for the planning and management of the State Water Project and the federal Central Valley Project.

Continued to provide support for the San Francisco Bay-Delta Science Consortium and its collaborative efforts.

Performance Measures and Assessment

Conducted external peer review of several program elements including In-Delta storage water quality assessment, San Joaquin dissolved oxygen problem identification and solution studies, and provided guidance to programs on peer review.

Conducted a Delta Cross Channel Project Review.

Recommended an organized review of systemwide salmon monitoring facilitated by IEP.

Conduct Issue Workshops and Prepare Whitepapers

Organizing series of workshops and symposia on water project operations and their impacts on critical fish species.

Conducted series of workshops on impacts EWA related activities on Salmonids and Delta smelt.

Completed White Papers on pertinent program-wide issues such as splittail, open water processes, and tidal wetlands.

In collaboration with the San Francisco Bay-Delta Science Consortium, convened workshops on Suisun Marsh Levee breach and salinity responses.

Communication

Continued effort to communicate the new knowledge and uncertainties associated with the balance between ecosystem protection and water supply reliability for which the Delta is a focal point, via Science Program website, Science News newsletter, and the E-journal. Additional efforts included briefings to the Bay Delta Public Advisory Committee, the Authority for the Bay Delta Program, Management Team, Tribal Forum, Water Education Foundation annual meeting, and numerous scientific conferences and workshops.

Publishing of White Papers in on-line E-journal.

Prepared comprehensive summaries of all Science Program workshops, conferences and symposia and disseminated via website, newsletters, and email reflectors.

To translate management questions into focused study topics, staff prepared science agendas for such key issues as Salmonids, Delta smelt, climate change, water ops and biology, and water operations modeling (part of PSP process).

Prepared management focused topical summaries, Management Cues, that describe new scientific information presented at recent conferences and workshops and highlight the relevance of this information to management needs. Management Cues from the State of the Estuary conference 2001 and 2002, and a Floodplain cue are available on the Science Program website under Management Resources: <http://science.calwater.ca.gov/management.shtml>

Co-sponsored the biennial State of the Estuary Conference (October 2002), and sponsored and organized the two biennial CALFED Science Conferences (October 2001 and January 2003). Both events provided an open forum for communicating most recent scientific information relevant to Bay-Delta Estuary and the CALFED program.

CROSS-PROGRAM INTEGRATION

Investment in Data Analysis and Identification of Critical Unknowns

Cost-shared major activities with individual programs such as targeting of critical unknowns identified by advisory panels and seeking proposals to investigate the use of Delta shallow water habitat by native fish species

Science Boards, Expert Panels, and Collaboration

Established an Independent Science Board to make recommendations on science issues to the Authority and Bay-Delta Public Advisory Committee. The board will help ensure that CALFED programs meet their goals by evaluating the science underlying the programs as well as the application of that science.

Supported efforts led by the Bay Delta Science Consortium in development of multi-institutional collaborations in many of the Signature Adaptive Project areas, including a Suisun Marsh pilot study and Yolo Bypass/Lower Consumnes riparian area and floodplain restoration.

In collaboration with ERP, supported team proposals for Merced restoration activities by the Adaptive Management Forum.

Conduct Issue Workshops and Prepare Whitepapers

Convened workshop focused on Battle Creek restoration and relationship of Coleman National Fish Hatchery to these efforts.

Organized workshop on Suisun Marsh to examine the convergence of restoration and water management, and focus on the needs for restoration success.

Performance Measures and Assessment

Provided guidance on existing monitoring programs and in design of new monitoring efforts and help define gaps and indicators based on specific management questions.

Assisted in design of data management strategy by continuously working with Delta region coordinators to better articulate expected environmental conditions resulting from planned CALFED actions (examples: Suisun marsh conceptual models, Delta fish facility evaluation conceptual models).

Communication

Established the Science Program website to clearly articulate program objectives and assist in reaching a broad audience with new information and upcoming events.

In collaboration with the Bay Delta Science Consortium, launched a new electronic journal serving as a forum for discussing science of interest to the CALFED community and publishing peer reviewed information.

Continued communication of new scientific information and its relevance to managers and policymakers by publication of periodic fact sheets on specific issues, preparation of white papers, and synthesis of management cues from new information presented at workshops and conferences.

PERFORMANCE ASSESSMENT

Performance Measures and Assessment

Developed a template for choosing indicators and performance measures to assess how projects and programs are meeting their objectives.

Collaboratively developed a draft set of prototype performance measures for Ecosystem Restoration, Levee, Drinking Water Quality, and Water Management programs, as well as helped define gaps in program-wide assessment.

Continued supporting development of workplans for individual programs.

Established peer review process for selection of indicators and written explanations.

Collaborated with the ERP to support enhanced external scientific review of proposals, provided external review of watershed program draft performance measure plan, and made resources available to Levee Program to support development of performance assessment workplan.

Science Boards, Expert Panels, and Collaboration

Facilitated the first technical review of the CALSIM II model, the general-purpose water management simulation model used for the planning and management of the State Water Project and the federal Central Valley Project.

Supported the establishment of Drinking Water Science Advisory panel and assisted in development of the panel's charge.

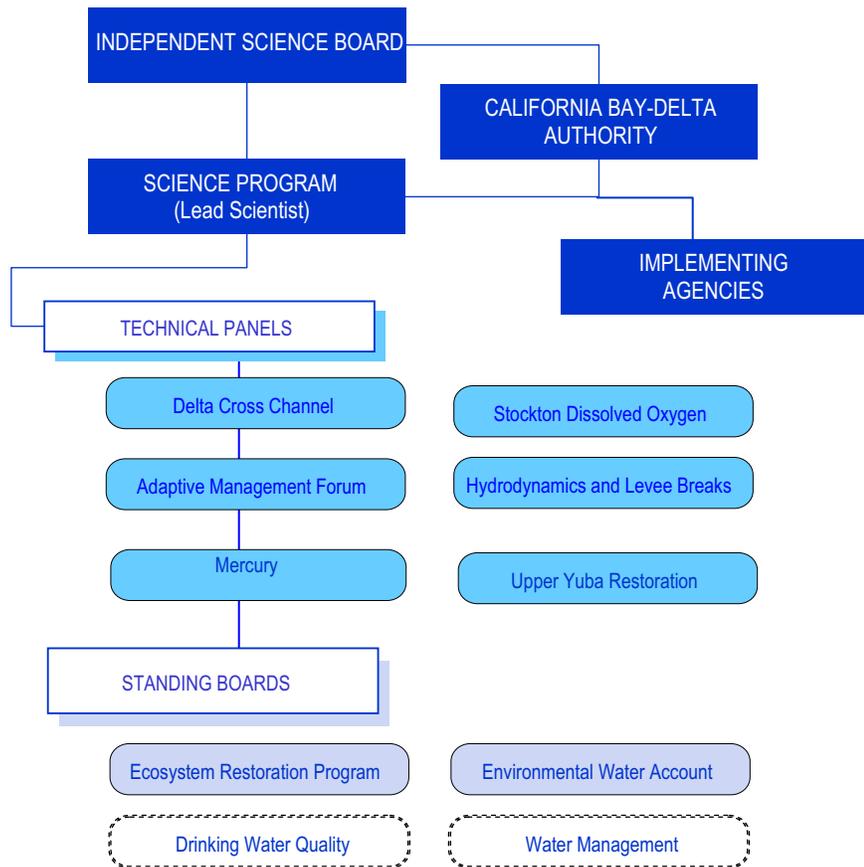
Provided input on the establishment of the Water Use Efficiency (WUE) Science Panel and advised on establishing peer review as part of their proposal solicitation process (PSP).

Communication

Conducted a workshop to present and provide the tools to CALFED program staff necessary for each program to develop and implement performance assessment as part of the science effort within each program area.

