

San Francisco Estuary Regional Monitoring Program for Trace Substances

Report of the 2003 Program Review

REGIONAL MONITORING PROGRAM FOR TRACE SUBSTANCES in the SAN FRANCISCO ESTUARY

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SFEI Contribution 303
July 2004

San Francisco Estuary Institute



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Final July 15, 2004

This report should be cited as:

Schubel, J.R., R. Berger, J. Conomos, P. Herrgesell, A. Mearns, and S. Weisberg. 2004. Report of the 2003 Program Review, Regional Monitoring Program for Trace Substances in the San Francisco Estuary. SFEI Contribution 303. San Francisco Estuary Institute, Oakland, CA.

2003 RMP Review

EXECUTIVE SUMMARY

The 2003 Program Review Panel has completed its review of the RMP through an examination of documents, interviews with staff and stakeholders, and two meetings. It came to the following conclusions:

- The RMP responded appropriately to the recommendations of the 1997 Program Review Panel. The changes resulted in a clarification of goals and objectives and in significant modifications of technical aspects of the Program including: sampling design; incorporation of new strategies for adding new elements to the RMP Program to respond to new or changed environmental management needs; and efforts to enhance collaboration with other Bay Area monitoring programs.
- Other changes in the RMP, driven in part by the recommendations of the 1997 Program Review Panel, and in part by the staff and governance bodies, have focused on ensuring that the RMP remains relevant. Two of the most important changes are the increased emphasis on assessing biological effects of the chemicals RMP monitors; and increased emphasis on the transformation of data into information by synthesizing RMP data and information with those from other sources, and developing mechanisms to ensure that RMP data and information are incorporated into the appropriate management decision-making processes. These efforts should receive even greater emphasis in the future.
- For the RMP to continue to evolve as one of the nation's best regional environmental monitoring programs, it must be embedded in a strong and highly regarded San Francisco Estuary Institute. We were impressed with the new leadership of SFEI and encourage support for their efforts.

INTRODUCTION

This report contains the findings of the second comprehensive five-year review of the Regional Monitoring Program for Trace Substances (RMP) in the San Francisco Estuary. The Program has successfully passed the ten-year mark and has matured into one of the most successful regional environmental monitoring programs in the nation. The partnership of a water quality regulatory agency, the regulated community, and an independent scientific institution has demonstrated that the concept of “adaptive management” does not need to remain a theoretical construct, but can be successfully implemented.

Brief History of the Regional Monitoring Program for Trace Substances (RMP)

This section briefly discusses the history of the RMP, its relationship to the San Francisco Estuary Institute (SFEI), and the Program’s context within Bay Area water quality management, with the intent of providing background for the review objectives, scope, and process.. It also relates the RMP to other tools that have been developed, since its inception, in response to increasingly complex environmental management issues and to informing the larger discussion about the search for sustainability. We consider this context important because it will help clarify some of the recommendations outlined in later sections of this report.

The founders of the RMP demonstrated great foresight when they built five-year, comprehensive peer reviews into the Program. The first of these reviews occurred in 1997 (Boesch et al. 1997). The authors of that report called the RMP an innovative program that could serve as a model and commented, “Such a partnership does not, to our knowledge, exist anywhere else in the nation or the world.”

It is a credit to the RMP that several other monitoring programs have emerged using similar institutional arrangements, approaches to program design and implementation, and have incorporated periodic reviews and evaluation steps (e.g., Monterey Bay Sanctuary Integrated Monitoring Network, Central Coast Long-Term Environmental Assessment Network, San Francisco Bay Regional Wetlands Monitoring Program, and Aquatic Pesticide Monitoring Program).

The impetus for the RMP was the need of the San Francisco Bay Regional Water Quality Control Board (Regional Board) to better manage chemical contamination in the San Francisco Estuary based on scientifically valid contaminant and toxicity measurements and to compare and converge these measurements with water quality objectives. The Regional Board has a well-articulated framework for managing contamination in the Bay,

which is contained in the Water Quality Control Plan for the San Francisco Bay Region (commonly referred to as the "Basin Plan").

