Comprehensive Monitoring and Assessment Strategy
to Protect and Restore California's Water Quality

SWAMP
Surface Water Ambient Monitoring Program

October 2005

California Water Boards
State Water Resources Control Board
and Regional Water Quality Control Boards

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Acknowledgements

Coordination and collaboration promote consistency and minimize duplication of effort. In that spirit, this document borrows liberally from the work of others. Most of the elements of SWAMP have been patterned after successful efforts that individual regions, other agencies, and other states are implementing. The result is a stronger, more cost effective program in terms of design and implementation. In particular, Terry Fleming at the U. S. Environmental Protection Agency, Region 9, the members of the SWAMP Roundtable, and the National Water Quality Monitoring Council have influenced the development of this document.

This document incorporates and builds on two previous reports on SWAMP that were submitted to the California Legislature in January and November 2000.

Preface

Water is California's most precious resource. It provides an essential lifeline between agriculture, industry, the environment, and urban and rural interests throughout the state. With a growing population of more than 35 million and a limited supply of fresh water, the protection of water for beneficial uses is of paramount concern for all Californians. The State Water Resources Control Board (The State Water Board) and the Regional Water Quality Control Boards (Regional Water Boards) are responsible for protecting California's water resources (The State Water Board Strategic Plan, November 2001). The 2002 Strategic Plan contains the Water Board's approach to water quality protection. The Surface Water Ambient Monitoring Program (SWAMP) operates within the context of the following overarching elements of The Water Board's Strategic Plan.

Our vision is a sustainable California made possible by clean water and water availability for both human uses and environmental resource protection.

Our mission is to preserve, enhance, and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations.

Our operating principles clarify how we intend to interact with internal and external stakeholders, defining our roles and responsibilities and approaches to decision-making. These operating principles address several areas that we aim to strengthen to improve our effectiveness.

SWAMP's Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality (the Strategy) incorporates the following principles from The State Water Board Strategic Plan where appropriate:

- The State and Regional Water Boards (Water Boards) will seek consistent approaches to policy and Program implementation, recognizing the distinct obligations, issues, and authorities of each Water Board.
- The Water Boards will enforce water laws and regulations in a consistent, predictable, fair, and equitable manner.
- The Water Boards will collaborate with agencies and other key stakeholders to effectively address issues.
- The Water Boards will provide education and outreach opportunities so that Californians understand their responsibilities and abilities to protect water quality.
- The Water Boards will take a watershed approach to decision-making and program development.
- The Water Boards will make timely decisions based on:
  - Input from fair and open public processes.
  - Consideration of a decision's impact on stakeholders and the environment.
  - Best available scientific and technical data.
  - Best judgment.
  - Clear findings and conclusions based on a developed record.
- The Water Boards will utilize technology to increase the efficiency and effectiveness of limited resources.
- The Water Boards will provide staff with clearly defined and prioritized expectations.

The Water Boards strategic plan contains six broad goals.

- The Water Boards' organizations are effective, innovative and responsive.
- Surface waters are safe for drinking, fishing, swimming, and support healthy ecosystems and other beneficial uses.
- Groundwater is safe for drinking and other beneficial uses.
- Water resources are fairly and equitably used and allocated consistent with public trust.
- Individuals and other stakeholders support our efforts and understand their role in contributing to water quality.
- Water quality is comprehensively measured to evaluate protection and restoration efforts.

The first and second goals require monitoring and assessment. Monitoring and assessment efforts by the Groundwater Ambient Monitoring and Assessment Program support the third goal. Information from monitoring and assessment programs support goals four and five. The sixth goal focuses on developing and implementing the monitoring and assessment framework needed to evaluate the California Water Boards' progress in meeting these goals. The Strategic Plan states that we will achieve the sixth goal by pursuing the following measurable objectives:

- Increase the amount of useable, quantitative data and information regarding water quality.
- Translate quantitative data into useful information regarding the status of water quality.
- Coordinate the collection and reporting of water quality information among programs, agencies and stakeholders.

To assess and report on our progress toward improving and restoring California's water resources, SWAMP must have the appropriate systems in place. At this time, we do not have enough monitoring resources to effectively evaluate the state's water quality. SWAMP will work with stakeholders to identify and implement additional monitoring resources. We will use measures to determine the effectiveness of our program activities and make modifications to improve that effectiveness. We will also work closely with stakeholders to develop and implement the most effective measurement and reporting tools so that we can communicate a consistent message regarding California's water quality. This effort includes our participation in the California Environmental Protection Agency's Environmental Protection Indicators of California (EPIC) project. Future updates of the Strategic Plan will incorporate several indicators, which will be an integral part of our measurement processes.

Further, the Strategic Plan proposes that developing the systems and processes to measure and demonstrate quantitative improvements in, and maintenance of, water quality will achieve these goals. A second emphasis is improving intra-agency, inter-agency, and stakeholder coordination of programs and data sharing. All of these concepts have been incorporated into SWAMP's Strategy described in this document.

Executive Summary

Adequate and accurate monitoring and assessment are the cornerstones to preserving, enhancing, and restoring water quality. The information gathered from monitoring activities is critical to protect the beneficial uses of water, develop water quality standards, conduct federal Clean Water Act assessments, and to determine the effects of pollution and of pollution prevention programs.

The federal Clean Water Act gives states and territories the primary responsibility for implementing programs to protect and restore water quality. In its Section 106(e)(1), the Clean Water Act requires the U. S. Environmental Protection Agency (USEPA) to determine that a state is monitoring the quality of navigable waters and compiling and analyzing data on water quality. In fact, before USEPA will award Section 106 grant funds, states must report their monitoring and assessment activities and submit that information in their obligatory Section 305(b) reports.

To meet those Clean Water Act requirements and provide comprehensive information on the status of beneficial uses of California's surface waters, The State Water Resources Control Board and the Water Boards introduced SWAMP in 2001.

To meet Clean Water Act objectives, SWAMP should answer the following questions:

- What is the overall quality of California's surface waters?
- To what extent is surface water quality changing over time?
- What are the problem areas and areas needing protection?
- What level of protection is needed?
- How effective are clean water projects and programs?

But SWAMP was envisioned to do more than simply fulfill statutory obligations. The program was designed to stretch beyond those federal requirements and coordinate a statewide framework of high quality, consistent, and scientifically defensible methods and strategies to improve the monitoring, assessment, and reporting of California's water quality.

The Strategy presents SWAMP's vision to fulfill California's Clean Water Act responsibilities and our "blueprint" for improving our monitoring, assessment and reporting activities to generate a statewide commitment to achieving better water quality through better monitoring and assessment.

Elements of a State Water Monitoring and Assessment Program

1. Monitoring Program Strategy
2. Monitoring Objectives
3. Monitoring Design
4. Core Indicators of Water Quality
5. Quality Assurance
6. Data Management
7. Data Analysis/Assessment
8. Reporting
9. Programmatic Evaluation
10. General Support and Infrastructure

To help states fulfill their federal requirements, USEPA produced Elements of a State Water Monitoring and Assessment Program (U. S. Environmental Protection Agency, 2003), which identifies the 10 basic elements of a state water quality monitoring program. The USEPA document referred to as USEPA "Elements" serves as a tool to help USEPA and the individual states determine whether a monitoring program meets the prerequisites of Clean Water Act Section 106 (e)(1). This Strategy outlines SWAMP's activities in each of the 10 basic USEPA elements. In each area, we first report the current status of our program relative to Clean Water Act statutory requirements. We then discuss our activities and plans to protect and restore California's water quality, emphasizing those actions SWAMP must take to have a technically defensible program.

Full implementation of our Strategy will take 10 years, as suggested by USEPA, and will require significant additional resources.

Appendix A of this Strategy paper includes USEPA's evaluation criteria for a state's monitoring and assessment program, as well as SWAMP's "self appraisal" of our program's current status and our ability to make progress on implementation.

Meeting And Exceeding The 10 Required Elements For A Successful Program

1. Strategy

SWAMP's vision is that water quality is comprehensively[1] measured to protect beneficial uses and that our protection and restoration efforts are adequately evaluated. This will require a comprehensive SWAMP strategy to meet the water quality management needs of the California Water Boards and address all California surface waters, including streams, rivers, lakes, reservoirs, estuaries, coastal areas and wetlands. This strategy document lays out a preliminary strategy to be further developed by the SWAMP Roundtable[2] . The SWAMP Strategy is a long-term plan, including a 10-year schedule for complete implementation. The Strategy is comprehensive in scope, covering monitoring objectives, monitoring design, water quality indicators, quality assurance, data management, data analysis/assessment, reporting, programmatic evaluation, general support, and infrastructure planning.

The existing SWAMP program being implemented by the Regional Water Boards consists of 12 separate programs focused on regional priorities but unified by a common set of field methods, quality assurance guidelines, and data management. Regional Water Board staff have been reluctant to develop a broader strategy because no resources have been identified for implementation. In fiscal year 2005-2006, the SWAMP Roundtable will refine the strategy outlined in this document as one of many steps to secure the additional resources that will enable comprehensive monitoring.

1. Comprehensive implies that all waterbody types are monitored to assess all applicable beneficial uses to meet all Clean Water Act monitoring objectives.
2. The SWAMP Roundtable is the coordinating entity for the program. Participants include staff from the State and Regional Water Boards, the Department of Fish and Game, the Marine Pollution Studies Laboratory,Moss Landing Marine Laboratories, contractors, and other interested entities.

2. Monitoring Objectives

Our vision is to define a complete set of monitoring objectives, based on beneficial use attainment and reflecting the full range of regulatory responsibilities and water quality programs for all water bodies. In November 2000, SWAMP identified monitoring objectives critical to the design of a monitoring program that is efficient and effective in generating data that serve management decision needs. Monitoring objectives include helping to establish water quality standards, determining water quality status and trends, identifying impaired waters, identifying causes and sources of water quality problems, implementing water quality management programs, and evaluating program effectiveness. Consistent with the Clean Water Act, monitoring objectives reflect the decision needs relevant to all types of state waters. The November 2000 Report to the Legislature[3] summarizes these objectives.

In fiscal year 2001-2002, resource imitations prompted the prioritization of program objectives. The SWAMP Roundtable prioritized regional objectives over statewide status and trend questions. Although focus is on beneficial use status, none of the regions is currently using the original objectives to drive the design of its monitoring programs, primarily because of a lack of sufficient resources to do so in a scientifically defensible manner. We do not have the resources to ask broad questions about beneficial use status across multiple types of water bodies. For example, instead of being able to ask (and answer) whether waters are "fishable," the best we can do is see whether any evidence exists that suggests waters are not "fishable. "The SWAMP Roundtable acknowledges that we are not monitoring in a way that allows us to meet the comprehensive objectives established in 2000. The Roundtable began to redefine short-term objectives during fiscal year 2001-2002. During fiscal year 2005-2006, the Roundtable will redefine short-term objectives based on available resources and will also prioritize long-term objectives coupled to appropriate monitoring designs for a comprehensive program.

3. Monitoring Design

Our vision is a monitoring design that maximizes our ability to meet our monitoring objectives with existing resources. The current design is limited to (1) a statewide status and trends monitoring program for wadeable streams and (2) site-specific watershed monitoring to identify and characterize water quality problems. The current approach balances two important monitoring needs of the California Water Boards and serves as a unifying framework for monitoring activities. It does not duplicate the monitoring efforts of other entities[4] . The current core program consists of watershed assessments designed and implemented by each Regional Water Board. The future SWAMP monitoring program will need to integrate several monitoring designs (for example, fixed station, intensive and screening-level monitoring, rotating basin, targeted and probability designs) to meet the full range of information and decision needs. The proposed SWAMP monitoring design also includes a probability-based network for making statistically valid inferences about the condition of all state water types over time. At this time, the only funded probability-based monitoring is the assessment of coastal waters and wadeable streams. The overall monitoring design also proposes the use of mathematical models to extend our assessment capabilities.

3. To view the Report to the Legislature, see www.waterWater Water Boards.ca.gov/legislative/docs/2000/Water Board_monitoring_rpt1100.pdf

4. There are several existing programs that conduct large scale assessments of other waterbody types, for example, the State Board's Groundwater Ambient Monitoring and Assessment Program, the Clean Beach Monitoring Program and Coastal EMAP. These programs provide answers to some of the SWAMP monitoring objectives.

4. Water Quality Indicators

Our vision is to develop a set of monitoring indicators and assessment thresholds (measurable standards that we must meet or exceed) that we can use to track the status and trends of water quality and to evaluate the effectiveness of management actions to improve water quality in the state. SWAMP currently uses core indicators that denote the health of different waterbody types and their associated beneficial uses. Core indicators for each type of waterbody include physical/habitat, chemical/toxicological, and biological/ecological endpoints as appropriate and can assess attainment with applicable water quality standards throughout the state. In addition, SWAMP uses supplemental indicators when we have reasonable expectations that a specific pollutant is present in a watershed, when core indicators suggest impairment, or to support a special study, such as screening for potential pollutants of concern.

In fiscal year 2006-2007, we plan to refine our core indicators to identify and develop those that accurately indicate water quality at the federal, state, watershed, and project (site-specific) scales of evaluation. In addition, we intend for those refined core indicators to better inform us of the relationship between water quality and the land use activity of the surrounding land and/or effects of landscape changes (for example, timber practices or landslides produced by rainstorms).

A long-term goal of SWAMP is the development of biocriteria to supplement our current chemical criteria to determine water quality. The development of monitoring designs to provide Environmental Protection Indicators for California data is also included in this section.

5. Quality Assurance

Our vision is to develop and implement a progressive quality assurance program using a systems-based approach to the generation and storage of application-appropriate data and metadata. The program will emphasize science-based decisions and flexibility to adapt when scientific needs and budgetary challenges demand change. We will evaluate new methods and quality assurance program changes with regard to SWAMP data quality objectives. The quality assurance program will solicit input from a variety of groups including other state programs, non-profit environmental organizations, and USEPA Region Nine.

The envisioned program will be flexible and well documented, and will include a "Quality Assurance Toolbox," a Web site and a quality assurance expert software system. To use resources most efficiently, SWAMP formed a quality assurance team lead by the SWAMP quality assurance officer. The quality assurance officer will develop, maintain and implement 12- and 18-month task plans that the SWAMP Roundtable and other user groups will assess. The quality assurance team consists of the quality assurance officer, a quality assurance coordinator, and several quality assurance specialists. The quality assurance officer reports to the SWAMP program coordinator and The State Water Board quality assurance program manager.

SWAMP has a quality assurance management plan combined with a quality assurance program plan, both established in accordance with USEPA policy to ensure the scientific validity of monitoring and laboratory activities, and the fulfillment of state reporting requirements with credible and comparable data. The existing State Water Board quality assurance management plan must be updated to include the combined SWAMP quality assurance management plan/

quality assurance program plan. Implementation of both plans needs evaluation. SWAMP staff anticipate the update of both the State Water Board plan and our own quality assurance management plan/quality assurance program plan in fiscal year 2005-2006. The SWAMP quality assurance team will oversee revision of these documents, while the State Water Board quality assurance program manager is responsible for The State Water Board quality assurance management plan. In fiscal year 2005-2006, the SWAMP quality assurance program and its implementation will be evaluated as part of the Scientific Planning and Review Committee's external peer review of the entire SWAMP program.

6. Data Management

SWAMP's vision is to make credible ambient monitoring data available to all stakeholders in a timely manner. SWAMP is completing development of an accessible electronic data system for water quality, fish tissue, toxicity, sediment chemistry, microbiology, habitat, and biological data, with appropriate metadata (consistent with the recommendations of the National Water Quality Monitoring Council) and geo-locational standards. SWAMP and other program users receive database support and training to achieve data comparability among The State Water Board programs. Additionally, SWAMP will make its data available to the public through the California Environmental Data Exchange Network Web site maintained by the Department of Water Resources and Moss Landing Marine Laboratories. Beginning in fiscal year 2006-2007, the California Environmental Data Exchange Network will also upload SWAMP monitoring data into the USEPA's STORET and Exchange Network national systems. The long-term goal of the California Water Boards is to include SWAMP data in the California Integrated Water Quality System.

The State Water Board is currently storing assessment information for California Water Act Section 305(b) reports and 303(d) lists in its geospatial waterbody system (GeoWBS). GeoWBS is being incorporated into the California Integrated Water Quality System, with a functional target date for fiscal year 2006-2007. GeoWBS is based on the USEPA assessment database and defines the geographic location of assessment units using the National Hydrography Dataset. The database includes sufficient descriptive metadata for the data to be shared and compared among managers and the public.

7. Data Analysis/Assessment

Our vision is to provide a consistent defensible framework for the evaluation of monitoring data relative to state and regional standards, the protection of beneficial uses, and for tracking the effectiveness of management actions. Regional Water Board staff are responsible for preparation of technical reports that summarize the findings of their watershed assessments. The State Water Board staff is responsible for technical reports that summarize the findings of statewide assessments. This information is used in the preparation of California Water Act Section 305 (b) reports and 303(d) listings.

The State Water Board recently adopted a Water Quality Control Policy (2005) outlining how to assess attainment of water quality standards based on analysis of various types of data (chemical, physical and biological) from various sources, for all state waters. The Water Quality Control Policy establishes listing and delisting criteria for establishing the Section 303(d) list of Impaired Waters. It also contains criteria to assist in establishing priorities for developing total maximum daily loads, guidelines for acceptability of data, and other measures necessary to facilitate the completion of total maximum daily loads. An

assessment methodology is being developed for classifying beneficial use status for individual water bodies that will integrate with the new listing policy. Beginning in 2007, the new methodology will be used for generating California's Integrated Report to satisfy the requirements of both California Water Act Section 305(b) and 303(d).

8. Reporting

Our vision is to report all collected data as usable information, and in a timely and publicly accessible manner. A variety of reports are used to support SWAMP. The reports will be available to the public in paper and electronic form. The types of reports being produced include fact sheets, data reports, quality assurance reports, interpretative reports, and the 305(b)/303(d) Integrated Report. These reports provide an analysis and interpretation of the data collected. The technical reports have written descriptions of the study design, methods used, graphical, statistical, and textual descriptions of the data, and interpretation of the data including comparisons to relevant water quality goals. SWAMP reports will be available to all interested parties through The State Water Board's Web site (http://www. WaterBoards. ca. gov). SWAMP staff are summarizing technical reports in fact sheets that capture key findings in a more readable format.

The state needs to produce timely, complete, and technically valid water quality reports and lists called for under California Water Act Sections 305(b) and 303(d). The policy and the upgrade to GeoWBS should facilitate this. The state also must submit annual updates of water quality information. The annual uploading of monitoring data to the national STORET database and the USEPA's Exchange Network via the California Environmental Data Exchange Network CEDEN exchange network will satisfy this requirement.

9. Programmatic Evaluation

Our vision is to conduct periodic reviews of each aspect of the program to determine its scientific validity, whether the program is being implemented as designed and how well it serves the water quality decision needs of the state. The SWAMP Program, in consultation with its external Scientific Planning, and Review Committee (SPARC), will conduct external peer reviews of each element in this strategy every three to five years to determine how well the program serves its water quality decision needs. This will involve evaluating both the state and regional monitoring programs to determine how well each of the elements is being addressed and determining how to incorporate necessary changes and additions into future monitoring cycles. The SPARC will be comprised of independent scientific and technical experts including, but not limited to, representatives from federal and state agencies and academics with expertise in fields such as monitoring program management, monitoring design, ecology, chemistry, quality assurance, pathogens, toxicology, and statistics. The next SPARC review is planned for fiscal year 2005-2006.

Regional Water Boards have obtained technical input and review of their programs in a variety of ways including the formation of technical advisory committees and external peer reviews. However, this input has been optional and uncoordinated at the program level. Beginning in fiscal year 2005-2006, external peer review will be incorporated into the preparation of monitoring plans and technical reports. These reviews will be coordinated through the State Water Board.

10. General Support and Infrastructure

Our vision is to provide the support needed to implement a coordinated and comprehensive monitoring and assessment program. Accomplishing this will require significant additional resources, first identified in November 2000. SWAMP intends to update this resource assessment to describe the funding and staff needed to implement the proposed strategy. In addition to quantifying staff and contract resources, SWAMP staff will describe other requirements including training, laboratory resources, and infrastructure needs. This will be completed during fiscal year 2006-2007.

Core Implementation Tactics

The Strategy envisions four overarching tactics to promote an efficient increase in the amount of usable water quality information that is available:

- Improve and strengthen SWAMP so that all State Water Board programs generate scientifically defensible, comparable, and comprehensive information by using a monitoring framework and data standards consistent with the guidance developed by the National Water Quality Monitoring Council.
- Develop and promote the use of multiple monitoring tools, such as statistically based surveys, judgmental surveys, predictive modeling, risk assessments, expert systems, and newer information and monitoring technologies.
- Continue working with monitoring programs currently coordinated through the California Environmental Data Exchange Network and hosted by the Department of Water Resources to increase data comparability, increase the potential for true collaboration with other entities collecting ambient water quality information, and make data available to the public.
- Build stronger partnerships with agencies, watershed groups, volunteer monitors, and others to facilitate the sharing of information, the collection of comparable data, and the use of monitoring tools. This includes working closely with the newly-formed Nonpoint Source Tracking and Monitoring Council.

Current Funding Status

SWAMP was originally envisioned to provide information for all the California Water Boards' decision-making needs. It was estimated that the program would cost between $59 and $115 million per year and include 87 to 132 staff positions. The current program is funded at $3. 4 million and 17 staff positions or approximately 7 percent of what is needed. Implementation of most of the strategy described in this document remains unfunded.

List of Acronyms

BMP	Best Management Practices
CEDEN	California Environmental Data Exchange Network
CERES	California Environmental Resource Evaluation System
CIWQS	California Integrated Water Quality System
CMAP	California Monitoring and Assessment Program
CRAM	California Rapid Assessment Methodology
CWA	Clean Water Act
DQIs	Data Quality Indicators
DQO	Data Quality Objective
EDF	Electronic Data Formats
EEDC	Estrogenic Endocrine Disrupting Chemicals
EIEN	Environmental Information Exchange Network
EMAPWest	Environmental Monitoring and Assessment Program Western Pilot
EPIC	Environmental Protection Indicators for California
ESMR	Electronic Self-Monitoring Reporting
GAMA	Groundwater Ambient Monitoring and Assessment
GeoWBS	Geospatial Waterbody System
IBI	Indices of Biological Integrity
ITFM	Intergovernmental Task Force on Monitoring
LUFT	Leaking Underground Fuel Tank
MCL	Maximum Contaminant Level
MLML	Moss Landing Marine Laboratories
MQO	Measurement Quality Objective
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source
NWQMC	National Water Quality Monitoring Council
PDA	Personal Digital Assistant
PAG	Public Advisory Group
QA	Quality Assurance
QAPP	Quality Assurance Program/project Plan
QC	Quality Control
QMP	Quality Management Plan
SCCWRP	Southern California Coastal Water Research Project
SDTP	Standardized Data Transfer Protocols
SFEI	San Francisco Estuary Institute
SMW	State Mussel Watch
SOPs	Standard Operating Procedures
SPARC	Scientific Planning and Review Committee
SDTP	Standardized Data Transfer Protocols
SWAMP	Surface Water Ambient Monitoring Program
SWIM	System for Water Information Management
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
TSMP	Toxic Substances Monitoring Program
USEPA	U. S. Environmental Protection Agency, Region 9
VOC	Volatile Organic Compound
WDPF	Waste Discharge Permit Fees
WDR	Waste Discharge Requirements

1. Strategy

Key Components and Essential Attributes

SWAMP's vision is that water quality is comprehensively measured to protect beneficial uses, and to evaluate our protection and restoration efforts. This requires a comprehensive strategy that serves all water quality management needs and addresses all state waters, including all waterbody types such as streams, rivers, lakes, reservoirs, estuaries, coastal areas, and wetlands. The Strategy is a long-term implementation plan and includes a 10-year timeline. It is built on the three existing efforts that include commitments made by the California Water Boards. These include the Water Board's 2002 Strategic Plan, the 2003 Partnership Agreement with USEPA, and the Governor's Action Plan for the Environment. The monitoring strategy must therefore provide for the infrastructure and design of a monitoring framework that can be used to help assess and track The State Water Board's efforts. The EPIC effort will be one of the tools used to evaluate the California Water Board's progress towards meeting these commitments. Additional indicators will be used as appropriate.

What constitutes a comprehensive ambient monitoring program?

Virtually every comprehensive assessment of environmental protection has acknowledged the need for a more coherent and comprehensive understanding of the state of the environment. To do this, monitoring programs should be built around several key attributes.

The key attributes are:

- Adaptability
- Coordination
- Clear objectives
- Use of available information
- Scientifically sound monitoring design
- Meaningful indicators
- Comparable methods of sampling and analysis
- Data evaluation
- Data management
- Continual refinement
- Regular reporting

Goals and Objectives[5]

To ensure the comprehensive nature of the Strategy, in April 2004, the SWAMP Roundtable refined and endorsed 10 long-term vision statements to guide the implementation of each of the Strategy's 10 elements.

Our vision is:

- That water quality is comprehensively measured to protect beneficial uses, and to evaluate our protection and restoration efforts.
- To define a complete set of monitoring objectives, based on beneficial use attainment and reflecting the full range of regulatory responsibilities and water quality programs for all waterbody types.
- To develop and implement a monitoring design that maximizes our ability to meet our monitoring objectives with existing resources.
- To develop and implement a set of monitoring indicators (and

5. Consistent with the State Water Board's Strategic Plan (November 2001), a goal is the desired end result which: a) addresses the key strategic issues; b) identifies what we want to achieve; c) provides a framework for more detailed, tactical planning; and d) will remain the same for three to five years. An objective is a specific, measurable target for accomplishing a goal which: a) describes a specific accomplishment (versus the way to accomplish a goal); b) focuses on a result to be achieved; and c) will be accomplished within one to three years.

assessment thresholds), which can be used to track the status and trends of water quality and to evaluate the effectiveness of management actions to improve water quality in California.

- To develop and implement a progressive quality assurance program using a systems-based approach to the generation and storage of application-appropriate data and metadata.
- To make credible ambient monitoring data available to all stakeholders in a timely manner.
- To provide a consistent science-based framework for the evaluation of monitoring data relative to state and regional standards and the protection of beneficial uses and for tracking the effectiveness of management actions.
- To report all collected data as information, and in a timely and publicly accessible manner.
- To conduct periodic reviews of each aspect of the program to determine its scientific validity and how well it serves the water quality decision needs of the state.
- To provide the support needed to implement a coordinated and comprehensive monitoring and assessment program.

Specific goals and objectives for implementing the strategy will be identified in the appropriate sections. A summary of the current SWAMP goals and objectives is in Appendix B.

Goal: Develop SWAMP monitoring strategy for developing and implementing an integrated comprehensive statewide monitoring program in 10 years.

- Prepare Strategy.

Goal: Implement SWAMP monitoring strategy.

- Develop annual workplan(s)
- Develop 3-year workplan
- Develop and implement process for periodic evaluations and updates

Goal: Promote coordination of monitoring activities and comparability of data.

- Continue monthly meetings of SWAMP Roundtable
- Establish a stakeholder group to provide guidance to Roundtable
- Actively participate in the NPS Tracking and Monitoring Council
- Engage the regulated community to maximize the National Pollution Discharge Elimination System (NPDES) and Waste Discharge Requirements (WDR) monitoring comparability with SWAMP
- Include volunteer monitoring and the Clean Water Team[6] in SWAMP
- Continue participation in the National Water Quality Monitoring Council (NWQMC)
- Identify, develop and implement joint projects with partners
- Participate in Web-based applications for tracking monitoring entities
- Continue SWAMP component of Water Board Training Academy to include courses for all stakeholders and interested parties

6. If necessary, the Clean Water Team is responsible for assisting volunteer monitors to ensure their monitoring programs are comparable with SWAMP guidance.

Current Status

SWAMP monitoring and assessment activities have been ongoing at the regional level since fiscal year 2001-2002. Most Regions are implementing a targeted design that provides information on existing conditions in watershed assessment units. Ideally a Region would monitor 20 percent of its watersheds annually, rotating through all watersheds on a five-year cycle. The size and complexity of several Regions does not allow for all watersheds to be monitored on a five-year cycle.

The SWAMP Program was originally envisioned to provide information for all The State Water Board's decision-making needs. It was estimated that the program would cost between $59 and $115 million per year and include 87 to 132 staff positions (November 2000 Report to the Legislature). The current program is funded at $3. 4 million and includes 17 staff positions or approximately 7 percent of what is needed. With the existing budget, the program has focused on enhancement and coordination of existing monitoring efforts and the gradual development of the necessary "infrastructure" for a comprehensive and comparable monitoring program. We have emphasized the development of standardized field procedures, a strong Quality Assurance (QA) program and a fully functional database. SWAMP has balanced the rate of program development against the need for regional monitoring, and we anticipate that the systems necessary for generating comparable and publicly accessible information will be completed in fiscal year 2007-2008.

Implementation Priorities

The remaining sections of this Strategy paper cover implementation priorities for the next three years. Overarching tactics or activities that involve multiple strategy elements are summarized in a single section, following the 10 elements. Priorities include continued monitoring, refining the Strategy, conducting and responding to an external peer review, and assessing the data collected during the first five years of the program. SWAMP views the monitoring strategy as a living document that we will update and modify on an annual basis. The Strategy will serve as the framework for monitoring priorities at both the State and Regional Water Boards.

Figure 1. Percent of Water Bodies Supporting Aquatic Life

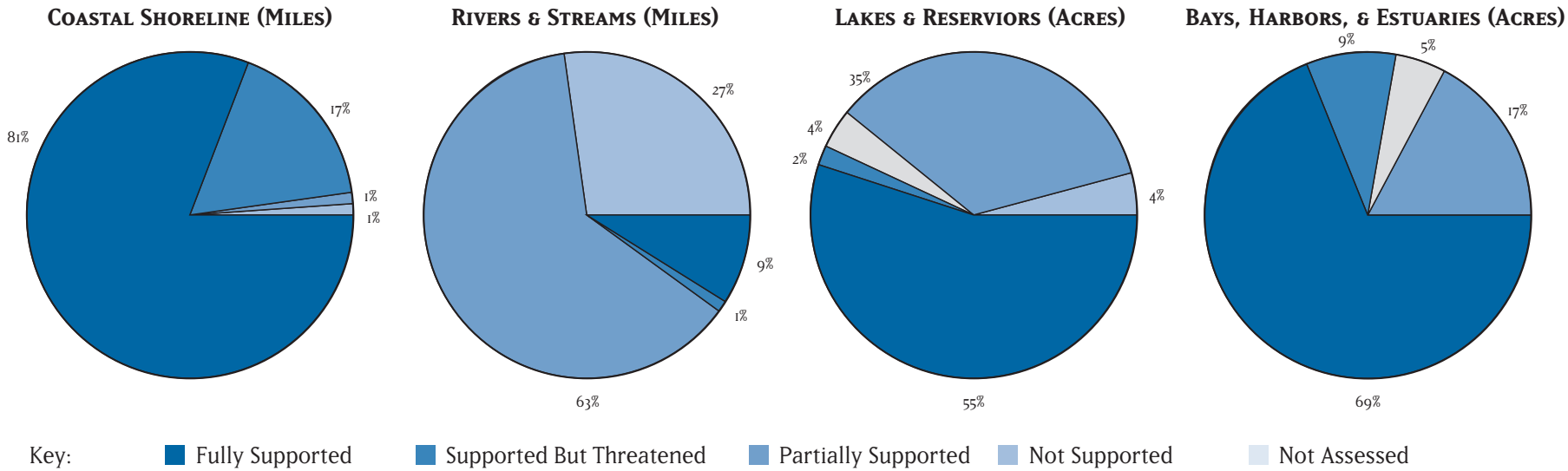
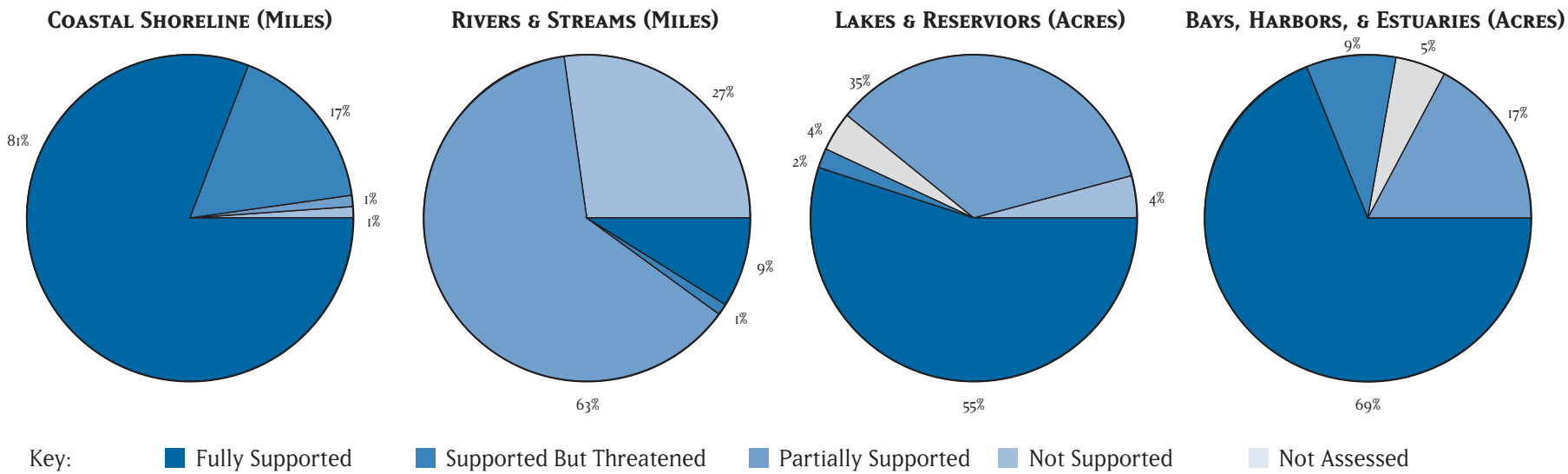


Figure 2. Percent of Water Bodies Supporting Swimming



2. Monitoring Objectives

Key Components and Essential Attributes

Our vision is to define a complete set of monitoring objectives, based on beneficial use attainment and reflecting the full range of regulatory responsibilities and water quality programs for all water bodies.