Program Structure

CALFED Science Program Organization



Agency	Roles and Responsibilities
California Bay-Delta Authority	<ul style="list-style-type: none"> • Oversight and coordination. • CALFED wide Science Board, expert panels examining cross-program issues and studies. • Conduct reviews of programs, large-scale activities cutting across program areas, advise on peer review in PSPs, and facilitate inclusion of outside experts. • Develop science agendas for cross-cutting issues, implement agendas by funding regional and large-scale monitoring gaps, signature projects, intensive multidisciplinary studies, and research aimed at building knowledge. • Support multiple communication tools and arenas, including online journal, science conferences and forums. • Invest in information needed to understand the integrated influences of all actions on system-wide response measures.
All Implementing Agencies	<ul style="list-style-type: none"> • Support Program-specific science advisors. • Conduct peer review of specific studies and tools, include peer review in PSP selection process. • Develop strategic science agendas specific to program assessment, fund studies and monitoring to implement agendas. • Invest in monitoring and performance assessment of classes of projects and cost-share studies of effects on a large-scale.

Major Activities

Needs for scientific information to support decision making and independent review and assessment for the CALFED Program are exceptionally broad and deep. Building new knowledge through ongoing investments and developing processes and practices to facilitate its use in decision making systems across the entire Program will take many years. The Science Program's strategy has been to focus intensively on specific areas of CALFED, designing and implementing practices that will support science integration over the long-term. There are three topics areas that cut across all program elements which have been the implicit priority for the Science Program since its inception in 2000: Water Operations and Environmental Resources, Cross-Program Integration efforts, and Performance Assessment. Specific tasks within these priority issue areas aim to enhance and sustain scientific practices through CALFED program, such as external peer review and scheduled assessments of program accomplishments, and promote the growth of new knowledge and synthesis of existing information through communication and collaboration.

The table below describes the major projects and activities planned by the Science Program for next five years to address program goals and attempt to meet ROD objectives. Under condition of reduced funding, the program would attempt to continue the identified activities, however, the level of effort or support would decrease dramatically. In addition to funding constraints, the program is also greatly affected by administrative issues that continue to hamper the process of bringing new information and better scientific practices to CALFED as a whole, including time limits placed on appropriations, fiscal year limitations on service contracts, and the lack of master agreements with collaborating state entities.

WATER OPERATIONS AND BIOLOGY

Investment in Data Analysis and Identification of Critical Unknowns

Conduct the first Proposal Solicitation Package (PSP) process and fund studies that will address critical information gaps and invest in analysis of existing data needed in support of program-wide management.

Schedule: Planned release of PSP July 2004 and begin funding projects in early 2005 with expected completion of multi-year studies by 2009

Continue support of multidisciplinary hydrodynamic, fish, and water quality studies in the Delta, focusing on impacts related to the Delta Cross Channel, Franks tract, South Delta channels and water diversion projects.

Schedule: Ongoing

Continue support of IEP monitoring efforts and collaboratively work to expand multidisciplinary studies, monitoring program reviews, and turning monitoring program information into knowledge (*See Appendix for complete IEP Program Plan*).

Schedule: Ongoing

Continue development of new information critical for water operations and biology.

Schedule: Ongoing with PSP release planned in 2006

Coordinate and advise the process of designing a long-term Environmental Water Account program, building on the past 4 years of programmatic and technical reviews.

Schedule: 2004-2005

Support a pilot monitoring effort of tidal wetland restoration effects, the Integrated Regional Wetland Monitoring (IRWM) Pilot Project, an interdisciplinary research effort examining wetland restoration in the North Bay and Delta regions of the San Francisco Estuary. For more information: www.irwm.org

Schedule: Ongoing

Science Boards, Expert Panels, and Collaboration

Provide support and assistance to the newly established Independent Science Board which makes recommendations on science issues to the Authority and Bay-Delta Public Advisory Committee. The board will help ensure that CALFED programs meet their goals by evaluating the science underlying the programs as well as the application of that science.

Schedule: Ongoing

Coordinate the transition of the *ad hoc* independent science panel for the Environmental Water Account (EWA) into a standing advisory science board for the EWA program.

Schedule: 2005

Provide advice through the Independent Science Board on the charge, structure, and coordination functions of two new advisory science boards for Water Management and Drinking Water Quality.

Schedule: 2004-2005

Provide support and guidance to individual program elements on programmatic review and assist in peer review efforts.

Schedule: Ongoing

Conduct Issue Workshops and Prepare Whitepapers

Organizing issue-specific workshops and symposia on water project operations and their impacts on critical fish species. Information gained will help prioritize future research.

Schedule: Ongoing

Continue discussion on impacts of EWA related activities on salmonids and Delta smelt in series of workshops. Upcoming workshop will focus on development of tools to help guide species management and water operation activities, such as building of lifecycle models for each species.

Schedule: Ongoing, with next workshop scheduled for September 2004

Complete series of White Papers on pertinent program-wide issues including Delta smelt, Central Valley salmonids, contaminants, riparian habitat, and sediment budgets.

Schedule: Expect Delta smelt and CV salmonid White Papers in 2004

Communication

Continue efforts to communicate the new knowledge and uncertainties associated with the balance between ecosystem protection and water supply reliability and the relevance of this information to managers and policymakers by publication of periodic fact sheets on specific issues, preparation of white papers, and synthesis of management cues.

Schedule: Ongoing

Prepare management focused summaries of Science Program workshops, conferences and symposia and disseminated via program website, Science News newsletter, and email reflectors.

Schedule: Ongoing

Continue to translate management questions into focused topic-specific science agendas and integrate these into a comprehensive CALFED-wide Science Agenda.

Schedule: Ongoing

In collaboration with the Bay Delta Science Consortium, continue support of the electronic journal, San Francisco Estuary and Watershed Science, which serves as a forum for discussion of science of interest and relevance to the CALFED community. The journal website information is: <http://repositories.cdlib.org/jmie/sfews/>

Schedule: Ongoing

Support and organize the 3rd biennial CALFED Science Conference for the public presentation of new and relevant scientific findings to the Bay-Delta community. The conference aims to not only communicate most recent information, but also highlight findings that are relevant to managers and decision makers.

Schedule: October 2004

Co-sponsor the biennial State of the Estuary Conference. Organized by the San Francisco Estuary Project, the biennial conference features new and relevant scientific information regarding the Bay-Delta Estuary.

Schedule: October 2005

Continue to improve and enhance existing channels of communicating scientific and programmatic information to a broad and diverse audience by developing a communication strategy for the program and implementing its recommendations.

Schedule: Ongoing, with draft strategy developed in 2004

PERFORMANCE ASSESSMENT

Performance Measures and Assessment

Assist and advise in defining gaps in program-wide assessment and collaboratively work with program managers in designing and improving existing performance measures for individual programs and projects.

Schedule: Ongoing

Provide support and advice in development of workplans for individual programs.

Schedule: Ongoing

Foster development and application of peer review processes for selection of performance indicators and written programmatic documentation.

Schedule: Ongoing.

Provide guidance on existing monitoring programs and in design of new monitoring efforts and help define gaps and indicators based on specific management questions.

Schedule: Ongoing

Continue to coordinate with IEP to support and enhance data analyses and periodic subprogram reviews.

Schedule: Ongoing

Science Boards, Expert Panels, and Collaboration

Provide support and assistance to the Independent Science Board as it begins to review many of the ongoing CALFED programs and evaluates the science underlying those programs, the application of that science, and the technical aspects of those programs, including performance assessment.

Schedule: Ongoing

Assist standing boards and expert panels in technical and programmatic review efforts, such as the annual review of the EWA by the EWA Review Science Panel, and the continuing technical review of CALSIM II model by an *ad hoc* expert panel.

Schedule: Ongoing

CROSS-PROGRAM INTEGRATION

Investment in Data Analysis and Identification of Critical Unknowns

Fund the California Bay-Delta Authority (Authority) Science Fellows Program that will be administered by the California Sea Grant Program (Sea Grant), to further collaborative data analysis and research projects relevant to ecosystem management and water supply reliability.

Schedule: Begin 2004 with annual solicitations for proposals

Continue to fund studies that fill systemwide information gaps and support efforts to develop integrated monitoring plans for species such as salmon.

Schedule: Ongoing

Continue to cost-share major activities with individual programs to develop new information on critical unknowns as identified by advisory panels.