The Basin Plan classifies the valued attributes of the Bay as "beneficial uses" and establishes water quality objectives that are protective of those beneficial uses. The Basin Plan provides a roadmap for actions designed to preserve and enhance water quality, and to protect beneficial uses in a manner that will result in maximum benefit to the people of California. Chemicals that are impairing beneficial uses are included on a list [the "303(d) List"], indicating the need for actions to reduce or eliminate the impairments. Listed chemicals are subject to the Total Maximum Daily Load (TMDL) measurement process, whereby a maximum allowable loading to the Bay is determined and regulatory efforts are made to ensure this load is not exceeded. A series of lawsuits in the mid-1990s put US EPA and the states administering the Clean Water Act on a timeline to implement the provisions of Section 303(d). The information generated by the RMP became a crucial element in impairment assessment and in placing the TMDL regulatory program on sound scientific footing.

Coincidentally, around the same time the RMP was planned, the San Francisco Estuary Project completed its Comprehensive Conservation and Management Plan (CCMP) for the Estuary. The signatories to the CCMP created the San Francisco Estuary Institute (SFEI) in 1994 by transforming the Aquatic Habitat Institute (AHI, which was founded in 1983 with a primary focus on water quality) into the SFEI, with an expanded mission. Since that time, the San Francisco Estuary Institute has expanded from an annual budget of less than \$200,000 in 1983, to a much more diverse organization with an annual budget of more than \$5 million in 2004.

The new Institute's mission was tied to a key goal in the Comprehensive Conservation and Management Plan to: "effectively monitor and conduct research on flow regime, pollutants, dredging and waterway modification, fish and other aquatic resources, wildlife, wetlands, and land use within the boundaries of the Estuary, using new and existing facilities, programs, and public involvement groups" (San Francisco Estuary Project, Comprehensive Conservation and Management Plan, June 1994, p.184).

These two events—the emergence of a contaminant monitoring program focused on water quality and the formulation of a regional monitoring strategy including other stressors impacting the San Francisco Estuary—made the linkage between the San Francisco Estuary Institute and the RMP for Trace Substances a natural next step. From the beginning of the RMP, the Institute staff felt that the RMP, as a water quality-driven monitoring program, could be enhanced and integrated into a more holistic ecosystem monitoring and assessment approach through other study, monitoring, and assessment components that were not funded by the National Pollutant Discharge Elimination System (NPDES) permittees.

The RMP has operated under a set of formal objectives since its beginning in 1993. These objectives were developed by the staff of the Regional Board, RMP participants,

and SFEI staff. The original RMP objectives focused principally on determining contaminant concentrations in Bay water, sediments, and bivalve tissues, and on biological responses relevant to determining water and sediment quality as revealed through toxicity tests.

Acting on recommendations of the 1997 Review Panel, the RMP's objectives were expanded to reach beyond a limited suite of chemical, physical, and toxicological indicators of impairment to include pollutant pathways and mass loadings to the Estuary, and to include enhanced use of additional physical, chemical, and biological indicators of impairment. However, the RMP is just beginning to reach beyond program-driven mandates of the Clean Water Act and the California Water Code to incorporate assessment components dealing with stressors other than pollutants.

The San Francisco Estuary Institute and the Regional Monitoring Program within the Bay Area Context

Even before the implementation of the RMP, numerous program-driven monitoring activities were taking place. When Congress created the National Estuary Program in the revised Clean Water Act of 1987 (Section 320), the intent was to ultimately integrate all existing information about ecosystem condition and human-induced stressors impacting valued resources, and to develop recommendations of desired management responses beyond those already implemented in disjointed fashion through existing statutory mandates and programs. The National Estuary Program (NEP) is based on the Chesapeake Bay and Great Lakes Programs: stakeholder-driven environmental planning and implementation efforts. Established in 1987 and one of 28 NEPs, the San Francisco Estuary Project (SFEP) developed a Comprehensive Conservation and Management Plan for the Bay-Delta Estuary through a consensus-based process and continues its implementation efforts today, through its local, state, and federal partners. Its area of focus is the Bay and Delta.

Established in 1995, the California Bay-Delta Authority (CBDA, formerly CALFED) is a state/federal partnership and the largest environmental restoration program west of the Mississippi River. The large infusion of funding for environmental restoration projects has become possible through the repeated commitments by the state's voters in authorizing the expenditure of bond funds (Propositions 204, 12, 13, 40, and 50) and a parallel commitment by the federal government through congressional appropriations for CBDA. The Authority's ability to fund ecosystem restoration and watershed projects created many links to desired actions listed in the Comprehensive Conservation and Management Plan developed by the SFEP a few years earlier. The CBDA and SFEP collaborate in carrying out their respective programs and work closely on mutually beneficial goals, primarily in the Delta, Suisun Bay, Carquinez Strait, and San Pablo Bay segments of the Estuary.

