

# Chapter 1. INTRODUCTION

## BACKGROUND

**CALFED mission and principles.** The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The CALFED Mission Statement is supported by a set of **Primary Objectives** and **Solution Principles**, as cited in the Executive Summary of the CALFED Bay-Delta Program Programmatic EIS/EIR, March 1998.

The **Primary Objectives** are:

- Water Quality – Provide good water quality for all beneficial uses.
- Ecosystem Quality – Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species.
- Water Supply – Reduce the mismatch between Bay-Delta water supplies and the current and projected beneficial uses dependent on the Bay-Delta system.
- Vulnerability of Delta Functions – Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.

The **Solution Principles** are to:

- reduce conflicts in the system,
- be equitable,
- be affordable,
- be durable,
- be implementable, and
- have no significant redirected impacts.

To fulfill its mission, the CALFED Bay-Delta program is proposing substantial changes to

many aspects of the Bay-Delta/Central Valley environmental and water-management system. In addition, many member agencies of CALFED are currently charged with activities and programs directly affecting this system.

**Mandate for CMARP.** In November 1997, the Secretary of the U.S. Department of the Interior, Bruce Babbitt, requested that U.S. Geological Survey (USGS) assist him in meeting a Congressional mandate to monitor the success of CALFED restoration efforts. Also during November, a proposal to develop a monitoring and research program for CALFED was sent to the CALFED Policy Group by the Interagency Ecological Program (IEP) and the San Francisco Estuary Institute (SFEI), USGS presented its proposal (USGS, 1998) to the CALFED Policy Group on December 19, 1997. On that day, the Policy Group directed IEP, SFEI, and USGS to develop a joint proposal to design a Comprehensive Monitoring, Assessment, and Research Program (CMARP) for CALFED.

A steering committee was formed by IEP, SFEI, and USGS to prepare a joint proposal. The CMARP Stage I Report, April 24, 1998 (Appendix I), was reviewed by agencies and stakeholders and presented to the Policy Group on May 1, 1998. The Policy Group accepted the proposal, provided \$1.8 million to finance the effort, and directed that the work be completed by the end of January 1999.

The CMARP Stage I report proposed development of a monitoring, assessment, and research program for CALFED programs and related agency programs. It called for an expanded steering committee to be composed of agency personnel and stakeholders (listed in Stage I report, Appendix I), and the performance of five tasks (Table 1-1).

Table 1-1. CMARP Steering Committee Tasks

- **TASK NUMBER ONE – Refine the Goals, Objectives and Needs of CALFED Programs and Agency Major Program Goals and Objectives** – Maintain a continuing and iterative process to:
  - A. Identify goals, objectives, and needs of CALFED Programs (Ecosystem Restoration, Water Quality, Water Transfers, Water Use Efficiency, Watershed Management Coordination and Delta Levees System Integrity) and related programs (Category III, Conservation Strategy, and Indicators);
  - B. Compile Agency major program goals and objectives;
  - C. Develop CMARP monitoring elements and a research program based on identified goals and objectives.
  
- **TASK NUMBER TWO – Develop a Conceptual Framework for the CMARP Program** - Develop explicit conceptual models for use in designing monitoring and research programs, and for documenting the basis of earlier decisions on program design. This task is being accomplished, in part, by taking advantage of experience gained in the development of monitoring and research programs in Puget Sound, Chesapeake Bay, and South Florida.
  
- **TASK NUMBER THREE – Design a Monitoring Program** – Carry out five sub-tasks to:
  - A. Inventory Existing Monitoring Programs;
  - B. Develop Monitoring Elements;
  - C. Develop a Process for Data Management;
  - D. Develop a Process for Data Analysis and Monitoring;
  - E. Institute a Category III Monitoring Process.
  
- **TASK NUMBER FOUR – Develop a CALFED Focused Research Program**- Define a process to identify and conduct research that is focused on addressing critical uncertainties about causes of ecosystem variability, change, and long-term trends.
  
- **TASK NUMBER FIVE – Recommend an Institutional Structure for CMARP** - Identify functions of a CMARP institutional structure and its relationship to CALFED. Recommend how it should operate, how it should be funded, and to whom it should be accountable.

**PURPOSE OF CMARP**

**Monitoring, assessment, and research** are three parts of an interactive process to understand and manage a natural resource system (figure 1-1).

**Monitoring** involves measuring and sampling physical, chemical, and biological attributes of the resources and social and

economic attributes of associated human activities.