Schedule: Ongoing

Science Boards, Expert Panels, and Collaboration

Support collaborative efforts such as the San Francisco Bay Delta Science Consortium, in an effort to develop multi-institutional collaborations that would effectively address some of the multi-disciplinary, cross-program and multi-regional information needs.

Schedule: Ongoing

Provide support and assistance to the Independent Science Board as it begins to review the implementation of the CALFED program towards achieving the fundamental Program goals.

Schedule: Ongoing

Conduct Issue Workshops and Prepare Whitepapers

Support and organize series of workshops to address issues and questions on floodplain habitat restoration.

Schedule: First workshop to be held May 2004

Organize a workshop that aims to bring together scientists and managers working river restoration to address gravel related issues.

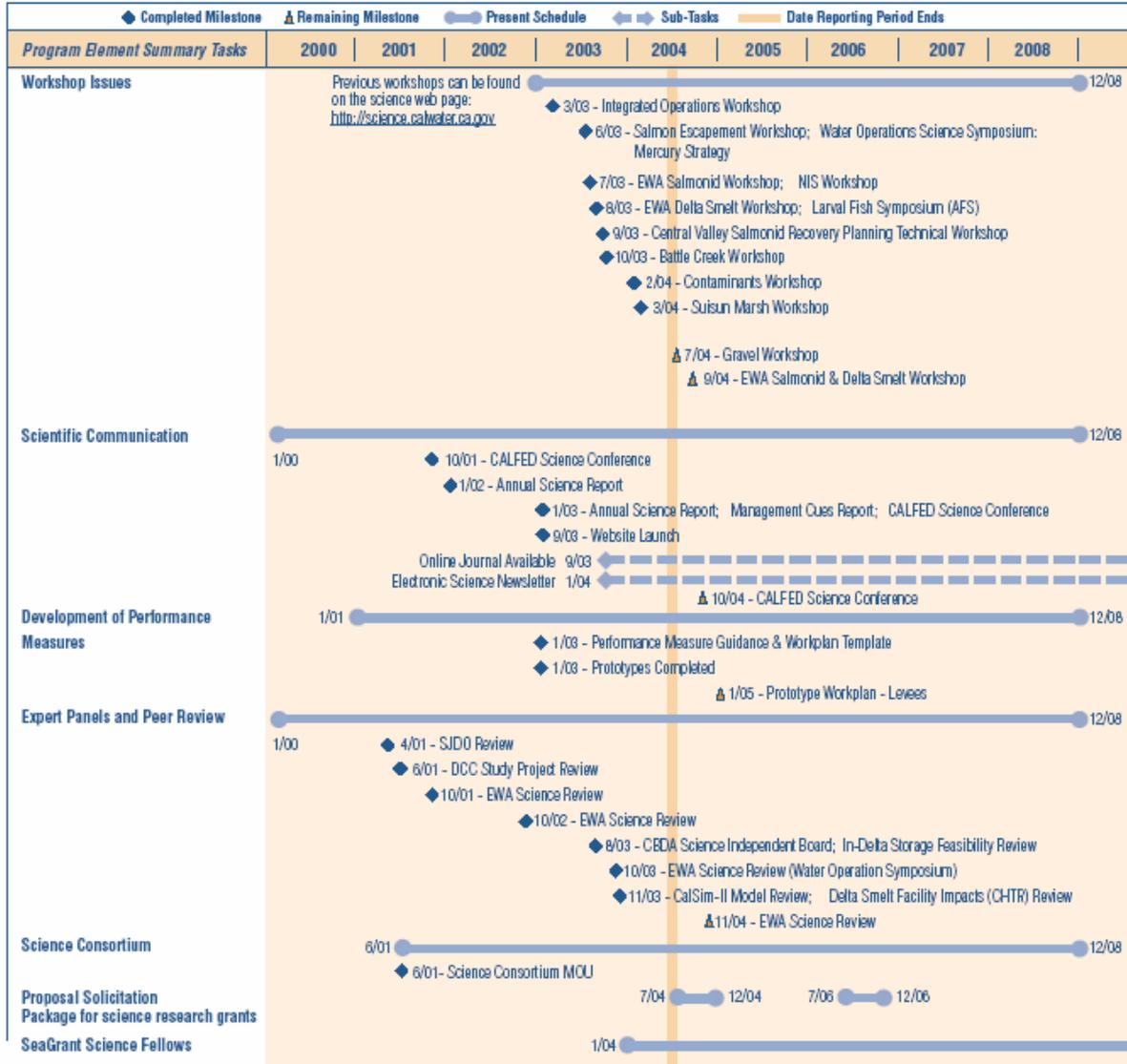
Schedule: Ongoing

Continue discussions on Suisun Marsh to examine the convergence of restoration and water management, and focus on the needs for restoration success by organizing follow-up workshops and workgroups.

Schedule: Ongoing

Schedule

SCIENCE



Integrating Environmental Justice and Tribal Relations

Environmental Justice:

The Science Program is working with the Environmental Justice Coordinator and members of the subcommittee to assist in the development of performance measures, communicating environmental justice specific issues to the scientific community via conference sessions, and continue efforts to incorporate science-based processes and peer review into the EJ workplan. In addition, Science Program is engaged in a dialogue with the Environmental Justice subcommittee to assist in the process of development of environmental justice-focused management needs that can then be integrated into broader science agendas and addressed in future funding solicitations.

Tribal Relations:

As with Environmental Justice program, Science will work with Tribal Relations to help identify tools for performance assessment, support potential research collaborations, and establish a strong education/information transfer element.

Cross-Program Relationships

There are three distinct organizational approaches used to integrate science activities across the CALFED program. The first organizational structure explains the distinction between the roles and responsibilities of the CALFED-wide Science Program and the responsibilities of each individual program for science. The second structure explains the system of external reviewers and advisors that the Science Program has established. The third structure outlines how the roles of the Authority, the Science Program staff, individual program staff, external panels, and the Executive Science Board work together on a specific issue.

The CBDA Science Program is focusing on large-scale issues that cut across multiple program elements and regions. Within each program area, however, there are also specific science and project technical needs including:

- Peer review of specific study designs, proposals submitted through proposal solicitations (PSPs), and final technical products
- Balanced and unbiased descriptions of the state of science relative to a specific issue
- Identifying critical unknowns needed to assess program performance or define classes of activities needed to reach program goals
- Specific data analyses and monitoring needed to support performance assessment

For example, the storage program is applying these scientific approaches to ensure its feasibility and environmental impact studies use the best available scientific information and to identify the strengths and weaknesses of one of its core tools (Department of Water Resources' CALSIM II model). The drinking water program is applying these approaches to develop a monitoring strategy that will feed into an overall assessment of program performance.

The immense scale of the CALFED program requires that a consistent protocol and a series of methodologies be developed to analyze the cumulative effects of its various actions such as restoration projects and water management actions. To address this need, the Science Program leads efforts to develop guides and indicators of performance assessment that can be used to evaluate and communicate the progress of every CALFED program. The development of performance assessment measures is an iterative process, where initial and prototype performance measures are evaluated for effectiveness. As knowledge of each program increases and more data becomes available, the Science Program will continue to provide advice, guidance, and review to agencies and program elements designing new performance measures. A complete "tool kit" to help guide development of performance measures and indicators for each program element is available on the Science Program website: http://science.calwater.ca.gov/sci_tools/performance_measures.shtml

Funding

Science ¹ (\$ in millions)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Grand Total
State ²	\$15.5	\$3.7	\$3.5	\$22.1	\$16.2	\$7.9	\$0.8	\$0.8	\$70.5
Federal ³	\$6.1	\$9.2	\$8.0	\$5.4	\$4.7				\$33.5
Local ⁴	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	\$0.2	0.197	\$1.6
Water User ⁴	\$1.1	\$2.5	\$5.9	\$6.9	\$6.9	\$6.2	\$6.2	6.201	\$41.9
Available Funding Total	\$22.9	\$15.6	\$17.6	\$34.6	\$28.0	\$14.3	\$7.2	\$7.2	\$147.4
Projected Needs Estimate ⁵	\$25.0	\$30.0	\$45.0	\$50.0	\$46.6	\$47.9	\$49.2	\$50.6	\$344.3
Original ROD Estimate (Aug, 2000) ⁶	\$25.0	\$30.0	\$45.0	\$50.0	\$50.0	\$50.0	\$50.0		\$300.0