This institutional arrangement has to some extent influenced the driving forces acting on the RMP. The San Francisco Estuary Institute not only administers the RMP and has responsibility for transforming the monitoring data into information valuable to managers, but also is one of the entities with a role in the implementation of the Comprehensive Conservation and Management Plan for the Estuary produced by the San Francisco Estuary Project. SFEI has, in some instances, been successful in extending beyond the RMP framework to provide a more comprehensive view of ecosystem conditions, trends in identified or presumed stressors, and in assessing the cumulative benefits of environmental management actions.

No funding mechanisms are in place, however, to integrate information on contaminant stressors as provided by the RMP with other environmental stressors that are not assessed as systematically. The Institute has seized expanded opportunities provided by bond funding to place contaminant information into a relative context with other stressors on ecosystem integrity. It has thereby helped generate information that has indirectly benefited water quality management decisions. This opportunistic and entrepreneurial approach has added value to the RMP, and is an approach we encourage SFEI to continue to pursue.

The San Francisco Estuary Institute fills a unique niche within the Bay Area, and to some extent within the entire watershed, of making the best and most relevant science available to the region's community of environmental decision-makers. The essential core competencies of SFEI include expertise in:

- Design of environmental monitoring programs,
- design and development of conceptual models,
- synthesis of data and information around key environmental issues and decisions, and
- structuring and facilitating discussions of scientists, managers, and policy-makers in evaluating alternative approaches to resolving environmental issues.

The success of the RMP is at the heart of the success of SFEI, and the sustained success of SFEI beyond the RMP adds significant value to the RMP.

Through the RMP, SFEI has been successful in meeting evolving management needs in one particular arena—water quality. Other environmental management needs do not have the same kind of science support built into their programs, thus making it more difficult to evaluate alternative management strategies designed to reduce stress on the Estuary ecosystem other than those caused by contaminants. However, in large part because of the stable funding base provided by the RMP, SFEI has been able to develop the capacity to play a more general science support role for the environmental management community as a whole. This stability in funding is critical not only to the sustained success of the RMP, which must evolve over time to maintain a good match between problems and programs, but also for SFEI to develop the collateral programs that provide context and perspective for the data and information generated through the RMP. Sources of funding

for other projects and programs—all of which benefit the RMP—are less predictable, more targeted, and not always conducive to allowing the Institute to play the longer-term role of provider of scientific information in service to society.

One of the topics this Panel was particularly sensitive to, was how the data and information generated through the RMP can be better integrated with other data and information streams (1) to generate better, more diagnostic, overall indicators of environmental health to support beneficial uses important to society, and (2) to develop management strategies to identify and manage the most important stressors. It is important to note that several billion dollars of state bond funds have recently been allocated for water quality management and research. The commitment expressed by the state's voters to the protection and restoration of beneficial uses—both through regulatory as well as incentive programs—requires even greater concomitant measures of accountability for these increased investments to yield anticipated benefits. Hence, the increased need for monitoring the environmental “health” benefits of this unprecedented influx of new funding and the integration with other monitoring efforts driven by regulatory needs. This is an opportunity for SFEI to grow in scope and stature with huge potential benefits not only to the RMP, but benefits that go far beyond the scope of the RMP.

THE 2003 PROGRAM REVIEW

Review Objectives

The primary objectives of this second five-year comprehensive review were:

- To evaluate the RMP's response to the recommendations of the 1997 Program Review Panel. Is it on track?
- To evaluate the transparency of the RMP's governance. Do the stakeholders understand how decisions are made?
- To evaluate opportunities for collaboration with other monitoring programs and integration of their findings into a comprehensive and coherent interpretive summary of the Bay's health. If this is not SFEI's role, then whose is it?
- To evaluate the RMP's progress in addressing the biological effects of the chemicals it is monitoring. Is the RMP effectively tracking the consequences of contamination of toxics in the Bay?
- To identify and explore opportunities for the RMP and SFEI over the next 5–10 years. What are the new challenges that will face future environmental managers in the future, and how can the RMP help them?