**Assessment** involves organizing and evaluating incoming information from monitoring and research activities, for example examining correlations between the abundance of a fish species and a physical factor, such as river flow, that might affect abundance.

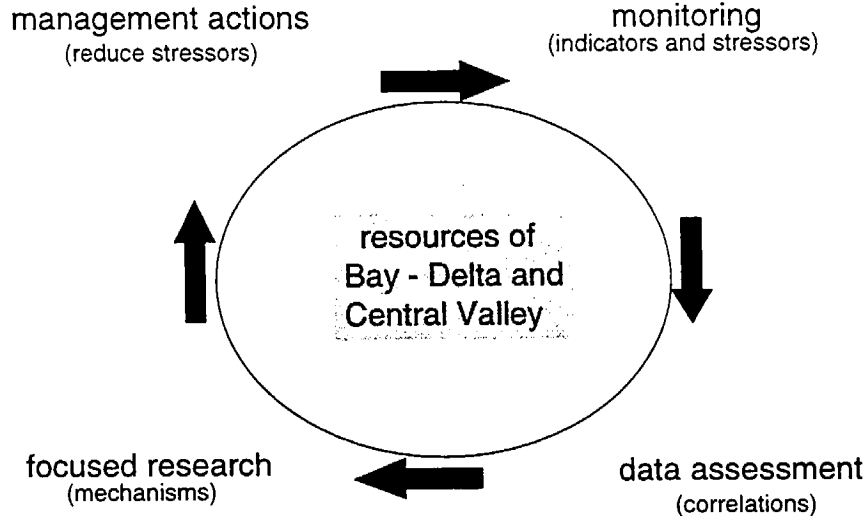


Figure 1-1. Elements of understanding and managing the natural resources of the Bay-Delta and Central Valley.

**Research** involves analysis or experiments to elucidate mechanisms that explain observed correlations, such as documenting fish distributions and mortalities for different flows.

The information generated from monitoring, assessment, and research provides resource managers with understanding needed to design actions, to detect responses to their actions, and to provide the public with information about the success of these actions.

CALFED needs a monitoring and research program for at least four reasons:

1. CALFED needs monitoring data and information to assess baseline conditions, resolve questions regarding the preferred alternative, and to carry out its related programs in the context of an adaptive management strategy.
2. CALFED needs to satisfy the Congressional mandate for indicators and performance measures with which

to judge the success of restoration efforts.

3. CALFED needs data and information with which to assure stakeholders that the actions being taken are having desired results.
4. CALFED needs to reduce the scientific uncertainty associated with the management and protection of valued natural resources.

*Thus, the purpose of CMARP is to provide those new facts and scientific interpretations necessary for CALFED to implement fully its preferred alternative and related programs and for the public and government to evaluate the success of CALFED actions.*

## SCOPE OF CMARP

**Challenges** – In developing the scope of CMARP, the Steering Committee recognized that the CALFED programs and the preferred alternative were not yet

completely defined. Moreover, no comprehensive list of ongoing monitoring programs existed. Therefore, for most issues, the Steering Committee relied on information available during late summer/early fall, 1998, and incorporated the objectives of existing monitoring programs into the development of a comprehensive monitoring and assessment program.

Because of the broad geographic range and scientific scope of the required program, the CMARP Steering Committee recognized the necessity of subdividing the task of developing monitoring and research strategies into manageable components. Thus, numerous smaller committees (work teams) were needed to review existing information in specific subject matter areas and to prepare recommendations.

**Organization** – The CMARP organizational structure (Appendix III) was developed to maximize the flow of information and interaction between the Steering Committee, agency staff, stakeholder groups, and program managers for the CALFED programs. Thirty technical work teams developed recommendations for research and monitoring, the basis of which were the CALFED programs and tasks to be completed by the CMARP (Appendix VII). About 250 individuals representing stakeholder groups, agency staff, CALFED staff, CALFED program managers, and other area scientists, served on these work teams (Appendix III). Representatives from major monitoring programs (Sacramento River Watershed Program, San Francisco Estuary Institute Regional Monitoring Program, DWR's Municipal Water Quality Investigations Unit, Interagency Ecological Program, CVPIA Comprehensive Assessment and Monitoring Program, USGS National Water Quality Assessment Program, and similar organizations) ensured that the CMARP will utilize existing monitoring programs and incorporate specific agency and stakeholder needs.