NOTES:

- Funding for Years 1 - 3 reflect actual State, Federal and Local obligations, commitments, encumbrances and expenditures updated to reflect actual fund amounts for each task. State funds for Years 4 & 5 reflect the Governor's Budget May Revision. Federal funds are the Year 4 enacted and President's FY 2005 proposed budget. Projected funding shown in Years 6 - 8 includes remaining estimates for State bond funds, ongoing State base funding, and local matching to grants for years where bond funding is available. Federal appropriations beyond Year 5 are unknown.
- The State budget includes funding for the California Bay-Delta Authority (Authority), Department of Water Resources (DWR), and the Department of Fish and Game (DFG).
- The Federal budget includes funding for the U.S. Bureau of Reclamation (Reclamation), U.S. Army Corps of Engineers (USACE), U.S. Fish & Wildlife Service (USFWS), U.S. Geological Survey (USGS), U.S. Environmental Protection Agency (USEPA), and the National Marine Fisheries Service (NMFS).
- Water User/Local funding includes State Water Project Funds and CVP/IA Restoration Funds that are collected from state water contractors and Central Valley Project water users, but are budgeted and appropriated through the federal and state governments. Local grant matching funds are estimated and updated as information becomes available.
- The Projected Needs Estimates are based on funding targets from the 10-year finance plan (July 2) and may change based on completion of the plan in November 2004.
- Original ROD Estimate represents the original Stage 1 (Years 1-7) funding estimates from the Record of Decision (Aug 2000). Cost estimates for the Interagency Ecological Program (IEP) were not included in the original ROD estimates, but are included in the funding totals and projected needs estimates.

Funding by Task

Science ¹ (\$ in millions)	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Grand Total
1) Oversight and Coordination	\$1.5	\$2.1	\$0.9	\$2.1	\$1.9	\$0.0	\$0.0	\$0.0	\$8.5
2) Data Analysis and Critical Unknowns	\$4.5	\$1.6	\$1.8	\$11.6	\$8.3	\$6.6			\$34.4
3) Science Boards, Expert Panels, and Collaboration	\$1.7	\$0.2	\$0.1	\$4.5	\$1.7				\$8.3
4) Workshops and White Papers	\$4.4			\$2.0	\$2.0				\$8.3
5) Performance Measures and Assessment	\$1.5	\$0.3		\$0.9	\$0.9				\$3.5
6) Communication	\$1.3	\$0.0		\$0.8	\$1.2	\$0.3			\$3.5
7) Interagency Ecological Program	\$8.0	\$11.4	\$14.8	\$12.8	\$12.1	\$7.5	\$7.2	\$7.2	\$81.0
Available Funding Total	\$22.9	\$15.6	\$17.6	\$34.6	\$28.0	\$14.3	\$7.2	\$7.2	\$147.4
Projected Needs Estimate ²	\$25.0	\$30.0	\$45.0	\$50.0	\$46.6	\$47.9	\$49.2	\$50.6	\$344.3
Original ROD Estimate (Aug, 2000) ³	\$25.0	\$30.0	\$45.0	\$50.0	\$50.0	\$50.0	\$50.0		\$300.0

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Geographical Distribution of Activities



Map of California with an expanded view of Sacramento-San Joaquin Bay-Delta region, highlighting recent and on-going projects supported by the Science Program efforts (in red).

The Interagency Ecological Program 3-Year Plan

The Interagency Ecological Program (IEP) is a collaboration of 3 state and 6 federal agencies. The purpose of this collaboration is to gather in an efficient, coordinated, and cooperative way the ecological information required by the agencies to effectively carry out their management and regulatory responsibilities in the San Francisco Bay and Sacramento-San Joaquin Delta system (San Francisco Estuary).

Each year, the IEP develops a program comprised of long-term monitoring, water operations monitoring, and special studies (program elements). Long-term monitoring studies are included in the program every year because they provide baseline data that has been used since 1970 to assess and make management decisions for the San Francisco Estuary. Water operations monitoring support water operational decisions and use of the Environmental Water Account. For these reasons, these studies remain the core focus of our program.

The IEP remains relevant to the dynamic needs of this estuary by incorporating special studies that address current information gaps and management concerns. Special studies may include investigating new sampling techniques, equipment and data analyses, expanding sampling geographically or temporally to gather more data, developing new models, and analyzing existing data.

The program is developed annually using priorities set by the IEP Coordinators, a group of management supervisors from each agency. Starting in 2004, these priorities will be guided by information needs and questions solicited from our stakeholders. The stakeholders include state and federal water contractors, operators of the State Water Project (SWP) and federal Central Valley Project (CVP), environmental groups, California Bay-Delta Authority (CBDA), and the Agency Coordination Team (ACT). Part of the approval process for the annual program is a review by the ACT and receipt of a determination of consistency with the CBDA Program. Table 2 gives a brief synopsis of each program element. Nearly all of these elements fall under the CBDA Science Program's "Water operations and biology" and "Improving monitoring capabilities" priorities.

Performance assessment of the program is done to ensure study goals are relevant and met, protocols minimize errors and biases, data are utilized fully, and to look for potential special studies that could improve the information gathered. There have been 2 major programmatic

reviews in the last 5 years: the Estuarine and marine fish monitoring survey and the Environmental Monitoring Program. In 2004, there will be a high-level management evaluation of the long-term fisheries monitoring program elements. This evaluation will assess the usefulness of the data being gathered by these studies and where costs can be cut without compromising data integrity.

Over the next 3 years, the IEP will continue its long-term and operations monitoring studies, fund the existing short-term special studies through completion, and support salmon studies such as the Winter-run race identification (DNA), DFG ocean salmon tag recovery, Coleman National Fishery Hatchery late-fall-run coded-wire tagging project, and data management of IEP database interface and website. The IEP will also maintain outside expertise consultations with the Scientific Advisory Group as well as strive to continue its use of post-doctorates. A consistent theme within the IEP is and will be to continue supporting and developing scientific expertise and applying their expertise to resolve critical issues in the estuary. Lastly, once the long-term fisheries monitoring projects assessment is completed, the IEP will do a management evaluation of the remaining long-term monitoring projects.

The IEP will be devoting resources to two large-scale programs in 2004 and outgoing years. One program involves researches on the impacts and benefits of existing and new salvage facilities for delta smelt. Comprehensively, these studies are referred to as the collection, handling, trucking, and release (CHTR) studies because they strive to identify 1) diagnostic indicators of acute or chronic adverse effects to salvaged delta smelt, 2) predation losses, 3) acute mortality and injury of salvaged delta smelt, and 4) new technologies and processes for CHTR.

The other program will concentrate on understanding what factors influence the entrainment of fish towards the CVP and SWP and what measures can be implemented to reduce entrainment. This is an interdisciplinary, integrative effort that will incorporate findings from four studies: 1) the influence of natural and anthropogenic factors on the flows in the South Delta, 2) influences of flow changes on fish movement and entrainment via hydroacoustics, 3) juvenile fish community structure, and 4) models of the zone of influence.

Table 3 provides the overall cost in the next 3 years. Funding for the IEP has been historically level-funded at approximately \$9 million. At the present cost projections, the IEP anticipates \$500,000 to \$900,000 will be available for new special studies as current special

studies are completed. In 2005, the IEP foresees a shortcoming of approximately \$1 million, but funding should return to current levels for 2006 and 2007. Consequently, the IEP does not anticipate soliciting for new work in 2005.