The Review Process

The review process included the following steps:

- Selecting and contracting recognized experts (Review Panel members) to conduct the review process. (This phase of the process was carried out by RMP staff and its governance bodies. The names of the panelists are listed in the following section and brief bios are included in Appendix A.)
- Formulating the objectives of the 2003 Program Review.
- Gathering and providing information on the RMP Review Panel.
- First-hand data and information gathering activities by the Review Panel through interviews of RMP participants, managers, scientists, and environmentalists. (A complete list of all those interviewed is included as Appendix B.)
- Reading numerous documents provided to the RMP Review Panel by multiple sources.
- Preparing a draft report for review by key participants.
- Preparing a final report for submission to the RMP Steering Committee.

Members of the RMP Five-Year Review Panel

- Robert Berger (retired, East Bay Municipal Utility District)
- John Conomos, (Interim Director, Bay–Delta Science Consortium)
- Perry Herrgesell (Chief, California Department of Fish and Game, Central Valley Bay–Delta Branch)
- Alan Mearns (Senior Staff Scientist, National Oceanic and Atmospheric Administration, Hazardous Materials Response Division)
- Jerry R. Schubel, Chair (President, Aquarium of the Pacific)
- Stephen Weisberg (Executive Director, Southern California Coastal Water Research Project)

Responsiveness of RMP to Recommendations of the 1997 Program Review Panel

In the spring of 1997, a team of seven experts conducted the first five-year review of the Regional Monitoring Program for Trace Substances. The team met on several occasions, including at the 1997 RMP Annual meeting, and conducted extensive interviews with selected sponsors, stakeholders, and the steering committees. To provide continuity with this second five-year review, one member of 1997 team (Dr. Alan Mearns), was invited to participate in this review.

A major underlying theme of the 1997 Program Review was to emphasize the need for all agencies in the Bay Area to develop a comprehensive program that would eventually lead to control and management of those contaminants in the Bay that have the greatest impact on marine resources. The linkages between management and monitoring were not at all clear. The 1997 Review identified 34 recommendations or benchmarks in three major areas (see Appendix C, Table 1 for a full list):

- Fundamental activities (aims, objectives, design),
- activities recommended for gradual implementation, and
- actions recommended for simple and direct implementation.

Fundamental Activities

The 1997 Review Panel urged that the RMP clarify its goals and objectives and the roles of contributing parties; expand the set of core questions; and re-evaluate the monitoring and research designs. RMP responded by completing eight activities (Appendix C, Table 1, part 1). Major changes of the Program goals and objectives were made and published. Procedures for identifying and developing Pilot and Special Studies have been published. A Five-Year Program Plan is now updated annually. Topical Work Groups have been formed and have addressed specific topics including the sampling design, which resulted in a shift from a network of fixed stations to randomized sampling while retaining enough

fixed stations to ensure continuity of important time-series records. And, there is clear internal guidance on how Pilot and Special Studies are linked directly to the basic Monitoring Program.

Activities Recommended for Gradual Implementation

The 1997 Review Panel identified six related major technical areas in need of better planning and implementation. RMP implemented two of these—(1) Integrate other data for a more holistic appraisal, and (2) Assess sources and develop mass balances—by developing a “Sources, Pathways, and Loadings Work Group,” and by developing and using conceptual and then numerical mass balance budget models to set priorities for additional data acquisition, literature reviews, and a Ten-Year Synthesis of contaminants in the Bay. The modeling led to new field studies of loadings of selected contaminants from atmospheric deposition, and from small and large tributaries. A mass budget model was originally developed for PCBs, but has been extended to include some PAHs and organochlorine pesticides.

At its inception, the RMP and other agencies had limited data to define impacts of contaminants on Bay resources and beneficial uses. The 1997 Review Panel underscored this point. As a result, the RMP developed an “Exposure and Effects Pilot Study,” overseen by an Exposure and Effects Work Group with considerable input from the Regional Board. The Pilot Study has included studies of multiple indicators of exposure and effects. These studies are in their early formative stages.