SWAMP has identified state and regional monitoring objectives critical to the design of a monitoring program that is efficient and effective in generating data that serve the California Water Boards' management decision needs. These objectives are the foundation of a monitoring program that reflects the full range of The State Water Board water quality management objectives including, but not limited to, Clean Water Act (CWA) goals. Consistent with the CWA, monitoring objectives reflect the decision needs relevant to all types of waters of the United States, including streams, rivers, lakes, reservoirs, estuaries, coastal areas, and wetlands.

Clean Water Act monitoring objectives include:

- Establishing, reviewing and revising water quality standards (Section 303[c]).
- Determining water quality standards attainment (Section 305[b]).
- Identifying impaired waters (Section 303[d]).
- Identifying causes and sources of water quality impairments (Sections 303[d], 305[b]).
- Supporting the implementation of water quality management programs (Sections 303, 314, 319, 402, and others).
- Supporting the evaluation of program effectiveness (Sections 303, 305, 402, 314, 319, and others).

Types and Extent of Water Bodies: California is a vast state with 158,700 square miles of surface area and a wide range of water bodies.

WATER BODY CLASSIFICATION	EXTENT
Total Miles of Rivers and Streams	211,513
• Perennial River Miles (Subset)	64,438
• Intermittent Stream Miles (Subset)	124,615
• Ditch and Canal Miles (Subset)	22,059
Number of Lakes/Reservoirs/Ponds	10,141
Acres of Lakes/Reservoirs/Ponds	1,672,684
Acres of Estuaries/Harbors/Bays	602,705
Miles of Shoreline	3,427
Acres of Wetlands	273,880

In general, a monitoring program that meets CWA objectives should be able to answer the following five questions:

1. What is the overall quality of waters in the regions and the state?

CWA Section 305(b) requires that states determine the extent to which their waters meet the objectives of the CWA, attain applicable water quality standards, and provide for the protection and propagation of balanced populations of fish, shellfish and wildlife (40 CFR 130. 8).

2. To what extent is water quality changing over time?

The California Water Boards must assess and report on the extent to which control programs have improved water quality or will improve water quality for the purposes of "the protection and propagation of a balanced population of shellfish, fish, and wildlife and . . . recreational activities in and on the water" (40 CFR 130. 8[b][2] and 130. 8[b][1]). Under Section 319(h)(11) of the CWA, the California Water Boards must report on reductions in nonpoint source loadings and related improvements in water quality. Under Section 314(a)(1)(F), a state reports on the status and trends of water quality in lakes. The California Water Boards should also be able to identify emerging environmental issues related to new pollutants or changes in activities within watersheds.

3. What are the problem areas and areas needing protection?

Under Section 303(d), the California Water Boards must identify impaired waters. The California Water Boards should also identify waters that are currently of high quality and should be protected from degradation. In order to protect and restore waters, monitoring and assessment programs should identify the causes and sources of impairment.

At the California Water Boards, monitoring questions have centered on providing the answers needed for existing programs. The number of specific monitoring objectives is daunting. For example, implementation of CWA Section 303(d) is a top priority of the California Water Boards. This requires the California Water Boards to identify all water bodies that do not meet water quality standards. For those "impaired" water bodies failing to meet standards, The State Water Board must establish TMDLs (Total Maximum Daily Load). TMDLs define how much of a specific pollutant a waterbody can tolerate and still meet relevant water quality standards. All of the combined pollution sources in a watershed may not discharge more than the TMDL limit. The establishment of TMDLs in California is one of the most significant and controversial efforts undertaken by the California Water Boards. Not only do the TMDLs have to be established, but they must also be implemented by allocating responsibility for corrective measures among a variety of dischargers. Approximately 1,800 waterbody-pollutant combinations requiring TMDL development have been identified. The Regional Water Boards are committed to the development of 500 to 800 individual TMDLs over the next 10 years, which will account for 1,500 of these waterbody-pollutant combinations. Significant monitoring resources will be required to accurately monitor and assess water bodies, work with stakeholders to develop and implement TMDLs and subsequently determine the success of the TMDLs in restoring the state's water to relevant standards.

WHY MONITOR?

- Characterize waters; Identify changes or trends
- Identify specific water quality problems
- Gather information to design pollution prevention or remediation programs
- Determine whether program goals are being met
  - Compliance with regulations
  - Implementation of control action

4. What level of protection is needed?

The USEPA and the California Water Boards establish the level of protection that is being monitored against. For example, the California Water Boards use data from monitoring programs to conduct triennial reviews of state water quality standards and Basin Plans, conduct use-attainability analyses, develop and adopt revised designated uses and water quality criteria, establish water quality-based effluent limits in NPDES permits, establish total maximum daily loads (TMDLs), and assess which levels of best management practices (BMPs) for nonpoint source are most appropriate.

5. How effective are clean water projects and programs?

The California Water Boards should monitor to evaluate the effectiveness of specific projects and overall programs, including but not limited to, Section 319 (nonpoint source control), Section 314 (Clean Lakes), Section 303(d) total maximum daily loads (TMDLs), Section 402 NPDES permits, water quality standards modifications, compliance programs (Discharge Monitoring Report information), and generally to determine the success of management measures, especially those implemented with state funds.

These are the five basic questions that should be asked for all the California Water Board programs, whether they be at the state or regional level. Recognizing that state and regional boards share common objectives is the first step in the development of a nested monitoring design, which accommodates differences in scale and precision. Ultimately, monitoring objectives should be developed for all California Water Board programs. Only the nonpoint source program has developed a set of monitoring objectives to evaluate the effectiveness of the program.

Goals and Objectives

Goal: Define statewide monitoring objectives.

- Compile and review existing objectives (in the CWA, Legislative Report, 2002 Strategic Plan, 2003 Partnership Agreement, Governors Action Plan for the Environment, EPIC).
- Provide recommendations for statewide monitoring objectives that can be addressed through the coordination of The State and Regional Water Board programs by SWAMP.

Goal: Define regional monitoring objectives.

- Compile and review objectives from Regional Water Boards for each of their regulatory and non-regulatory programs.
- Identify areas of overlap among regions and with state objectives.

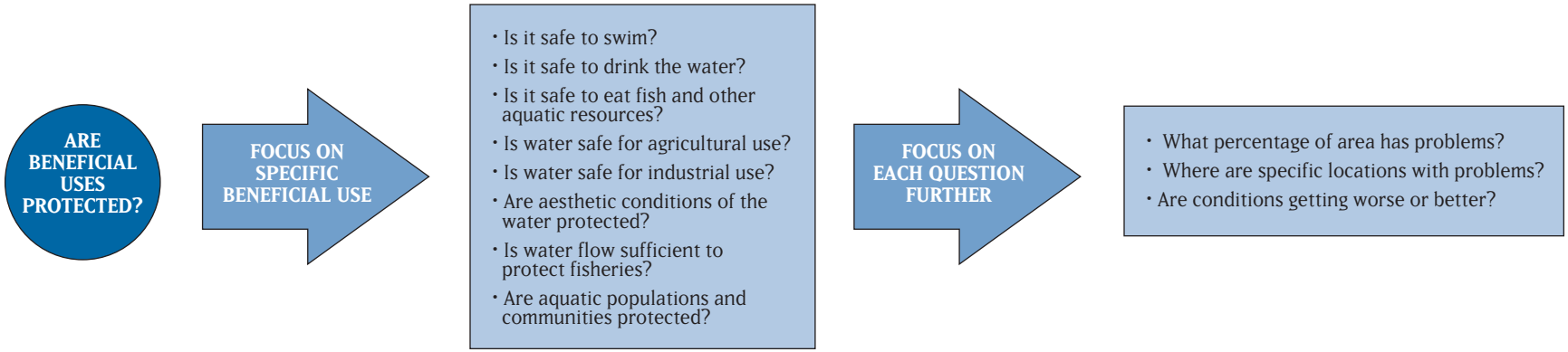
Goal: Develop consensus on shared objectives.

- Identify shared objectives.

Current Status

In November 2000, SWAMP submitted a comprehensive set of objectives to the State Legislature. In fiscal year 2001-2002, resource limitations prompted a prioritization of objectives to guide program implementation. The SWAMP Roundtable prioritized regional objectives over statewide status and trend questions. Although regions focus on beneficial use status, none of the Regional Water Boards is currently using the original objectives to drive the design of its monitoring programs. This is primarily attributable to a lack of sufficient resources to do so in a scientifically defensible manner. We do not have the resources to ask broad questions about beneficial use status across multiple types of water bodies. For example, instead of being able to ask (and answer) whether waters are "fishable," the best we can do is see whether any evidence exists that suggests waters are "not fishable. "The SWAMP Roundtable acknowledges that we are not monitoring in a way that allows us to meet the comprehensive objectives established in 2000. The Roundtable began to redefine short-term objectives during fiscal year 2001-2002. This is done on an annual basis based on available funding. During fiscal year 2005-2005, the Roundtable will again redefine short-term objectives based on available resources, and will also prioritize long-term objectives coupled to appropriate monitoring designs for a comprehensive program. Until that task is completed, the primary SWAMP effort will be a continued focus on existing regional objectives. Each region has developed a set of regional monitoring objectives coupled with an appropriate monitoring design. This information is summarized in Appendix C.

Specific monitoring objectives for most statewide programs are still needed. Only the California Nonpoint Source Program has developed specific monitoring objectives that identify the program's data and information needs, and will be used to design and implement monitoring activities that will provide information to better guide implementation of nonpoint source pollution control measures. Some of these data and information needs will be addressed through SWAMP. The NPS Program will address others. The NPS monitoring objectives are included in Appendix D.



Implementation Priorities

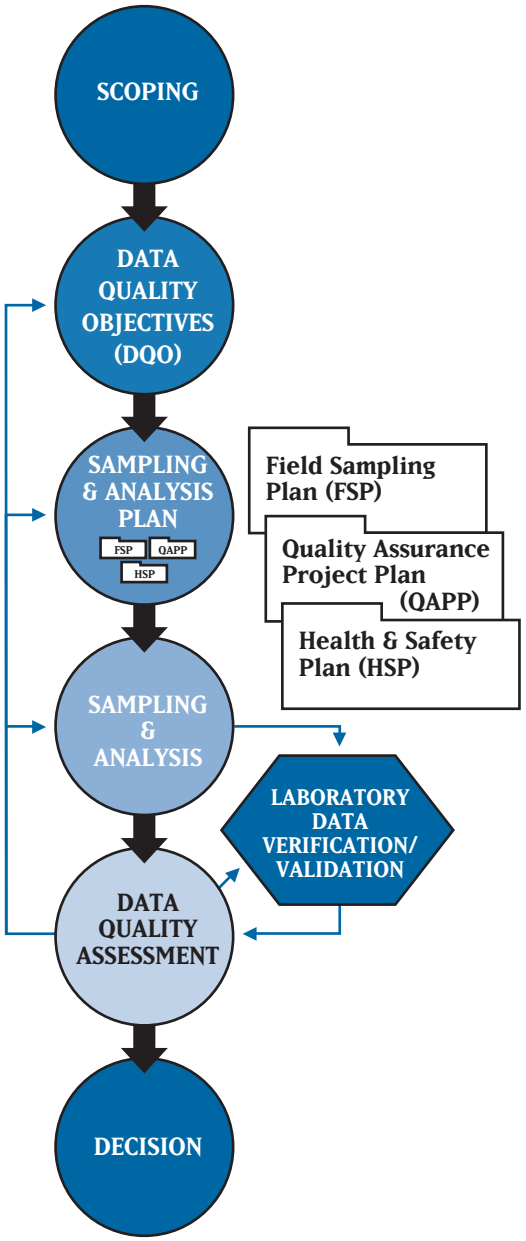
The overall purpose of SWAMP is to provide the information needed for effective environmental management. To be successful, the program must "translate" management information needs into clear objectives that guide the design and implementation of state and regional monitoring. Clear statements of information needs and objectives are important scientifically and managerially. In fiscal year 2004-2005, the SWAMP Roundtable began the process of generating and collecting management information needs. The Roundtable is using the combined science and management framework for developing monitoring objectives that was developed by Bernstein, Thompson and Smith (1993). The Roundtable will complete its refinement of objectives for all waterbody types in fiscal year 2005-2006. It must be emphasized that the program still lacks the resources to conduct additional monitoring. However, once monitoring objectives have been articulated, it may be possible to leverage existing resources to answer the highest priority questions. It should also be possible to implement a monitoring design that maximizes our ability to address the highest priority objectives.

3. Monitoring Design

Key Components and Essential Attributes

Our vision is to develop and implement a monitoring design that maximizes our ability to meet our statewide (e.g., EPIC, 305(b)) and regional monitoring and assessment objectives. The state monitoring program will by necessity have to integrate several monitoring designs to meet the full range of information needs. The goal is a nested design that uses the most efficient combination of monitoring designs to meet both statewide and local objectives. It is anticipated that the integrated monitoring design would incorporate multiple tools in a tiered approach to address management decisions at multiple scales. These tools include probabilistic designs, landscape and water quality modeling, and targeted site-specific monitoring[7] . This tiered approach will enable the state to make statistically valid inferences of the extent to which waters meet water quality standards, to predict which waters are most likely degraded or at risk for degradation, and to target site-specific monitoring needed to address local water quality concerns.

The efficiencies of an integrated design extend beyond monitoring costs to program costs because they can help states prioritize which waterbodies need more immediate attention. The design should include a comprehensive approach to assessment using multiple indicators for all waters on a continuing basis. The elements of the monitoring design should support the state's estimation of the amount or percentage of waters that are impaired, for each waterbody type, with a high degree of confidence. To meet its monitoring objectives, the state should ensure that the selected monitoring design yields scientifically valid results and meets the needs of decision makers. The monitoring design should balance the possibility of making incorrect decisions. The levels of precision and confidence should be appropriate to the monitoring objective and the type of data collected.



7. Appendix F contains supplemental material for the SWAMP Roundtable to consider as we go through the process of developing monitoring objectives coupled to appropriate designs. An ongoing debate in the SWAMP program centers on the use of probabilistic monitoring tools. Appendix F includes copies of two U.S. Geological Survey fact sheets for a Congressional briefing on February 25, 2005. They are a succinct summary of how different monitoring objectives require different monitoring tools, including the use of models..

The SWAMP monitoring design will also take advantage of ongoing monitoring programs that meet or complement the SWAMP monitoring objectives. For example, the California Water Boards have worked with local agencies to develop a statewide monitoring strategy for beaches under the Federal Beach Act. The State Water Board also has developed a program for statewide monitoring of groundwater resources (GAMA). These do not need repetition or replication in the SWAMP program. Other agencies also conduct monitoring that can provide the information to answer SWAMP objectives. For example, the California Department of Fish and Game reports catch statistics, which can be used to assess the status of the fisheries resources off the coast. Similarly, the SWAMP Strategy is building upon federal programs such as the USEPA's Environmental Monitoring and Assessment Program Western Pilot (EMAP-West) to support assessment of streams and coastal waters for aquatic life use. To facilitate data sharing among programs, the SWAMP Strategy calls for establishing data quality objectives that are similar, ensuring that data quality is comparable and integrating data standards to facilitate data exchange so that better assessments can be made.

Effective management of water quality will require a commitment not only to monitoring but also to the development of predictive tools such as models. Models are needed to extrapolate measured water quality conditions to unmonitored, comparable areas. This ability to extrapolate or make predictions is critical for cost-effective assessment. For example, the expense of monitoring limits the number of stream miles that can be measured. As noted in the most recent 305(b) report, California has assessed only15 percent of the more than 211,500 stream miles in the state.

"In addition, models can establish linkages between water quality conditions and contaminant sources on land; track contaminants from their upstream origins to downstream destinations; and simulate changes in water quality resulting from management actions or trends in human activities. Such information provides estimates of conditions that often cannot be directly measured, such as the percentage of contamination in a stream that originates from different sources or the effects of specific pollution controls." (United States Geological Survey 2005, Appendix F). SWAMP needs to include the use of models and other predictive tools into our monitoring strategy and designs.

Goals and Objectives

Goal: Refine management questions for assessing core beneficial uses for all waterbody types.

- Recreational uses (swimming).
- Fishing uses.
- Aquatic life support.
- Drinking water use.

Goal: Inventory management questions of existing programs and monitoring entities.

- Identify programs collecting relevant data.
- Establish/Continue coordination to promote data sharing.

Goal: Develop strategy to answer assessment questions for each waterbody type.

- Addressing rivers and wadeable streams.
- Addressing lakes and reservoirs.
- Addressing beaches.

- Addressing marine coastal areas, bays and estuaries.
- Addressing wetlands.
- Addressing groundwater.

Goal: Design cost-effective monitoring program.

- Develop designs to meet statewide monitoring objectives.
- Develop nested framework for integrating Regional Water Board efforts into statewide program.
- Develop framework for integrating other State Water Board efforts into statewide program.
- Develop framework for integrating other monitoring efforts into statewide program.

Goal: Develop and implement a suite of predictive tools to maximize our ability to effectively manage water quality.

- Develop process for incorporating use of models and other predictive tools into the existing SWAMP strategy.

Current Status

Regional Designs

Regional monitoring designs can be broadly classified as one of three types. Two regions are using a probabilistic design to assess the overall status of specific water bodies. Five regions are implementing a targeted design that can link water quality to land use. Three regions are conducting special studies to develop appropriate indicators or support their TMDL program. A majority of Regions have adopted a "rotating basins" approach. A summary of the current regional monitoring programs is included in Appendix C.

Statewide Designs

Rivers and Streams: There are 211,513 river miles in California. The Regional Water Boards have assessed about 15 percent of the total. There is no systematic statewide monitoring design to assess all the rivers and streams in California. The California Monitoring and Assessment Program (CMAP) for perennial wadeable streams was initiated in 2003. The program builds on EMAP-West inland surface waters portion, implemented in California from 1999 through 2003. The overall objective of the EMAP-West program was to demonstrate an integrated comprehensive monitoring program within the western states to assess the condition of perennially flowing rivers and streams using a survey-based (probabilistic) monitoring approach. Samples were collected from a base statewide study of 50 probabilistically assigned sites per year. Additional probabilistic sites were collected in study areas in southern (south coast and central coast) and northern coastal California and at targeted reference sites. The current state effort (CMAP for Perennial Streams) will be used to (a) provide a framework for producing statistically valid assessments of condition for perennial streams in California and (b) develop tools to facilitate these assessments. CMAP is funded primarily through 6319 Nonpoint Source funds. As part of this program, historic EMAP-West data will be analyzed to produce baseline ecological assessments of the condition of streams in the different study areas. In addition, a monitoring study that incorporates broad nonpoint source land use categories (agricultural, forested,

urban) will be implemented in order to assess aquatic life beneficial use protection in streams. Assessments will be done using existing tools and through the development of new assessment tools. The study uses a probabilistic monitoring design and incorporates a core suite of indicators. Results will be included in the 305(b) Report.

Lakes and Reservoirs: There are an estimated 2,164,417 acres of lakes and reservoirs in California. There is no systematic design for assessing and evaluating lakes in the state on a regular basis. Rather, lakes and reservoirs are assessed on a case-by-case basis by Regional Water Boards. Collectively over the years, the Regional Water Boards have evaluated or monitored about 692,341 acres.

Coastal Waters, Bays and Estuaries: The Southern California Coastal Water Research Program, the San Francisco Estuary Institute and the Moss Landing Marine Laboratory partnered with USEPA in the design and implementation of a probabilistic monitoring program to assess coastal waters of the state. Through the EMAP Western Pilot, the status of coastal estuaries of the state were monitored in 1999 and 2000, and the status of the offshore coastal waters were assessed in 2003. In 2004 monitoring focused on bays and estuaries, as will the 2005 and 2006 efforts. The results of these monitoring studies were used in the National Coastal Assessments. The results are also being incorporated into the 305(b) report. It is anticipated that the National Coastal Assessments will occur at 5-year intervals and that the state will partner with federal agencies and entities conducting the current program on this effort.

Beaches: State law mandates monitoring of recreational beaches in California. The monitoring is implemented by county health agencies using funds distributed by the California Department of Health Services. This is supplemented by the Federal Beach Act, which requires a statewide monitoring strategy for coastal recreational beaches.The state has a three-tiered monitoring strategy, which requires daily to weekly sampling at all tier one beaches (high use and near pollutant sources as defined by California Assembly 2001 Bill 411), weekly sampling at tier two beaches (high use or near pollutant sources) and minimal sampling at tier three beaches (low use and far from sources of pollution). The monitoring information from these programs is submitted to The State Water Board on a monthly basis and to EPA and the state legislature on an annual basis. Long-term trends are reported in the 305(b) report.

Wetlands: Wetland monitoring and assessment methodology development has received considerable attention in recent years. A three-tiered design is envisioned for wetland monitoring. Level 1 is broad scale landscape assessment, which builds off recent improvements to the National Wetlands Inventory. Level 2 is the rapid field assessment using the California Rapid Assessment Methodology (CRAM), which would provide sufficient information for making assessments of wetland condition. Level 3 is intensive site-level monitoring that would be of sufficient rigor for making regulatory decisions. Similar to the monitoring network for wadeable streams, CRAM supports statistically valid inferences about wetland condition. It would also allow for development of predictive tools from intensively studied sites. Although funds are not available to implement a statewide wetland monitoring program at this time, state and regional entities (such as the Southern California Coastal Wetlands Recovery Project, the San Francisco Estuary Project, and the California Coastal Conservancy) are working to build the infrastructure to support the vision.

Groundwater: California has 476 identified groundwater basins. The Groundwater Ambient Monitoring and Assessment (GAMA) Program was developed in response to state legislation (Groundwater Quality Monitoring Act of 2001) which mandated the monitoring and assessment of groundwater used for public water supply to municipalities. The GAMA program identified 116 priority basins, which collectively include more than 75 percent of the public supply wells in California. These priority basins were combined into 50 study units. In each study unit, 50 to 120 water supply wells are monitored to assess status, trends and sources of contamination.

Implementation Priorities

Once monitoring objectives have been articulated, a set of monitoring designs can be developed for both state and regional monitoring. The goal is to develop designs that answer specific management questions at a certain scale, but also provide context for monitoring conducted at other scales.

Based on these monitoring designs, The State and Regional Water Boards will implement both regional and statewide monitoring of wadeable streams and will coordinate these efforts with stream assessment efforts of other monitoring entities. The State Water Board will also encourage efforts to develop a statewide design framework for wetlands. The State Water Board anticipates participating with USEPA and NOAA in the next National Coastal Assessment. The designs of these programs should be evaluated relative to both State and Regional Water Board needs.

Well-established statewide programs exist to deal with coastal recreational beaches and groundwater. Some emphasis should be placed on evaluating utility of these statewide programs to Regional Water Board needs.

Models are currently limited in use to the TMDL program. We recognize that models are powerful tools, but we also recognize that models are incomplete tools without adequate monitoring to calibrate and validate them. Over the next three years, if funding levels increase, the Roundtable would like to evaluate the use of models to make predictions about the quality of waters that have not been assessed. Appendix F includes a summary of the recent use of models by the U. S. Geological Survey to extrapolate water quality conditions.

4. Indicators

Key Components and Essential Attributes

Our vision is to develop and implement a set of monitoring indicators (and assessment thresholds), which can be used to track the status and trends of water quality and to evaluate the effectiveness of management actions to improve water quality in the state.

This requires that we define a core set of indicators (for example, water quality parameters) for each water resource type that includes physical/habitat, chemical/toxicological, and biological/ecological endpoints as appropriate; that reflect designated uses; and that can be used routinely to assess attainment with applicable water quality standards throughout the state. Indicators should also be defined that contribute to the understanding of overall watershed health. The core set of indicators must be monitored to provide statewide or basin/watershed level information on the fundamental attributes of the aquatic environment, and to assess water quality standards attainment/impairment status.

The core set of indicators must also contribute to statewide tracking of water quality indicators being implemented under the Environmental Protection Indicators for California (EPIC) Project. EPIC was created to establish and implement a process for developing statewide environmental indicators. The EPIC Project is responsible for maintaining an environmental indicator system to assist environmental programs in evaluating the outcomes of their efforts, and in identifying areas that require more attention. The water quality indicators of EPIC are:

1) Assessment of aquatic life and swimming uses
2) Coastal beach availability—extent of coastal beaches posted or closed
3) Bacterial concentrations in commercial shellfish growing waters
4) Fish consumption advisories—coastal waters
5) Spill/release episodes
6) Leaking underground fuel tank (LUFT) sites
7) Drinking water supplies exceeding maximum contaminant levels (MCLs). The SWAMP program is expected to provide information on the first four of these indicators.

We should also describe a process for identifying supplemental indicators to monitor when we have reasonable expectation that a specific pollutant may be present in a watershed, when core indicators indicate impairment or to support a special study such as screening for potential pollutants of concern and emerging contaminants. Supplemental indicators are often key to identifying causes and sources of impairments and targeting appropriate source controls. The use of supplemental indicators is as important as the use of core indicators.

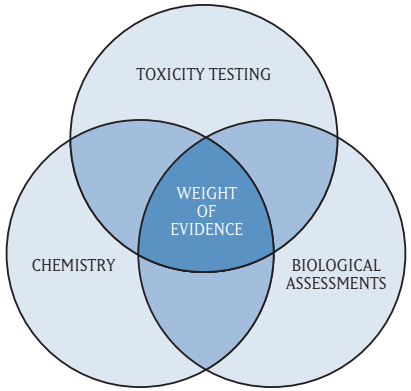
Goals and Objectives

Goal: Define core indicators for statewide monitoring and assessment for each designated use and for overall watershed health.

- Review existing indicators from the USEPA, the Report to the Legislature, and Environmental Protection Indicators for California (EPIC).
- Provide recommendations on core indicators for statewide assessment.
- Recommend appropriate design for assessing EPIC Indicators.
- Recommend assessment thresholds for statewide assessment.

Goal: Recommend set of core and supplemental indicators for use at local watershed scale.

- Review indicators used by Regional Water Board efforts and other entities.
- Recommend core set of indicators for local assessment.
- Recommend supplemental set of indicators for local assessment.
- Recommend appropriate monitoring design for local indicators.



Goal: Develop indices for assessment of biological communities for different waterbody types.

- Foster development and application of indices of biological integrity for wadeable streams.
- Foster development and application of indices for marine waters, bays and estuaries.
- Foster development of California Rapid Assessment Methodology indicators for assessing wetland condition.
- Identify short-term and long-term research needs for development of indices for other waterbody types, such as large rivers, intermittent streams, lakes, reservoirs.

Goal: Develop a set of locally appropriate indices of biological integrity (IBI) for wadeable streams.

- Summarize existing biological assessment information for California
- Conduct a performance-based methods comparison
- Recommend appropriate methods for specific stream type
- Determine reference conditions, as appropriate
- Develop IBIs

Current Status

In November 2000, SWAMP proposed a tiered approach to monitoring that included a core set of baseline indicators selected to represent each applicable designated use, plus supplemental indicators selected according to site-specific or project-specific decision criteria. These indicators are essentially the same ones suggested by USEPA and are summarized in Table 1. Progress in monitoring these indicators has been limited by funding constraints.

Rivers and Streams

Since its inception in 2000, SWAMP has made considerable progress in advancing bioassessment and monitoring for wadeable streams. In 2001, staff from the California Water Boards formed a SWAMP Bioassessment Committee (the Committee) that has served to coordinate bioassessment efforts throughout the state. Prior to that time, various entities throughout the state used numerous methods for bioassessment. The Committee worked to conduct and evaluate rigorous "methods comparison" studies to determine the most cost-effective methods for wadeable streams and then collaborated with bioassessment practitioners throughout the state to obtain consensus for using consistent methods for bioassessment sampling. The methods comparison studies have been submitted to scientific journals for publication, and there is now wide agreement on a single consistent method for use in most streams in California. At this writing, the Committee is continuing its efforts to coordinate selection of consistent bioassessment methods for low-gradient streams and measurement of physical habitat parameters.

SWAMP also used bioassessment data during the first five years of the program to develop indices of biological integrity (IBIs) for wadeable streams in several areas, including the south-central coast, the north coast, and the eastern Sierra. These IBIs can now be used to evaluate attainment of aquatic life uses in these areas. SWAMP is currently developing IBIs for other areas of the state. and making progress on the development of an index for statewide assessment of wadeable streams.

There is currently no systematic effort to develop statewide indices for large rivers or non-wadeable streams.

Lakes and Reservoirs

Table 1 describes the proposed core indicators for lakes. It should be noted that there is currently no systematic statewide effort to develop biological indicators for lakes and reservoirs.

Coastal Areas, Bays and Estuaries

A benthic response index has been developed for use in offshore waters of Southern California. Response indices have also been developed for estuaries in Southern California and San Francisco Bay. The state is currently working on a standardized approach that would be applicable throughout the state. This effort is building upon data collected through Bay Protection and Toxics Cleanup Program, Coastal EMAP and Regional Monitoring Efforts in Southern California and San Francisco Bay. This effort is being funded in part through the sediment quality task force.

Environmental Indicators Selection Criteria
(from Intergovernmental Task Force on Monitoring Water Quality. 1995. The nationwide strategy for improving water quality monitoring in the United States. Final Report of the Intergovernmental Task Force on Monitoring Water Quality Technical Appendix E. Open File Report 95-742).