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**Table 2. Summary of the 2004 Interagency Ecological Program Monitoring,
Special Study and Fish Facility Activities (Elements)**

Element costs are approximate and expressed in thousands of dollars
Revised 12/19/03

I. Monitoring Elements

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
A. HYDRODYNAMICS			
1. Bay salinity monitoring. (2004-029)	Provides for the continuous collection of salinity, water temperature, tide and meteorological measurements at five fixed sites in San Francisco Bay. Data is used for hydrodynamic model development and verification. (P. Buchanan, USGS)	Monitoring	\$189
2. Delta flow measurement and database management. (2004-030)	Measurements via UVMs and ADCPs of channel flow and flow splits at key Delta sites. Data is used to evaluate fish transport and migration issues and to validate hydrodynamic models. Maintenance of the time series database of Bay and Delta hydrographic data (tides, currents salinity, wind, and Delta flows information collected by USGS) will continue. (K. Ruhl and J. Burau, USGS)	Monitoring	\$805
			\$ 994

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
B. ENVIRONMENTAL MONITORING			
1. D-1641 water quality compliance monitoring (Environmental monitoring program). (2004-072)	Implementation of the Bay-Delta environmental monitoring program as described in SWRCB Water Right Decision D-1641. Program includes both monthly boat based water quality cruises to 21 sites in San Pablo Bay, Suisun Bay, and the Delta and continuous, telemetered monitoring at 7 stationary sites. In addition to basic water quality parameters, chlorophyll, phytoplankton, benthic and zooplankton samples are taken. (S. Hayes and P. Giovannini, DWR)	Monitoring	\$1,541
2. Upper estuary zooplankton sampling. (2004-077)	Monthly sampling for Neomysis shrimp and other zooplankton at 16 sites in San Pablo Bay, Suisun Bay, and the Delta. The monthly sampling is coordinated with the Environmental Monitoring Program (2003-072). (L. Mecum, DFG)	Monitoring	\$212
3. Operation of thermograph stations. (2004-104)	Operation of the thermograph and sediment sampling stations at Vernalis on the San Joaquin River and the Sacramento River below Wilkins Slough. (J. Smithson, USGS)	Monitoring	\$33
			\$1,786

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
C. FISH & MACROINVERTS			
1. Delta resident shoreline fish sampling. (2004-001)	Electrofishing survey of shoreline habitats in the Delta to monitor annual trends in the abundance of resident fishes, analyze the diet of fishes collected and assess species/habitat associations. Data will be used to determine trends in abundance, distribution, species composition and diet of delta resident species, especially centrarchids in the Delta. (D. Michniuk and P. Coulston, DFG)	Monitoring	\$175
2. Adult striped bass population parameters. (2004-002)	Annual capture and marking of adult striped bass for the purpose of making mark-recapture estimates of legal-size striped bass abundance, age distribution, mortality rates and evaluating factors affecting abundance. (N. Kogut and P. Coulston, DFG)	Monitoring	\$204
3. Fall midwater trawl survey. (2004-003)	Annual midwater trawl sampling between September and December at approximately 90 sites from San Pablo Bay through the Delta to monitor fish abundance and distribution, especially striped bass and delta smelt. This survey has been conducted since 1967. Data is used to calculate young-of-the-year indices of several important species including striped bass, American shad and delta smelt. The fall midwater trawl index of delta smelt is specifically referenced in the Delta Smelt Recovery Plan. (K. Souza, DFG)	Monitoring	\$146
4. Adult sturgeon tagging (adult abundance and mortality). (2004-005)	Periodic (every 2 to 4 years) collection, marking and release of legal-size sturgeon. Analysis of recaptures in subsequent sampling efforts provides estimates of abundance, age distribution, and mortality rates that are used to set angling regulations and evaluate factors affecting year class strength. There is no sampling scheduled for 2004. (N. Kogut and P. Coulston, DFG)	Monitoring	\$72
5. Sturgeon year-class strength monitoring. (2004-006)	Annual otter trawl and baited set-line sampling in San Pablo and Suisun bays and the Delta targeting 30-91cm sturgeon to provide an index of juvenile sturgeon year-class strength that can be related to environmental factors. (R. Schaffter and P. Coulston, DFG)	Monitoring	\$83
6. Summer Towntet survey. (2004-007)	Spring-summer sampling (since 1959) with a towed, small mesh net at 31 sites from San Pablo Bay through the Delta to monitor the annual abundance and distribution of juvenile fish in the upper estuary and evaluate factors affecting abundance. Data is used to establish the striped bass 38mm index. (M. Bryant and R. Gartz, DFG)	Monitoring	\$277
7. Estuarine and marine fish abundance and distribution survey. (2004-011)	Monthly (since 1980) trawling survey at 52 channel and shoal stations from South San Francisco Bay to the lower Sacramento and San Joaquin rivers to track abundance and distribution trends of marine and estuarine fishes. Data is used to assess the status of marine and estuarine fishes in the estuary. (K. Hieb, DFG)	Monitoring	\$391

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
8. Bay shrimp and crab abundance and distribution surveys. (2004-012)	The trawling surveys described for 2003-011 also include the collection and processing of shrimp species to track abundance and distribution trends of Bay and estuarine shrimp species. Data is used to assess the status of shrimp in the estuary. (K. Hieb, DFG)	Monitoring	\$186
9. Juvenile salmon and delta fishes abundance and distribution sampling. (2004-053)	A program of trawling and seining at key sites in the lower rivers, Delta and estuary targeting all races of juvenile salmon emigrating through, and rearing in the Delta. The program is multipurpose, providing information on the timing of emigration extent of rearing in the Delta, and annual production. Although this effort focuses on juvenile salmon, information is also collected on other delta fishes. (P. Cadrett, USFWS)	Monitoring	\$981
10. Part of Knight's Landing juvenile salmon monitoring. (2004-074)	Continuous sampling by rotary screw trap of juvenile salmonids emigrating from the Sacramento River. Near real-time reporting of data provides early detection of salmon entering the Delta for management purposes. This element is being funded by DFG. (B. Snider and R. Titus, DFG)	Monitoring	\$25
11. Spring Kodiak trawl. (2004-088)	Monthly Kodiak trawl sampling between February and April at approximately 39 sites from San Pablo Bay through the Delta to monitor the abundance and distribution of estuarine fishes, specifically adult delta smelt during the late winter and spring. This survey replaces the spring midwater trawl (conducted in 1992-2001). Data is used to determine the abundance, distribution and maturity of adult, pre-spawning delta smelt. (K. Souza and R. Baxter, DFG)	Monitoring	\$146
12. UCD Suisun Marsh fish monitoring. (2004-093)	Monitoring of fish abundance and distribution at 26 sites in Suisun Marsh channels. Monthly sampling is done using otter trawls or beach seines. Larval fish sampling using a towed fine mesh plankton net is done at five sites on a monthly basis between February and June. All work is done by UCD personnel. (P. Moyle, UCD)	Ongoing	\$45
			\$2,731

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
D. OP's MONITORING			
1. 20mm delta smelt survey. (2004-033)	A fine-mesh towed net survey of the estuary and Delta to determine the distribution and abundance of post-larval delta smelt. Sampling is conducted every two weeks during the period April through July at 35-40 stations from San Pablo Bay through the Delta. The real time processing of the 20mm samples is included in this element. (M. Dege and K. Fleming, DFG)	Ongoing	\$448
2. Part of juvenile salmon and delta fishes abundance and distribution sampling. (part of 2004-053)	Sampling juvenile salmon and other delta fishes with midwater trawls, Kodiak trawls and beach seines in the delta that supports or provides information useful to water project operations. (P. Cadrett, USFWS)	Ongoing	\$657
3. Spring/summer delta ops real time monitoring (RTM). (2004-071)	Collation and reporting of data from all strategically important sampling programs. Support of daily Kodiak sampling at Mossdale during April through June. Additional sampling at strategically located stations on the periphery of the Delta and its interior during the months of April, May, and June on an "as needed basis". Overall effort is to provide "near-time" information on the relative vulnerability of key fish species to water project operations. Sampling results are made available within 48-hours via the Internet along with data to guide the decision making of the CALFED Ops Group. (B. Fujimura, DFG)	Ongoing	\$144
4. Water quality telemetred data collection. (part of 2004-072)	Water quality data, mainly electrical conductivity or salinity, from seven telemetry sites used for day-to-day CVP and SWP operational decisions. (H. Gebhard, DWR)	Ongoing	\$500
5. San Joaquin River dissolved oxygen monitoring. (2004-073)	Summer and fall monitoring of dissolved oxygen and temperature levels at several sites in the San Joaquin River near Stockton to evaluate the cause of seasonal dissolved oxygen levels and trigger placement at the Head-of-Old-River Barrier. Data is used to guide water project operations and barrier placement. (S. Hayes and J. Giulianotti, DWR)	Ongoing	\$50
6. Part of Knights Landing juvenile salmon monitoring. (part of 2004-074)	Sampling at Knights Landing for juvenile salmon that supports or is mandated by listed salmonid protection plans. DFG is funding this effort. (B. Snider and R. Titus, DFG)	Ongoing	\$74
			\$1,873
	Total Estuary Monitoring		\$7,384