In seeking advice on the creation and refinement of the CMARP design, the Steering Committee worked with the Green Mountain Institute for Environmental Democracy (GMI) to gather details about institutional structures, decision-making processes, and monitoring and research programs in twelve large, ecosystem-level management projects across the United States. This information was gathered through interviews with key individuals and from program documents of Chesapeake Bay, South Florida/Everglades, Puget Sound, the Southern Appalachian Assessment, the Mid-Atlantic Integrated Assessment, the Interior Columbia Basin Ecosystem Management Project, Great Lakes, Gulf of Mexico, Prince William Sound, Gulf of Maine, the Forest Ecosystem Assessment, and the Greater Yellowstone Ecosystem. Additionally, the regional monitoring program of the Southern California Coastal Waters Project was reviewed. GMI is compiling the information into a summary of the key findings that will be available as an appendix VII.I.1 to this report. Meanwhile, the information from the interviews was used in the development of recommendations contained in the Institutional Structure and Data Management, Assessment, and Reporting Chapters and Appendices (Chapters 5 and 6, Appendix VII.H).

**Geography**—The geographic scope of the CMARP is determined by attributes of the chemical, biological, and physical environment associated with implementation of CALFED Stage 1 actions. For example, monitoring of chinook salmon necessitates some form of sampling from the headwaters, down the rivers, through the Bay/Delta and into the ocean. Conceptual models of the life histories of salmon were used to determine the specific variables that will be monitored and to identify when and where monitoring should occur. Monitoring associated with other program elements, such as water transfers, will also have wide geographic scope.

**Monitoring Objectives**—Principal CMARP monitoring objectives include:

- documenting conditions,
- recognizing trends,
- assessing causes of observed changes,
- partnering with agency/ecosystem management for adaptive management, and
- reducing scientific uncertainties.

CALFED will need to assure the regulatory community and stakeholders that certain actions specific to project development are carried out. Examples include implementing mitigation measures that address project impacts and complying with standards and objectives required as permit conditions to construct and operate projects. Terms of the National Resource Council (NRC) (1990) are used, with definitions slightly modified for the CALFED program. Different types of monitoring will be implemented to address these objectives:

Compliance/Mitigation Monitoring – Determines whether and to what degree specified objectives, standards or mitigation measures are being met. A permitting authority usually requires this type of monitoring as a result of project development and operation.

Model Verification or Validation Monitoring – Determines whether and to what degree a specified practice has achieved its immediate objectives. (Did the project do what it was supposed to do?) Monitoring is used to validate hypotheses and conceptual models that predict relationships among variables. It validates theories on the effectiveness of certain actions in the context of adaptive management.

Trend Monitoring – Provides consistent data through time for evaluating, identifying, and quantifying longer-term changes in key indicators or conditions (including physical, chemical, and biological variables such as fish populations, streamflow, temperature,

salinity, area of habitat restored) that are most likely associated with changes in key conditions and/or human activities. Trend monitoring addresses the questions “what”, “when” and to some extent, “why” things have changed.

Operations Monitoring – Supports specified project operations. Although not mentioned by the NRC, Operations Monitoring is useful in San Francisco Bay-Delta. It is intended to provide up-to-date (within 24 to 48 hours) information to managers and operators on effects of project operations for specified environmental variables, or provide specified environmental information to determine how projects should operate. This monitoring is a tool that allows for flexibility in project operations. Examples include real-time fishery and water-quality monitoring.

These monitoring types are not mutually exclusive and some are interdependent. They require coordinated and integrated data-collection efforts. The objectives and plans of each monitoring program will be clearly specified, and the overlaps in data needs among programs will be identified and eliminated, where possible, to achieve cost savings.

## APPROACH TO DESIGN

**Principles** – Prior to developing the monitoring and research recommendations, members of the Steering Committee, agency staff, and CALFED staff agreed to several principles that formed the basis for the CMARP tasks and provided the direction necessary for completing the work products. The principles are:

- Recommendations for monitoring and research are based, in part, upon development of conceptual models that incorporate current thinking about how the physical, chemical, and biological systems are structured and how they function (see Chapter 3).
- CMARP is to be built upon coordination and integration, where feasible, of

existing monitoring programs, resulting in reduced capital and operation costs (see Chapters 2 and 4).