CRITERIA	DEFINITIONS	
Measurable/ quantitative	Feature of water quality measurable over time; has defined numerical scale and can be quantified simply.	SCIENTIFIC VALIDITY (TECHNICAL CONSIDERATION)
Sensitivity	Responds to range of conditions or perturbations within an appropriate time frame and geographical scale; sensitive to potential impacts being evaluated.	
Resolution/ discriminatory power	Ability to discriminate meaningful differences in environmental condition with a high degree of resolution.	
Integrate effect/ exposure	Integrates effects or exposure over time and space.	
Validity/accuracy	Parameter is true measure of some environmental condition within constraints of existing science. Related or linked unambiguously to an endpoint in an assessment process.	
Reproducible	Reproducible within defined and acceptable limits for data collection over time and space.	
Representative	Changes in parameter/species indicate trends in other parameters they are selected to represent.	
Scope/applicability	Responds to changes on a geographic and temporal scale appropriate to the goal or issue.	
Reference value	Has reference condition or benchmark against which to measure progress.	
Data comparability	Can be compared to existing data sets/past conditions.	
Anticipatory	Provides a warning of changes.	
Cost/cost effective	Information is available or can be obtained with reasonable cost/effort. High information return per cost.	PRACTICAL CONSIDERATIONS
Level of difficulty	• Ability to obtain expertise to monitor. • Ability to find, identify, and interpret chemical parameters, biological species, or habitat parameters. • Easily detected. • Generally accepted methods available. • Sampling produces minimal environmental impact.	
Relevance	Relevant to desired goal, issue, or SWRCB/RWQCB mission; for example, fish fillets for consumption advisories; species of recreational or commercial value.	WATER QUALITY PROGRAMMATIC CONSIDERATIONS
Program coverage	Program uses suite of indicators that encompass major components of the ecosystem over the range of environmental conditions that can be expected.	
Understandable	Indicator is or can be transformed into a format that target audience can understand; for example, non-technical interpretation for the public.	

Wetlands

Significant progress has been made to calibrate and validate the California Rapid Assessment Method (CRAM). The attributes and metrics developed for CRAM reflect the common, visible characteristics of all wetlands in all regions of California. Sets of narrative statements reflect a gradient in the condition of the wetland and are related to the degree of stress affecting it. Wetland managers identify stressors using a stressor checklist, which enables them to identify which stressors are most likely to account for observed conditions within and among wetlands. Observed conditions can then form the foundation for more intensive, diagnostic follow-up using supplemental indicators (Level 3 monitoring). The CRAM has been successfully calibrated and validated in coastal wetlands in three coastal regions. The goal is to build upon the existing CRAM database to test the applicability of the CRAM for wetlands throughout the state.

Coastal Beach Availability

Recreational beaches in California receive extensive monitoring. State law requires the monitoring of beaches for total coliform, fecal coliform, and enterococcus. The state also mandated a set of consistent assessment thresholds for posting advisories and reports regularly on the number of beach closures, postings, and rain advisories. Beach-mile days are the key indicator used to evaluate and track the extent of beaches affected by closures and postings. Beach-mile days are useful because they incorporate both the spatial and the temporal extent of the impairment. The State Beach Water Quality Workgroup effectively deals with issues of assessment methodology and consistency.

Supplemental Indicators

A number of potential indicators exist that can be used to assess the condition of the resource, to identify causes and sources of impairments, or to help interpret the core indicators. Toxicity testing in either water column or sediment may be a valuable tool for assessing acute or chronic impacts of chemicals that may not be seen with simple chemical analysis or with community analysis. A Regional Water Board may have chemicals of concern that are unique to their region. There are also emerging chemicals that have not been well characterized (see sidebar). Supplemental indicators may be used by Regional Water Boards to address specific issues but are not part of the overall core program, which is driven by statewide questions.

Developing Indicators for Emerging Contaminants of Concern: Endocrine Disruption

Evidence is accumulating that documents the occurrence of endocrine disrupting chemicals in surface waters across the nation. Estrogenic endocrine disrupting chemicals (EEDCs), compounds that mimic or interfere with the reproductive function of estrogen, can have variable effects on fish, ranging from behavioral changes to feminization of males. SWAMP is supporting development of water quality monitoring tools (endocrine disrupter assays) that can screen surface waters for the presence and effects of endocrine disrupting chemicals. The current focus of the SWAMP endocrine disrupter assay work includes development and application of an economical short-exposure method capable of detecting low concentrations (5 – 10 ng/L) of EEDCs in ambient surface waters. The procedure involves exposing larval rainbow trout (Oncorhynchus mykiss) to water samples and analyzing their livers for vitellogenin mRNA (Vg) using SYBR Green or TaqMan® RT-qPCR (reverse-transcription quantitative polymerase chain reaction). The project is currently conducting initial screening level assessments on select ambient waterways. The ambient water assessments will take place through September 2005. Next steps include analyses and interpretation of data, preparation of a final report, and further assessments in waterways suspected of containing EEDCs at concentrations that may threaten aquatic life.

Table 1.
USEPA Recommended Water Quality Indicators for General Designated Use Categories

Recommended Core and Supplemental Indicators				
	Aquatic Life & Wildlife	Recreation	Drinking Water	Fish/Shellfish Consumption
Recommended Care Indicators	• Condition of Biological communities (USEPA recommends the use of at least two assemblages) • Dissolved oxygen • Temperature • Specific Conductance • pH • Habitat assessment • Flow • Nutrients • Landscape conditions (e. g. , % cover of land uses) Additional indicators for lakes: • Eutrophic condition Additional indicators for wetlands: • Wetland hydrogeomorphic settings and functions	• Pathogen indicators (E. coli, enterococci) • Nuisance plant growth • Flow • Landscape conditions (e. g. , % cover of land uses) Additional indicators for lakes: • Secchi depth • Nutrients • Chlorophyll Additional indicators for wetlands: • Wetland Hydrogeomorphic settings and functions	• Trace metals • Pathogens • Nitrates • Salinity • Sediments/TDS • Flow • Landscape conditions (e. g. , % cover of land uses)	• Pathogens • Mercury • Chlordane • DDT • PCBs • Landscape conditions (e. g. , % cover of land uses)
Supplemental Indicators	• Ambient toxicity • Sediment toxicity • Other chemicals of concern in water column or sediment • Health of organisms	• Other chemicals of concern in water column or sediment • Hazardous chemicals • Aesthetics	• Volatile Organic Conpounds (in reservoirs) • Hydrophyllic pesticides • Nutrients • Other chemicals of concern in water column or sediment • Algae	• Other chemicals of concern in water column or sediment

Implementation Priorities

The SWAMP Roundtable will revisit the selection of core and supplemental indicators as part of the refinement of monitoring objectives and design. Work will continue on the development and use of biological and habitat assessment methodologies. Participants in SWAMP will work with other entities to coordinate the use of indicators across monitoring scales and across programs.

Development of the IBI for wadeable streams is a high priority goal, because many of the Regional Water Boards are using bioassessment procedures to assess wadeable streams in their regions. The specific tasks are to:

- Summarize existing biological assessment information for California.
- Conduct a performance-based methods comparison.
- Recommend appropriate methods for specific stream type.
- Determine reference conditions, as appropriate.
- Develop IBIs.

5. Quality Assurance

Key Components and Essential Attributes

Our vision is to develop and implement a progressive quality assurance/quality control (QA/QC) program using a systems-based approach to the generation and storage of application-appropriate data and metadata. In the SWAMP framework quality assurance (QA) and quality control (QC) are distinct but related activities. QA involves the upfront planning and management activities conducted prior to sampling and analysis to ensure that the appropriate kinds and quantities of data are collected. QC activities are implemented to evaluate the effectiveness of QA activities. While the focus is on data generated by SWAMP program, the principles and procedures are applicable to the generation of ambient monitoring data by other State Board and Regional Board programs.

The key components of the SWAMP QA program are: a QA Management Plan (QMP), a Quality Assurance Program Plan (QAPrP), QA Project Plans (QAPPs), and a QA personnel team to implement the program and provide quality control. Implementation of the SWAMP QA/QC program includes QA reports to management, data verification and validation procedures, expert software, a QA toolbox, corrective action procedures, a QA calendar, and audit procedures for Regional Boards, field sampling teams and analytical laboratories participating in the SWAMP program.

It is required that QMPs, QAPrPs, and QAPPs are developed, maintained, and peer reviewed in accordance with EPA policy to ensure the scientific validity of monitoring and laboratory activities. The QMP and QAPrP document how SWAMP will plan, implement, and assess the effectiveness of its quality assurance and quality control operations. Quality Assurance Project Plans document the planning, implementation, and assessment procedures for a particular project, as well as any specific quality assurance and quality control activities. QAPPs are required for all data collection efforts conducted by the Regional Boards or contractors under SWAMP. These plans must reflect the level of data quality that is appropriate for the specific uses of the data, such as comprehensive assessment and listing of impaired waters, TMDL development, and NPS effectiveness. Data quality and quantity needs are expected to vary according to the consequences of the resulting water quality decisions.

Under 40 CFR 130. 4(b), state monitoring programs are to include collection and analysis of physical, chemical, and biological data, and quality assurance and control programs to ensure the data are scientifically valid. QA plans are required whenever federal grant funds are used for data generation (40 CFR 31. 45). Where Section 106 funds are used for monitoring activities, the Quality Assurance Program must describe how:

- Each study or monitoring program objective is defined in specific qualitative and quantitative terms and linked to an environmental management decision or reporting requirement associated with the goals of the Clean Water Act.
- Selected indicators offer the most direct means of assessing the environmental attribute under study, based upon the associated requirement and goals of the Clean Water Act.
- The uncertainty associated with estimates and conclusions drawn from each component of the monitoring program are understood, quantified, and limited to a reasonable extent, commensurate with the potential costs (both monetary and environmental) of decision errors.
- The proposed sampling scheme will yield data that are representative of the environmental attribute under study, with consideration of statistical probabilities associated with sampling.
- The quality of the data is assessed and validated to ensure that the data quality objectives of the programs were met.

Deffnitions of some key quality assurance terms.

QMP	Quality Management Plan: a document that describes a quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted.
QAPrP	Quality Assurance Program Plan: a document describing in comprehensive detail the necessary decisions and decision criteria to be used by
QAPP	Quality Assurance Project Plan: a document describing in comprehensive detail the necessary quality assurance, quality control and other technical activities that must be implemented to ensure that the results of the work performance will satisfy the stated performance criteria.
DQO Process	Data Quality Objectives Process: a seven-step systematic planning process developed by EPA which provides a procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, tolerable level of decision errors, and how many samples to collect.
DQOs	Data Quality Objectives: qualitative and quantitative statements derived from the outputs of the first six steps of the Data Quality Objectives process that clarify the study objective, define the most appropriate type of data to collect, determine the most appropriate conditions from which to collect the data, and specify tolerable limits on decision errors which will be used as the basis for establishing the quantity and quality of data needed to support the decision.
MQOs	Measurement Quality Objectives: the individual performance or acceptance goals for the individual Data Quality Indicators, such as precision or bias.
DQIs	Data Quality Indicators: quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of the data to the user. The principal Data Quality Indicators include precision, accuracy, representativeness, completeness, comparability, and sensitivity (or PARCCS).

Goals and Objectives

Goal: Implement Quality Assurance Team to provide technical oversight and direction to SWAMP QA activities

- Establish QA Team
- Define roles and responsibility of team

Goal: Develop and document SWAMP Data Quality Objectives (DQOs) for each of the core indicators

- Lead SWAMP Roundtable through the DQO process
- Re-assess the SWAMP DQOs on an annual basis

Goal: Evaluate the existing QA/QC program, including new methods and program changes, against SWAMP DQOs

- Assess current SWAMP Measurement Quality Objectives (MQOs) against SWAMP DQOs and revise them as necessary
- Create/Revise SWAMP QMP and SWAMP QAPrP

Goal: Implement QA activities to produce data of high consistency/comparability among projects of different scales

- Review QAPPs against SWAMP DQOs and MQOs and provide feedback

Goal: Implement QC procedures to produce defensible, credible data that meets SWAMP QMP/QAPrP

- Conduct intercomparison studies and performance evaluation tests.
- Conduct laboratory audits
- Verify data
- Validate data
- Direct production of control charts
- Produce QA Reports
- Conduct training workshops
- Review and approve Standard Operating Procedures (SOP)
- Direct production of studies such as holding time studies, sample container studies, method development studies, method detection limit studies, etc. in order to produce technically defensible data

Goal: Integrate SWAMP QA/QC procedures in other State Water Board programs

- Develop timeline for integrating SWAMP standards
- Evaluate DQOs of State Water Board programs
- Create a "QA Tool Box"
- Provide assistance and training
- Act as a QA consultant and liaison for other State Water Board programs

Current Status

In January 2005, SWAMP formed its QA Team, consisting of a QA Officer, QA Coordinator, and two QA Specialists. The QA Officer leads the team and reports to the SWAMP Program Coordinator and the Water Board QA Program Manager. Job descriptions for each member are assessed on an annual basis. The QA Team designates a liaison for each Regional Water Board as well as for each testing parameter. The QA Team holds bi-monthly meetings and reports its progress to the SWAMP Round Table on a monthly basis. Starting September 2005, the QA Officer will produce quarterly reports that will be submitted to the SWAMP Program Coordinator and the Water Board QA Program Manager, as well as other interested parties and organizations.

The QA Officer will lead the SWAMP Roundtable through the DQO process beginning in August 2005. In June 2005, the QA Team collected names for DQO Team candidates, mapped out a tentative timeline for DQO Team progress, and collected the relevant state and federal water policies. The QA Officer will use the method outlined in the US EPA document, Guidance for the Data Quality Objectives Process (EPA QA/G-4). This document provides a standard working tool for project managers and planners to develop DQOs for determining the type, quantity, and quality of data needed to reach defensible decisions.

The USEPA definition of the DQO process is "a seven-step planning approach to develop sampling designs for data collection activities that support decision making. This process uses systematic planning and statistical hypothesis testing to differentiate between two or more clearly defined alternatives"(US EPA, Office of Environmental Information, EPA/600/R-96/055, Guidance for the Data Quality Objectives Process (EPA QA/G-4), August 2000. pp. 0-5). The DQO Team will begin by scoping the monitoring goals from various program offices since SWAMP is to serve the decision-making needs of multiple end-user groups and organizations. It is anticipated that the DQO process will be completed by June 2006. After SWAMP clarifies its DQOs, MQOs will be defined to meet the DQO requirements.

The QA Team formed focus groups in May 2005 to address each program testing parameter. There are six focus groups consisting of toxicity testing, organic analytes, inorganic analytes, conventional analytes, bioassessment studies, and field measurements. Each group is used as a resource for sample collection, analysis, reporting, and data assessment. The first task of the focus groups was to assess the SWAMP QMP/QAPrP's MQOs and the resulting DQIs. New MQO tables have been formulated and are available in draft format. The tables will be reviewed by the QA Officer in July 2005 and sent out to other programs, organizations and groups for comment.

The QA Team has begun revision of the current QAPrP, with the final first revision anticipated in November 2005. The resulting documents will be a QMP and a QAPrP. The current QMP/QAPP serves many groups and organizations and is now almost 6 years old. It is necessary to revise some of the tables and layout in order to make the document easier to use for the now larger and varied SWAMP audience. Further, some of the MQOs, personnel, and organizations have changed. These updates will be made in the first revision. The next revision due June 2006 will be incorporated to meet the new DQOs also due in June 2006.

The QA Team also reviews new and existing QAPPs for Regional Water Boards and provides comments through a spreadsheet and a narrative format. The QA Coordinator is the lead QA Team member for this procedure. Since January 2005, the QA Team has reviewed over 30 QAPPs. The QAPPs are judged against the SWAMP DQOs and MQOs and the EPA 24-element QAPP protocols. Through a private consultant, the QA Team is assisting in development of an expert software system for

the generation of QAPPs.

In addition, as part of a system-based approach, the QA Team has developed SWAMP-specific standard operating procedures for contract laboratory data verification/validation, data classification, QA Team data validation, corrective action reports, and laboratory, field and regional audits. All standard operating procedures are ground-tested prior to finalization, and are re-assessed after nine months from inception.

Much of the current effort is focused on the QA portion of the QA/QC program. Over the next three years SWAMP will initiate a number of activities related to QC. The QC components that will be added as additional funding becomes available are inter-laboratory comparison and performance evaluation studies, assessments of monitoring, field and sampling plans, method detection limit studies, analytical method assessments, control charts, split sample assessments, and other detailed assessments of data quality and usability.

Implementation Priorities

The SWAMP QA program's priority activities for the next twelve months are:

- Lead the SWAMP Roundtable through the DQO process producing a DQO document
- Revise the current QMP/QAPrP as an update, with simple reformatting, and correction of errors and omissions
- Revise the second version of the QMP/QAPrP to incorporate new DQOs and the subsequent changes to the MQOs
- Implement the SWAMP QMP/QAPrP
- Review QAPPs as needed
- Develop SWAMP-compliant QA narratives for placement into requests for proposals and contracts
- Begin third-party QA Team validation of a percentage of data from the permanent side of the SWAMP database
- Implement a corrective action report file
- Finalize all QA Team standard operating procedures
- Develop experimental studies as needed and as directed by the SWAMP Program Coordinator
- Continue laboratory audits
- Develop a design for inter-laboratory comparison studies and performance evaluation tests
- Educate the SWAMP Roundtable and participants on the best uses of QA components and quality control samples
- Produce quarterly QA reports to management
- Implement the QA toolbox with internet, web access

The SWAMP QA Program's priority activities for the next thirty-six months are:

- Develop a system for management review of the DQOs and QA program
- Develop a system for method detection limit studies and their evaluation
- Develop a system for cataloging method modifications made by laboratories
- Implement field and regional auditing
- Develop a system for control charting
- Implement inter-laboratory comparison studies and performance evaluation tests

- Perform third-party data validation on a percentage of data using hardcopy reports
- Set-up a process to ensure that studies or monitoring program objectives are defined in specific qualitative and quantitative terms and linked to an environmental management decision or reporting requirement associated with the goals of the Clean Water Act
- Set-up a process to ensure that selected indicators offer the most direct means of assessing the environmental attribute under study, based upon the associated requirement and goals of the Clean Water Act
- Develop a system and provide training to Regional Water Boards to ensure that the uncertainty associated with estimates and conclusions drawn from each component of the monitoring program are understood, quantified, and limited to a reasonable extent, commensurate with the potential costs (both monetary and environmental) of decision errors
- Audit and review proposed sampling schemes to ensure they will yield data that are representative of the environmental attribute under study, with consideration of statistical probabilities associated with sampling
- Develop a system for data quality assessment to ensure that the DQOs of the program were met

6. Data Management

Key Components and Essential Attributes

Our vision is to make credible ambient monitoring data and information available to all stakeholders in a timely manner. The foundation for this cooperative information management system is a centralized storage database designed around a sample-driven model, capturing geospatial data for every sample collected, and designed to transfer data into larger data exchange networks. Water quality, toxicity, sediment chemistry, microbiological, habitat, biological, fish and shellfish tissue data, and metadata is associated with federal and state assessment units such as the National Hydrography Dataset (NHD), CalWater and Regional Water Board Basin Plans.

SWAMP ambient monitoring data is accessible to SWAMP users via the primary database maintained at Moss Landing Marine Laboratories. Additionally, SWAMP data will be made available to the public through the California Environmental Data Exchange Network (CEDEN), maintained by the Department of Water Resources, with annual data uploads into STORET and the Environmental Information Exchange Network (EIEN) through CEDEN beginning in fiscal year 2006-2007. The long-term goal is to include SWAMP data in the California Integrated Water Quality System (CIWQS), which will store assessment information for Clean Water Act Section 305(b) reports and 303(d) lists.

Goals and Objectives

Goal: SWAMP ambient monitoring data will be stored and checked for comparability in the SWAMP database.

- Establish and maintain an electronic data management system for integrating multiple ambient monitoring data types
- Develop guidelines and technical specifications for data organization, flow and verification/validation to maintain SWAMP quality and comparability
- Load historic and current SWAMP monitoring data into the temporary side of the database
- Verify and validate data on temporary side and migrate it to the permanent side of the database

Goal: Provide training and tools to facilitate the use of SWAMP data and information by The State Water Board (intra-agency) and non-State Water Board (inter-agency) programs.

- Develop and provide program-specific training and tools to facilitate the use of SWAMP information by SWAMP participants to improve intra-agency coordination within the California Water Boards
- Facilitate intra- and inter-agency data comparability by developing and providing general use tools such as protocols and formats for electronic data transfer, procedures and tools for batch uploading of data, protocols and tools for data verification and validation, and query and analytical tools for summarizing and analyzing data

Goal: Integrate SWAMP data with information collected by the California Water Boards (intra-agency) and non-State Water Board (inter-agency) programs.

- Develop framework for integrating SWAMP with CEDEN.
- Develop framework for integrating SWAMP with CIWQS and Geospatial Waterbody System.
- Coordinate with the TMDL program on SWAMP formats, business rules, and training tools.
- Coordinate with the Agricultural Waiver program on SWAMP formats, business rules, and training tools.
- Coordinate with grant projects on SWAMP formats, business rules, and training tools.

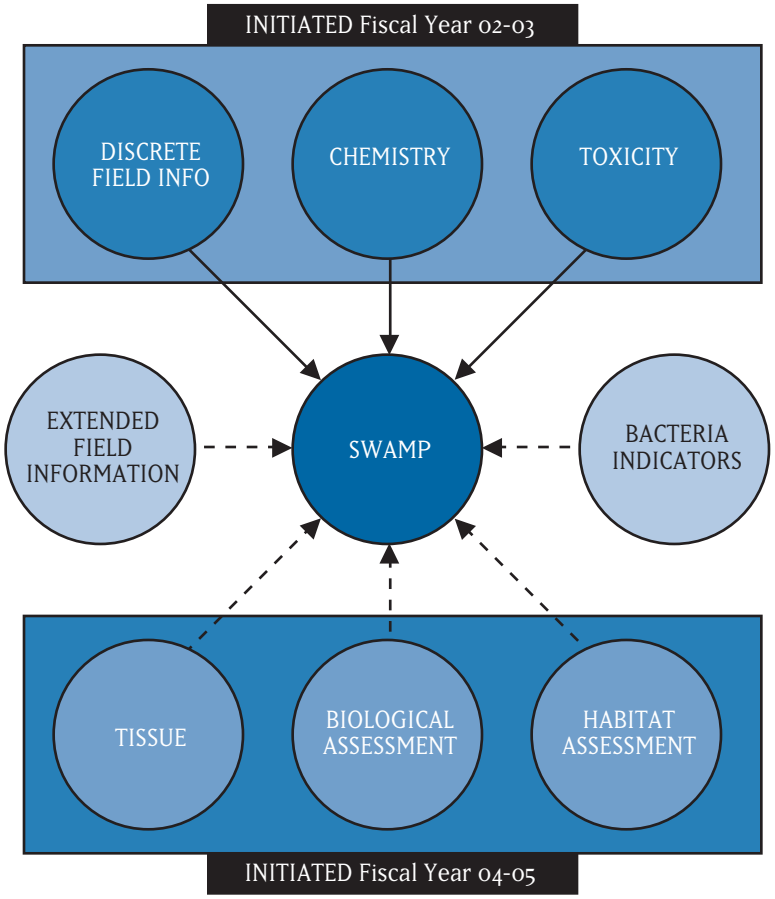
CalWater	A system for cataloging, nesting, and naming hydrologic entities in CA; the official California State hierarchical watershed maps and GIS datasets. Related to the Interagency Watershed Mapping Committee
CEDEN	California Environmental Data Exchange Network, an integrated network of environmental data repositories ("Nodes") that allows for comprehensive web-based retrieval
CERES	California Environmental Resource Evaluation System, is an information system developed by the California Resources Agency to facilitate access to a variety of electronic data describing California's rich and diverse environments.
CIWQS	California Integrated Water Quality System, the new State Water Board database system. CIWQS will contain existing GeoWBS modules and provide a means for creating new GIS layers based on the National Hydrography Dataset.
EDF	Electronic Data Formats, a set of templates for submission of data in electronic formats that insures compatibility with target database
EIEN	Environmental Information Exchange Network, a National network for exchanging environmental data among EPA and its state, tribal, and territorial partners.
ESMR	Electronic Self-Monitoring Reporting, a data entry and transfer program used by the regulated community to submit their compliance monitoring data
GeoTracker	GeoTracker is the interface to the Geographic Environmental Information Management System (GEIMS), a data warehouse which tracks regulatory data about underground fuel tanks, fuel pipelines, and public drinking water supplies
GeoWBS	Geospatial Waterbody System, a GIS database that currently contains California's water quality assessment information
NHD	National Hydrography Dataset, is a comprehensive set of digital spatial data that contains information about surface water features in the United States such as lakes, ponds, streams, rivers, springs and wells.
SDTP	Standardized Data Transfer Protocols, a set of steps, business rules, and crosswalks applied to the process of data transfer, e.g., batch file upload from the generating entity to the target database.
SWIM1	System for Water Information Management (Version 1), a database used by Regional Boards to track compliance with regulatory mandates; discontinued in 2004

- Coordinate with volunteer monitoring groups to facilitate use of the SWAMP data management system.
- Establish data server nodes at major data generators throughout the state (for example, MLML, SCCWRP, SFEI) to serve as points of data consolidation for The State Water Board programs, data analysis, and public access of data.
- Provide for incorporation of SWAMP metadata in the California Environmental Resource Evaluation System. (CERES)
- Create links to STORET and the Environmental Information Exchange Network (EIEN) through CEDEN to annually upload SWAMP data.

Current Status

Staff began development of the SWAMP data management system in 2001 based on a Microsoft Access® centralized storage database as a sample-driven model using a relational structure with standardized data transfer protocols (SDTP). This system is designed for enhanced data sharing, standardization, and data exchange among replicated databases while minimizing redundant data entry and possible data loss. The design is modular and flexible for adapting new tables and modules as needed. Tables for discrete field measurements, water column and sediment chemistry, and water column and sediment toxicity have been completed. Modules and data systems for metadata, bacteria indicators, fish and shellfish tissue residue (bioaccumulation), biological and habitat assessment, and continuous field measurements are in development and near completion.

Staff began loading historical SWAMP data collected prior to the database development in fiscal year 2003-2004 and should have the data verified, validated and transferred to the permanent side of the database by fiscal year 2005-2006. We hope to have historical data



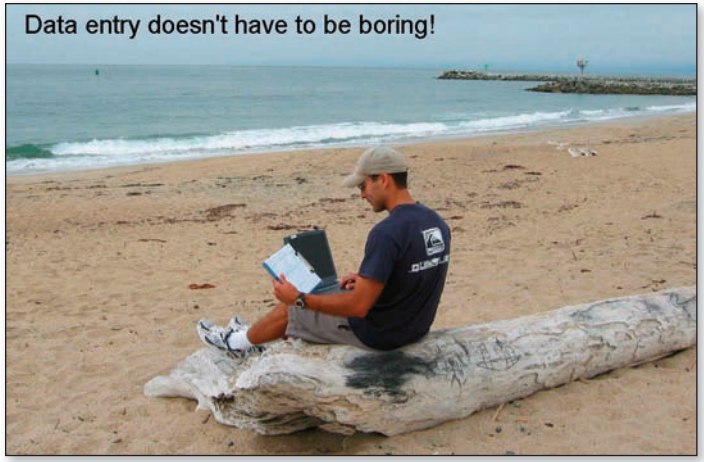
from The State Water Board monitoring programs such as the Toxic Substances Monitoring (TSM), State Mussel Watch (SMW), and Coastal Fish, verified, validated, and transferred to the permanent side of the database by fiscal year 2006-2007 if funding becomes available. Loading SWAMP data collected after database development is an ongoing function, with data first loaded to the temporary side, where it is verified and validated before transfer to the permanent side. To date,

the temporary side has been populated with over 260,000 data results from over 8,300 samples of discrete field measurements, water column and sediment chemistry, and water column and sediment toxicity. Staff will verify, validate, and transfer data from fiscal years 2000-2001 and 2001-2002 to the permanent side of the database by the end of fiscal year 2004-2005.

Because the SWAMP database is designed around a sample-driven model, capturing geospatial data for every sample, the data is linked to federal and state assessment units, such as the National Hydrography Dataset (NHD), CalWater, and Regional Water Board Basin Plans. This link should help in producing the state's Clean Water Act 305(b) reports and 303(d) lists, and should complement the Geospatial Waterbody System (GeoWBS) that currently contains the state's assessment information.

The SWAMP Information Management Plan is a '"living document" that is updated periodically to provide standard protocols for data transfer, data submittal, data organization and the milestones and mechanisms by which the data will be made accessible to project participants, other organizations and the general public. Other guideline and technical specification documents such as Standard Operating Procedures (SOPs) for data verification and validation and data submission formats have been developed and made available to SWAMP users and the public via the Internet. The Data Management Team has also provided training workshops, manuals for training and database use, and analytical and query tools to facilitate the use of the SWAMP database and data by The State Water Board (intra-agency) and non-State Water Board (inter-agency) programs.

A group of major data generators from Moss Landing Marine Laboratories (MLML), Southern California Coastal Water Research



Project (SCCWRP), the San Francisco Estuary Institute (SFEI), and other interested parties have been in discussion concerning the establishment of data server nodes throughout the state. However, lack of funding has slowed progress.

The SWAMP Data Management Team is collaborating with the Department of Water Resources to develop the framework for the California Environmental Data Exchange Network (CEDEN) maintained by the Department of Water Resources. Preliminary beta tests transferring data to USEPA's STORET have occurred with the intent of moving SWAMP data from the permanent side to STORET by the end of 2005. With funding provided by the USEPA's EIEN, CEDEN should be functional and integrated with EIEN in 2006.

Water quality assessment information for 305(b) reports and 303(d) lists are currently contained in the state's GeoWBS, which consists of geographic information stored in ArcView shape files and textual assessment information stored in a Microsoft Access® 2000 database.

Current plans are underway to integrate the functionality of GeoWBS, the System for Water Information Management (SWIM1), and the Electronic Self-Monitoring Reporting (ESMR) application into the Geotracker architecture to develop the CIWQS. CIWQS will contain GeoWBS modules that provide assessment information through existing GIS layers (GeoWBS Map Navigator), and provide a means for creating new GIS layers based on the National Hydrography Dataset (GeoWBS Map Editor). The SWAMP database is structured to readily provide monitoring data to GeoWBS and CIWQS to help The State and Regional Water Boards prepare fact sheets, 305(b) reports, and 303(d) lists.

Implementation Priorities

The SWAMP Data Management Team will continue database development to integrate multiple ambient monitoring data types, such as continuous field measurements, and they will maintain and update the database as new technologies are developed. The team will also complete and implement beta testing of the bioaccumulation (fish and shellfish tissue) and bioassessment databases. The data management team will continue to load SWAMP ambient monitoring data to the temporary side, verify and validate it, and then transfer it to the permanent side. The team will also continue to develop tools and training modules, and to coordinate The State Water Board and non-State Water Board programs to facilitate the use of the SWAMP database and data to increase data comparability throughout California. The SWAMP Data Management Team will also continue participating in the development of CEDEN and will establish the framework necessary for making regularly scheduled data transfers

to GeoWBS, CIWQS, and STORET through CEDEN to make the SWAMP ambient monitoring data available to the public in a timely manner.

Key Components and Essential Attributes

Our vision is to provide a consistent, defensible framework for the evaluation of monitoring data relative to state and regional standards, for the protection of beneficial uses, and for tracking the effectiveness of management actions.

This will require a methodology for assessing attainment of water quality standards based on analysis of data types (chemical, physical, biological, land use) from various sources for all waterbody types and all state waters. The methodology must describe how existing available data and information relevant to applicable water quality standards, including both core and supplemental indicators, will be compiled and analyzed to make attainment decisions. The methodology should:

- Identify the required or likely sources of existing and available data and information, and procedures for collecting or assembling it.
- Describe or reference requirements relating to data quality and representativeness, such as analytical precision, temporal and geographical representation, and metadata documentation needs.
- Include or reference procedures for evaluating the quality of datasets.
- Explain data reduction procedures (for example, statistical analyses) appropriate for comparing data to applicable water quality standards.

Goals and Objectives

Goal: Develop a method for assessing standards attainment for listing purposes (303(d))

- Provide guidance on translation and interpretation of narrative standards
- Implement State Listing policy

Goal: Develop guidance to assist in 303(d) and 305(b) assessments, consistent with the 303(d) listing policy.