II. Special Study Elements

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
A. SALMONID MIGRATION & SURVIVAL			
1. Winter-run race identification. (2004-004)	Conduct genetic studies to develop unambiguous identifiers of the various races of Central Valley Chinook salmon. (S. Greene, DWR)	Ongoing Year 7 of 7	\$267
2. Winter-run captive broodstock program. (2004-008)	USBR and DWR contributions to a multi-agency effort to establish and maintain a captive stock of winter-run Chinook salmon brood fish to guard against species extinction. Experimental programs have been established at Bodega Marine Lab and Steinhart aquarium. (K. Lentz, USBR)	Ongoing Year 10 of 10	\$495
3. IEP support for DFG Ocean Salmon Project. (2004-009)	To assist in port sampling for coded-wire tags and to collect and process CWTs from Central Valley hatcheries and spawning surveys. (C. Armor, DFG)	Ongoing	\$147
4. Coleman Nat. Fish Hatchery late-fall run production tagging. (2004-059)	Coded-wire tagging of all CNFH late-fall run production to ensure proper race identification during subsequent recovery of fish at Delta export facilities and in juvenile and adult sampling programs. Recovery of tagged late-fall run fish is also part of the spring-run recovery plan. (P. Brandes, USFWS)	Ongoing	\$216
5. Spring DFG Region 4 salmonid sampling at Mossdale. (2004-100)	Sampling for outmigrant fishes at Mossdale during April – June. This is sampling done in addition to the sampling done by RTM at Mossdale. The added data collected is reported with the RTM data. (D. Marston, DFG)	Ongoing	\$9
6. Hatchery and wild steelhead data analysis. (2004-045)	This element will provide baseline life history information of wild versus hatchery fish, predictors of SWP and CVP salvage, and emigration cues. (S. Foss, DFG and P. Cadrett, USFWS)	Ongoing Year 2 of 3	\$22
			\$1,156

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
B. RESIDENT SPECIES			
1. An analysis of the longfin smelt data and to develop models based on that data. (2004-051)	This is a pilot effort to bring in a post doctorate researcher to carry out an extensive analysis of all available longfin smelt data. This effort will pair the post-doc with an IEP researcher in a process that will result in the publication of peer-reviewed article(s). The IEP's Science Advisory Group specifically recommended that a post-doctoral researcher be used to assist in the analysis of longfin smelt data and that this could be a way to bring in outside expertise, complete needed analyses and publish papers. (P. Moyle, UCD)	Ongoing Year 3 of 3	\$58
2. Growth and diet of early life stage splittail. (2004-042)	Study will address two questions: 1) does the growth of juvenile splittail vary among floodplain, riverine, freshwater marsh and brackish marsh habitats and 2) does the diet of juvenile splittail vary among floodplain, riverine, freshwater marsh and brackish marsh habitats? This work will be coordinated with other CALFED funded work directed at splittail. (F. Feyrer, DWR, T. Sommer, DWR, and R. Baxter, DFG)	Ongoing Year 3 of 3	\$97
3. Food habits of white and green sturgeon in the S.F. Estuary. (2004-043)	Investigates the food habits of white and green sturgeon in the S.F. Estuary and compares them to work done in the 1960s. One central question will be if the diet of sturgeon have changed as the benthic fauna of the estuary has changed since the 1960s. Very little is known about sturgeon diet especially for green sturgeon. (N. Kogut, DFG)	Ongoing Year 3 of 3	\$85
4. Testing effects of temperature and substrate on delta smelt egg and early larval survival. (2004-049)	In a laboratory setting, this work will determine if delta smelt deposit eggs with greater frequency in particular habitat zones. Outdoor tanks containing various substrates will be tested. The effect of temperature on survival of egg and early larvae will also be investigated. This information is needed to fill in gaps in our knowledge of delta smelt life history and to assist field programs focused on egg and early life stage collection. There was a contract delay in 2003. Subsequently, work will be done in 2004 with 2003 funds. (S. Doroshov, J. Lindberg, and B. Baskerville-Bridges, UCD)	Ongoing Year 2 of 3	\$0
5. Predator-prey dynamics in shallow water habitats in the Delta. (2004-083)	This element is a continuation of 2002-083 to define the predator-prey relationships of the fish that inhabit the shallow water habitats in the delta. (M. Nobriga, DWR, M. Chotkowski, USBR and M. Dege, DFG)	Ongoing Year 4 of 5	\$148
6. Forage species length-weight. (2004-034)	This study will collect the data needed and develop weight-length relationships for the common forage species in the estuary and use these relationships to calculate biomass and condition indices for the forage species. (R. Gartz and R. Baxter, DFG)	Ongoing Year 2 of 3	\$17

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
7. Delta smelt feeding success. (2004-035)	This study will determine the effect of food limitation on the early success of delta smelt. Specifically it will investigate the hypotheses 1) delta smelt growth is constrained by food limitation in spring, 2) food limitation arises through a mismatch between development of larval delta smelt and abundance or composition of their food, 3) the annual spring decline in abundance of Eurytemora affinis occurs through recruitment failure brought about by high mortality of nauplii and 4) the calanoid copepods E. affinis and Pseudodiaptomus forbesi interact competitively through egg production of the adult females and growth of the young stages. (W. Kimmerer, RTC and Bill Bennett, BBML)	Ongoing Year 2 of 2	\$20
			\$ 425

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
C. ECOLOGICAL PROCESSES			
1. S. F. Bay Hydrodynamics modeling. (2004-069)	Development and documentation of a computer based 3-D hydrodynamic model of S.F. Bay to be used for making long-term (at least seasonal) simulations of Bay flows, particles and salinity. (P. Smith, USGS)	Ongoing	\$206
2. Evaluating models for examination of predator impacts in the Delta. (2004-023)	This element will develop, test and apply individual-based models of predator – prey interactions in the Delta to help assess the importance of predation by piscivores to survival of native species of concern. These models will help focus research on those data items most needed. This was scheduled to start in 2002, but was delayed to 2003 due to contracting difficulties. (W. Kimmerer, RTC and M. Nobriga, DWR)	Ongoing Year 2 of 2	\$75
3. Hydrodynamic studies in the Delta. (2004-027)	2004 will be used to analyze existing data and write up results from 2003 work, which comprises of looking at Frank’s Track and adjacent waters, Three Mile Slough and adjacent waters and the Delta Cross Channel. These three areas are of specific interest to scientists working in the estuary and detailed hydrodynamic information is needed on each. In each case the work being proposed here is highly coordinated with other IEP and CALFED research efforts. (J. Burau and C. Ruhl, USGS)	Ongoing Year 3 of 3	\$294