Two general recommendations of the 1997 Panel—(1) Test seasonality of the RMP data and (2) Determine rates of particle burial—have been directly addressed by the new “Design Integration Work Group” and by mass budget modeling. RMP has dropped most seasonal sampling of contaminants to provide better spatial characterization (especially around the periphery of the Bay). This increase in spatial coverage provides important new data that will probably more than offset any loss of statistical power in trend analysis. The critical factor in establishing trends is the length of the record. Through USGS studies and mass balance modeling, it is now clear that on a Bay-wide basis, sediments are eroding, not accumulating, thus revealing that historically-deposited pollutants will remain a long-term issue. Continued development of mass balance models is underway to quantify the effects of this erosion on the recovery of the Bay.

A sixth recommendation of the 1997 Review Panel encouraged the RMP to “test the validity of using only TSS measurements to monitor exceedances of water quality criteria.” While the Program participants determined that the management questions related to water quality criteria exceedances were better answered through other means, an appropriate emphasis was placed on the importance of contaminant–particle interactions. These interactions have been explored by the USGS in their work on sediment dynamics in the Bay, and integrated into studies of contaminant loading from the Delta and the

Guadalupe River that are based on quantifying the relationships between suspended sediment and contaminant concentrations.

Actions Recommended for Simple and Direct Implementation

The 1997 Review Panel identified 25 actions that, if implemented, would enhance communications, outreach, and day-to-day activities with little financial impact (see Appendix C, Table 1, part 3). Of these 25 recommendations, 22 have been implemented. Information dissemination and communications have been significantly improved and appear to meet the needs of most stakeholders and sponsors. The continuing progress of the entire Program is clear. Specific actions on data quality control and management have been in place for several years. Advanced planning and conduct of work group and Steering Committee meetings appear to be routine. A five-year plan is revised annually.

Overall Evaluation of Responsiveness to First Five-Year Review

This 2003 Review Panel finds that the RMP has been very responsive both to specific recommendations of the 1997 Panel and to the intent and spirit of their report. It was recognized at the time by the 1997 Panel that many of their recommended actions would have substantial financial impact on the RMP. Through judicious ranking of priorities and considerable in-kind involvement by stakeholders and the Steering Committees, and by targeted and funded proposals, the RMP managers have remolded the Program within the budget available. We applaud them for this achievement! Their responsiveness is expressed not only with many actual specific accomplishments (Appendix C) but also in the evolution of the RMP as a tool for developing and implementing management actions based upon scientifically sound data and information—the overall intent of the Regional Monitoring Program.

Evaluation of the Transparency of RMP Governance: Do Stakeholders Understand How Decisions are Made?

The 1997 Review Panel concluded that “the management system does not provide the structure and definition needed to guide the Program through its next phase of development.” The Panel strongly recommended that:

- The roles, responsibilities, and authorities of the RMP’s members be better described, and
- formal decision-making procedures be detailed, and that the means to address and resolve conflict about the Program’s overall direction be developed.

Responding to these recommendations was generally accomplished by the creation of Pilot and Special Study Selection Procedure in 2000. The Procedure not only delineates the roles and responsibilities of the Regional Water Quality Control Board (RWQCB), the

Steering Committee (SC), the Technical Review Committee (TRC), and SFEI staff but also describes each of the decision-making steps in the selection of Special and Pilot Studies and their potential application and integration in the RMP's base monitoring program. In addition to the Pilot and Special Study Selection Procedure, the RMP also developed guidance on how to interpret data (i.e., "endow data with relevance and purpose") with the Water Board defining what purposes the data would be put to, and what the respective roles of the parties should be.

The responses of individuals who were interviewed by us as part of the 2003 Review attested to the success of SFEI staff efforts in developing effective RMP governance processes and procedures. Stakeholders, directly involved in the RMP, felt that Program governance was sufficiently circumscribed and that the decision-making process was well understood. In fact, some stakeholders expressed concern that over-formalization of the process might hurt the RMP by reducing its programmatic flexibility, timeliness, and responsiveness. However, individuals who were not direct participants in the RMP, lacked the same level of understanding of the Program's decision-making processes and institutional framework. This lack of understanding by non-stakeholders may also account for the response of attendees to the Report Card exercise at the RMP Annual Meeting in May 2003. A significant number of meeting respondents felt that the coupling of Program results to environmental decision-making, and to follow-on research and modeling, was no better than adequate (see Figure 1). However, through the establishment of clear role definitions, Water Board staff recognized that management decisions and adjustments need to be closely coupled with scientific information for the "adaptive management cycle" to work properly.