- Emphasis of CMARP will be on data evaluation and use. Evaluative reports, subject to peer review, will be published on a regular basis (see Chapter 5).
- CMARP is to be fully coordinated with similar assessment activities of other local, State, Federal, and regional organizations. Through the active cooperation and participation of all organizations, duplication of effort will be minimized (see Chapter 5).
- Through a quality-assurance and quality-control program, CMARP will encourage standardization of sampling equipment, sampling methodologies and analytical methodologies.
- CMARP's data-management structure will ensure that the data collected are available to public agencies and the public on a timely basis (see Chapter 5).

#### **Development of Recommendations—**

Initial activities to develop monitoring and research recommendations began with a review of the established CALFED goals and objectives for all programs, including the Conservation Strategy and Category III elements. Participants worked with agency staff and stakeholders to identify CALFED agency goals and objectives for existing monitoring and research programs. However, because of the short time frame for the development of this report, the details on which particular element should be monitored and how (e.g., gear type/methodology), and who will do the monitoring, were postponed pending approval to work on implementation of specific CMARP elements.

### **PURPOSES OF THE REPORT**

This report describes the initial design of the monitoring, assessment, and research program, and proposes early implementation tasks and additional

program refinement prior to a Record of Decision on CALFED's programmatic environmental impact report. In addition, a number of specific issues presently important to CALFED and its stakeholders are addressed. These include:

**A need for indicators** (see Chapter 5) – In addition to the congressional mandate to develop indicators of ecosystem health, a need exists to agree on water supply, water quality, and levee-reliability indicators, and perhaps to agree on social and economic indicators of associated human activities. The development and use of indicator values in turn need to be conducted in an unbiased and clearly defined way, based on sound monitoring and research data, and provided to the public in a timely fashion.

**Adaptive management** (see Chapter 3) – Recognizing the level of uncertainty about the resources, CALFED proposes to use an adaptive approach to managing the natural resources. Adaptive management involves designing and executing actions, monitoring and assessing the responses of the natural resources to these actions, and thereby learning how actions affect the resources. At issue is the type of adaptive management to be employed - traditional passive adaptive management or a more active adaptive management recommended by the ERP Strategic Plan (1998). Appropriate and timely assessment of monitoring and research data is critical to effective adaptive management.

**Questions raised by Diversion Effects on Fish Team (DEFT)** (see Chapter 7) – Information and assumptions about the effects of delta exports and diversions on the abundance and distribution of fish species, particularly threatened species, are the foundation of biological opinions that constrain operation of the Central Valley and State Water Projects to deliver water south of the delta. The Diversion Effects on Fish Team (DEFT) has assessed available information to recommend how to use flexible operations of the water projects to

improve the welfare of salmon, delta smelt, and striped bass in the delta. DEFT recognized the need for improved information to help refine and judge the efficacy of its recommendations during Stage I of CALFED program implementation.

**Drinking-water quality of exports and diversions** (see Chapter 7) – As drinking-water regulations for disinfection by-products are revised and water-treatment technology evolves, and as more blending and recycling of delta water are needed to meet increasing municipal water demands, an increasing need exists to reduce concentrations of bromides, organic carbon, and dissolved salts in delta exports and diversions. CALFED has recognized the need to investigate and implement measures to effect these reductions during Stage I, and these activities will need strong monitoring and research support.

**Implementing CMARP** – An underlying issue for CALFED and CMARP is what organization or organizations will implement the monitoring, assessment, and research programs. This issue is particularly important because of the expressed intent to use an adaptive management approach to implement the CALFED programs. As the debate continues, necessary ingredients for a CMARP organizational structure need to be defined.

## **TOPICS COVERED IN THIS REPORT**

The following chapters contain discussions and summaries of key topics relevant to the implementation of CMARP:

**Chapter 2** – refinement of goals and objectives and inventory of existing monitoring programs.

**Chapter 3** – development and use of conceptual models in CMARP.

**Chapter 4** – recommended monitoring and research programs and proposed indicators

for all of the CALFED programs, including DEFT-related work in the ecosystem restoration section and drinking water-related work in the water quality section. More detailed descriptions of the design work are presented in the numerous appendices to this document.

**Chapter 5** – a data assessment and reporting process to provide information derived from the monitoring data to decision makers, resource managers, and the public.

**Chapter 6** – organizational ingredients needed to implement CMARP.

**Chapter 7** – proposed interim-implementation tasks (including DEFT and drinking-water-related tasks), program refinements during 1999, clarification of active adaptive management issues, and suggestions regarding potential costs and financing mechanisms for CMARP.