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
4. Learning from particle tracking models. (2004-031)	Study will extend the use of a particle tracking model of the Delta to provide vital information on scaling of export effects, assess effects of agricultural diversions, and analyze the distribution of delta smelt. Specifically three questions will be addressed 1) what is the best index to use to scale export flows in the Delta so as to provide a measure of prediction of probability for entrainment of neutrally buoyant particles and (possibly) resident and migrant fish, 2) what is the likely impact of agricultural diversions on fish species of concern and 3) can the abundance patterns of delta smelt be understood on the basis of hydrodynamic conditions. This was scheduled to start in 2002, but was delayed to 2003 due to contracting difficulties. (Wim Kimmerer, RTC, Matt Nobriga, DWR and Bill Bennett, UCD)	Ongoing Year 2 of 2	\$115
5. Community level analysis of the Delta Outflow/San Francisco Bay Study fish and invertebrate data. (2004-054)	This is a pilot effort to bring in a post doctorate researcher who in partnership with an IEP researcher will carry out an extensive community level analysis of the Delta Outflow/San Francisco Bay Study's data. This effort will result in the publication of peer-reviewed article(s). The IEP's Science Advisory Group recommended that post-doctoral researchers be used as a way to bring in outside expertise, complete needed analyses and publish papers. This was scheduled to start in 2002, but was delayed to 2003 due to contracting difficulties. (W. Kimmerer, RTC)	Ongoing Year 2 of 2	\$71
6. 3-D modeling of flows in the DCC and HOR. (2004-022)	The element is to conduct modeling and where needed data collection to understand the detailed circulation patterns in the vicinity of the Delta Cross Channel and Head of Old River. (P. Smith, USGS; B. Younis, UCD; and H. Wong, USBR)	Ongoing Year 2 of 3	\$90
7. Corbicula - carbon in San Joaquin R. (2004-013)	This study will determine if the grazing by Corbicula fluminea in the lower San Joaquin drainage has an important effect on the transport and fate of organic carbon. This element complements an existing CALFED funded effort. (L. Brown, J. Thompson, and L. Lucas, USGS)	Ongoing Year 2 of 2	\$42
8. Community-level analysis. (2004-046)	This element will conduct community-level analysis of IEP data sets including midwater trawl, USFWS beach seine, summer Towntnet survey. Work will be done in collaboration with IEP staff. CALFED will be funding Larry Brown's time. (L. Brown, USGS)	Ongoing Year 2 of 2	\$98
			\$ 991

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
D. ESTUARINE MONITORING			
1. Mitten crab monitoring and reporting. (2004-026)	Element will operate the online reporting system for mitten crab collections and observations and would implement summer surveys of mitten crab distribution and abundance. The main part of this element will be funded and staffed by USFWS exotic species personnel with some sharing of resources from IEP. (K. Webb, USFWS, and K. Hieb, DFG)	Ongoing	\$59
2. Evaluation of South Delta temporary barriers. (2004-103)	Program monitors the potential impacts of South Delta temporary barriers installation and operation to water quality and resident and migratory fishes. One specific activity is monitoring the movement of juvenile salmon through the culverts of the Head of Old River barrier. This work is a condition DWR's 1601 agreement for these barriers. (A. Rockriver, DFG)	Ongoing	\$150
3. Yolo Bypass fish monitoring. (2004-047)	This element is investigating the potential of establishing a fish monitoring program for the Yolo Bypass. This is a two-year effort after which it will be evaluated for inclusion as a monitoring element. Funding shifted from IEP to CALFED for this work. (T. Sommer, DWR)	Ongoing	\$371
4. DO monitoring evaluation. (2004-032)	This element will compare the performance of current DO monitoring equipments with the new optical fluorescence sensor. (V. Nieuwenhuysse, USBR, and M. Dempsey, DWR)	Ongoing Year 2 of 2	\$21
5. S. F. Bay salinity-temperature data analysis. (2004-041)	This element will analyze long-term data from 2004-029 to determine if there are any trends in the salinity and water temperature for S. F. Bay since 1990, if there are any relative contributions of forcing mechanisms (fresh water flow, meteorological conditions, and climate), and if small changes in discharge affect salinity and temperature during low flow periods. (D. Schoellhamer and G. Shellenbarger, USGS)	Ongoing Year 2 of 3	\$72
6. Addition of 1970-1974 data to IEP database. (2004-039)	This element will expand the IEP database to include the USBR water quality data from STORET for 1970-1974. Funding is part of 2004-072. (P. Lehman and K. Jacobs, DWR)	New Year 1 of 1	\$0
7. <i>Microcystis</i> sampling protocol (2004-079)	This will establish a protocol to sample <i>Microcystis aeruginosa</i> , quantify its density and biomass in the S.F. Estuary, determine its geographical extent, gain information on its potential toxicity and develop a literature review of its potential human and ecological impact. Funding is part of 2004-072. (S. Waller, P. Lehman, and P. Giovannini, DWR)	New Year 1 of 1	\$0
			\$ 673

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
E. FISH FACILITIES			
1. Effects of covering the secondary screen/louvers at the Skinner Fish Facility. (2004-055)	The goal of this effort is to determine if light is a significant factor in the salvage rate of fish at the Skinner Delta Fish Facility. This work will determine the effects of covering the secondary screening bays during daylight hours on salvage rates and determine the effects of covering the secondary screening bays during a 24-hour period. (J. Morinaka, DFG)	Ongoing Year 3 of 3	\$10
2. Effectiveness of bar racks & experimental leaky louvers for separation of fish by size. (2004-TF1)	This study attempts to refine the ability to separate fish in a system heavily laden with debris. It will develop vertical separator configurations (bar racks and louver walls) that separate larger fish from smaller prey-sized fishes. (C. Karp, USBR)	Ongoing Year 2 of 3	\$200
3. Fish sorting/debris handling & cleansing in lab holding tank physical models with small mesh screens. (2004-TF2)	This is a passive/active fish separator study using a horizontal type separator. Information will be used towards TFTF design data, using a 1:3 scale physical model, an hydraulic and biological performance, and serve as a facility to evaluate fish sorting, dewatering, debris control, and fish holding issues in fish, separator/holding facilities downstream of TFTF bypass lifts. (L. Hanna, USBR)	Ongoing Year 3 of 4	\$200
4. Development of testing designs/plans for a future on-site Tracy Demonstration Flume. (2004-TF9)	Develop study plans and design for a demonstration flume (250 cfs) to be constructed at Tracy for the purpose of testing new technologies in a prototype facility arrangement. Components will include fish friendly lift pumps, sorters, separators, positive barrier screens, leaky louvers, automated debris cleaning, etc. (C. Liston, USBR)	Ongoing Year 1 of 5	\$50
5. 2-D individual based model for prediction of fish salvage efficiency. (2004-TF4)	This is a validation experiment to verify current individual-based models that predict louver efficiencies for various louver configurations. (M. Bowen, USBR)	Ongoing Year 2 of 3	\$40
6. Evaluation of dual frequencies identification sonar (DIDSON) for underwater observations. (2004-TF5)	This study will be an application and further development in technology for detailed underwater observations of fish movements and responses to internal structures of existing and proposed fish salvage facilities independent of water clarity or time of days. Information gained from this study will guide operations and designs of internal components of future fish salvage facilities. (S. Hiebert, USBR)	Ongoing Year 2 of 4	\$150