- Provide guidance on acquisition and use of primary and secondary data for assessments

Current Status

The California Water Boards have not used consistent guidelines in establishing the status of water bodies. At present, the available information cannot be used to make year-to-year comparisons. Appropriate measures are being developed to address this deficiency.

Water Board Listing Policy: Pursuant to California Water Code Section 13191. 3(a), this state policy for water quality control (Listing Policy) describes the process by which The State Water Board and

Regional Water Boards shall comply with the listing requirements of Section 303(d) of the federal Clean Water Act. The goal of this Policy is to establish a standardized approach for developing California's Section 303(d) list. CWA Section 303(d) requires states to identify waters that do not meet applicable water quality standards after the application of certain technology-based controls. The methodology to be used to develop the Section 303(d) list (40 CFR 130. 7[b][6][I]) is established by the Listing Policy and includes:

- California listing factors and delisting factors.
- The process for evaluation of readily available data and information.
- Total maximum daily load priority setting and scheduling.

The Listing Policy applies only to the listing process methodology used to comply with CWA Section 303(d). To make decisions regarding standards attainment, this Policy provides guidance to interpret data and information by comparison to beneficial uses, existing numeric and narrative water quality objectives and antidegradation considerations. The Policy shall not be used to:

- Determine compliance with any permit or waste discharge requirement provision.
- Establish, revise or refine any water quality objective or beneficial use.
- Translate narrative water quality objectives for the purposes of regulating point sources.

Implementation Priorities

An assessment methodology is being developed for classifying beneficial use status for individual water bodies that will integrate with the new listing policy. Beginning in 2007, the new methodology will be used for generating California's Integrated Report to satisfy the requirements of both CWA Section 305(b) and 303(d).

California's Integrated Report will satisfy the requirements of the Clean Water Act Section 305(b) and 303(d). Based on the level of beneficial use support, the water quality of California's waters will be reported in the following categories:	
State Water Board Assessment Categories*	
CATEGORY 1	All designated uses are met, no use is threatened, and the anti-degradation policy is supported.
CATEGORY 2	Available data and /or information indicated that some, but not all, of the designated uses are met.
CATEGORY 3	The designated use has not been assessed or there is insufficient available data and/ or information to assess whether a specific designated use is being met or if the anti-degradation policy is supported.
CATEGORY 4C	Available data and /or information indicate that at least one designated use is not met or is threatened and /or the anti-degradation policy is not supported, but a TMDL is not needed. In Category 4C, the non-attainment of any applicable water quality standard is the result of pollution and not caused by a pollutant.
CATEGORY 5A	Available data and /or information demonstrate that a water quality standard is not attained (indicating a designated use is not being met); the standards non-attainment is due to toxicity, a pollutant, or pollutants; and remediation of the standards attainment problem requires one or more TMDLs.
CATEGORY 5B1	Available data and /or information indicate that the water quality standard is not attained (indicating a designated use is not being met); the standards non-attainment is due to toxicity, a pollutant, or pollutants; but a TMDL is not needed. A TMDL has been developed and approved by USEPA and the approved implementation plan is expected to result in full attainment of the standard within a specified time frame.
CATEGORY 5B2	Available data and /or information indicate that the water quality standard is not attained (indicating a designated use is not being met); the standards non-attainment is due to toxicity, a pollutant, or pollutants, but a TMDL is not needed. An existing regulatory program is reasonably expected to result in the attainment of the water quality standard within a reasonable, specified time frame.
**State Water Board Assessment Categories are based on USEPA Assessment Categories, that were modified to be consistent with California's 303(d) Listing Policy.*	

8. Reporting

Key Components and Essential Attributes

Our vision is to report all collected data as information, and in a timely and publicly accessible manner. This will require the dissemination of the results of data analysis by various means for use by water quality managers and the public. Conveying results and information to users needs to take many forms, depending upon the information need, timeliness sought, and the management style of the decision maker.

The Clean Water Act requires the state to provide certain reports and lists, including those listed below.

- The Section 305(b) water quality inventory report, which characterizes the condition and quality trends of monitored waters within the state and is due on April 1 of even-numbered years. This is the primary state monitoring program report to USEPA and draws upon information from the Non-Point Source program, TMDLs, and other national, state, and local assessments.

- The Section 303(d) list identifies all impaired waters based on existing and readily available information. The list is also due on April 1 of even-numbered years.
- Development and submission of 305(b) water quality reports and Section 303(d) lists of impaired waters can be integrated. The Integrated Report will satisfy CWA reporting requirements for both Section 305(b) water quality reports and Section 303(d) lists.
- The annual data update requirement may be satisfied by uploading monitoring data to the national STORET warehouse or updating the 305(b) assessment information in the CIWQS, which is compatible with the National Assessment Database.
- Section 406 of the Clean Water Act, as amended by the Beaches Environmental Assessment and Coastal Health Act of 2000, requires states with Section 406 grants to submit information on monitoring and notification programs for coastal recreation waters. Details on the California program are included in the Annual Clean Beach Initiative Report to the Legislature.

Goals and Objectives

Goal: Produce timely and complete water quality reports and lists as required by the Clean Water Act and consistent with current USEPA guidance.

- Prepare 305(b)303(d) Integrated Report
- Prepare 303(d) list
- Prepare Beach report

Goal: Report to the public on water quality, taking into account the needs of interested audiences. Use various formats and media such as brochures, fact sheets, report cards, oral presentations, and the Internet.

- Prepare fact sheets summarizing SWAMP elements
- Prepare fact sheets summarizing state and regional beneficial use status
- Provide input on status and trends in EPIC indicators
- Re-design and begin improvement of SWAMP web site

Goal: Produce technical reports and peer-reviewed journal articles resulting from monitoring program activities.

- Prepare technical reports within two years of data collection
- Complete preparation of reports from SWAMP monitoring conducted through 2003.

Current Status

A variety of reports support SWAMP. Most of the reports are available to the public in paper and electronic form, and include fact sheets, data reports, quality assurance reports, interpretative reports, and the 305(b)/303(d) Integrated Report. These reports provide an analysis and interpretation of the data collected. The technical reports have written descriptions of the study design; methods used; graphical, statistical and textual descriptions of the data; and interpretation of the data including comparisons to relevant water quality goals. Technical reports are being summarized in fact sheets that capture key findings in a more readable format.

The state needs to produce timely, complete, and technically valid water quality reports and lists called for under CWA Sections 305(b) and 303(d). The listing policy and the upgrade to GeoWBS should facilitate this. The state also must submit annual updates of water quality information. The annual update of monitoring data to the national exchange network and STORET warehouse via the CEDEN exchange network beginning in fiscal year 2006-2007 will satisfy this requirement.

Implementation Priorities

In fiscal year 2005-2006, the California Water Boards will approve the 2004-2006 303(d) list, and staff will prepare the 2006 305(b) report. Annually, The State Water Board produces a report to the Legislature that summarizes coastal beach postings and closures

The regions vary in their assessment and reporting of their monitoring data. Because of resource constraints, several regions have focused on data collection instead of assessment and reporting. Beginning in fiscal year 2005-2006, the Roundtable will work toward timely reports produced within two years of data collection. If SWAMP obtains additional resources, we will also submit results for publication in peer-reviewed journals.

In addition to technical summaries, the Roundtable recognizes the need for the translation of data into information for decision makers. This has been occurring informally in each of the Regions, where monitoring designs have been based on local information needs. Beginning in fiscal year 2005-2006, the Roundtable is committed to producing timely fact sheets to make information more accessible to all interested parties. In fiscal year 2006-2007, we will redesign the SWAMP Web site to improve the public's access to monitoring information.

9. Programmatic Evaluation

Key Components and Essential Attributes

Our vision is to conduct periodic reviews of each aspect of the program to determine its scientific validity, whether it is being implemented as designed, and how well it serves the water quality decision needs of the state.

This will require the California Water Boards, in consultation with USEPA Region Nine, to conduct periodic reviews of each aspect of the SWAMP program to determine how well the program is being implemented and how well it serves the water quality decision needs for all state waters, including all waterbody types. This review must include an evaluation of the monitoring program to determine how well each of the 10 elements is addressed, and how to incorporate needed changes and additions into future monitoring cycles. This evaluation will take into consideration the effects of funding shortfalls on implementation of the monitoring program strategy.

SWAMP should be evaluated as part of a continuous improvement feedback loop. This may include, for example, undertaking audits focused on implementation of the monitoring program objectives, quality assurance protocols, laboratory procedures, and data assessment procedures.

Goals and Objectives

Goal: Ensure that the program is being implemented as designed.

- Review annual workplans to ensure that all program elements are addressed in workplans
- Use information from regional audits to document the extent of compliance with elements

Goal: Ensure that the SWAMP program is meeting the needs of other Board programs (for example, the TMDL or NPS programs).

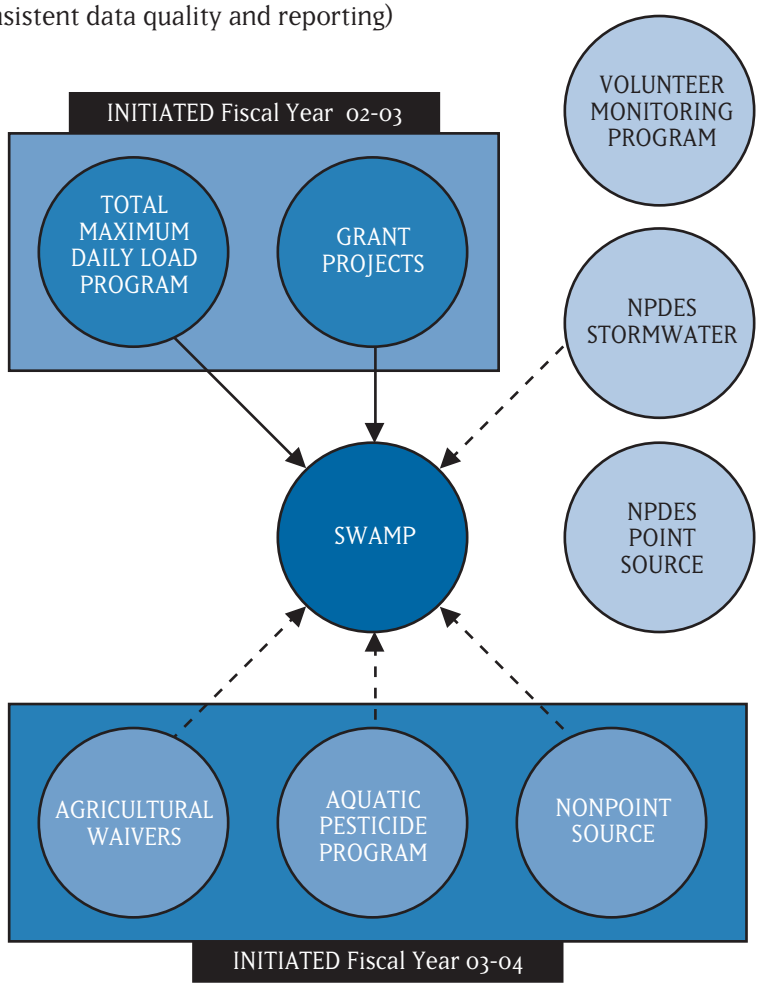
- Annual evaluation by SWAMP
- Annual evaluation by USEPA
- Periodic evaluation by program offices

Goal: Ensure that the program is technically sound.

- Ensure technical defensibility of Monitoring Plans and technical reports
- Triennial review by Scientific Planning and Review Committee
- Develop and implement process to respond to Scientific Planning and Review Committee

Water Board Monitoring Coordination

(Consistent data quality and reporting)



LEGEND

SWAMP	Surface Water Ambient Monitoring Program
TMDL	Total Maximum Daily Load Program
NPDES	National Pollutant Discharge Elimination System Permitting Program

Current Status

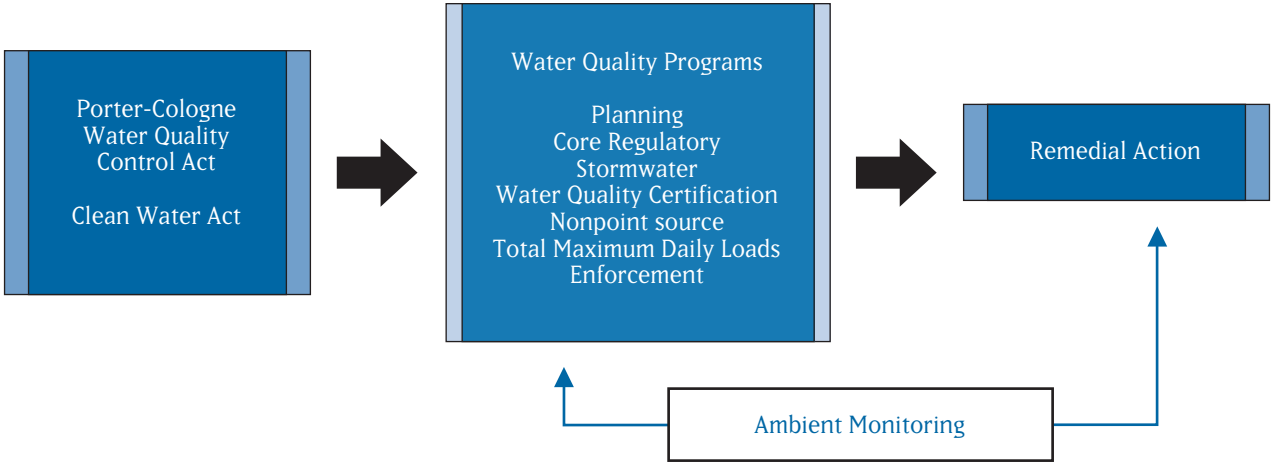
Currently, the SWAMP program receives input, review, and guidance from a number of entities. SWAMP needs to develop and implement a new advisory group process that meets goals and objectives, and takes advantage of the resources of the entities already formed to assist the program.

SWAMP Roundtable

Coordination of SWAMP is achieved through monthly meetings of the SWAMP Roundtable. The Roundtable is composed of State and Regional Water Board staff and representatives from other agencies and organizations, including the Department of Fish and Game, the Marine Pollution Studies Lab, and the University of California. Interested parties, including members of other agencies, consultants, or other stakeholders are welcome to participate. Roundtable members provide programmatic, technical, and logistical support and guidance on the implementation of the program. Generally, decisions are made by consensus. The strength of the current program resides in the Roundtable. Together, the skills, knowledge, abilities, and perspectives of the individual members combine to form a coordination entity stronger than its individual participants.

Watershed Technical Advisory Committees

Some regions have elected to receive reviews and coordinate their watershed assessments by relying on locally appointed technical advisory committees (TACs). The TAC functions vary and may include planning and/or review. Although effective for individual regions, TACs' inconsistent implementation among regions limits their overall program value.



Assembly Bill 982 Public Advisory Group (PAG)

Formed in response to Assembly Bill 982, the Public Advisory Group is an advisory stakeholder group composed of 12 representatives of the discharger community and 12 representatives from environmental organizations. SWAMP is required to implement all consensus recommendations of the PAG. The PAG had a major role in the original SWAMP design, but has not been active in almost two years.

Scientific Planning and Review Committee

An external scientific panel, the Scientific Planning and Review Committee (SPARC) was organized by SWAMP to review monitoring objectives, design, approaches, indicators, and other relevant topics. Committee members are representatives from federal and state agencies and academics with expertise in fields such as monitoring program management, monitoring design, ecology, chemistry, quality assurance, pathogens, toxicology, and statistics. An external peer review is scheduled for the end of 2005.

Implementation Priorities

Beginning in fiscal year 2003-2004, SWAMP has been supported through a monitoring surcharge on Waste Discharge Permit Fees. The regulated waste discharger community has requested input on the design and implementation of the program. The program needs to establish the requested stakeholder group. However, the Roundtable is seeking input from a group with broader make-up than just regulated dischargers. Technical experts, the regulated community, environmental groups, and The State Water Board staff should all be part of the committee. The first meeting is scheduled for Spring 2006.

The Roundtable will establish and implement a systems approach to program evaluation in fiscal year 2005-2006. This will include annual evaluation of program elements and peer review of all monitoring plans and technical reports.

10. General Support and Infrastructure Planning

Key Components and Essential Attributes

Our vision is to provide the support needed to implement a coordinated and comprehensive monitoring and assessment program.

This will require the resources to maintain the existing program, and it will require the identification of current and future resource needs to fully implement the SWAMP strategy. As part of an ongoing triennial review and planning process, the following needs should be assessed, considering current conditions and planned improvements.

- Identify the required number of staff needed for SWAMP implementation
- Identify needed laboratory support to perform scientifically appropriate documented methods
- Identify training needs for program implementation, including for field, laboratory, data management, and data assessment staff
- Identify required funding (for example, for salaries, training, travel, equipment, and laboratory analysis) for implementing the program, along with anticipated sources and amounts of funding, and the effects of any shortfalls

As part of its overall strategy, SWAMP will optimize the use of available resources to leverage funding and maximize the generation of useful information.

Goals and Objectives

Goal: Provide ongoing program coordination, administration and oversight.

- Provide program coordination
- Provide regional coordination
- Provide administrative oversight

Goal: Update the SWAMP needs assessment.

- Identify annual monitoring needs of Regional Water Boards
- Identify annual monitoring needs of The State Water Board
- Prepare budget for upcoming year
- Forecast budget needs for three years

Current Status

SWAMP is currently funded at approximately 7 percent of the original estimate in the 2000 Needs Assessment. The lack of adequate resources has seriously limited what we can accomplish. It is highly unlikely that the program will ever have the resources described in 2000. The development of this Strategy is seen as a critical first step in designing a more cost efficient program.

Implementation Priorities

SWAMP resource needs were identified in November 2000. This needs assessment needs to be updated to describe the proposed strategy funding and staff needs, as well as training, laboratory resources, and infrastructure needs. Staff will complete this update during fiscal year 2006-2007.

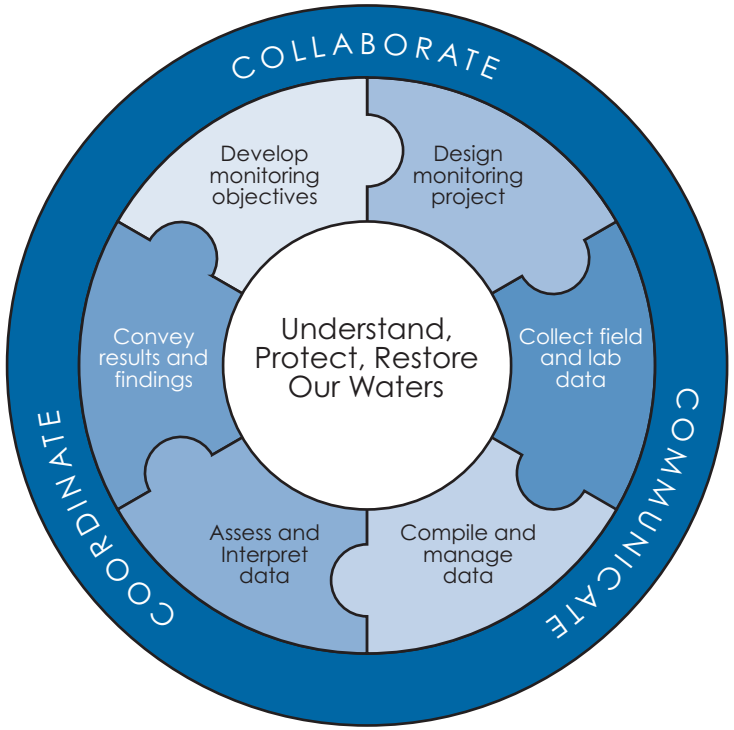
Core Implementation Priorities

SWAMP's Strategy incorporates the operating principles, monitoring goal, monitoring objectives, and strategies of The State Water Board Strategic Plan. The 10 elements of the SWAMP strategy are integrated through the implementation of four overarching priorities that parallel the USEPA priority actions for monitoring.

- Improve and strengthen SWAMP so that all California Water Board programs generate credible, comparable, and comprehensive information by using a monitoring framework and data standards consistent with the guidance developed by the NWQMC.
- Develop and promote the use of multiple monitoring tools such as statistically based surveys, judgmental surveys, predictive modeling, risk assessments, expert systems, and newer information and monitoring technologies.
- Continue working with monitoring programs currently coordinated through the California Environmental Data Exchange Network hosted by the Department of Water Resources. This coordination will increase data comparability, increase the potential for true collaboration with other entities collecting ambient water quality information and will make data available to the public.
- Build stronger partnerships with agencies, watershed groups, citizen monitors, and others to facilitate the sharing of information, the collection of comparable data and the use of monitoring tools. This includes working closely with the newly formed Nonpoint Source Tracking and Monitoring Council.

Priority Action 1

Implementing the aforementioned priorities has been the focus of the statewide SWAMP effort for the past three years. Specific actions to continue implementation of those four priorities involve multiple strategy elements.



(from http://water.usgs.gov/wicp/acwi/monitoring/)

1. Gradually strengthen state and regional programs

A) IMPLEMENT THE NWQMC MONITORING FRAMEWORK. (Objectives, Design, Data Management, Data Analysis/Assessment, and Reporting)

The monitoring framework is the product of the NWQMC. It was designed to meet the data and information challenges facing water quality management today and closely follow the 10 elements of the USEPA Elements document. The purpose of the monitoring framework is to permit a general and common comprehension of the diverse activities involved in monitoring. Such an understanding is critical to the production of scientifically sound, consistent, and comparable water quality information required to support fair and equitable water

quality decision making (American Water Resources Association 2003). The framework consists of six phases: (1) Develop specific objectives; (2) Design monitoring program; (3) Collect field and laboratory data; (4) Compile and manage data; (5) Assess and interpret data; and (6) Convey findings and evaluate program. The monitoring framework is described more fully in Appendix F.

SWAMP will use the monitoring framework to ensure that we sufficiently and consistently address each phase. The framework will "guide the activities of the program by identifying, connecting, and prioritizing specific aspects of the various framework elements to ensure that all components are included, balanced, connected, and collectively focused on producing quality information"(NWQMC fact sheet, reprinted in Appendix F).

B) CONDUCT PRIORITIZATION EXERCISE FOR MONITORING OBJECTIVE IMPLEMENTATION:
Specific tasks for the next three years include:

- Complete the process of clearly defining the water-resource assessment questions. These water quality issues or questions determine monitoring objectives. The objectives determine the monitoring design. The Roundtable is outlining the decisions that will be made from the data and then identifying the data (or monitoring) needed to make the decision. (Objectives, Design)
- Examine the status of existing state and regional programs. Existing monitoring programs will be cataloged for their management questions and their current and potential abilities to address specific monitoring objectives related to waterbody type and beneficial use assessment. This task will be initiated in fiscal year 2004-2005 and completed in fiscal year 2005-2006. The NPS Monitoring Council will be asked to add to the catalog. Catalog format and parameters will be consistent with the format being developed by the NWQMC. (Design)
- Identify gaps, weaknesses, and redundancies of the state's monitoring programs. (Design)
- Identify gaps and weaknesses in Basin Planning and Standard Development. (Indicators)
- Prioritize objectives. (Objectives, Design)
- Conduct technical peer review. Following the prioritization exercise and the development of objectives and an appropriate monitoring design, submit the strategy to the SWAMP SPARC for evaluation before implementation. (Program Evaluation)

C) CONTINUE DEVELOPMENT AND IMPLEMENTATION OF COMPARABLE DESIGN, SAMPLING, AND ANALYSIS PROCEDURES:
Specific tasks for the next three years include:

- Develop and implement a comparable approach for regional watershed assessments to maximize the information gained from all SWAMP monitoring. When SWAMP monitoring was initiated in fiscal year 2000-2001, 12 different approaches were used for conducting watershed assessments. One region has four separate approaches. Since that time, progress has been made toward statewide standardization, with the majority of regions adopting a "rotating basins" approach. The common approach needs to promote greater statewide consistency and comparability while still being flexible enough for Regional Water Boards to focus on region-specific issues. Ideally, the state and regional monitoring efforts should inform one another. This issue has been a particularly difficult one for the SWAMP Roundtable, largely due to the lack of sufficient funding for a comprehensive approach, but also because the Regions feel that the ability to address

region-specific issues should be paramount. In general, the Regions do not support the need for comparability among regional programs simply for the sake of consistency. They want to focus the available funding on addressing key issues at the regional scale, which differ from region to region and often require different monitoring methods. Further, SWAMP is an umbrella program, which the Regions use to coordinate their region-specific monitoring efforts and collaborate with other existing programs and monitoring projects. Coordination and collaboration with other programs and stakeholders requires flexibility in monitoring approaches. (Objectives, Design, and Indicators)

- Produce second edition of the SWAMP QMP. (Quality Assurance)
- Complete summary of current field methods, relevant data quality objectives, training tools, standard operating procedures, and training CD ROM. (Quality Assurance)
- Develop and implement a system for the performance-based comparison of methods.
- Develop and implement systems for quality assurance audits of laboratories, field activities, and The State Water Board Programs. (Quality Assurance)
- Develop and implement systems for data verification and validation processes. (Quality Assurance and Data Management)
- Develop query tools for the SWAMP database. (Data Management and Data Assessment)
- Develop and implement assessment and reporting guidance. (Design and Reporting)
- Expand the SWAMP component of the Water Board Training Academy. (General Support and Infrastructure Planning)
- Develop and implement processes for evaluating program implementation, program effectiveness, and technical validity. (Programmatic Evaluation)
- Gradually increase the number of The State Water Board programs that utilize SWAMP standards and guidance.

D) EXPAND USE OF PREDICTIVE TOOLS, LANDSCAPE MODELS: (Design, Indicators and Assessment)

There will never be sufficient resources to individually monitor all water bodies for attainment of all beneficial uses. More information than can be measured is required for comprehensive water resource management. Therefore, a critical step in providing a cost-effective understanding of water quality is to begin development and verification of predictive tools and models. Such tools and models are needed to extrapolate or forecast conditions to unmonitored, yet comparable areas—both spatially and temporally.

- As part of a comprehensive monitoring design, include pilot projects that rely on predictive tools, landscape models, and expert systems.
- Plan for increased use of predictive models and tools as part of first strategy revision.

Priority Action 2

Encourage integrated use of multiple monitoring methods and tools

Specific tasks for the next three years include:

- Expand the application of consistent monitoring approaches across regions to address regional and statewide objectives. These may include both probabilistic and rotational watershed designs. (Design)
- Facilitate the use of new technologies and tools for quality assurance. (Quality Assurance)
- Facilitate the use of new technologies and tools for field monitoring, that is, remote sensing, use of multi-meters and satellite images. (General Support and Infrastructure Planning)
- Facilitate the use of new technologies and tools for information management, that is, personal digital assistants (PDAs) for field data entry, Electronic Data Formats (EDFs) for batch uploads of lab data and expert systems for planning and assessment. (Indicators, Quality Assurance, Data Management, General Support and Infrastructure Planning)
- Provide appropriate training for developing data quality objectives, monitoring design, monitoring technology, and tools. (General Support and Infrastructure Planning)

Priority Action 3

Expand accessibility and use (comparability) of data.

SWAMP is making excellent progress in this area. Specific tasks for the next three years include:

- Complete database development. (Data Management, Data Analysis/Assessment)
- Complete data reporting documentation. (Data Management)
- Implement metadata guidance. (Data Management)
- Continue method performance studies. (Quality Assurance)
- Develop field performance criteria. (Quality Assurance)
- Gradually increase the number of The State Water Board programs that utilize SWAMP standards and guidance. (General Support and Infrastructure)
- Continue partnering with the Department of Water Resources to use the CEDEN. (Data management, Reporting)
- Continue coordination with other monitoring efforts. (Design, Indicators, Assessment)
- Provide relevant, timely, and cost-effective information to the Legislature, decision makers, stakeholders, and citizens about ambient water quality conditions. (Reporting)

Priority Action 4

Promote Partnerships. : (all elements)

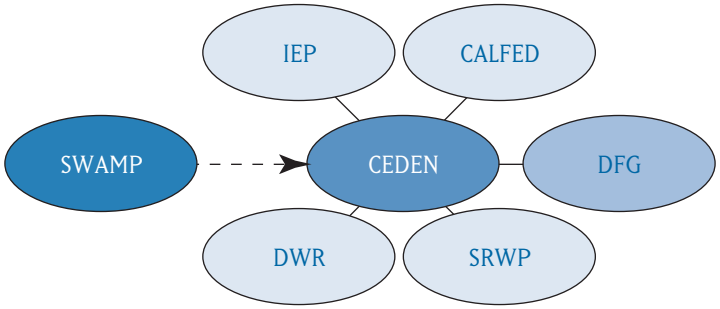
Each phase of the monitoring strategy requires communication, coordination, and collaboration, the "Three Cs" as referred to by NWQMC. The "Three Cs" indicate the importance of inclusion in the monitoring process and move us closer to monitoring that is consistent, comparable, and scientifically defensible. The resulting information is more accessible and facilitates sound decision making by all stakeholders. This will be enhanced by including other entities as partners in monitoring efforts, as well as encouraging appropriate public participation throughout the monitoring process.

The formation of the California Nonpoint Source Tracking and Monitoring Council (Monitoring Council) and the further development of CEDEN will assist with the " Three Cs. "The Monitoring Council was initiated in 2005 by the State Water Board and California Coastal Commission, in cooperation with USEPA, to help improve water quality monitoring and implementation tracking at many levels (for example, from local watershed organizations to state and federal agencies and the private sector) and to enhance efforts to address nonpoint source pollution and protect designated uses. For more information, refer to the Monitoring Council Charter in Appendix D.

SWAMP has a number of ongoing and proposed approaches to enhance monitoring partnerships.

- Continue monthly meetings of SWAMP Roundtable.
- Establish a stakeholder group to providing guidance to the Roundtable.
- Actively participate in the NPS Tracking and Monitoring Council.
- Engage the regulated community to maximize National Pollution Discharge Elimination Systems and waste discharge requirements monitoring comparability with SWAMP.
- Expand the role of volunteer monitoring and the Clean Water Team in SWAMP.
- Continue participation in NWQMC.
- Identify, develop, and implement joint projects with partners.
- Participate in Web-based applications for tracking monitoring entities.
- Expand the SWAMP component of Water Board Training Academy to include courses for all stakeholders and interested parties.

Database Integration



SWAMP	Surface Water Ambient Monitoring Program
CEDEN	California Environmental Data Exchange Network
IEP	Interagency Ecological Program
DFG	Department of Fish & Game
SRWP	Sacramento River Watershed Program
DWR	Department of Water Resources
CALFED	State and Federal Interagency GroupAmerican Water Resources Association, 2003. Water Resources Impact. American Water Resources Association, Middleburg, VA

CITIZEN MONITORING

Citizen monitoring is defined as any environmental monitoring activity that relies in whole or in part on the participation of volunteers, students, or other non-paid staff. Citizen monitoring activities include collecting water quality data, evaluating habitat, or making visual observations of a waterbody's health. By monitoring local waterbodies, local watershed groups are able to collect valuable data and identify potential pollution sources or widespread problems. Citizens are the eyes of the State in all the State's watersheds. They live there and see what is happening. Citizen monitoring groups have an additional advantage in being able to cost effectively collect large amounts of information. California's citizen monitors have the ability to make a significant positive impact in the health of the State's waters.

Citizens conduct monitoring for many reasons. Goals may include gathering baseline information, assessing the conditions of their creeks, testing the effectiveness of management measures and management practices, trend monitoring, assessing restoration projects, first flush monitoring, and responding to specific pollution events. These citizen monitoring projects are as robust as any other monitoring effort. Their projects involve the designing of a Monitoring Plan, forming a technical advisory committee, implementing a Quality Assurance Project Plan, using databases and geographical information systems, and preparing health and safety documents and training manuals.