Figure 1



A Monitoring Report Card for the RMP



Subject	A	B	C	D	F	Avg Grade
Clear goals and objectives that the general public can understand.	37	33	18	7	4	B
A carefully crafted architecture of questions, the program is designed to answer coherent with these goals and objectives.	23	54	23	0	0	B
Technical design that is based on the current understanding of the San Francisco Bay system linkages and processes.	46	42	8	4	0	B
Stability of financial support.	42	23	27	4	4	B
An identified set of clients.	30	52	18	0	0	B
A public education program which involves the public in understanding the importance of the monitoring program, how its results are used, and how they can be involved.	12	27	38	12	12	C
Integration into the decision-making system. (Can you point to specific environmental decisions made in response to environmental monitoring data?)	22	37	26	11	4	C+
Coupling of results to research and modeling programs designed to support integrated decision-making.	15	44	33	4	4	C+

This Panel believes these differences in perception between individuals participating directly in the RMP and those who do not, reflect inevitable differences in the levels of familiarity with the Program and its processes, and do not constitute a general deficiency of RMP governance. These differences in perception can best be reduced by better educating the general public on the RMP's decision-making processes and its functional framework.

This Panel also believes that the Pilot and Special Study Selection Procedure provides an appropriate level of direction for management and governance at the points where it is most needed. Pilot and Special Studies are the programmatic elements that enable the RMP to respond to new or changed environmental management information needs, to evaluate new monitoring matrices/techniques, and to apply RMP data in new ways. The adaptive nature of these study elements presents the greatest challenge for timely planning and decision-making, and creates the most pressing need for formal management and governance procedures to minimize such challenges. In practice, the governance procedures for Pilot and Special Studies have, in the opinion of stakeholders and this Panel, worked well since their establishment. In addition, these same general procedures can serve as a model for adding new elements to the RMP, should the need arise.

On the other hand, one of the observations from the 1997 evaluation that does not appear to have been adequately addressed is the lack of any formal process to resolve situations when a consensus-based decision cannot be reached. Based on the on-going and expected technical and institutional changes to the RMP, we concur with the conclusions of the first Panel that: "Consensus decision-making may in fact limit the ability of the organization to move decisively and make needed changes" and "can become more important to the coalition than identifying and resolving differences of opinion."

Although this Panel feels that consensus decision-making has been remarkably successful since the inception of the RMP, the technical and institutional evolution of the RMP will likely make achieving such success in the future more difficult.

From a technical perspective, consensus-based decisions require that there be general confidence in, and acceptance of, the monitoring techniques and the selection and application of metrics to convert data into environmental information useful in making decisions. To date, the RMP has relied primarily on the quantification of pollutant levels through analytical chemistry and the characterization of pollutant effects through aquatic toxicity tests. Both methods have been employed in a wide variety of environmental monitoring programs over a considerable period of time, and there is a relatively high level of confidence in their ability to reflect existing environmental quality and to detect changes.

Increasingly, however, the RMP is looking to expand the scope of biological effects measures including histopathology and biochemical and ecological (population and community level) methods to assess environmental quality in the water column and sediment. The majority of these methods, which are being studied in the 2001 Exposure

and Effects Pilot Study, have not been employed as widely, or for as long, as the more conventional chemical analyses and toxicity test methods. Additionally, there is a broader range of opinion regarding the precision and accuracy of these methods, and over the interpretation of the significance of their results. The controversial nature of these monitoring methods and the manner in which they may be applied, may make consensus-based decision-making increasingly more protracted and difficult.

From an institutional perspective, consensus-based decisions require that stakeholders share and trust Program objectives and goals. To date, RMP stakeholders generally have long-term working relationships that foster shared expectations and acceptance of not only the Program's goals and objectives, but the Program's planning and decision-making processes. Changes in specific stakeholders and/or broadening the representation in such structures as the Steering Committee (SC) and Technical Review Committee (TRC) may incorporate individuals who lack experience with, and have different levels of appreciation of the Program's monitoring elements and institutional processes. Also, the goals of the RMP have been fairly consistent since its inception and have been determined in a relatively autonomous manner. Application of RMP data to other efforts (including TMDLs, wetland restoration, and water quality attainment strategies), as well as the influence of other SFEI programs on the conduct of the RMP and interpretation of its data, may strain the shared expectations of stakeholders and challenge the success of consensus-based planning and decision-making. Despite these challenges, this Panel knows of no acceptable alternative to consensus-based decision-making.