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
7. Modification & evaluations of the TFCF above ground oval holding tank towards TFTF. (2004-TF6)	This project will modify existing above-round fish holding tank at the TFCF to provide a holding facility with vertical screens similar to that proposed for TFTF. Eventually, results will provide in situ evaluations of a production model for a pumped bypass salvage and holding facility similar to that proposed for TFTF. The study will also acquire data on holding tank flow conditions, fish behavior and health, debris removal methods, unwatering and fish off loading methods, and long-term operation and monitoring. (B. Mefford, USBR)	Ongoing Year 2 of 4	\$175
8. Design & evaluation of electric pulse fish crowders in association with TFTF development. (2004-TF7)	This is a pilot study that will investigate the potential of using weak intermittent (pulsed) electric current fields to deter large predator fish from taking up residency at a fish screen/louver structure. It will design a system and evaluate use of directional antenna arrays combined with electric pulse generators. (B. Mefford, USBR)	Ongoing Year 1 of 2	\$50
9. Development of research designs for statistical efficiency for Tracy facility studies. (2004-TF8)	This project will provide sound quantitative fundamentals underlying the hypothesis testing to occur with evaluations of the new TFTF. Some of the considerations include analyzing preliminary data, determining sample sizes needed to distinguish hypotheses, and power tests. This approach will assist development of efficient study designs for maximizing benefits from testing with statistical validity. (M. Bowen, USBR)	Ongoing Year 3 of 5	\$20
12. TFCT primary louver bypass modification (phase II). (2004-TF11)	This study will identify and develop additional bypass improvements to recommend modifications based on phase I results for retrofit of TFCF primary louver bypass. (J. Kubitschek), USBR)	Ongoing Year 3 of 3	\$60
13 Holding tank influences on fish condition & survivorship at the TFCF. (2004-TF12)	This investigation will analyze the effects of recessed holding tank environment on louvered fish at the TFCF. (C. Karp, USBR)	Ongoing Year 3 of 3	\$60
14. Designs for a modified fish transport bucket & a modified fish sampling bucket. (2004-TF13)	This investigates the ability to minimize fish injury that may occur between the holding tanks and the loading of fish into hauling trucks through improved design. (R. Christensen, USBR)	Ongoing Year 2 of 2	\$50
15. Full facility and Facility component TFCF louvering & collecting efficiencies for major & important Delta species. (2004-TF14)	This study experimentally verifies the louver efficiencies in the primary and secondary louver channels at the TFCF with recommendations toward delta smelt, salmon, stripers, splittail, and salvage operations. (M. Bowen, USBR)	Ongoing Year 1 of 3	\$150

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
16. Fish taxonomic refinement & external assessment of test fish for FFIP/TFTF/TFCF operations. (2004-TF15)	This project provides expertise and training in fish identification for daily fish salvage activities at the TFCF, and external injury assessments of test and control fish used in TFFIP/TFTF experiments; provide useful keys and identification photos of early life stages of fish for use by researchers and managers dealing with fish studies and monitoring in the Delta. (L. Hess, USBR)	Ongoing Year 6 of 10	\$80
17. Basic water quality monitoring & assessment of incoming flows at the TFCF. (2004-TF16)	This assessment will provide accurate high quality and frequent water quality monitoring of incoming flows at the TFCF, including interpretation of effects of water year, pumping, and South Delta Barrier operations. (D. Craft, USBR)	Ongoing Year 4 of 5	\$70
18. Development of a fish recovery system downstream of the secondary louvers. (2004-TF17)	This will develop and implement a system to recover small fish that have “slipped” through the secondary louvers at the TFCF. (B. Bridges, USBR)	Ongoing Year 1 of 3	\$100
19. Evaluation of the 10 minute count screen for collecting small fish at the TFCF. (2004-TF18)	This experiment will test and compare screening efficiencies of the present fish counting screen to the previous counting screen used for concentrating and retaining fish > 20 mm length. (L. Hess, USBR)	Ongoing Year 2 of 2	\$20
20. Tracy Technical Report Series editing and coordination. (2004-TF19)	This project enhances control and quality of the Tracy Technical Report Series (volumes) with greater formalization of peer review and editorial activities. It also increases organization and public distribution and develop keyword abstracting for the Tracy and Red Bluff peer reviewed technical report series. (D. Craft, USBR)	Ongoing Year 2 of 5	\$45
21. Biotelemetry studies of striped bass movement & distribution at the TFCF; assessing advanced hydro-acoustics for predator population estimates near trashracks. (2004-TF20)	This experiment will give further understanding of the movements and holding of fish predators in fish salvage systems and the influencing factors contributing the movements. Results will ultimately assist in finding methods to minimize predator fish residency and holding times. (L. Helfrich, W. Frizzel and R. Bark, USBR)	Ongoing Year 2 of 3	\$200

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
22. Evaluation of debris removal techniques using the mitten crab traveling screen and other methods for continuous debris removal at the TFCF. (2004-TF21)	This study will determine if the mitten crab traveling screen at the TFCF can be used to effectively remove debris throughout the year from primary bypass flows entering the secondary louver chamber. The information increases our understanding in general of seasonal debris loading at TFCF. (J. Boutwell and D. Sisneros USBR)	Ongoing Year 3 of 5	\$150
23. Initial evaluation of the TFCF south bay. (2004-TF22)	This project initiates basic water quality studies of the bay for identifying the aquatic habitat in relation to fisheries needs, begin characterization of fish species and use of the bays, and develop baseline information in anticipation of potential influences on the bay from construction activities related to future TFCF/TFFIP developments. (A. Montano and C. Karp, USBR)	Ongoing Year 2 of 3	\$80
24. USBR/UCD graduate studies program associated with CHTR. (2004-TF23)	This project implements intensive research effort on aspects of fish handling, trucking, and release that are complimentary to ongoing state research and that are necessary to improve fish salvage facility efficiencies. This will involve a Ph. D. candidate with assistantship and study support for 3-4 years. (C. Liston and D. Portz, USBR)	Ongoing Year 2 of 4	\$120
25. Tracy Fish Collection Facility fish entrainment. (2004-TF24)	This study will monitor the effectiveness of the TFCF and vulnerability of various species to the Tracy Pumping Plant (TPP) entrainment. (C. Dealy, USBR)	Annual	\$98
			\$2,178

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
F. Ag and Municipal Diversion Evaluations			
1. North Bay Aqueduct fish egg and larva entrainment monitoring. (2004-096)	Monitoring the potential entrainment of fish eggs and larvae into the North Bay Aqueduct via plankton townet sampling in adjacent sloughs. Sampling is being conducted to guide pumping operations, as per the terms of the CVP/SWP delta smelt Biological Opinion. (K. Fleming, DFG)	Monitoring	\$138
			\$ 138

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
G. CLIFTON COURT INVESTIGATIONS			
1. No elements are being done for this category			
			\$ 0

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
H. CONTAMINANT EFFECTS			
1. No elements are being done for this category			
			\$ 0

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
I. RESTORATION EVALUATION			
1. Striped bass hatchery evaluation project. (2004-010)	CWT creel censusing of hatchery-reared striped bass released into the Bay-Delta to partially mitigate for water project entrainment losses. Element results will be used to evaluate the success of these mitigation efforts. (P. Coulston, DFG)	Ongoing	\$348
2. Napa River/Napa Creek fisheries monitoring plan. (2004-105)	The U.S. Army Corps of Engineers has started its Napa River/Napa Creek Flood Control Project. This project entails the restoration of several areas. The Biological Opinion for the project requires monitoring and the Corps have prepared a monitoring program. The Corps will have IEP review the monitoring plan and any reports issued as part of the Project. (M. Dietl, USACE)	Ongoing	\$220
			\$ 568

PROGRAM ELEMENT	ELEMENT DESCRIPTION	TYPE	COST
J. IEP FUNCTIONS			
1. Data Management and Utilization. (2004-016)	Management and dissemination of data and information generated by IEP and CVPIA-CAMP monitoring and special study activities. (K. Jacobs, DWR and C. Armor, DFG)	Ongoing	\$558
2. Science Advisory Group Support. (2004-017)	Funding to support the program review activities of the 8 members of the IEP Science Advisory Group. (C. Armor, DFG)	Ongoing	\$35
	Total IEP Functions		\$ 593
	TOTAL SPECIAL STUDIES		\$6,722
	TOTAL MONITORING AND SPECIAL STUDIES		\$14,106

III. Program Management

III. PROGRAM MANAGEMENT			
Dept. of Fish and Game	For all agencies Program Management refers primarily to management and oversight activities, such as performance of Coordinator and Management Team responsibilities.	Ongoing	\$436
Dept. of Water Resources			\$54
Water Resources Control Board			\$10
U.S. Bureau of Reclamation			\$336
U.S. Fish and Wildlife Service			\$238
U.S. Geological Survey			\$15
U.S. Environmental Agency			\$40
National Marine Fisheries Service			\$5
U.S. Army Corps of Engineers			\$16
TOTAL PROGRAM MANAGEMENT			\$1,150
OVERALL 2003 PROGRAM TOTAL			\$15,256

Notes:

^a = funding from DWR Planning

^b = funding from DWR Operations

^c = funding from Suisun Marsh group (60% DWR and 40% USBR)

^d = funding from USBR Tracy Operations