A wide variety of organizations throughout California have been involved in citizen monitoring projects. These include, but are not limited to, grassroot efforts, non-profit groups, Resource Conservation Districts, Coordinated Resource Management and Planning groups, local government agencies, and educational organizations (universities, colleges, and schools). The State Water Resources Control Board and many of the Regional Water Quality Control Boards are actively involved in citizen monitoring. Successful Prop. 13, 319(h), or 205(j) contractors have also received funds through the State Water Resource Control Board, Department of Water Resources, and the California Coastal Commission that support citizen monitoring.

The Clean Water Team, a part of SWAMP, works with citizen monitors to help provide meaningful, usable, and reliable data of known quality for a variety of purposes, and to meet many of the Strategy objectives. Work by the Clean Water Team also provides for statewide consistency and the reliability of citizen monitoring programs.

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Appendices

Appendix A
SWAMP Report Card

Evaluating State Monitoring and Assessment Programs and Strategies

Introduction

Every State water monitoring and assessment program should have as its foundation a long-term strategy that addresses how all water management needs will be met in all waterbody types (e.g., streams, lakes, wetlands, estuaries, and large rivers) in the State. The program should be driven by a clear set of monitoring objectives, and by monitoring designs (i.e., designs that integrate multiple monitoring tools) that best meet those objectives. It should use a common set of core water quality indicators that can be compared over time and across State boundaries; maintain peer reviewed and updated quality assurance plans; use accessible data management systems; and report on its water quality findings in a timely manner. Further, each program should clearly spell out its resource needs and regularly revisit its progress toward meeting those needs. The United States Environmental Protection Agency's (USEPA) *Elements of a State Water Monitoring and Assessment Program,* issued in March 2003, lays out this set of basic components for an effective State monitoring program.

Attached is a table developed by USEPA as a means of ensuring consistency in evaluating the States' monitoring strategies and their implementation of the *Elements of a State Monitoring and Assessment Program.* Through the process of developing long term monitoring strategies, USEPA expects States to fully evaluate their monitoring programs, identify program gaps, and develop implementation plans to address those gaps.

Using This Table

First, note that each level in this table builds on the ones before it. Thus, a Level 4 program will have the characteristics of a Level 3 program PLUS a Level 4 program.

The table should be interpreted as follows:

- Level 1 and Level 2 programs are not consistent with the *Elements* guidance.
- Level 3 programs are consistent with *Elements* guidance. State monitoring strategies should lay out a process for reaching Level 3. Strategies that do not do so are not consistent with guidance.
- Level 4 represents an enhanced program.

The USEPA Region, in conjunction with the State, will review the State's monitoring strategy to determine whether the strategy includes appropriate steps to implement the *Elements of a State Monitoring and Assessment Program.* This evaluation will take into account the effects of funding shortfalls on implementation of the State monitoring strategy. USEPA Headquarters will participate in assessing overall State progress from a national perspective. Attached is a "self appraisal" of the current status of SWAMP and information on our ability to make progress.

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
Strategy: A comprehensive monitoring program strategy addresses all water quality management needs and all waters of the State, including all waterbody types (e.g., streams, rivers, lakes, Great Lakes, reservoirs, estuaries, coastal areas, wetlands, and groundwater).	The State does not have a monitoring strategy, or the State monitoring strategy does not address each Element.	The State's monitoring strategy includes information on all Elements, but does not provide a complete description of program status, identify program needs, or include an implementation plan with milestones to address these needs.	The State has a comprehensive monitoring program strategy that serves its water quality management needs and addresses all State waters. The strategy contains, or references, a description of how the State plans to address each of the remaining nine Elements. The strategy includes a time line, not to exceed ten years, for implementation. The strategy identifies technical issues and resource needs that are currently impediments to an adequate monitoring program.	The State strategy addresses all water resource management needs including the need to support decisions at scales beyond state boundaries (e.g., inter-jurisdictional waters, ecoregions, national). The State strategy includes plans for periodic updates every 3-5 years.
	Exceed this level.	Current status It should be noted that the current strategy has achieved several attributes of Levels 3 and 4.	This will be achieved by the end of FY06-07. Strategy implementation will be dependent on resources.	The strategy is a living document that will be updated annually. Major revisions will occur in response to triennial external peer review, as necessary. National comparability will be achieved by implementing NWQMC guidance. Groundwater and border issues are covered by other state programs.

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
Objectives: The State monitoring program is guided by clearly delineated objectives consistent with the requirements, goals, and intent of the CWA and relevant State laws.	The State does not define its monitoring objectives that include the CWA and other program needs.	The State has identified some, but not all, monitoring objectives to support decision needs relevant to all types of State waters.	The State has identified monitoring objectives critical to the design of a monitoring program that is efficient and effective in generating data that serve management decision needs. This full range of monitoring objectives includes, but is not limited to, Clean Water Act goals. Consistent with the CWA, monitoring objectives reflect the decision needs relevant to all types of State waters.	State monitoring objectives reflect the need to collect data in order to support decisions at scales beyond State boundaries (e.g., inter-jurisdictional waters, ecoregions, national).
	Exceed this level.	Current status. The November 2000 Report to the Legislature lays out a set of monitoring objectives that support most, but not all decision needs. The SWAMP roundtable has agreed to focus on this topic in FY04-05 and FY05-06.	This will be achieved by the end of FY06-07. Strategy implementation will be dependent on resources.	National comparability will be achieved by implementing NWQMC guidance. The Lahontan Regional Water Quality Control Board's SWAMP monitoring reflect the need to provide data to the State of Nevada. The Colorado River Regional Water Quality Control Board's SWAMP monitoring reflect the need to provide data on US-Mexico border issues.

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
Design: The State has a comprehensive monitoring program design and rationale for selection of monitoring sites that incorporate several approaches (e.g., fixed station, intensive and screening level monitoring, rotating basin, judgmental, and probability design) to meet the range of program objectives.	The State does not have documented monitoring program designs or rationale for how its designs meet program objectives.	The State has documented monitoring program designs and rationale for selection of monitoring sites for some, but not all, monitoring objectives and waterbody types.	The State has a documented approach and rationale for selection of monitoring designs and sample sites that best serve its monitoring objectives. The State monitoring program uses several monitoring designs (e.g., fixed station, intensive and screening-level monitoring, rotating basin, judgmental and probability design) to meet the full range of decision needs. The State monitoring design includes a probability-based network for making statistically valid inferences about the condition of all State water types, over time. The State uses the most efficient combination of monitoring designs to meet its objectives.	The State integrates probability sampling, landscape and other predictive tools, and targeted, special-issue approaches into a tiered monitoring design that covers all resource types, all uses and all programs. The overall State monitoring design reflects the need to collect data in order to support decisions at scales beyond State boundaries (e.g., inter-jurisdictional waters, ecoregions, national).
	Exceed this level.	Current status. Each Region has a monitoring design to address Regional objectives. It should be noted that the current strategy has achieved several attributes of Levels 3 and 4.	This will be achieved by the end of FY06-07. The State monitoring design includes a probability-based network for making statistically valid inferences about the ecological condition of wadeable streams and coastal waters Implementation will be dependent on resources.	National comparability will be achieved by implementing NWQMC guidance. Staff is participating in the development of the National Monitoring Network.

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
Indicators: The State monitoring strategy defines a core set of monitoring indicators (e.g., water quality parameters), including physical/habitat, chemical/toxicological, and biological/ecological endpoints used to assess attainment.	The State does not have a core set of indicators that includes biological and chemical measures.	The State has a core set of indicators that includes biological, physical, and chemical measures for some, but not all, uses and major waterbody types. Also, the State describes how indicators are linked to the uses.	The State uses a tiered approach to monitoring that includes core indicators selected to represent each applicable designated use, plus supplemental indicators selected according to site-specific or project-specific decision criteria. Core indicators for each water resource type include physical/habitat, chemical/toxicological, and biological/ecological endpoints as appropriate, and can be used routinely to assess attainment with applicable water quality standards throughout the State.	State indicators reflect the need to collect data in order to support decisions at scales beyond State boundaries (e.g., inter-jurisdictional waters, ecoregions, national).
	Exceed this level.	Exceed this level.	Current status: SWAMP has a core set of indicators that includes biological and chemical measures, but they are not being implemented in every region.	

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
QualityAssurance: Quality Management Plans (QMPs) and Quality Assurance Program/Project Plans (QAPPs) are developed, maintained, and peer-reviewed in accordance with USEPA policy to ensure the scientific validity of monitoring and laboratory activities.	The State does not have a Quality Management Plan and/or appropriate Quality Assurance Project Plans.	State has an USEPA approved Quality Assurance Project Plan and Standard Operating Procedures, but not a Quality Management Plan. The State implements QA activities, as defined in plans.	The State's Quality Management Plan and Quality Assurance Program/Project Plans are established, maintained, and peer reviewed in accordance with USEPA policy to ensure the scientific validity of monitoring and laboratory activities, and to ensure that State reporting requirements are met. State implements QA activities, as defined in plans.	Quality Assurance approval authority has been delegated to the State level. The State implements QA activities, as defined in plans. State quality assurance plans and implementation reflect the need to collect data in order to support decisions at scales beyond State boundaries (e.g., inter-jurisdictional waters, ecoregions, national).
The evaluation of current status on this element refers only to Quality Assurance activities of the SWAMP Program, and does not include the overall QA program of the Water Boards.	Exceed this level.	Exceed this level.	Current Status. Quality Assurance activities are a top priority of the SWAMP Program. Considerable progress has been made since the formation of the SWAMP QA Team. The SWAMP QA Officer solicits input from the Water Boards and USEPA Region 9.	The SWAMP QA Program has a 36-month implementation calendar that would allow the program to go beyond State boundaries.

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
DataManagement:The State stores and manages data in a timely and accessible electronic system. USEPA will require States to directly or indirectly (via the Central Data Exchange (CDX) and the Monitoring Data Standards) use the new STORET (STOrage and RETrieval) system.	The State does not have a computerized database.	The State has a computerized database that includes appropriate metadata and State/Federal geo-locational standards.	The State uses an accessible electronic data system for water quality, fish tissue, toxicity, sediment chemistry, habitat, biological data, with timely data entry (following appropriate metadata and State/Federal geo-locational standards) and public access. The State uploads data to STORET and uses the Assessment Data Base (ADB) or an equivalent database, and the National Hydrography Dataset (NHD) (where available).	The State works with other major data producers to get their data into STORET. The State uploads data to STORET more frequently than annually. State data management activities reflect the need to collect data in order to support decisions at scales beyond State boundaries (e.g., inter-jurisdictional waters, ecoregions, national).
The evaluation of current status on this element refers only to data management activities of the SWAMP Program, and does <u>not</u> include the overall data management program of the Water Boards.	Exceed this level.	Current status. It should be noted that the current strategy has achieved several attributes of Levels 3 and 4.	Public access is available through CEDEN. ADB and NHD equivalent system for assessment information will be functional in FY06-07. Data will be uploaded to STORET through CEDEN in FY06-07.	National data comparability will be achieved by implementing NWQMC guidance. CEDEN will be linked to the Pacific Northwest data exchange network in FY06-07.

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
Data Analysis:The State has a methodology for assessing water quality based on analysis of various types of data (chemical, physical, biological, land use) from various sources, including all waterbody types and all waters of the State.	The State provides little or no information on its assessment methodology.	The State's assessment methodology does not address all waterbody types and uses, or the methodology is not reproducible, or the State is not using data from other sources.	The State has a documented methodology for assessing attainment of water quality standards based on analysis of various types of data (chemical, physical, biological, land use) from various sources, for all waterbody types and all State waters. The methodology includes criteria for compiling, analyzing, and integrating all readily available and existing information (e.g., volunteer monitoring data, discharge monitoring reports).	The State's data management system supports/ automates the assessment process. The State has a documented methodology to measure how it performs and assesses cumulative effectiveness of water quality programs. The State has documented methods for assessing stressors (causes/sources) associated with impaired or vulnerable waters. The State has data analysis plans formulated to address other water program needs, (e.g., NPDES program effectiveness and permitting, trend analyses, water effect ratios, TMDL calculations, etc.). State monitoring objectives reflect the need to collect data in order to support decisions at scales beyond State boundaries (e.g., inter-jurisdictional waters). ecoregions, national).
	Exceed this level.	Exceed this level.	Current status.	

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
Reporting: The State produces useful reports on its findings under CWA Sections 305(b), 303(d), 406, and others.	The State does not provide water quality reports including 305(b) and 303(d) (or the Integrated Report). The State does not provide required annual updates.	The State provides water quality reports including 305(b) and 303(d) (or the Integrated Report) and annual updates. Reports may not be timely or complete.	The State produces timely and complete water quality reports and lists called for under Sections 305(b) and 303(d) (or the Integrated Report) of the Clean Water Act and Section 406 of the Beaches Act.	The State uses the Integrated Reporting format, including reporting results of randomized design and aggregating site-specific assessment findings for the whole State. The State provides timely updates to the ADB to reflect changes based on final 303(d) lists. The State provides the information on web sites.
	Exceed this level.	Current status. California has been chronically late in submitting both the 305(b) report and 303(d) list.	Beginning in 2008 the State will submit an Integrated Report. The report will include reporting results from randomized design for entire state.	

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
Program Evaluation: The State, in consultation with its USEPA Region, will conduct periodic reviews of each aspect of its monitoring program to determine how well the program serves its water quality decision needs for all navigable U.S. waters in the State, including all waterbody types.	The State does not have a monitoring program evaluation process.	The State has an incomplete monitoring program evaluation process. For example, the State lacks a process for soliciting feedback from all programs.	The State, in consultation with its USEPA Region, conducts periodic reviews of each aspect of its monitoring program to determine how well the program serves its water quality decision needs for all State waters, including all waterbody types. This consultation should involve evaluating the monitoring program to determine how well each Element is addressed and determining how needed changes and additions are incorporated into future monitoring cycles.	The State seeks external participation in program evaluation (e.g., from scientific peer review, monitoring councils, volunteer organizations, academic institutions, local government, private organizations, etc.).
	Exceed this level.	Current Status.		Current Status. SWAMP has an external peer review process—the Scientific Planning and Review Committee (SPARC).

Evaluating State Monitoring and Assessment Programs and Strategies

Monitoring Program Element	Level of Development			
	Level 1	Level 2	Level 3	Level 4
General Support and Infrastructure: States identify current and future monitoring infrastructure needs.	The State does not document current and future resource needs.	The State provides an incomplete report of current and future resource needs to implement its monitoring programstrategy.	The State identifies current and future resources required to fully implement its monitoring program strategy. This needs assessment includes funding, staff, training, laboratory resources, and upcoming improvements.	The State plan for meeting resource needs includes use of other partners (e.g., other state agencies, volunteer organizations, academic institutions, local government, private organizations, etc.)
	Exceed this level.	Current Status. In the November 2000 Report to the Legislature the resource needs for a comprehensive program were identified.	This will be achieved during FY06-07.	This will be achieved during FY07-08.

Appendix B
Summary of SWAMP Goals and Objectives

Table B1. Summary of SWAMP Strategy goals and objectives.

VISION STATEMENT	GOALS	OBJECTIVES
1 **Strategy** That water quality is comprehensively measured to protect beneficial uses, and to evaluate our protection and restoration efforts.	Develop SWAMP monitoring strategy for developing and implementing an integrated comprehensive statewide monitoring program in 10 years.	Prepare stategy
	Implement SWAMP monitoring strategy	Develop annual workplan(s)
		Develop 3-year workplan
		Develop and implement process for periodic evaluations and updates
	Promote coordination of monitoring activities and comparability of data	Continue periodic meetings of SWAMP Roundtable
		Establish a stakeholder group to provide guidance to Roundtable Actively participate in the NPS Tracking and Monitoring Council
		Engage regulated community to maximize NPDES and WDR monitoring comparability with SWAMP
		Include Volunteer Monitoring and the Clean Water Team in SWAMP
		Continue participation in NWQMC
		Work on joint projects with partners
		Participate in web-based applications for tracking monitoring entities
		Continue SWAMP component of Water Board Training Academy to include courses for all stakeholders and interested parties
2 **Monitoring Objectives**· To define a complete set of monitoring objectives, based on beneficial use attainment and other water quality objectives, and reflecting the full range of regulatory responsibilities and water quality programs for all water bodies.	Define statewide monitoring objectives	Compile and review existing objectives (in Clean Water Act, Legislative Report, 2002 Strategic Plan, 2003 Partnership Agreement, Governor's Action Plan for the Environment, EPIC)
		Provide recommendations for statewide monitoring objectives that can be addressed through the coordination of State and Regional Board program by the SWAMP program
	Define regional monitoring objectives	Compile and review objectives from Regional Water Boards for each of their regulatory and non-regulatory programs
		Identify areas of overlap among Regions and with State objectives
	Develop consensus on shared objectives	Identify shared objectives

Table B1. Summary of SWAMP Strategy goals and objectives.

VISION STATEMENT	GOALS	OBJECTIVES
3 **Monitoring Design·** To develop and implement a monitoring design that maximizes our ability to meet our monitoring objectives with existing resources.	Refine management questions for assessing core beneficial uses for all waterbody types	Recreational uses (swimming)
		Fishing uses
		Aquatic life support
		Drinking water use
	Inventory management questions of existing programs and monitoring entities	Identify programs collecting relevant data
		Establish/continue coordination to promote data sharing
	Develop strategy to answer assessment questions for each waterbody type	Addressing rivers and wadeable streams
		Addressing lakes and reservoirs
		Addressing marine coastal areas, bays and estuaries
		Addressing wetlands
		Addressing groundwater
	Design cost-effective monitoring program	Develop designs to meet statewide monitoring objectives
		Develop nested framework for integrating Regional Water Board efforts into statewide program
		Develop framework for integrating other Water Board efforts into statewide program
		Develop framework for integrating other monitoring efforts into statewide program
	Develop and implement a suite of predictive tools to maximize our ability to effectively manage water quality	Develop process for incorporating use of models and other predictive tools into the existing SWAMP strategy
4 **Indicators·** To develop and implement a set of monitoring indicators (and assessment thresholds), which can be used to track the status and trends of water quality and to evaluate the effectiveness of management actions to improve water quality in the State.	Define core indicators for statewide monitoring and assessment for each designated use and for overall watershed health	Review existing indicators from USEPA, the Report to Legislature and EPIC
		Provide recommendations on core indicators for statewide assessment
		Recommend appropriate design for addressing EPIC indicators
		Recommend assessment thresholds for statewide assessment
	Recommend set of core and supplemental indicators for use at local watershed scale	Review indicators used by Water Board efforts and other entities
		Recommend core set of indicators for local assessment
		Recommend supplemental set of indicators for local assessment
		Recommend appropriate monitoring design for local indicators
	Develop a set of locally appropriate indices of biological integrity (IBI)	Summarize existing biological assessment information for California

Table B1. Summary of SWAMP Strategy goals and objectives.

VISION STATEMENT	GOALS	OBJECTIVES
		Conduct a performance-based methods comparison
		Recommend appropriate methods for specific stream type
		Determine reference conditions, as appropriate
		Develop IBIs
	Develop indices for assessment of biological communities for different waterbody types	Foster development and application of IBIs for wadeable stream
		Foster development and application of indices for marine waters, bays and estuaries
		Foster development of CRAM indicators for assessing wetland condition
		Identify short-term and long-term research needs for development of indices for other waterbody types (e.g. large rivers, intermittent streams, lakes, reservoirs)
5 Quality Assurance· To develop and implement a progressive quality assurance (QA) program using a systems-based approach to the generation and storage of application-appropriate data/metadata.	Implement QA Team to provide technical oversight and direction to SWAMP QA activities	Establish QA Team
		Define roles and responsibility of team
	Develop and document SWAMP DQOs for each of the core indicators	Lead SWAMP Roundtable through the DQO process
		Re-assess the SWAMP DQOs on an annual basis
	Evaluate the existing QA/QC program including new methods and program changes against SWAMP DQOs	Assess current SWAMP MQOs against SWAMP DQOs and revise them as necessary
		Create/Revise SWAMP QMP and SWAMP QAPrP
	Implement QA activities to produce data of high consistency/comparability among projects of different scales	Review QAPPs against SWAMP DQOs and MQOs and provide feedback
	Implement QC procedures to produce defensible, credible data that meets SWAMP QMP/QAPrP	Conduct intercomparison studies and performance evaluation tests (as funded)
		Conduct laboratory audits
		Verify data
		Data validation
		Direct production of control charts Produce QA Reports
		Conduct training workshops
		SOP Review and Approval
		Direct production of studies such as holding time studies, sample container studies, method development studies, method detection limit studies, etc. in order to produce technically defensible data

Table B1. Summary of SWAMP Strategy goals and objectives.

VISION STATEMENT	GOALS	OBJECTIVES
	Integrate SWAMP QA/QC procedures in other State Water Board programs	Develop timeline for integrating SWAMP standards
		Evaluate DQOs of Water Board programs
		Create a QA Tool Box
		Provide assistance and training
		Act as a QA consultant and laison for other programs
6 Data Management· To make credible ambient monitoring data and information available to all stakeholders in a timely manner.	SWAMP ambient monitoring data will be stored, checked for quality assurance, and is comparable in the SWAMP database	Establish and maintain an electronic data management system for integrating multiple ambient monitoring data types
		Develop guidelines and technical specifications for data organization, flow, and verification/validation to maintain SWAMP quality and comparability
		Load historic and current SWAMP monitoring data into the temporary side of the database
		Verify and validate data on temporary side and migrate it to the permanent side of the database
	Provide training and tools to facilitate use of SWAMP data and information by Water Board (intra-agency) and non-Water Board (inter-agency) programs	Develop and provide program-specific training and tools to facilitate the use of SWAMP information by SWAMP participants to improve intra-agency coordination within the Water Board
		Facilitate intra-and inter-agency data comparability by developing and providing general use tools such as protocols and formats for electronic data transfer and document these procedures.
	Integrate SWAMP data with information collected by Water Board (intra-agency) and non-Water Board (inter-agency) programs	Develop framework for integrating SWAMP with CEDEN
		Develop framework for integrating SWAMP with CIWQS and GeoWBS
		Coordinate with the TMDL program on SWAMP formats, business rules and training tools
		Coordinate with the Ag Waiver Program on SWAMP formats, business rules and training tools
		Coordinate with Grant Projects on SWAMP data formats, business rules and training tools
		Coordinate with volunteer monitoring groups to facilitate use of the SWAMP data management system
		Establish data server nodes at major data generators throughout the State (e.g. MLML, SCCWRP, SFEI) to serve as points of data consolidation for Water Board programs, data analysis, and public access of data
		Provide for incorporation of SWAMP metadata in the CERES system

Table B1. Summary of SWAMP Strategy goals and objectives.

VISION STATEMENT	GOALS	OBJECTIVES
		Create links to STORET and EIEN through CEDEN to annually upload SWAMP data
7 **Data Analysis and Assessment**· To provide a consistent science-based framework for the evaluation of monitoring data relative to state and regional standards, the protection of beneficial uses and for tracking the effectiveness of management actions.	Develop a method for assessing standards attainment for listing purposes (303(d))	Provide guidance on translation/interpretation of narrative standards
		Implement State Listing policy
	Develop guidance to assist in 303(d)/305(b) assessments, consistent with the 303(d) listing policy	Provide guidance on acquisition and use of primary and secondary data for assessments
8 **Reporting** To report all collected data as information, and in a timely and publicly accessible manner.	Produce timely and complete water quality reports and lists as required by the CWA, and consistent with current USEPA guidance.	Prepare CWA 305(b)/303(d) Integrated Report
		Prepare 303(d) list
		Prepare Beach report
	Report to the public on water quality, taking into account the needs of interested audiences. Use various formats and media such as brochures, fact sheets, report cards, oral presentations, and the Internet.	Prepare fact sheets summarizing SWAMP elements
		Prepare fact sheets summarizing state and regional beneficial use status
		Provide input on status and trends in EPIC indicators
		Re-design and begin improvement of SWAMP web site
	Produce technical reports and peer reviewed journal articles resulting from monitoring program activities	Prepare technical reports within two years of data collection
		Complete preparation of reports from SWAMP monitoring conducted through 2003
9 **Programmatic Evaluation**· To conduct periodic reviews of each aspect of the program to determine its scientific validity, if it is being implemented as designed, and how well it serves the water quality decision needs of the State.	Ensure that program is being implemented as designed	Review annual workplans to ensure that all elements are addressed

Table B1. Summary of SWAMP Strategy goals and objectives.

VISION STATEMENT	GOALS	OBJECTIVES
		Use information from regional audits to document extent of compliance with elements
	Ensure that program is meeting needs of other Board programs	Annual evaluation by SWAMP
		Annual evaluation by USEPA
		Periodic evaluation by program offices
	Ensure that program is technically sound	Ensure technical defensibility of monitoring plans and technical reports
		Trienniel review by SPARC Respond to SPARC
10 General Support and Infrastructure· To provide the specific support needed to implement a coordinated and comprehensive monitoring and assessment program.	Provide ongoing program coordination, administration and oversight	Provide program coordination
		Provide regional coordination
		Provide administrative oversight.
	Update the SWAMP needs assessment	Identify annual monitoring needs of Regional Boards
		Identify annual monitoring needs of State Board
		Prepare budget for upcoming year
		Forecast budget needs for 3 years.

Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
1 **Strategy** That water quality is comprehensively measured to protect beneficial uses, and to evaluate our protection and restoration efforts.	Develop SWAMP monitoring strategy for developing and implementing an integrated comprehensive statewide monitoring program in 10 years.	Prepare stategy	Compile necessary information	F	F	F	F	F
			Articulate vision, goals, objectives, current status, priorities	U	U	F	F	U
			Review, revise and go through approval process of document.	U	U	F	F	U
			Submit to management, USEPA.	U	U	F	F	U
			Respond to comments and revise as needed.	U	U	F	F	U
			Finalize initial strategy	U	U	F	F	U
			Conduct periodic updates of the strategy	U	U	U	F	F
	Implement SWAMP monitoring strategy	Develop annual workplan(s)	Prepare state and regional workplans.	F	F	F	F	F
			Review and approve annual workplans.	F	F	F	F	F
		Develop 3-year workplan	Prepare 3-year workplan.	U	U	F	F	U
		Develop and implement process for periodic evaluations and updates	Develop and implement process for periodic evaluations and updates.	U	U	U	U	F
	Promote coordination of monitoring activities and comparability of data	Continue periodic meetings of SWAMP Roundtable	Schedule and coordinate logistics	F	F	F	F	F
			Prepare agenda and other meeting materials	P	P	P	P	P
			Facilitate meeting.	F	F	F	F	F
			Record and summarize.	F	F	F	F	F
		Establish a stakeholder group to provide guidance to Roundtable	Identify an appropriate mix of stakeholders	F	F	U	F	U
			Develop and implement process for stakeholder input	F	F	U	F	U
			Facilitate and coordinate periodic meetings of stakeholders	F	F	U	F	U
		Actively participate in the NPS Tracking and Monitoring Council	Attend and participate in meetings	U	U	F	F	P
			Prepare presentations as needed	U	U	F	F	U

F Fully Funded
P Partially Funded
N Not Funded
F(a) Fully Funded by USEPA Challenge Grant
- Not Applicable

* Old 305(b) and 303(d) format will be used until new CIWQS GeoWBS is completed

Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Engage regulated community to maximize NPDES and WDR monitoring comparability with SWAMP	Identify and prioritize groups/programs to work with	U	U	U	U	U
			Review permit monitoring activities.	U	U	U	U	U
		Include Volunteer Monitoring and the Clean Water Team in SWAMP	Create partnerships between SWAMP Programs and Citizen Monitors	P	P	P	P	P
			Develop SWAMP water quality training modules that	P	P	P	U	U
			Conduct water quaility and bioassessment	P	P	P	P	P
			Obtain equipment and supplies for training and	P	P	U	U	U
			Create and maintain a web accessible SWAMP	U	P	U	U	U
		Continue participation in NWQMC	Attend and participate in meetings	U	U	P	U	U
		Work on joint projects with partners	Identify partners	P	P	P	P	P
			Identify projects or develop projects	P	P	P	P	P
			Participate in joint projects	P	P	P	P	P
		Participate in web-based applications for tracking monitoring entities	Identify web-based applications for tracking.	U	U	U	U	U
			Submit SWAMP monitoring activities to tracking entities	U	U	U	P	U
			Maintain current information in tracking applications	U	U	U	U	U
		Continue SWAMP component of Water Board Training Academy to include courses for all stakeholders and interested parties	Identify and prioritize training needs	U	P	P	P	P
			Draft proposal and get approval.	U	P	P	P	P
			Develop training	U	P	P	P	P
			Conduct training	U	P	P	P	P
			Evaluate training	U	P	P	P	P
			Incorporate evaluations into ongoing trainings	U	P	P	P	P

F Fully Funded
P Partially Funded
N Not Funded
F(a) Fully Funded by USEPA Challenge Grant
- Not Applicable

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Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
2 **Monitoring Objectives·** To define a complete set of monitoring objectives, based on beneficial use attainment and other water quality objectives, and reflecting the full range of regulatory responsibilities and water quality programs for all water bodies.	Define statewide monitoring objectives	Compile and review existing objectives (in Clean Water Act, Legislative Report, 2002 Strategic Plan, 2003 Partnership Agreement, Governor's Action Plan for the Environment, EPIC)	Review existing objectives in Clean Water Act	F	F	F	F	F
			Review existing objectives in Legislative Report, 2000	F	U	P	P	U
			Review existing objectives in Water Board Strategic Plan	U	F	P	P	U
			Review existing objectives in Partnership Agreement	-	F	F	F	U
			Review existing objectives in Governor's Action Plan for the Environment	-	-	F	P	U
			Review existing objectives in EPIC	-	F	F	P	P
			Develop process for choosing applicable objectives	U	U	P	P	U
			Compile applicable objectives	U	U	P	P	U
		Provide recommendations for statewide monitoring objectives that can be addressed through the coordination of State and Regional Board program by the SWAMP program	Provide recommendations based on compiled objectives.	U	U	U	P	U

F Fully Funded
P Partially Funded
N Not Funded
F(a) Fully Funded by USEPA Challenge Grant
- Not Applicable

* Old 305(b) and 303(d) format will be used until new CIWQS GeoWBS is completed

Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
	Define regional monitoring objectives	Compile and review objectives from Regional Water Boards for each of their regulatory and non-regulatory programs	Identify regulatory and non-regulatory programs that have monitoring objectives	U	U	U	U	U
			Request monitoring objectives from identified programs	U	U	U	U	U
			Compile and review objectives	U	U	U	U	U
		Identify areas of overlap among Regions and with State objectives	Identify areas of overlap among regional and state objectives	U	U	U	U	U
	Develop consensus on shared objectives	Identify shared objectives	Develop process	U	U	U	P	P
			Achieve consensus if possible	U	U	U	P	P
3 **Monitoring Design·** To develop and implement a monitoring design that maximizes our ability to meet our monitoring objectives with existing resources.	Refine management questions for assessing core beneficial uses for all waterbody types	Recreational uses (swimming)	Develop assessment questions	F	U	F	F	U
		Fishing uses	Develop assessment questions	F	U	F	F	U
		Aquatic life support	Develop assessment questions	F	U	F	F	U
		Drinking water use	Develop assessment questions	F	U	F	F	U
	Inventory management questions of existing programs and monitoring entities	Identify programs collecting relevant data	Identify programs with common assessment questions	P	P	P	P	P
			Identify programs collecting relevant data	P	P	P	P	P
		Establish/continue coordination to promote data sharing	Establishing coordination to promote data sharingEstablishing coordination to promote data sharing	P	P	P	P	P

F Fully Funded
P Partially Funded
N Not Funded
F(a) Fully Funded by USEPA Challenge Grant
- Not Applicable

* Old 305(b) and 303(d) format will be used until new CIWQS GeoWBS is completed

Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
	Develop strategy to answer assessment questions for each waterbody type	Addressing rivers and wadeable streams	Develop strategy to answer assessment questions for rivers and wadable streams.	P	P	P	P	P
		Addressing lakes and reservoirs	Develop strategy to answer assessment questions for lakes and reservoirs.	U	U	U	U	U
		Addressing marine coastal areas, bays and estuaries	Develop strategy to answer assessment questions for coastal areas, bays and estuaries.	U	U	U	U	U
		Addressing wetlands	Develop strategy to answer assessment questions for wetlands	U	U	U	U	U
		Addressing groundwater	Develop strategy to answer assessment questions for groundwater	*	*	*	*	*
	Design cost-effective monitoring program	Develop designs to meet statewide monitoring objectives	Develop nested designs to meet statewide monitoring objectives	U	P	P	P	P
		Develop nested framework for integrating Regional Water Board efforts into statewide program	Develop nested framework for integrating Regional Water Board efforts into statewide program	U	P	P	P	P
		Develop framework for integrating other Water Board efforts into statewide program	Develop framework for integrating other Water Board efforts into statewide program	U	P	P	P	P
		Develop framework for integrating other monitoring efforts into statewide program	Develop framework for integrating other monitoring efforts into statewide program	U	P	P	P	P
	Develop and implement a suite of predictive tools to maximize our ability to effectively manage water quality	Develop process for incorporating use of models and other predictive tools into the existing SWAMP strategy	Develop process for incorporating use of models and other predictive tools into the existing SWAMP strategy	U	U	U	U	U

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Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
4 **Indicators·** To develop and implement a set of monitoring indicators (and assessment thresholds), which can be used to track the status and trends of water quality and to evaluate the effectiveness of management actions to improve water quality in the State.	Define core indicators for statewide monitoring and assessment for each designated use and for overall watershed health	Review existing indicators from USEPA, the Report to Legislature and EPIC	Compile existing indicators.	U	U	U	U	U
			Define a process for choosing appropriate indicators for each designated use	U	U	U	U	U
		Provide recommendations on core indicators for statewide assessment	Provide recommendations	U	U	U	U	U
		Recommend appropriate design for addressing EPIC indicators	Develop design that can address statewide trends	U	U	U	U	U
			Participate in EPIC indicator workgroups	U	U	U	U	U
		Recommend assessment thresholds for statewide assessment	Develop assessment thresholds for statewide assessment	U	U	U	U	U
	Recommend set of core and supplemental indicators for use at local watershed scale	Review indicators used by Water Board efforts and other entities	Request and compile indicators.	U	U	U	U	U
		Recommend core set of indicators for local assessment	Recommend core set of indicators for local assessment	U	U	U	U	U
		Recommend supplemental set of indicators for local assessment	Recommend supplemental set of indicators for local assessment	U	U	U	U	U
		Recommend appropriate monitoring design for local indicators	Recommend appropriate monitoring design for local indicators	U	U	U	U	U
	Develop a set of locally appropriate indices of biological integrity (IBI)	Summarize existing biological assessment information for California	Summarizing existing biological assessment information for California	F	-	-	-	-
		Conduct a performance-based methods comparison	Conduct a performance-based methods comparison	F	F	-	-	-
		Recommend appropriate methods for specific stream type	Recommend appropriate methods for specific stream type	-	-	-	F	F
		Determine reference conditions, as appropriate	Determine reference conditions, as appropriate	P	P	P	U	U
		Develop IBIs	Develop IBIs	P	P	P	P	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
	Develop indices for assessment of biological communities for different waterbody types	Foster development and application of IBIs for wadeable stream	Identify funding source.	P	P	P	P	U
		Foster development and application of indices for marine waters, bays and estuaries	Identify funding source.	U	U	U	U	U
		Foster development of CRAM indicators for assessing wetland condition	Identify funding source.	U	U	U	U	U
		Identify short-term and long-term research needs for development of indices for other waterbody types (e.g. large rivers, intermittent streams, lakes, reservoirs)		U	U	U	U	U
5 Quality Assurance· To develop and implement a progressive quality assurance (QA) program using a systems-based approach to the generation and storage of application-appropriate data/metadata.	**Implement QA Team to provide technical oversight and direction to SWAMP QA activities**	Establish QA Team	Secure funding for appropriate number of PYs	-	-	F	F	U
			Write job descriptions for each position	-	-	F	F	U
			Recruit personnel for QA Team positions	-	-	F	F	U
			Provide orientation and training for new members	-	-	F	F	U
		Define roles and responsibility of team	Revise job descriptions annually, as needed	-	-	-	F	U
			Communicate tasks and responsibilities via weekly QA Team Meetings	-	-	F	F	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
	Develop and document SWAMP DQOs for each of the core indicators	Lead SWAMP Roundtable through the DQO process	Identify specific intended uses for DQO Processes based on priority beneficial uses and associated indicators	U	U	U	F	U
			Identify the Planning Team members	-	-	U	F	U
			Identify the project schedule, resources, milestones and requirements	-	-	U	F	U
			Describe the program goals and objectives	-	-	U	F	U
			Identify the type of data needed	-	-	U	F	U
			Identify the constraints to data collection	-	-	U	F	U
			Determine the quality and quantity of data needed	-	-	U	F	U
			Describe how, when and where the data will be obtained	-	-	U	F	U
			Generate a comprehensive DQO Report that summarizes DQOs for all SWAMP intended uses	-	-	U	F	U
			Revise DQO report following SWAMP RT feedback	-	-	U	F	U
		Re-assess the SWAMP DQOs on an annual basis	Identify emerging intended uses and prioritize DQO Process needs	-	-	U	P	U
			Perform DQO Process for new intended uses	-	-	U	P	U
			Construct DQO tables for new intended uses	-	-	U	P	U
			Reevaluate existing DQOs	-	-	U	P	U
			Edit tables for existing DQOs	-	-	U	P	U
			Update Comprehensive DQO Report	-	-	U	P	U
	Evaluate the existing QA/QC program including new methods and program changes against SWAMP DQOs	Assess current SWAMP MQOs against SWAMP DQOs and revise them as necessary	Modify MQOs based un updated DQO Report	-	-	U	F	U
			Communicate modifications, as needed	-	-	U	F	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Create/Revise SWAMP QMP and SWAMP QAPrP	Generate outline for QMP following guidance in EPA QA R-2	U	U	U	F	U
			Write QMP	U	U	U	F	U
			Revise QMP based on input from the SWAMP RT	U	U	P	F	U
			Convert existing QAMP to a QAPrP following EPA Region 9 QAPrP Guidance Document	U	U	P	F	U
			Revise QAPrP based on input from the SWAMP RT	U	U	P	F	U
	Implement QA activities to produce data of high consistency/comparability among	Review QAPPs against SWAMP DQOs and MQOs and provide feedback	Develop QAPP Checklist, based on EPA QA/G-5, to ensure objective review of QAPPs	U	P	P	P	U
			Identify deficiencies in QAPPs and request modification	U	U	P	P	U
			Approve QAPPs based on SWAMP compatibility	U	U	P	P	U
	Implement QC procedures to produce defensible, credible data that meets SWAMP QMP/QAPrP	Conduct intercomparison studies and performance evaluation tests (as funded)	Prioritize studies based on the frequency that methods are used within the SWAMP Program	U	U	U	U	U
			Identify optimal chemicals for each study	U	U	U	U	U
			Identify appropriate concentrations for intended evaluation	U	U	U	U	U
			Conduct studies and tests	U	U	U	U	U
			Assess data quality and generate reports	U	U	U	U	U
			Identify needs for corrective actions, if applicable	U	U	U	U	U
			Incorporate follow up in future audits	U	U	U	U	U
		Conduct laboratory audits	Develop schedule for individual audits	U	U	P	P	U
			Write SOP for audits	U	U	F	F	U
			Conduct audits and generate audit reports	U	U	P	P	U
			Incorporate follow up in future audits	U	U	P	P	U

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		Verify data	Develop SOP for objective data verification	U	U	F	F	U
			Request and incorporate feedback from SWAMP participants	U	U	F	F	U
			In cooperation with the DMT, verify data against	U	U	P	P	U
			Assess data verification practices to identify areas for improvement	U	U	P	P	U
			Communicate and implement changes to improve verification process	U	U	P	P	U
		Data validation	Develop SOP for data validation	U	U	P	P	U
			Request and incorporate feedback from SWAMP participants	U	U	P	P	U
			Validate data against SWAMP DQOs	U	U	P	P	U
			Assess data validation practices to identify areas for improvement	U	U	P	P	U
			Communicate and implement changes to improve validation process	U	U	P	P	U
		Direct production of control charts	Identify potential endpoints for Control Charts	U	U	U	P	U
			Prioritize Control Charts needs based on the frequency methods are used within the SWAMP Program	U	U	U	P	U
			Develop SOP for appropriate interpretation of charts	U	U	U	P	U
			Communicate the circumstances under which control charts will be generated via the QAPrP and DMT SOPs	U	U	U	P	U
		Produce QA Reports	Evaluate data quality on intra- and inter-laboratory scales	U	U	U	P	U
			Identify key areas of success and areas for improvement	U	U	U	F	U
			Write report and recommend changes	U	U	U	F	U
			Implement appropriate changes	U	U	U	P	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Conduct training workshops	Identify training gaps and prioritize training needs	P	P	U	U	U
			Develop curriculum for individual classes	U	P	P	P	U
			Provide training to SWAMP participants	U	P	P	P	U
			Evaluate training effectiveness using evaluation forms	-	P	P	U	U
			Revise training curriculum, as needed	-	P	P	U	U
		SOP Review and Approval	Develop SOP Checklist based on EPA QA/G-6 guidance	U	U	U	P	U
			Compare SOP specifications to SWAMP guidelines	U	U	U	P	U
			Approve SOPs following appropriate revisions	U	U	U	P	U
			Upload SOP into electronic library for historic reference	U	U	U	P	U
		Direct production of studies such as holding time studies, sample container studies, method development studies, method detection limit studies, etc. in order to produce technically defensible data	Prioritize studies based on SWAMP RT concerns and data qualifiers.	U	U	U	P	U
			Secure funding to conduct studies	U	U	U	P	U
			Design and conduct studies	U	U	U	P	U
			Summarize results for SWAMP participants	U	U	U	P	U
			Incorporate gained knowledge into SWAMP documents	U	U	U	P	U
	Integrate SWAMP QA/QC procedures in other State Water	Develop timeline for integrating SWAMP standards	Establish milestones for integration	U	U	U	U	U
			Establish communication network to inform people of recent changes	U	U	U	U	U
		Evaluate DQOs of Water Board programs	Develop an SOP and DQO checklist, based on EPA QA G-4	U	U	U	U	U
			Evaluate DQOs of programs	U	U	U	U	U
			Recommend changes to optimize decision errors	U	U	U	U	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Create a QA Tool Box	Identify knowledge and ability gaps of SWAMP participants	U	P	P	P	U
			Prioritize Tool development based on the size of gaps and return on investment	U	P	U	P	U
			Develop Tools	U	P	U	P	U
			Evaluate tool efficacy through evaluation forms	U	P	U	P	U
			Revise and upgrade Tool Box as needed	U	P	U	P	U
		Provide assistance and training	Communicate QA Team availability and training opportunities through established communication channels	-	-	U	U	U
			Provide electronic educational materials through website	U	P	U	U	U
			Assist individuals, as requested	U	U	U	U	U
		Act as a QA consultant and laison for other programs	Identify primary liaisons for each program	U	U	U	U	U
			Provide advice, as requested	U	U	U	U	U
6 Data Management· To make credible ambient monitoring data and information available to all stakeholders in a timely manner.	SWAMP ambient monitoring data will be stored, checked for quality assurance, and is comparable in the SWAMP database	Establish and maintain an electronic data management system for integrating multiple ambient monitoring data types	Create data tables and information management system for metadata	U	U	P	U	U
			Create data tables and information management system for water column and sediment chemistry	F	-	-	-	-
			Create data tables and information management system for water column and sediment toxicity	F	-	-	-	-
			Create data tables and information management system for discrete field measurements	F	-	-	-	-

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
			Create data tables and information management system for bacteria indicators	U	U	F	-	-
			Create data tables and information management system for fish and shellfish tissue residue	U	U	F	P	-
			Create data tables and information management system for biological and habitat assessment	U	U	P	F	-
			Create data tables and information management system for continuous field measurements	U	U	U	F	-
			Maintain and update all modules as needed	F	F	F	F	U
		Develop guidelines and technical specifications for data organization, flow, and verification/validation to maintain SWAMP quality and comparability	Develop the data information management system (IMS) document	U	F	-	-	-
			Maintain, update document periodically	-	-	F	F	U
		Load historic and current SWAMP monitoring data into the temporary side of the database	Load water column and sediment chemistry historic data into database temporary side	U	U	F	F	-
			Load water column and sediment toxicity historic data into database temporary side	U	U	F	F	-
			Load discrete field measurements historic data into database temporary side	U	U	F	F	-
			Load bacteria indicators historic data into database temporary side	U	U	F	F	-
			Load biological and habitat assessment historic data into database temporary side	U	U	U	U	U
			Load continuous field measurements historic data into database temporary side	U	U	U	U	U
			Load current data into database temporary side	P	F	F	F	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Verify and validate data on temporary side and migrate it to the permanent side of the database	Verify and validate metadata for historic data in database temporary side, and migrate data to permanent side	U	U	U	U	F
			Verify and validate water column and sediment chemistry historic data in database temporary side, and migrate data to permanent side	U	U	F	F	U
			Verify and validate water column and sediment toxicity historic data in database temporary side, and migrate data to permanent side	U	U	F	F	U
			Verify and validate discrete field measurements historic data in database temporary side, and migrate data to permanent side	U	U	F	F	U
			Verify and validate bacteria indicators historic data in database temporary side, and migrate data to permanent side	U	U	F	F	U
			Verify and validate biological and habitat assessment historic data in database temporary side, and migrate data to permanent side	U	U	U	U	U
			Verify and validate continuous field measurements historic data in database temporary side	U	U	U	U	U
			Verify and validate current data in database temporary side, and migrate data to permanent side	U	U	F	F	F
	Provide training and tools to facilitate use of SWAMP data and information by Water Board (intra-agency) and non-Water Board (inter-agency) programs	Develop and provide program-specific training and tools to facilitate the use of SWAMP information by SWAMP participants to improve intra-agency coordination within the Water Board	Identify and assist database management-related training needs and training tools in conjunction with TMDL program corrdinator	U	U	P	U	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
			Identify and assist database management-related training needs and training tools in conjunction with Ag Waiver program coordinator	U	U	P	U	U
			Identify and assist database management-related training needs and training tools in conjunction with Grant Project Monitoring coordinator	U	U	P	U	U
			Identify and assist database management-related training needs and training tools for volunteer monitoring coordinator	U	U	U	P	P
		Facilitate intra-and inter-agency data comparability by developing and providing general use tools such as protocols and formats for electronic data transer and document these procedures.	Procedures and Tools for batch uploading of Data	U	F	U	U	U
			Develop Basic Query Tools for summarizing and accessing data in Access database	U	F	F	F	-
			Develop Data analysis tools	U	U	U	U	U
			Data verification and validation SOPs for field operators, laboratories, project managers and the Data Management Team	U	U	F	F	U
	Integrate SWAMP data with information collected by Water Board (intra-agency) and non-Water Board (inter-agency) programs	Develop framework for integrating SWAMP with CEDEN	Develop contract with Department of Water Resources for cooperative project	U	U	P	F(a)	P
			Initate SWAMP User group meetings to share information	U	U	P	U	U
		Develop framework for integrating SWAMP with CIWQS and GeoWBS	Provide regular briefings of SWAMP databasestatus to CIWQS and GeoWBS	U	U	U	U	U

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		Coordinate with the TMDL program on SWAMP formats, business rules and training tools	Initiate SWAMP User group meetings to share information	U	P	U	U	U
		Coordinate with the Ag Waiver Program on SWAMP formats, business rules and training tools	Initate SWAMP User group meetings to share information	U	P	U	U	U
		Coordinate with Grant Projects on SWAMP data formats, business rules and training tools	Initate SWAMP User group meetings to share information	U	P	U	U	U
		Coordinate with volunteer monitoring groups to facilitate use of the SWAMP data management system	Initate SWAMP User group meetings to share information	U	P	U	U	U
		Establish data server nodes at major data generators throughout the State (e.g. MLML, SCCWRP, SFEI) to serve as points of data consolidation for Water Board programs, data analysis, and public access of data	Initate SWAMP User group meetings to share information	U	U	U	U	U
		Provide for incorporation of SWAMP metadata in the CERES system	Identify CERES Metadata formats and system requirements	U	U	U	F(a)	-
			Create Metadata from SWAMP in CERES formats	U	U	U	F(a)	-
		Create links to STORET and EIEN through CEDEN to annually upload SWAMP data	Provide SWAMP data to CEDEN for upload to STORET	U	U	F	F	F
			Upload CEDEN data to STORET	U	U	U	U	P

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
7 **Data Analysis and Assessment·** To provide a consistent science-based framework for the evaluation of monitoring data relative to state and regional standards, the protection of beneficial uses and for tracking the effectiveness of management actions.	Develop a method for assessing standards attainment for listing purposes (303(d))	Provide guidance on translation/interpretation of narrative standards	Develop guidance	-	-	U	U	U
		Implement State Listing policy	Develop guidance	-	-	-	P	P
	Develop guidance to assist in 303(d)/305(b) assessments, consistent with the 303(d) listing policy	Provide guidance on acqusition and use of primary and secondary data for assessments	Draft templates for letters that request data and information on the water quality of the waters of CA to all interested parties	-	-	-	U	U
			Develop instructions on how to obtain mailing lists and procedure for mailing out letters	-	-	-	U	U
			Develop instructions on how to post letter requesting data and information, and subsequent documents for public review	-	-	-	U	U
			Develop method for efficient display of data received to compare with existing criteria, objective and standards	-	-	-	U	U
			Develop detailed guidance for determining data quality based on the 303d listing policy	-	-	-	U	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
			Develop an efficient/useful display of applicable critiera, objectives, and standards to aid in 303d listing policy assessments	-	-	-	U	U
			Prepare tables and examples of acceptable translation/interpretation of narrative standards	-	-	-	U	U
			Develop guidance on determining beneficial use status of supporting, insufficient information, and not assessed (Integrated Report categories 1,2 and 3) consistent with 303d listinb policy determination of a listing (I.e. a not supported use)	-	-	-	U	U
			Provide training on how to use the GeoWBS Online and Desktop editor for storing supporting information for 305b and 303d assessment decisions	-	-	-	U	U
8 **Reporting** To report all collected data as information, and in a timely and publicly accessible manner.	Produce timely and complete water quality reports and lists as required by the CWA, and consistent with current USEPA guidance.	Prepare CWA 305(b)/303(d) Integrated Report	Maintain GeoWBS assessment database.	U	U	U	U	U
			Oversee migration of GeoWBS info into CIWQCS	-	-	-	U	U
			Regional Boards enter assessment information into GeoWBS.	U	U	-	U	U
			Regional Boards map assessed waterbodies in GeoWBS.	U	U	-	U	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
			Summarize assessments into Integrated Report categories for each Region	-	-	-	U*	-
			Regional Boards adoption of Category 5A 303d list	U	-	-	U	-
			State Board adoption of statewide Category 5A 303d list	-	U	-	U	-
			USEPA approval of statewide Category 5A 303d list	-	F	-	F	-
			Incorporate USEPA changes to Category 5A 303d list	-	U	-	U	-
			Summarize assessments into Integrated Report categories for entire State	-	U*	-	U*	-
			Submit the 305b/303d Integrated Report to USEPA	-	-	-	U*	-
			Submit 305b/303d database files to USEPA	U	U	U	U	U
		Prepare 303(d) list	Done by Listing Unit or Regional Boards	-	-	-	-	-
		Prepare Beach report	Done by OSI	-	-	-	-	-
	Report to the public on water quality, taking ito account the needs of interested audiences. Use various formats and media such as brochures, fact sheets, report cards, oral presentations, and the Internet.	Prepare fact sheets summarizing SWAMP elements	Determine format	U	U	F	F	U
			Gather content	U	U	F	F	U
			Draft fact sheets	U	U	P	F	U
			Review and approval	U	U	P	F	U
			Finalize fact sheets	U	U	P	F	U
			Coordinate distribution	U	U	P	F	U
			Coordinate posting with OIT	U	U	P	F	U

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VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Prepare fact sheets summarizing state and regional beneficial use status	Determine format (note: the ability to produce report tables and charts on individual benficial use support has been included in Phase 2 of GeoWBs)	U	U	P	P	U
			Gather content	U	U	P	P	U
			Draft fact sheets	U	U	P	P	U
			Review and approval	U	U	P	P	U
			Finalize fact sheets	U	U	P	P	U
			Coordinate distribution	U	U	P	P	U
			Coordinate posting with OIT	U	U	P	P	U
		Provide input on status and trends in EPIC indicators	Select appropriate EPIC indicators	P	P	P	P	U
			Develop appropriate monitoring design	P	P	P	P	U
		Re-design and begin improvement of SWAMP web site	Establishing website	P	U	U	U	U
			Evaluate current site and determine updates, improvements needed	U	U	U	P	U
			Gather content	U	U	U	P	U
			Draft revisions	U	U	U	P	U
			Review and approval	U	U	U	P	U
			Finalize design and content updates	U	U	U	P	U
			Coordinate necessary design and content changes with OIT	U	U	U	P	U
			Periodic review and maintenance of site design and contents	U	U	U	P	U
	Produce technical reports and peer reviewed journal articles resulting from monitoring program activities	Prepare technical reports within two years of data collection	Compile data	P	P	P	P	P
			Analyze and assess data	P	P	P	P	P
			Draft report	P	P	P	P	P
			Review, revision and approval of document.	P	P	P	P	P
			Finalize	P	P	P	P	P
			Make available to interested parties	P	P	P	P	P

F Fully Funded
P Partially Funded
N Not Funded
F(a) Fully Funded by USEPA Challenge Grant
- Not Applicable

* Old 305(b) and 303(d) format will be used until new CIWQS GeoWBS is completed

Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Complete preparation of reports from SWAMP monitoring conducted through 2003	Prioritize and complete reports	P	P	P	F	P
9 **Programmatic Evaluation·** To conduct periodic reviews of each aspect of the program to determine its scientific validity, if it is being implemented as designed, and how well it serves the water quality decision needs of the State.	Ensure that program is being implemented as designed	Review annual workplans to ensure that all elements are addressed	Review annual workplans by DWQ	U	P	P	F	P
		Use information from regional audits to document extent of compliance with elements	Conduct audits	U	P	P	F	P
			Provide feedback to regions	U	P	P	F	P
	Ensure that program is meeting needs of other Board programs	Annual evaluation by SWAMP	Self-audit (based on compliance with strategy elements)	U	U	U	U	U
		Annual evaluation by USEPA	Consult with EPA	U	U	U	U	U
			Respond to EPA evaluation	U	U	U	U	U
		Periodic evaluation by program offices	Consult with other Board programs	U	U	U	U	U
	Ensure that program is technically sound	Ensure technical defensibility of monitoring plans and technical reports	Peer review of monitoring plans	U	U	U	F	F
			Peer review of technical reports	P	P	P	F	F

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N Not Funded
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Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Trienniel review by SPARC	Determine guidelines for committee member selection	F	U	F	F	U
			Form committee	F	U	F	F	U
			Develop and refine questions to be addressed by committee	F	U	F	F	U
			Prepare reports or presentations needed by committee	F	U	F	F	U
			Coordinate SPARC	F	U	F	F	U
			Participate in SPARC	F	U	F	F	U
		Respond to SPARC	Review SPARC report	P	U	F	F	U
			Develop process to respond to SPARC recommendations	P	U	F	F	U
			Implement process to respond to SPARC	P	U	F	F	P
10 General Support and Infrastructure· To provide the specific support needed to implement a coordinated and comprehensive monitoring and assessment program.	Provide ongoing program coordination, administration and oversight	Provide program coordination	Respond to legislature, management, and public	P	P	P	P	P
			Intra and inter-agency coordination	P	P	P	P	P
			Education and outreach	P	P	P	P	P
		Provide regional coordination	Intra and inter-agency coordination	P	P	P	P	P
			Education and outreach	P	P	P	P	P
		Provide administrative oversight.	Contract management	F	F	F	F	F
			Budgeting	F	F	F	F	F
	Update the SWAMP needs assessment	Identify annual monitoring needs of Regional Boards	Review current funding & match tasks to reflect true budget	F	U	U	U	F

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P Partially Funded
N Not Funded
F(a) Fully Funded by USEPA Challenge Grant
- Not Applicable

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Table B2. Summary of vision statements, goals, objectives, and tasks.

VISION STATEMENT	GOALS	OBJECTIVES	TASKS	FY 02-03	FY 03-04	FY 04 - 05	FY 05 06	FY 06-07
		Identify annual monitoring needs of State Board	Review current funding & match tasks to reflect true budget	F	U	U	U	F
		Prepare budget for upcoming year	Ideni\tify required number of staff	F	F	F	F	F
			Identify needed laboratory support	F	F	F	F	F
			Identify training needs	F	F	F	F	F
			Identify required funding	F	F	F	F	F
		Forecast budget needs for 3 years.	Ideni\tify required number of staff	F	F	F	F	F
			Identify needed laboratory support	F	F	F	F	F
			Identify training needs	F	F	F	F	F
			Identify required funding	F	F	F	F	F

F Fully Funded
P Partially Funded
N Not Funded
F(a) Fully Funded by USEPA Challenge Grant
- Not Applicable

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Appendix C
Summary of Regional Water Board Goals and Objectives

Summary of
Regional Water Quality Control Boards

Goals & Objectives

REGION 1. North Coast Regional Water Quality Control Board

A. North Coast Region – Description

The North Coast Region comprises all basins draining into the Pacific Ocean from the California -Oregon state line (including Lower Klamath Lake and Lost River Basins) southerly to the southern boundary of the watershed of the Estero de San Antonio and Stemple Creek in Marin and Sonoma Counties. The North Coast Region covers all of Del Norte, Humboldt, Trinity, and Mendocino Counties, major portions of Siskiyou and Sonoma Counties, and small portions of Glenn, Lake, and Marin Counties. The North Coast Region encompasses a total area of approximately 19,390 square miles, approximately 12 percent of California's total land area, and accounts for 35 percent of the State's fresh water runoff, mostly from winter rainfall. There are approximately 24,000 river miles in our various watersheds and 340 miles of coastline.

B. Goals and Objectives

Goal - The goal for the Region 1 SWAMP efforts is to monitor and assess the water quality in the Regions watersheds with the primary objective of determining if the beneficial uses are being protected.

Objective - The watershed evaluation process employed by the North Coast Region (NCR) is responsive to the Watershed Management Initiative (WMI) as called for in the State Water Resources Control Board *Strategic Plan* (June 22, 1995). It essentially involves designating Watershed Management Areas (WMAs) and performing monitoring with the following objectives:

1. Assessing water quality related issues on a watershed basis.
2. Employing a sampling design that allows the measurement and evaluation of spatial and temporal trends in watershed water quality.
3. Using standard sampling protocols, SWAMP QAMP procedures and the SWAMP database to provide statewide consistency and availability of data.
4. Developing prioritized water quality goals for watersheds from the issues,
5. Addressing the issues with various programs through a multi-year implementation strategy, and
6. Evaluating progress at the end of a specified time period.

C. Methods to Achieve Objectives

1. *Assessing water quality related issues on a watershed basis.*

Region One has adopted two strategies in its watershed assessment process. The first strategy is the establishment and monitoring of several long-term trend stations within our major watersheds. The second strategy is utilizing the rotating basin approach in which temporary stations are established within each WMA and sampled on a five-year rotation.

2. *Employing a sampling design that allows the measurement and evaluation of spatial and temporal trends in watershed water quality.*

To address spatial trends, monitoring stations are established along the main stem of the major drainages of the WMA and integrator stations are sited below the confluence of major tributaries. During a WMA basin rotation, additional stations are sited along the main stem and at the confluence of minor tributaries.
To address temporal or seasonal trends, we have adopted a sampling frequency of five times per year. This frequency allows us to capture all phases of the hydrologic cycle within each WMA. as well as capturing seasonal events within the watershed such as irrigation tail-water discharges and pesticide and herbicide applications.

In order to provide the sampling frequency needed to resolve the temporal variability associated with the hydrologic cycle, we rely heavily on trained Regional Board staff to collect the samples.

We have chosen a standard set of water quality indicators to assess water quality at all stations. These indicators include standard minerals, nutrients, total trace metals, Chlorophyll-a and TOC. In addition, at selected stations and seasons, sampling for chlorinated pesticides, organophosphate pesticides, Triazine herbicides, surfactants and PCBs is added. Field parameters including dissolved oxygen, water temperature, specific conductivity, pH and turbidity is measured at each site visit for all stations.

In partnership with Region 5, we are in the process of developing a method for screening surface water for estrogenic endocrine disrupting compounds (EEDCs) using Vitellogenin gene analysis by polymerase chain reaction (PCR) methods in juvenile Rainbow Trout.

Recent funding reductions have necessitated the reduction in the number of trend stations and the elimination of the basin rotation for the upcoming fiscal year (FY04-05). Funding for the EEDC program and other projects was curtailed as well.

3. *Using standard sampling protocols, SWAMP QAMP procedures and the SWAMP database to provide statewide consistency and availability of data.*

All SWAMP sampling within the Region is pursuant to the sampling protocols established by the SWAMP QAMP. Sampling personnel are trained in the classroom and in the field prior to conducting any SWAMP related fieldwork. All samples are processed by subcontract laboratories through the Department of Fish and Game master contract. All regional grant programs with a water quality monitoring component are required to be consistent with SWAMP protocols.

Regional Board personnel are trained in the operation of the SWAMP database. Field and analytical data are posted to the SWAMP database as soon as practical. Data dissemination to the public is made pursuant to the directive established buy the Data Management Team.

4. *Developing prioritized water quality goals for watersheds from the issues.*

As data is collected and assimilated into the planning and assessment process, the goals set forth in the WMI Chapter for each WMA are revisited and adjusted as necessary.

5. *Addressing the issues with various programs through a multi-year implementation strategy.*

As water quality issues are identified within each WMA, information is directed to various internal and external programs. Those programs include TMDL Development and Implementation, Grants, Nonpoint source, Core Regulatory and Watershed protection. We also provide information to external programs as well including resource conservation districts, U.S. fish and Wildlife Service, California Department of Fish and Game and various Indian tribes.

6. *Evaluating progress at the end of a specified time period.*

We use an iterative process to assess and evaluate the issues within each WMA and the progress and implementation of the SWAMP program. On an annual basis, we review the progress of the program and make changes and adjustment s where necessary. This information is fed back into the next WMI Chaper revision.

REGION 2. San Francisco Bay Regional Water Quality Control Board

A. San Francisco Bay Region – Description

The San Francisco Bay system is the dominant feature of the Region. The San Francisco Bay/Delta estuary is the largest estuary on the west coasts of North and South America and receives runoff from approximately 40% of California's land area. The San Francisco Bay Region covers the western portion of the estuary from the confluence of the Sacramento and San Joaquin rivers to the Golden Gate. San Francisco Bay functions as the only drainage outlet for waters of the Central Valley and also marks a natural topographic separation between the northern and southern coastal ranges. The region extends from the northern tributaries to San Pablo Bay to the southern tributaries to South San Francisco Bay. Coastal waters off of San Mateo, San Francisco and Marin Counties, and bays and coastal tributaries in these counties are included in the region. The region's creeks, bays and wetlands form the centerpiece of the United States' fourth largest metropolitan area. The region is made up of 7 hydrologic units including all or major portions of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties.

B. Goal and Objectives

Goal – The goal of the SWAMP funded program in the San Francisco Bay Region is to monitor and assess water quality in all of the watersheds in the region to determine whether beneficial uses are protected. (We require that dischargers participate in the San Francisco Estuary Regional Monitoring Program (RMP). This program is an integral part of our SWAMP strategy to monitor water quality in the San Francisco Estuary and determine if beneficial uses are protected.).

Objectives –
1. Measure environmental stressors (pollutants or other water quality parameters), biological effects (e.g., toxicity tests), and ecological indicators (e.g., benthic community analysis) to evaluate whether beneficial uses are being protected.
2. Use a design that allows for evaluation of spatial and temporal trends in the watersheds of the region.
3. Identify minimally disturbed reference conditions.
4. Determine if impacts are associated with specific land uses and/or water management.
5. Use standard sampling protocols, SWAMP QAMP procedures and the SWAMP database to provide statewide consistency and availability of data.
6. Evaluate monitoring tools in watersheds in order to develop a program that uses the best environmental indicators to achieve the goal of the program.
7. Generate data and associated information for the development of indices to evaluate ecological indicators (e.g., IBIs for macroinvertebrates).
8. Use a rotating watershed approach to collect data in each hydrologic unit at least once every 5 years.

C. Method to Achieve Objectives

Objective #1 - Measure environmental stressors (pollutants or other water quality parameters), biological effects (e.g., toxicity tests), and ecological indicators (e.g., benthic community analysis) to evaluate whether beneficial uses are being protected.– Our monitoring program includes measuring environmental stressors (pollutants and other water quality measurements such as temperature and dissolved oxygen), biological effects (EPA 3 species aquatic toxicity tests and Hyalella sediment toxicity tests), and ecological indicators (macrobenthic community analysis). These monitoring parameters are associated with the evaluation of specific beneficial uses. The beneficial uses we are concentrating on evaluating in this program relate to human health and aquatic life. To evaluate beneficial uses related to human health we evaluate water contact (REC-1) and noncontact recreation (REC-2) and fish consumption (COMM). To evaluate water contact (REC-1) we measure fecal coliforms and E. coli at places where there is water contact and/or there are potential sources of pathogens. To evaluate noncontact recreation we measure bacteriological indicators and also

conduct trash assessments with a methodology that was developed in this region. To evaluate whether fish are safe to eat by humans we conduct studies to measure contaminants in fish in reservoirs and coastal areas. We use the RMP to evaluate fish contamination in the SF Estuary. We have written a report on contaminants in fish in Tomales Bay and 10 reservoirs in the region (Chemical Concentrations in Fish Tissues from Selected Reservoirs and Coastal Areas: San Francisco Bay Region), worked with OEHHA to develop advisories and coordinated with the County Health Departments and responsible parties to develop information in appropriate languages to convey clear and consistent information to the public.

To evaluate beneficial uses associated with aquatic life such as Cold Freshwater Habitat (COLD), Estuarine Habitat (EST), Marine Habitat (MAR), Fish Migration (MIGR), Preservation of Rare and Endangered Species (RARE), Fish Spawning (SPWN), Warm Freshwater Habitat (WARM) and Wildlife Habitat (WILD) we measure contaminant concentrations, nutrients, temperature, dissolved oxygen, conductivity and pH, conduct toxicity tests, evaluate macroinvertebrate communities and assess physical habitats. Dynamic parameters such as temperature, dissolved oxygen, pH and conductivity are measured at 15-minute intervals using data sondes deployed for a week. Some of these parameters, such as nutrients and conductivity, can also be used to evaluate Municipal and Domestic Supply (MUN) although the utilities that supply water have extensive monitoring programs and data that can be used for assessments.

Objective #2 – Use a design that allows for evaluation of spatial and temporal trends in the watersheds of the Region. - To evaluate spatial trends we distribute sampling stations fairly evenly throughout a watershed and at all major confluences. We commonly use a paired watershed design to compare watersheds and use a rotating watershed approach to spatially cover the watersheds in the region. To evaluate intra-annual temporal variability we take contaminant, toxicity and nutrient samples during the wet, spring (declining hydrograph) and dry seasons. We measure temperature, pH, conductivity and dissolved oxygen with continuous monitoring probes over a week long period four times a year in each watershed, concentrating on the dry season. We evaluate trash four times a year to determine where the trash is coming from (runoff or dumping) and how much accumulates over a particular length of time. To evaluate inter-annual variability we use a rotating watershed approach, and we work with local agencies and citizens groups to conduct follow up monitoring on watersheds we have monitored. This year we will be starting to deploy HOBO temps for continuous monitoring of temperature in watersheds we have monitored in year one of the program. From 1999 to 2002 staff from the Water Board used separate funding to conduct a special study on inter-annual variability in Wildcat and San Leandro Creeks. This data will be incorporated in to the interpretive report we are writing this year on these watersheds.

Objective #3 - Identify minimally disturbed reference conditions. Each year we identify and sample at stations that are minimally disturbed and can represent different ecoregions within our region. In 2004 we collected benthic macroinvertebrate samples from chosen reference sites in various ecoregions. Reference site data are particularly important to evaluate benthic macroinvertebrate data and for the development of an Index of Biological Integrity (IBI), a potential numeric biocriterion.

Objective #4 – Determine if impacts are associated with specific land uses and/or water management. - Our sampling design is deterministic. We locate sampling stations above and below particular land uses such as agriculture, industrial areas, golf courses and areas of hydromodification to test hypotheses on the impact of these land uses on water quality. We also locate sampling stations at major tributary confluences to evaluate water quality at the lower portion of major catchments and sub-watersheds.

Objective #5 - Use standard sampling protocols, SWAMP QAMP procedures and the SWAMP database to provide statewide consistency and availability of data. - We use standard sampling protocols, SWAMP QAMP procedures and have data entered in to the SWAMP database to provide statewide consistency and availability of data. We also encourage monitoring partners (stormwater programs, volunteers) to use SWAMP methods, sampling design and the QAMP so that this data can be incorporated in to the SWAMP database. Projects funded through our grant programs that include water quality monitoring are required to be consistent with SWAMP.

Objective #6 – Evaluate monitoring tools in watersheds in order to develop a program that uses the best environmental indicators to achieve the goal of the program. - The first monitoring protocol that we have developed is a methodology for trash assessment. We have developed a protocol that has been tested for variability and sensitivity using different assessment teams. This protocol is now considered part of the standard procedures in our region. We are encouraging stormwater agencies and community monitoring groups to use this protocol.

Objective #7 - Generate data and associated information for the development of indices to evaluate ecological indicators (e.g., IBIs for macroinvertebrates). - We have sampled benthic macroinvertebrates at reference sites and at various ecoregions in our region for the development of IBIs. We are currently coordinating with other local efforts to collect and evaluate macroinvertebrate data through the Bay Area Macrobenthic Invertebrate Network (BAMBI). In 2005 SWAMP is funding the evaluation of this data, based on certain criteria, and entering this data in to Cal EDAS. These evaluations are leading to draft indices based on ecoregion and land use. In the future we plan to develop objectives in our Basin Plan for biological integrity.

Objective #8 – Use a rotating watershed approach to collect data in each hydrologic unit at least once every 5 years. - We have divided our region in to 48 planning watersheds and have developed a plan (see 5-year Workplan) of rotating through these watersheds based on certain criteria. We have planned to monitor specific watersheds in various hydrologic units so that we collect data in each hydrologic unit at least once every 5 years. This objective, however, has been difficult to achieve due to cutbacks in funding for the program. After 5 years of monitoring we have collected data from 17 of the 48 watersheds. Based on a review of our interpretive report, we may change our study design to measure less parameters less frequently in order to cover a larger spatial area each year. The seven selection criteria for prioritizing watersheds include:

(1) Existing Local Efforts. Build on existing watershed monitoring and assessment efforts, including citizen monitoring.
(2) Sensitive Aquatic Resources. Focus in areas with sensitive aquatic resources or species, such as habitat for the federally listed salmonid species.
(3) Pre-Project Information. Collect pre-project ambient data in areas proposed for urbanization, stream restoration, or hydromodification.
(4) Waterbodies with Limited Information. Initiate monitoring in areas that have little or no current water quality and habitat information.
(5) Monitor in all Ecoregions. Fill information gaps in certain ecoregions, for instance with stream bioassessment data to support biocriteria development or geomorphic data to support physical criteria development.
(6) Paired Watersheds. Monitor paired watersheds, with similar drainage area, land use, geology, vegetation, and climate for cross-comparison and testing of the ability to extrapolate findings from one watershed to another.
(7) Geographic Balance. The prioritized list of watersheds should be balanced geographically and by ecoregion, in order to capture the full range of stream types in the region and to recognize watershed management efforts in all parts of the region.
(8) Hydrologic Units. Collect data in each hydrologic unit at least once every 5 years. There are 7 hydrologic units in this region.

REGION 3. Central Coast Regional Water Quality Control Board

A. Central Coast Region - Description

The Central Coast Regional Water Quality Control Board is responsible for water quality issues along the central coast of California. The region extends from southern San Mateo County in the north to northern Ventura County in the south, and includes Monterey, Santa Cruz, San Benito, San Luis Obispo, Santa Barbara and portions of Santa Clara counties. The Central Coast Ambient Monitoring Program is the Central Coast Regional Water Quality Control Board's ambient monitoring program, and a major portion of its funding comes from SWAMP.

B. Goals and Objectives

Goals - The goal of monitoring in the Central Coast region is to provide a screening level assessment of water quality in all hydrologic units, based on a variety of chemical, physical and biological indicators. Monitoring data is used to evaluate beneficial use support in the surface waters of the Region. Monitoring approaches include conventional water quality, water toxicity, sediment chemistry and toxicity, tissue chemistry, rapid bioassessment for benthic invertebrates, and habitat assessment. The Central Coast region uses a rotating basin approach where conventional water quality monitoring is conducted monthly at all sites, and at a subset of the sites other monitoring approaches are conducted annually or biannually. Approximately thirty sites are monitored in each watershed rotation area. Over a five-year period all of the Hydrologic Units in the Region are monitored and evaluated. Thirty coastal confluence sites, just above salt-water influence, are monitored continuously, and serve for long-term trend monitoring and as "integrators" of upstream impacts.

In order to develop a broad picture of the overall health of waters in the Central Coast Region, a similar monitoring approach is applied in each watershed area. This provides compatibility across the Region and allows for prioritization of problems across a relatively large spatial scale. However, additional watershed specific knowledge is incorporated into the study design, so that questions which are narrower in focus can also be addressed. For example, in watersheds where Total Maximum Daily Load assessments are being undertaken, other program funds can be applied to support additional monitoring for TMDL development. Special studies are undertaken as funding and staffing permits to further focus monitoring on questions of interest specific in individual watersheds.

Watershed characterization involves three major components: acquisition and evaluation of existing data, monitoring of surface water and habitat quality, and developing a watershed assessment based on findings. Data is intended for use in evaluating waterbodies for 305(b) reporting and 303(d) listing.

Objectives - General programmatic objectives of the monitoring program are to:

1. Determine the status and trends of surface, estuarine and coastal water quality and associated beneficial uses in the Central Coast Region
2. Coordinate with other data collection efforts
3. Provide information in easily accessible forms to support decision-making

C. Methods for Achieving Objectives

The following specific monitoring objectives address questions posed in the SWAMP Site-Specific Monitoring Guidance related to beneficial use support. Monitoring approach and the water quality criteria that address these objectives are discussed.

(1) Is there evidence that it is unsafe to swim?
Beneficial Use: Water Contact Recreation (REC-1)
Objective(s): At sites throughout water bodies that are used for swimming, or that drain to areas used for swimming, screen for indications of bacterial contamination by determining percent of samples exceeding adopted water quality objectives and EPA mandated objectives. CCAMP data as well as data collected by local agencies and organizations will be used to assess shoreline and creek conditions.
Monitoring Approach: Monthly monitoring for indicator organisms (e.g. *E. coli*, fecal coliform, Enterococcus); compilation of other data sources
Assessment Limitations: CCAMP currently samples for fecal and total coliform; assessments are typically based on these two parameters only. Sampling is conducted at a monthly interval only; Basin Plan criteria are typically based on percent exceedance within a 30-day period. The Basin Plan objective for geomean of fecal coliform is based on 5 samples in a 30-day period; therefore exceedance using this criteria does not represent actual Basin Plan violation, but is a useful measure of the magnitude of the problem.
Criteria:

- 10% of samples over 400 MPN/100 ml fecal coliform
- Geomean of fecal coliform over 200 MPN/100 ml
- 10% of samples over 235 MPN/100 ml *E. coli*
- 10% of samples over 104 MPN/100 ml Enterococcus (bays and estuaries only)
- Fecal to Total coliform ratio over 0 .1 when Total Coliform exceeds 1000 MPN/100 ml (bays and estuaries only)

(2) Is there evidence that it is unsafe to drink the water?
Beneficial Use: Municipal and Domestic Water Supply (MUN)
Objective(s): At sites throughout water bodies that are sources of drinking water, determine percent of samples that exceed drinking water standards or adopted water quality objectives used to protect drinking water quality. Screen for presence of chemicals which may cause detrimental physiological response in humans using multi-species toxicity testing
Monitoring Approach: Monthly sampling for nitrate and pH; annual or bi-annual multi-species toxicity testing and followup chemistry or toxicity identification evaluations where possible.
Assessment Limitations: CCAMP does not typically sample for metals or organic chemicals in water; assessment is based on conventional parameters and toxicity only.
Criteria:

- Nitrate (as N) over 10 mg/L
- pH under 6.5 or above 8.3
- Water toxicity effects significantly greater than reference tests and survival, growth, or reproduction less than 80% of control

(3) Is there evidence that it is unsafe to eat fish and other aquatic resources?
Beneficial Uses: Commercial and Sport Fishing (COMM), Shellfish Harvesting (SHELL)
Objective(s): At sites located near the lower ends of streams and rivers, and in lakes, enclosed bays and estuaries, screen for chemical pollutants by determining the concentration of chemical contaminants in fish and shellfish samples, and assess whether samples exceed several critical threshold values of potential human impact (advisory or action levels).
Monitoring Approach: Annual fish and mussel tissue collection and chemical analysis

Assessment Limitations: CCAMP samples for an array of metals and organic chemicals commonly analyzed by the State Mussel Watch Program. This array does not include all currently applied pesticides, pharmaceuticals, and numerous other synthetic organic chemicals. Many chemicals do not have readily available human health critera or advisory levels.
Criteria: Exceedance of Office of Environmental Health Hazard Assessment Criteria for fish and shellfish tissue

(4) Is there evidence that aquatic life uses are not supported?
Beneficial Uses: Cold Freshwater Habitat (COLD); Preservation of Biological Habitats (BIOL); Warm Freshwater Habitat (WARM); Wildlife Habitat (WILD); Rare and Endangered Species (RARE); Spawning (SPAWN)
Objective(s): At sites along the main stem and at the lower ends of major tributaries of streams and rivers, screen for indications of water quality and sediment degradation for aquatic life and related uses, using several critical threshold values of toxicity, biostimulation, benthic community condition, habitat condition, and physical and chemical condition.
Monitoring Approach: Spring synoptic sampling for sediment and water column toxicity, sediment chemistry, benthic invertebrate assemblages, and associated habitat quality. Toxicity Identification Evaluation and/or chemistry follow-through for toxic sites. Monthly conventional water quality monitoring for nutrients, dissolved oxygen, pH, turbidity and water temperature. Pre-dawn or 24-hour continuous sampling for dissolved oxygen sags.
Assessment Limitations: CCAMP samples for an array of metals and organic chemicals commonly analyzed by the State Mussel Watch Program. This array does not include all currently applied pesticides, pharmaceuticals, and numerous other synthetic organic chemicals. Habitat sampling is conducted only in association with benthic invertebrate sampling and is not comprehensive. Sampling sites are located typically at the lower ends of major tributaries, and do not encompass upper watershed habitat.
Critera:

- Sediment or water toxicity effects significantly greater than reference tests and survival, growth, or reproduction less than 80% of control
- Sediment concentrations of organic chemicals above detection limits
- Tissue concentrations of organic chemicals over established U.S. Fish and Wildlife and National Academy of Sciences guidelines for protection of aquatic life. Tissue concentrations for chemicals without guidelines above detection limits.
- Dissolved oxygen levels lower than 7.0 mg/L in cold water streams and 5.0 mg/l in warm water streams
- Median oxygen levels less than 85%.
- pH levels lower than 7.0 or above 8.5
- Unionized ammonia levels over 0.025 mg/L as N.
- Biostimulatory risk rank above scoring range of high quality sites, for a given stream stratum
- Index of Biotic Integrity below scoring range of high quality sites, for a given stream stratum

(5) Is there evidence that agricultural uses are not supported?
Beneficial Use: Agricultural supply (AGR)
Objective(s): At sites throughout waterbodies that are used for agricultural purposes, determine percent of samples with concentrations of nutrients and salts above screening values or adopted water quality objectives used to protect agricultural uses.
Monitoring Approach: Monthly sampling for nutrients and salts
Assessment Limitations: CCAMP does not typically sample for all of the parameters identified in the Central Coast Water Quality Control Plan for protection of agricultural beneficial uses.
Criteria:

- pH below 6.5 or above 8.3
- Electrical conductivity over 3000 for salinity

- Sodium absorbtion ratio over 9.0
- Chloride over 106 mg/L
- Boron over 2.0 mg/L
- Sodium over 69 mg/L
- Ammonium over 30 mg/L
- Nitrate over 30 mg/L as N

(6) Is there evidence that aesthetic and other non-contact recreational uses are not supported?
Beneficial Use: Non-Contact Water Recreation (REC-2)
Objective(s): At sites throughout waterbodies that are used for non-contact recreation, screen for indications of bacterial contamination by determining the percent of samples exceeding adopted water quality objectives and assess aesthetic condition for protection of non-contact water recreation
Monitoring Approach: Monthly sampling for pathogen indicator organisms (E. coli, total and fecal coliforms); monthly qualitative assessment of % algal cover, presence of scum, odor, trash, etc.
Assessment Limitations: CCAMP does not currently conduct a formal assessment for trash.
Criteria:

- pH under 6.5 or over 8.3
- 10% of samples over 4000 MPN/100 ml fecal coliform
- Dry weather turbidity persistently over 10 NTU
- Algal cover persistently over 25%
- Scum, odor, trash, oil films present

REGION 4. Los Angeles Regional Water Quality Control Board

A. Los Angeles Region – Description

The Los Angeles Region encompasses all coastal drainages flowing to the Pacific Ocean between Rincon Point (on the coast of western Ventura County) and the eastern Los Angeles County line, as well as the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente). In addition, the Region includes all coastal waters within three miles of the continental and island coastlines. The largest drainages are the Ventura River Hydrologic Unit (300 square miles), the Santa Clara-Calleguas Hydrologic Unit (1,760 square miles), Malibu Hydrologic Unit (242 square miles), and Los Angeles-San Gabriel Hydrologic Unit (1,608 square miles).

Land use varies considerably within the Region. In Ventura County, land uses are changing from open space and agriculture to urban residential and commercial. In southern Los Angeles County, the predominant land uses are urban residential, commercial and industrial. In northern Los Angeles County, open space rapidly is being transformed into residential communities. More than 10 million people live within the Region.
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B. Goals and Objectives

Goal - The goal of the regional SWAMP program is to monitor all waters throughout the Los Angeles Region and identify those with degraded water quality and those of high quality.

Objectives - The two main objectives of the regional SWAMP program are:

1) Assess whether beneficial uses in Region 4 inland, estuarine and coastal waters are being protected.
2) Assess whether water quality conditions are getting better or worse over time.

C. Methods to Achieve Objectives

Region 4 has been divided into 10 watersheds. We intend to sample all 10 watersheds at least once every 5 years on a rotational basis.

In certain large watersheds (e.g., Santa Clara River, Los Angeles River, San Gabriel River), we are employing a randomized (probabilistic) sampling approach to assess overall condition. This type of approach allows us to answer the question: What percentage of the watershed exceeds a given water quality threshold? (e.g., what percentage of the Santa Clara River has nitrate levels above the Basin Plan objective). As we accumulate monitoring data every 5 years, we also will be able to evaluate trends to answer the question: Are water quality conditions getting better or worse over time? We also employ targeted sampling to complement the randomized approach, locating several stations at the confluences of major tributaries with the main stem of the river. These targeted stations serve to monitor the overall condition of waters in the main subwatersheds and ensure that we are able to characterize each major tributary (which cannot be guaranteed with the randomized approach).

In other smaller watersheds we employ targeted sampling to monitor representative points. This type of approach allows us to identify water quality problems and identify areas with high quality waters, but it is difficult to assess the areal extent of good or degraded conditions. This type of approach also allows us to answer the trend question.

The ecological conditions of coastal ocean waters are monitored very thoroughly in Southern California by the bightwide comprehensive monitoring studies. These surveys answer the questions pertaining to percentage of area impacted and long-term trends. Surveys were conducted in 1994, 1998 and 2003, and we expect these to continue at 5-year intervals. The 1998 and 2003 surveys also included sampling of many enclosed bays, estuaries, lagoons and marinas, so we are limiting targeted sampling in such waterbodies.

D. Indicators

Where applicable, a triad approach (water chemistry, benthic community analysis and toxicity testing) will be used. At randomized stations, we are relying primarily upon an assessment of the health of the biological community (bioassessment of the epibenthic macroinvertebrates in wadeable streams, benthic infaunal community in lakes and estuaries), water column toxicity and conventional pollutants (primarily nutrients). At targeted stations, we also add measurement of trace metals and trace organics. At estuarine stations, we may add sediment chemistry measures and sediment toxicity. In selected watersheds, we add bioaccumulation monitoring.

Due to funding constraints, monitoring is limited to a single sampling event for each watershed every five years. Sampling normally is conducted during the spring/summer period.

E. Monitoring Gaps

Due to funding constraints, we are not conducting monitoring in most lakes or reservoirs. These are excluded from the study design for selection of randomized sampling stations and we cannot afford to conduct targeted sampling in most cases. Except in rare circumstances, we are not conducting microbiological monitoring. It is difficult to deal with logistical problems (samples must be returned to the lab so that the test can be started within 6 hours) and we cannot afford to collect the 4 or 5 samples needed within a 30-day period for comparison to our Basin Plan objectives. We cannot afford to conduct trace metal and trace organic analyses at the majority of our sampling stations, so this monitoring is limited to selected sentinel stations at major confluences in a given watershed and at the outlets to the ocean.

REGION 5. Central Valley Regional Water Quality Control Board

Region 5 is the largest and most geographically diverse region in the State of California, covering over 60,000 square miles and furnishing over 50% of the State's managed water supply as well as containing 77% of the State's irrigated agriculture. Recognizable landmarks include Mount Shasta and Yosemite at the higher elevations, remains from the gold rush in the foothill areas, wetlands critical to the Pacific Flyway in the valley, and the Sacramento-San Joaquin Delta, from which water is diverted through the California Aquaduct to southern California.

Three major basins have been delineated within this region, namely the Sacramento River, San Joaquin River, and Tulare Lake Basins. SWAMP efforts within each basin have been developed to meet the following overarching goal:

- Monitor surface water throughout the Region to determine ambient water quality and whether beneficial uses are being impacted.

The overarching regional objectives include:

- Coordinate all SWAMP activities to maximize monitoring frameworks already in place and leverage existing resources, and
- Utilize SWAMP comparable sampling and analytical methods and data quality assurance protocols.

With the unique characteristics, variety of existing monitoring frameworks, and diverse water quality issues faced within each basin, separate approaches toward meeting the overall goals and objectives have emerged that can be generalized as follows: the Upper Sacramento River Basin augmented monitoring efforts by local watershed groups; the Lower Sacramento River Basin focused initial efforts on special studies evaluating effluent dominated water bodies with broader monitoring conducted by the Sacramento River Watershed Program; the San Joaquin River Basin built its monitoring effort off of the existing framework utilized in the Grassland Bypass Project; and the Tulare Lake Basin focused on watersheds with known water quality impairments.

More detail on the individual basin efforts follow, including expanded goals and objectives based on the unique concerns within each watershed.

I. Sacramento River Watershed

A. Sacramento River Region - Description

The Sacramento River Watershed spans over 69,900 square kilometers and is the source of water for over 20 million California residents, businesses, and farms. There are 10 hydrologic sub-regions in the Sacramento River Watershed Basin. Five sub-regions are located in the upper (Redding) watershed, and five sub-regions are located in the lower (Sacramento) watershed of the Basin:

1. Redding Sub-Regions

    1) Northeast (Pit River, McCloud River, Upper Sacramento R.).
    2) Upper Feather River (North/Middle/South Forks Feather u/s Oroville).
    3) Westside Sacramento Valley (Cottonwood, Redbank, Elder, Thomes, Stony Creeks).
    4) North and East-side Sacramento Valley (Clear, Cow, Bear, Battle, Mill, Deer, Big Chico, Butte Creeks).
    5) Sacramento River (Redding to Hamilton City).

2. Sacramento Sub-Regions

1) Southwest side of Sacramento Valley (Cache and Putah Watersheds).
2) Yuba and Bear River Watersheds.
3) American River Watershed.
4) Lower Sacramento Valley Floor (Sacramento River Hamilton City to I St Bridge).
5) Sacramento Delta.

3. Strategy

The vision of the entire Sacramento River Watershed Basin SWAMP program is for a two-component monitoring program consisting of a combination of 1) rotational sub-regional monitoring and 2) limited special screening level studies (including better characterizing of known problems). The following are the goals and objectives of the SWAMP program in the Sacramento Basin and the methods to achieve those goals.

B. Goals and Objectives

Goals - The goals of the SWAMP funded program in the Sacramento River Basin of Region 5 are:

1) Conduct ambient monitoring program that addresses all 5 sub-regions in each of the two sub-basins of the Sacramento River Watershed using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized data management. This monitoring program will be an umbrella program that monitors and interprets data for each hydrologic sub-basin at least one time every five years. Monitoring will build upon and be coordinated with monitoring being conducted by other entities.
2) Document ambient water quality conditions in potentially clean and polluted areas. The scale of these assessments ranges from site-specific to watershed-wide (or sub-region).
3) Conduct special screening level studies as needed for emerging contaminant issues.
4) Identify specific water quality problems preventing the SWRCB, and RWQCB's, and the public from realizing beneficial uses of water in targeted watersheds.
5) Provide the data to assist in evaluation of the overall effectiveness of water quality regulatory and nonregulatory programs in protecting beneficial uses of waters of the state.

Objectives - The objectives of the SWAMP funded program in the Sacramento River Basin of Region 5 are:

1) Gather and conduct preliminary analysis of existing water quality data to identify data gaps and/or suspected problems needing better characterization.
2) Assess at least one hydrologic sub-basin in each sub-basin of the Sacramento River Basin a year and rotate back through each sub-basin at least once every five years.
3) Identify beneficial uses in each sub-region and assess attainment and protection of those uses.
4) Incorporate and coordinate relevant and available monitoring data from other agencies and watershed groups in final interpretation of sub-regional assessments.

C. Methods to Achieve Objectives

The methods used to achieve objectives of the SWAMP funded program in the Sacramento River Basin of Region 5 are:

1) Monitoring may include chemical, physical, and/or biological analyses. The type of monitoring analyses used in each fiscal year of SWAMP monitoring will depend upon a preliminary analysis of available information.
2) Prior to any monitoring, the preliminary analysis of existing water quality data will be used to identify data gaps and/or suspected problems needing better characterization.
3) Other programs/groups collecting monitoring data, such as TMDL's, Ag Waiver, watershed groups (grant projects), and other will be valuable for identification of data gaps, identification of suspected problems needing better characterization, and for use in interpretation and final reporting of each rotational cycle of sub-regional monitoring data. Such analysis will be used to focus rotational and/or screening level monitoring efforts each fiscal year.
4) Priority may be given to coordinating SWAMP monitoring with CVRWQCB programs and other watershed management programs based on data gaps, needs, and available funding.

II. San Joaquin River Watershed

B. San Joaquin River Region - Description

The San Joaquin River (SJR) Basin covers roughly 16,000 square miles and has had a highly managed hydrology since implementation of the Central Valley Project (CVP) in 1951. Most of the SJR flow is diverted into the Friant-Kern Canal, leaving the river channel upstream of the Mendota Pool dry except during periods of wet weather flow and major snowmelt. Flows resume downstream of the Mendota Pool with eastside discharges dominated by snowmelt from the Sierra Nevada and westside discharges dominated by agricultural drainage. The major land use along the valley floor is agriculture with urban growth along the I-5 corridor rapidly converting historical agricultural land to urban areas. The basin has been divided into the following six sub-areas.

1) Northeast Basin (Consumnes, Mokolumne and Calaveras River Basins)
2) Eastside Basin (Stanislaus, Tuolumne, and Merced River Basins)
3) Southeast Basin (area east of the main river channel and upstream of the Merced River Basin)
4) Grassland Watershed (Salt and Mud Sloughs and the Drainage Project Area)
5) Westside Basin (Ingram, Hospital, Del Puerto, Salado and Orestimba Creek Watersheds)
6) Southern portion of the Sacramento-San Joaquin Delta

B. Goals and Objectives (Obj.)

Goal 1 Monitor surface water (potential clean and polluted) throughout the Region to determine ambient water quality
- Obj. 1.1 Coordinate internal and external activities to maximize monitoring frameworks already in place and leverage existing resources
- Obj. 1.2 Utilize SWAMP comparable sampling and analytical methods and data quality assurance protocols
- Obj. 1.3 Select sites that will allow for trend monitoring as well as the evaluation of annual and seasonal changes
- Obj. 1.4 Set up a rotational framework that allows annual rotation through the sub-basins in order to sample a broad spectrum of water bodies (as funding permits).

Goal 2 Evaluate whether the most limiting beneficial uses in a water body are being impacted
- Obj. 2.1 Identify most sensitive beneficial uses in water bodies to be samples
- Obj. 2.2 Identify suite of parameters to be analyzed to determine if beneficial use threatened

Goal 3 Help identify sources of potential impairment in evaluated water bodies

Obj. 3.1 Set up selected sampling locations in areas of confluence of distinct sub-watersheds
Obj. 3.2 Set up selected sampling locations upstream and downstream of specific land uses
Obj. 3.3 Conduct special studies to identify sources of unknown toxicity

Goal 4 Provide the data needed to assist in evaluation of the overall effectiveness of water quality regulatory and non-regulatory programs in protecting beneficial uses of waters of the state.

Obj. 4.1 Set up long-term trend monitoring sites at locations upstream and downstream of management activities.
Obj. 4.2 Identify and monitor for constituents that would be an effective measure of the impacts of management activities.

Goal 5 Insure that water quality data collected is available to the public.

Obj. 5.1 Develop Region 5 specific SWAMP website
Obj. 5.2 Insure that existing web based water quality database is updated at least quarterly
Obj. 5.3 Develop mechanism to transfer information in current database to statewide SWAMP database.

C. Methods to Achieve Objectives

Obj. 1.1. *Coordinate internal and external activities to maximize monitoring frameworks already in place and leverage existing resources*: Staff conducts an annual overview of internal and external programs prior to sampling for the next fiscal year. Internally, key staff from various programs including TMDL, Selenium Control Program, and Irrigated Ag Program as well as managers of water quality improvement grants, are provided a list of potential SWAMP monitoring locations and asked to comment and provide a list of their own monitoring activities. Externally, key agencies are queried including USGS, USFWS, USEPA, University of California, DWR, DFG and local watershed groups. Survey forms are sent to all interested parties (including all cities and water agencies) prior to a rotation into a subwatershed, and opportunities are provided for input into the sampling design and coordination between efforts. All information is captured on a wall size map and tables listing site location (GIS coordinates), parameters measured, frequency and contact information. The information is currently being reviewed under a contract with USEPA to be developed into a web based monitoring clearing house.

Obj. 1.2. *Utilize SWAMP comparable sampling and analytical methods and data quality assurance protocols*: Current program and procedures are under review by the SWAMP Quality Assurance team. In addition, the Selenium Control Program (upon which the SWAMP framework is based) is has a multi-agency QAPP, which undergoes annual review and each participating agency is subject to an annual external audit. Special studies are underway with the University of California to determine appropriate sampling and analytical methods for E. coli measurements and reasonable sample recoveries and analytical variability.

Obj. 1.3. *Select sites that will allow for trend monitoring as well as the evaluation of annual and seasonal changes:* Sites along the main stem of the San Joaquin River and those representing drainage inflows from five sub-basins have been designated as permanent monitoring locations. These sites will also allow evaluation of water quality over time and over water year types that can range from flood to critically dry years. River sites are monitored weekly and drainage basin sites monthly.

Obj. 1.4. *Set up a rotational framework that allows annual rotation through the sub-basins in order to sample a broad spectrum of water bodies (as funding permits).:* With limited funding the program has been initiated and two basins completed (Northeast and Eastside) with a third in progress (Westside). Typically funding allows for the addition of approximately 20-sites per sub-watershed which are sampled twice per month for a minimum of field parameters (EC, pH, temperature, DO and photo documentation), TOC, and E. coli. As funding permits, additional parameters such as water column toxicity are included.

Obj. 2.1. *Identify most sensitive beneficial uses in water bodies to be sampled:* The Region 5 Basin Plan for the SJR Basin is reviewed and listed beneficial uses identified for each water body.

Obj. 2.2. *Identify suite of parameters to be analyzed to determine if beneficial use threatened*: The following parameters were selected to measure beneficial use impacts: salt, bacteria, TOC (drinking water); temperature, trace elements, toxicity, bioassessments (aquatic life); salt, boron, minerals (irrigation water supply); bacteria (recreation); and selenium (waterfowl).
Obj. 3.1. *Set up selected sampling locations in areas of confluence of distinct sub-watersheds*: To identify potential sources of impairment, a layered monitoring framework was developed. The first layer contains sites selected along the main stem of the river downstream of major inflows. The second layer is a series of sites representing inflows from specific sub-watersheds into the main stem of the river. The final layer is a more detailed survey of water quality within each of the sub-watersheds-once every 5-years and the majority of sites are selected at the confluence of sub-watersheds.
Obj. 3.2. *Set up selected sampling locations upstream and downstream of specific land uses*: During the rotational basin portion of the sampling effort, selected sites are located upstream and downstream of urban influences and agricultural influences or other potential disturbance.
Obj. 3.3. *Conduct special studies to identify sources of unknown toxicity*: TIE's have been conducted on both water column and sediment samples. The sediment TIE's have led to significant studies on the potential impact of pyrethroids in agricultural areas of the SJR Basin. The TIE's are being coordinated with other agencies' monitoring to leverage resources.
Obj. 4.1. *Set up long-term trend monitoring sites at locations upstream and downstream of management activities*. The framework for the SJR Basin SWAMP efforts has been based on the multi agency selenium control program and sites selected for SWAMP are consistent with the basinwide compliance monitoring points for the control program. Sites along the river are monitored weekly while sites representative of sub-basin inflows are monitored monthly.
Obj. 4.2. *Identify and monitor for constituents that would be an effective measure of the impacts of management activities*: Constituents monitored are coordinated with internal regulatory programs to insure that appropriate constituents are evaluated (e.g. selenium, salt, and boron for TMDL efforts; TOC for emerging drinking water program).
Obj. 5.1. *Develop Region 5 specific SWAMP website:* The current website allows posting of both raw data by site and summary reports. Go to http://www.waterboards.ca.gov/centralvalley/programs/agunit/swamp/index.html
Obj. 5.2. *Insure that existing web based water quality database is updated at least quarterly:* Updates are conducted as funding allows student resources.
Obj. 5.3. *Develop mechanism to transfer information in current database to statewide SWAMP database:* Currently under contract with SWAMP Database Management Team to develop crosswalk.

II. Fresno – Tulare Lake Watershed

A. Fresno / Tulare Lake -Description

The Tulare Lake Hydrologic Basin (Basin) comprises roughly fifty percent of the Central Valley floor and includes the historical lakebed, with the remainder comprised of Kings Canyon and Sequoia National Parks and substantial portions of Sierra, Sequoia, Inyo, and Los Padres National Forests. The Tulare Lake Basin is essentially a closed basin since surface water drains north into the San Joaquin River only in years of extreme rainfall. The Kings River, Kaweah River, Tule River, Kern River, and all waters tributary drain the west face of the Sierra Nevada Mountains and provide the bulk of native surface water supply in the Tulare Lake Basin. These surface waters are augmented with imported water from the San Luis Canal/California Aqueduct System, Friant-Kern Canal, and the Delta Mendota Canal.

The Tulare Lake Basin is divided into six watershed management areas. Each area is defined as the designated groundwater basin. Thus, the Kern County Basin Management Area includes the Kern River and the Poso Creek drainage areas, as well as the drainage areas of westside streams in Kern County. The Tulare Lake Basin Management Area consists of the historical lakebed. The Tule Basin Management Area includes the Tule River, Deer

Creek, and White River drainage areas. The Kaweah Basin Management Area includes the Kaweah River and Yokohl Creek drainage areas. The Kings Basin Management Area includes the Kings River drainage area as well as the drainage area for the tributaries and distribution systems of the Kings River. The Westside Basin includes the drainage areas of westside streams in the Kings and Fresno counties.

B. Strategy

The strategy of the Tulare Lake Basin SWAMP is for a two-component monitoring program consisting of a combination of 1) rotational watershed management area monitoring and 2) limited special screening level studies (including better characterization of known problems). The purpose of the program is to conduct ambient monitoring program using consistent and objective monitoring, sampling, and analytical methods; consistent data quality assurance protocols; and centralized data management. The following are the goals and objectives of the SWAMP program in the Tulare Lake Basin and the methods to achieve those goals.

C. Goals and Objectives

Goals

1) Conduct ambient monitoring program that addresses all 6 watershed management areas of the Tulare Lake Basin using consistent and objective monitoring, sampling, and analytical methods; consistent data quality assurance protocols; and centralized data management. This monitoring program will be an umbrella program that monitors and interprets data for each watershed management area at least one time every five years.
2) Document ambient water quality conditions and characterize surface water quality as either maintaining beneficial uses or as impaired. The scale of these assessments ranges from site-specific to watershed wide.
3) Conduct limited special screening level studies as needed for emerging contaminant issues.
4) Determine whether there is an association between land use and water quality impacts.
5) Provide the data to evaluate the overall effectiveness of water quality regulatory programs in protecting beneficial uses of waters of the State.

Objectives

1) Gather and conduct preliminary analysis of existing water quality data to identify data gaps and/or suspected problems needing better characterization.
2) Assess one watershed management area per year and rotate back through each watershed management area at least once every five years.
3) Identify beneficial uses associated with surface waters in each watershed management area and assess attainment of the water quality objectives that support those beneficial uses.
4) Incorporate and coordinate relevant and available monitoring data from other agencies and watershed groups in final interpretation of watershed management area assessments.

D. Methods to Achieve Objectives

The methods used to achieve objectives of the SWAMP funded program in the Tulare Lake Basin of Region 5 are:

5) Monitoring may include chemical, physical, and/or biological analyses. The type of monitoring analyses used in each fiscal year of SWAMP monitoring will depend upon a preliminary analysis of available information.

6) Prior to any monitoring, the preliminary analysis of existing water quality data will be used to identify data gaps and/or suspected problems needing better characterization.
7) Other programs/groups collecting monitoring data, such as TMDL's, Irrigated Lands Waiver, watershed groups (grant projects), and others will be valuable for identification of data gaps, identification of suspected problems needing better characterization, and for use in interpretation and final reporting of each rotational cycle of monitoring data. Such analysis will be used to focus rotational and/or screening level monitoring efforts each fiscal year.
8) Priority may be given to coordinating SWAMP monitoring with CVRWQCB programs and other watershed management programs based on data gaps, needs, and available funding.

REGION 6. Lahontan Regional Water Quality Control Board

A. Lahontan Region - Description

The Lahontan Region is the second largest region in California. (Only the Central Valley Region is larger.) The Lahontan Region spans eastern California from the Oregon border in the north, to the Mojave Desert and San Bernardino mountains in the south. The Region is nearly 600 miles long and has a total area of more than 33,000 square miles (larger than the State of Maine). It includes the highest point (Mount Whitney, +14,494 ft.) and lowest point (Badwater, Death Valley, –282 ft.) in the contiguous United States, more than 3,000 miles of streams, more than 700 lakes, and two designated Outstanding National Resource Waters (Lake Tahoe and Mono Lake).

The Lahontan Region is unique in at least two respects. First, the region's Basin Plan contains numerous site-specific numeric objectives that were adopted more than thirty years ago, and for which little or no monitoring data was available prior to creation of the SWAMP program in 2000. Second, the region contains large inter-state rivers, requiring a consideration of the receiving state's (i.e., Nevada's) standards.

B. Goals and Objectives

Goal - The overall goal of the regional SWAMP program is to monitor (to the extent to which funding is available), surface waters throughout the region to identify water bodies that meet water quality standards and those that do not.

Objectives - The main objectives of the regional SWAMP program are:

1. to determine (to the extent to which funding is available) whether ambient water quality at selected sites is in compliance with the chemical and physical water quality objectives contained in the Basin Plan.

2. to determine (to the extent to which funding is available) whether water flowing from California into the State of Nevada meets the State of Nevada's water quality objectives.

3. to develop (to the extent to which funding is available) indices of biological integrity (IBIs) for streams and rivers based on instream benthic macroinvertebrate and algae assemblages, to be used as a tool for evaluating biological integrity.

4. to determine (to the extent to which funding is available) whether water quality conditions are getting better or worse over time.

A key future objective (which has not been possible to pursue given past/current funding levels) is to determine, with statistical confidence, the proportion of surface water bodies that: (a) fully support designated beneficial uses, (b) partially support beneficial uses, or (c) do not support beneficial uses.

C. Methods to Achieve Objectives

Objective #1: This is accomplished by conducting quarterly water sampling at a region-wide array of sampling stations, for which public access is readily available. The selected monitoring sites are generally located near the bottoms of watersheds (i.e., "integrator sites") at locations where the Basin Plan contains discrete numeric objectives. This allows a direct comparison of the sampling results to the site-specific objectives contained in the Basin Plan.

Objective #2: This is accomplished by conducting sampling at the state line, and comparing results to standards adopted by the State of Nevada.

Objective #3: This is accomplished by sampling benthic macroinvertebrates and periphyton, and developing IBIs following USEPA guidance and other applicable methods (i.e., multivariate analyses).

Objective #4: This will be accomplished in at least two ways. First, sites sampled under Objective #1 will be sampled in the long-term. That is, at least some of the locations sampled under Objective #1 will be permanent or semi-permanent monitoring stations. Second, the IBIs developed under Objective #3 will be used to establish baseline conditions at selected sites, and then re-sampled over time to measure changes.

The future objective may only be accomplished via probabilistic sampling. If funding becomes available for such an endeavor, the region will coordinate with other regions to pursue a statewide probabilistic monitoring design using appropriate indicators and assessment criteria.

REGION 7. Colorado River Basin Region

A. Colorado River Basin - Description

The Colorado River Basin Region covers approximately 13 million acres (20,000 square miles) in the southeastern corner of California. It includes all of Imperial County and portions of San Bernardino, Riverside, and San Diego Counties. The Colorado River Basin Region is located in the most arid area of California. The majority of the Region's surface waters are located in the Imperial Valley and East Colorado River planning areas, with a few situated in the Coachella Valley, Lucerne, Anza-Borrego, and Hayfield planning areas. Hence, the ambient surface water-monitoring program focuses on the water bodies in the Imperial Valley and the Lower Colorado River planning areas.

The Salton Sea Trans-boundary Watershed contains five of six, 303(d)-listed impaired surface water bodies. Water from the Colorado River has created an irrigated agricultural ecosystem throughout this watershed. Wildlife and aquatic species are dependent on habitat created and maintained through the discharge of agricultural return flows. Major water bodies in the watershed include the Salton Sea, Alamo River, New River, Imperial Valley Agricultural Drains, and Coachella Valley Storm Water Channel. San Felipe Creek and Salt Creek also occur in this watershed and provide critical habitat for the endangered species.The designated beneficial uses of the waters in the Watershed include agricultural supply, aquaculture, cold freshwater habitat,[1] groundwater recharge, hydroelectric power generation, industrial, municipal and domestic, rare and endangered species[1], warm freshwater habitat, water contact recreation[2] and wildlife habitat. At the Water Quality Control Plan all the water quality objectives for the region are specified.

B. Goals and Objectives

Goal. The goal of Region 7's SWAMP program is to monitor the surface water bodies within the Region's watersheds in order to evaluate if beneficial uses are being protected and to establish a baseline for water quality trend monitoring.

Objectives:

1. to identify impaired water bodies as required by Section 303 (d) of the Federal Clean Water Act
2. to collect additional information at sites that are known to or suspected of having water quality problems.
3. to evaluate the effectiveness of specific management practices (MP) employed to improve water quality of impaired water bodies
4. to coordinate and share information with other monitoring efforts at the region.

C. Methods of Achieving Objectives

The Regional Board selected 13 strategic sampling locations to assess water quality. The strategic sites are along the Lower Colorado River, New River, Alamo River, Whitewater River, and Salton Sea, which are the five surface water bodies of major interest in the Region. These water bodies are the focus on priority TMDLs for sediments, nutrients, selenium, pesticides, and pathogens. Physical, chemical, and biological parameters are used as water quality indicators. Monitoring data collected include conventional water quality parameters, organic chemistry, trace metals, bacteria

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[1] Aquatic life –related uses
[2] These include water contact recreation and non- contact recreation

indicators and aquatic toxicity at the water column.The monitoring data collected for sediments include organic chemistry, trace metals and sediment toxicity. The monitoring events are, most of the time, conducted biannually. Information gathered through the SWAMP Program is used to support Basin Planning activities and objectives, and will complement other past and present studies conducted at the Region. SWAMP will provide a comprehensive view of changes that occur with MP implementation and will help with TMDL development.

REGION 8. Santa Ana Basin

A. Santa Ana Basin - Description

The Santa Ana Region is the smallest of the nine regions in the state and is located in southern California, roughly between Los Angeles and San Diego. Although small, the region's four million residents make it one of the most densely populated regions. In very broad terms the Santa Ana region is a group of connected inland basins and open coastal basins drained by surface streams flowing generally southwestward to the Pacific Ocean. The average annual rainfall in the region is about fifteen inches, most of it occurring between November and March. The two major rivers draining the upper watersheds in our region are the Santa Ana River and the San Jacinto River. Several smaller streams such as the Peters Canyon Wash, Coyote Creek, and other smaller creeks along the coast drain the lower watersheds in the region.

B. Goals and Objectives

Goals: The goal of the Surface Water Ambient Monitoring Program in the Santa Ana Region is to determine the percent area of a given water body that meets water quality standards.

Several goals of the State Water Resources Control Board's Strategic Plan are incorporated in the Santa Ana Region's Monitoring and Assessment approach as follows:

Goal	Implementation by Region 8 Monitoring Approach
Surface waters are safe for drinking, fishing, wimming, and support healthy ecosystems and other beneficial uses.	The monitoring objectives for each water body sampled have been established. These include answering the questions: Are aquatic populations and communities protected? Does water quality meet the body contact, non-body contact and habitat beneficial uses?
Individuals and stakeholders support our efforts and understand their role in contributing to water quality	Following the sampling activities, and data analyses, a staff report will be presented in a public Board Meeting as an information item. Further, members from the public will be encouraged to volunteer in the sampling activities.
Water Quality is comprehensively measured to evaluate protection and restoration efforts	The Santa Ana Region's approach to monitoring includes adherence to the SWAMP QAMP and the use of standard sampling and analyses protocols to ensure the data gathered is of good quality and adequate to reach sound conclusions.

<u>Consistency with EPA's Partnership Agreement:</u>

The Santa Ana Region's Monitoring Approach is also consistent with EPA's Partnership Agreement as follows:

Partnership Agreement Objective	Implementation in Region 8's Monitoring Approach
Implement the law	Allow for data sharing within the agency for use by

	NPDES permitting, enforcement, TMDL and Stormwater Programs.
Improve Efficiency	Allow for bioassessment data gaps to be filled by region wide stream bioassessment study in 04/05
Target Critical Problems	Allow for detecting water bodies not meeting water quality objectives and using the data for listing purposes on 303 (d) List
Address the concerns of the public	Providing the data and staff report to the public at a public board meeting and allow public to comment on report and findings.

Objectives:
The Objectives are as follows:

- Target water bodies for monitoring where water quality information is scant;
- To determine the percent area of a given water body that meets or does not meet beneficial uses by comparing data to numerical objectives or guidelines;
- To provide ambient water quality data to decision makers and to the public;
- To coordinate with other data collection efforts
- To use ambient water quality data to determine the overall conditions of water bodies in the region for inclusion in the 305(b) Report and the 303(d) list;

C. Methods of Achieving Objectives

Each water body has been pre-selected by Regional Board staff and the sampling points have been pre-determined by a statistician using a randomized sampling design. These water bodies will be sampled during wet and dry seasons to allow for comparisons of water quality between these two periods.
Furthermore, these water bodies will be re-sampled every five years to determine if over all water quality has changed.

Each year, a work plan has been developed for each water body to be sampled, a water body specific QAPP plan and a sampling plan. A report will be prepared with the results and interpretations of the data collected. Both the report and the data will be considered during the water quality assessment process required under Section 305 (b) of the Clean Water Act.

The strategy used for lakes, bays and harbors focuses on the triad approach to assess these water bodies. In the triad approach, the toxicity, chemistry and benthic infauna data is considered simultaneously to determine whether the water body is meeting water quality standards.

The strategy used for streams focuses on using bioassessment information to determine the percent of streams impaired when compared to a reference condition. This strategy also involves gathering additional information such as the land use, physical habitat of the stream, and nutrient concentrations and physical parameters such as pH, temperature, and dissolved oxygen.

REGION 9. San Diego Region

A. San Diego Region – Description

The San Diego Region stretches along 85 miles of scenic coastline from Laguna Beach to the Mexican Border and extends 50 miles inland to the crest of the coastal mountain range. In a mild coastal climate, the Region's growing population enjoys many water-related activities; however little precipitation falls within this semi-arid Region. Approximately 90 percent of the Region's water supply is imported from Northern California and the Colorado River.

C. Goals and Objectives

Goals - SWAMP monitoring in the San Diego region is intended to provide reliable, high quality information necessary to produce water quality assessment [305(b)] and impaired waters [303(d)] lists that are more comprehensive and more defensible than those of past years.

Objectives - At this time, the primary objectives for SWAMP monitoring in the San Diego region (from the SWRCB Report to the Legislature) are as listed below.

Objective # 1 - At sites influenced by point sources (e.g., storm drains, publicly owned treatment works, etc.) or nonpoint sources of pollutants, identify specific locations of degraded water or sediments in rivers, lakes, near shore waters, enclosed bays, or estuaries using several critical threshold values of toxicity, water column or epibenthic community analysis, habitat condition, and chemical concentration.

Objective # 2 - At sites influenced by point sources (e.g., storm drains, publicly owned treatment works, etc.) or nonpoint sources of pollutants, identify specific locations of degraded sediment in rivers, lakes, near shore waters, enclosed bays, or estuaries using several critical threshold values of toxicity, water column or epibenthic community analysis, habitat condition, and chemical concentration.

Objective # 3 - Identify the areal extent of degraded sediment locations in rivers, lakes, near shore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

These objectives are related to the question of whether aquatic populations, communities, and habitats are protected. There are a number of other questions and objectives pertinent to other beneficial uses of surface waters in the San Diego region. Those questions are being, will be, or should be addressed by other entities and/or other monitoring programs and/or may be included in the SDRWQCB objectives for SWAMP monitoring in the future if/when additional SWAMP funding is available.

D. Methods to Achieve Objectives

Given the anticipated funding constraints mentioned above, SDRWQCB staff plans to focus SWAMP monitoring efforts on main stem rivers and streams and major tributaries within the various hydrologic units. If/when additional funding is available in the future, SDRWQCB staff plans to expand SWAMP monitoring efforts to include estuaries, coastal lagoons, bays, harbors, ocean waters, and other waters of the region.

In general, SDRWQCB plans to locate monitoring sites on:

a. Main stem rivers and streams, just above tidal influence;
b. Main stem rivers and streams just above the confluence with major tributaries, and
c. Major tributaries just above the confluence with the main stem rivers and streams.

For various reasons, locations of certain stations may not fit these general rules. The site reconnaissance, which provides assessment beyond the reach scale, will provide the necessary information to support site selection or identify alternate sites that better support the primary objectives discussed above.

Due to resource constraints, watersheds will be sampled every five years. It the fifth year, three watersheds will need to be sampled to complete the sampling of the entire region in 5 years.

All San Diego region SWAMP sampling and analyses will be performed under the SWRCB statewide master contract with the Department of Fish and Game. This arrangement will make use of the monitoring expertise of the Department of Fish and Game and avoid the need for SDRWQB staff to manage a region-specific contract. SDRWQCB staff will conduct site reconnaissance.

Stream flow conditions in the San Diego region vary substantially seasonally (and from year to year). The four planned sampling periods are intended to cover different stream flow conditions, i.e.,

February - between storm events
April- high base flow rates
May / June - declining base flow rates (and bioassessment index period)
September / October - minimum base flow rates (and bioassessment index period)

There are no surface water flows in some San Diego region streams at certain times of the year. Streams with varying flow regimes drain the Pueblo San Diego, Sweetwater and Tijuana watersheds. In these watersheds, monitoring efforts will be tiered with an emphasis on Winter (February) and Spring (April) monitoring with fully integrated monitoring limited to selected streams and rivers. Partnerships with other agencies, non-governmental organizations, and Tribal Nations will continue to be sought to expand the planned monitoring in all watersheds.

E. Water Quality Indicators

In general, SDRWQCB staff plans to use the same suite of indicators at all monitoring sites in the first years of SWAMP. The staff of the SDRWQCB plans to transition to a tiered approach in which SWAMP monitoring at sites lower in a watershed emphasize integrative measures/indicators and to only monitoring some sites for a subset of parameters

In order to accomplish the SWAMP monitoring objectives identified above, SDRWQCB plans to use the indicators (described in the SWRCB Report to the Legislature) listed in the table below. This table also shows the link between the monitoring objectives, indicators and beneficial uses. These indicators will be used in all waterbodies sampled in the Region.

Additional indicators may be used if/when additional SWAMP funding is available.

Beneficial Use	Monitoring Objectives[1]	Category	Indicator
Fish and Shellfish Contaminatio n	1 & 2	Contaminant exposure	Fish tissue chemistry Shellfish tissue chemistry Coliform bacteria in shellfish Fecal coliform/Enterococcus in water
Aquatic Life	1, 2 & 3	Biological response	Sediment toxicity Water toxicity
		Pollutant exposure	Shellfish or fish tissue chemistry Nutrients Inorganic and organic water chemistry
		Habitat	Sediment grain size and gradations Hydrogen sulfide (sediment) Ammonia (water)

Appendix D
Summary of Monitoring Activities
of the Nonpoint Source (NPS) program

CALIFORNIA NONPOINT SOURCE (NPS) MANAGEMENT PROGRAM
TRACKING & MONITORING OBJECTIVES
December 28, 2004

This working paper lays out tracking and monitoring objectives for the California NPS Program. These objectives clarify the California NPS Program information needs The aim is to use these objectives to design and implement activities that will provide information to better guide continued and improved implementation of nonpoint source pollution control measures. These objectives will be addressed through the Water Board's monitoring program (SWAMP), and related monitoring and implementation tracking activities. The definitions associated with these objectives should be considered to be 'functional' definitions only for the purpose of this effort.

Objective #1: What is the quality of water in California?

a. Indicate the extent and location of water quality impairments.
b. Indicate the extent and location of water quality threatened water bodies.
c. Indicate the extent and location of high quality waters.

Objective #2: What is the extent of impairments associated with nonpoint sources?

a. Indicate the extent and location of impairments associated with nonpoint versus point source pollution.
b. Indicate the extent and location of waters that are threatened by existing or potential nonpoint sources.

Objective #3: What are the nonpoint sources that are impairing or threatening water quality?

a. Indicate the pollutants that are associated with the source of the impairment or threat.
b. Associate nonpoint source impaired or threaten waters with various land use activities.
c. Indicate extent of impairment or threat associated with each land use activity.

Objective #4: Is water quality getting better or worse?

a. Indicate the trend of impairments over time.
b. Indicate the trend of point versus nonpoint source impairments over time.
c. Indicate the trend of NPS impairments for each land use category and pollutant.

Objective #5: Is the California NPS Program investing resources consistent with water quality problems?

a. Indicate the location and extent of resources expended.
b. Associate location and extent of resources expended with NPS threatened and impaired water bodies.
c. Indicate the location and extent of management measures/practices being implemented.
d. Indicate the extent and location of implementation compared to NPS threaten and impaired water bodies.

Objective #6: Are NPS investments effective in protecting and restoring water quality?

a. Indicate the improvement in water quality where investments have been made.
d. Indicate the improvement in water quality where management measures have been implemented.
e. Indicate the technical effectiveness of specific management practices.
f. Indicate cost-effectiveness associated with implementation of management practices.

Definitions

High Quality Water: High quality water for the purpose of NPS Monitoring is a water body that supports all of it's designated beneficial uses. It may also be a threatened water body.

Impairment: A water body is considered impaired when it is unable to support designated beneficial uses. The water body may be on the final SWRCB 303(d) list for one or more stressors, but will have been determined to be deficient in support of a designated beneficial use. It may also be on the 'Pollution List' which means that it is not necessarily impacted by a pollutant, but rather by other factors such as invasive species, reduced stream flow, or water diversion.

Investments:Refers to the activities that are supported with theresources(as identified above) that are available to address NPS water quality concerns.

Land Use Activities: For the purpose of NPS Monitoring, the Land Use Activities refer to Agriculture, Forestry, Urban (NPDES and non-NPDES), Marinas and Hydromodification. These categories are a subset of the 6 management categories identified in the California Nonpoint Source Management Plan. Wetlands is an additional management category that should also be considered for the monitoring program. *(Please note that the NPS Program is working to develop a more detailed template regarding these land use categories.)*

Management Measures (MM)/Practices (MPs): MMs are groupings of Management Practices (MPs) which when implemented, address water quality problems that occur from specific types of land-use activities. There are 62 MMs in the California NPS Program Plan. The goal of the program is to implement these management measures by 2013

Nonpoint Sources: For the purpose of the NPS Monitoring, the Clean Water Act definition of Nonpoint Sources will be utilized. The CWA does not provide a detailed definition of nonpoint sources. Rather, they are defined by exclusion -- anything not considered a "point source" according to the Act and EPA regulations.

Point Source: Discrete conveyances, such as pipes or man made ditches that discharge pollutants into waters of the United States. This includes not only discharges from municipal sewage plants and industrial facilities, but also collected storm drainage from larger urban areas, certain animal feedlots and fish farms, some types of ships, tank trucks, offshore oil platforms, and collected runoff from many construction sites.

Pollutants: The term pollutant is define in Section 502(6) of the Clean Water Act as "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biologicalmaterials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and idustrila, municipal and agricultural waste discharged into water."

Resources: The resources directly available by the CA NPS Program includes (1) "project funds" that support a wide range of project activities conducted by "third parties" (e.g., Resource Conservation Districts, watershed groups, municipalities, and others) and (2) "staff funds" that support SWRCB and RWQCB staff activities (e.g., outreach, monitoring, inspections, enforcement, etc.). The source of "project funds" includes state bonds (e.g., Propositions 13, 40 & 50, CWA Section 319, the State Revolving Fund) and the source of "staff funds" includes State General Funds and CWA Section 319. Additional resources indirectly available by the CA NPS Program include (1) other state agencies "projects funds" and "staff funds" and (2) other federal agencies "project funds" (e.g., EQIP through NRCS) and "staff funds" and (3) other public and private expenditures.

Threatened water body: For the purpose of the NPS Monitoring, a water body will be considered threatened if there are stressors in the watershed of a quantity or concentration such that continued land use activities would possibly create a loss to one or more of its designated beneficial uses. The water body would most likely be on the SWRCB 'Planning List', which means that some data supports the idea that it may become 'impaired'.

California Nonpoint Source Tracking and Monitoring Council

February 2005

CHARTER

Mission

To help improve implementation tracking and water quality monitoring to enhance local, state, federal, tribal and private efforts to address nonpoint source pollution and protect designated uses.

Description

The Council will focus on addressing the implementation tracking and water quality monitoring needs associated with the California Nonpoint Source Pollution Control Program. The Council's efforts will be designed to enhance information needed for implementation at many levels (e.g., from local watershed organizations to state and federal agencies and the private sector) and among various programs. The activities of the Council will be coordinated with the Water Boards' Surface Water Assessment and Ambient Monitoring Program (SWAMP) and other related efforts. The SWRCB and CCC are forming the Council, in cooperation with U.S. EPA, as a subcommittee of the State's NPS Interagency Coordinating Committee, and will provide staff support.

Scope

The Council will address the biological, chemical, physical and ecosystem aspects of tracking and monitoring, including surface and ground waters, freshwaters, estuarine, and mairine environments in California. Therefore, the Council will encourage comprehensive, watershed-based, and cross-programmatic monitoring.

Members

Representatives from local, state, tribal and federal agencies, watershed groups, universities, and the private sector are welcome to participate on the Council. Meetings will be open, informal and consensus driven with votes taken, only as needed, with one vote per organization. It is anticipated that the Council will eventually identify co-chairs and an executive committee.

Need for Council

Monitoring indicates that nonpoint pollution is the leading cause of water quality impairments. However, numerous entities have identified the need and importance for continued work toward coordinating and improving water quality monitoring. Congress, the State Legislature and others are increasingly emphasizing the need to tie assessments of our NPS programs and corresponding public expenditures to improvements in water quality. Since 1990, CWA Section 319 has provided over $90 million to the CA NPS Program and state bonds are now investing $100's of millions more. Several NPS related programs (TMDLs, Conditional Waivers for Irrigated Agriculture, water bonds, CWA Section 319, etc.) have tracking and monitoring requirements and it is important to coordinate with these efforts. Improved monitoring is essential to identify NPS sources, provide a further understanding of their impacts, guide control efforts and ultimately prove the value of the controls.

Goals

- Enhance coordination, communication and collaboration among various tracking and monitoring programs for data collection, data management, data sharing and assessment.
- Provide consistent and scientifically defensible water quality monitoring data.
- Maintain an effective, performance-based approach to making decisions regarding investment of resources to reduce or prevent NPS pollution in California.
- Document the extent and effectiveness of NPS implementation, and ultimately the value of implementation for the preservation of designated uses and water quality.
- Foster goal-oriented monitoring that supports watershed management.
- Strengthen project monitoring (e.g., bond & 319 funded "on-the ground" projects).
- Help establish and carry-out a state monitoring strategy.
- Establishmechanismstocorrelatelanduseactivitiesandwater quality.
- Support and encourage the utilization of new monitoring and assessment methods and techniques, as appropriate (e.g., probabilistic sampling, bioassessment, etc.).

Anticipated Activities

- Inventory of existing monitoring, tracking, and assessment programs.
- Review and comment on California's NPS tracking and monitoring strategies, and SWAMPs long term water quality monitoring strategy.
- Establish and test methodologies to track NPS implementation.
- Help prepare a CA NPS Program annual report based on tracking and monitoring data – and is so doing, identify data gaps, and monitoring and assessment needs.
- Provide technical guidance to the California Monitoring and Assessment Program (CMAP).
- Sponsor water monitoring technical workshops.
- Integrate local and volunteer monitoring with state/regional programs.
- Enhance data management, exchange and compatibility.
- Coordinate use of environmental indicators.
- Leverage resources (e.g., joint projects).
- Advocate NPS monitoring needs at various levels.

Annual Council Performance Review

On an annual basis the Council will review its performance to confirm the need to continue, and determine future activities and direction. This review will include consideration of whether the Council would benefit by expanding its mission beyond nonpoint source pollution.

Appendix E
Policy for Developing
California's CWA Section 303(d) List

(Available at: http://swrcb2.swrcb.ca.gov/tmdl/docs/ffed_303d_listingpolicy093004.pdf)

SWAMP
Surface Water Ambient Monitoring Program

October 2005

California Water Boards

State Water Resources Control Board
and Regional Water Quality Control Boards