Communication, Cooperation and Collaboration with Other Programs and Integration of Data Across Programs

Since the 1997 Review, RMP staff has effectively used feedback mechanisms between management questions and monitoring information to adjust and adapt the Program. Much of the feedback has occurred through communication, cooperation, and collaboration with other monitoring programs. Relevant monitoring programs include:

- Regional Board 2 activities
- U.S. Geological Survey (USGS)
- National Oceanic and Atmospheric Association (NOAA)
- US Environmental Protection Agency (US EPA)
- Clean Estuary Partnership (CEP)
- Interagency Ecological Program (IEP)
- Surface Water Ambient Monitoring Program (SWAMP)
- Regional Board 5 activities
- Sacramento River Watershed Program
- Northern California Society of Environmental Toxicology and Chemistry (SETAC)
- California Bay-Delta Authority (CBDA, formerly the CALFED Program)
- National Pollutant Discharge Elimination System (NPDES)

- Bay Area Stormwater Management Agencies Association (BASMAA)
- Bay Area Clean Water Agencies (BACWA)
- California Coastal Conservancy
- Long-Term Management Strategy (LTMS)
- Dredged Material Management Office (DMMO)
- The Bay–Delta Modeling Forum
- various TMDL work groups and committees

Communication, cooperation, and collaboration represent increasing levels of partnership along a continuum. Communication is critical at all three levels. Communication requires little cooperation, but cooperation is a pre-requisite to collaboration. And, collaboration implies that each party involved has something at stake, and that a failure for one party is a failure for all. The boundaries between communication, cooperation and collaboration are fluid and the nature of a partnership may change in either direction. The characterizations of the nature of the partnership with each of the monitoring programs listed above was provided by RMP staff and calibrated in interviews by the 2003 Review Panel.

The RMP communicates with all of these programs, cooperates with many, and has a true collaboration with USGS, CEP, BASMAA, BACWA, NOAA, US EPA, and various TMDL work groups (a true collaboration requires both communication and cooperation). Interactions with SETAC represent a cooperative relationship. For the remainder, the interactions can be best described as falling within the realm of communication. It should not be surprising that the degree and quality of the interaction of the RMP with other monitoring programs varies with program and organization.

The collaborations with USGS, CEP, NOAA and US EPA are quite strong. Collaboration with USGS is achieved primarily through shared projects, in RMP work group meetings, and in developing informational products. Collaboration with CEP is achieved through meeting participation and collaborative projects. Sharing is the norm, which includes work groups, tasks, and projects. NOAA/EPA collaboration presently focuses on analyzing the extensive and valuable EMAP (Environmental Monitoring and Assessment Program) data set.

RMP communicates with SWAMP, NPDES, CBDA, and the California Coastal Conservancy. Communication with SWAMP is achieved through the participation of a Regional Board representative (their Regional Monitoring and Assessment Coordinator) who is both very active on the RMP TRC and is the SWAMP regional manager. To strengthen this partnership, additional information exchange is scheduled for future joint meetings. Communication with NPDES is accomplished primarily by the Regional Board representatives on the TRC and Steering Committee, supplemented by meetings with Permit Division staff, and as with SWAMP, additional meetings are in the planning stages.

Communication with CBDA and the Coastal Conservancy occurs through participation of RMP staff in meetings and projects of these organizations. Better communication, coordination, and cooperation with CBDA is seen by RMP staff as a considerable challenge. Linking biogeochemistry studies (mercury, etc.) and habitat restoration efforts, as well as different areas of geographic coverage, will require focused efforts and additional technical staff.

Communication with IEP and LTMS/DMMO needs to be improved. Although RMP and IEP staff attend each other's meetings and share some minor collaborative projects, no major projects are shared. One important project underway that links IEP, SWAMP, RMP, and other programs is an effort to develop a common database to promote data exchange. The dredging community desires better linkage of the RMP with the LTMS and DMMO. In response, RMP has planned a modest study of dredged material in 2004.

The production of comprehensive and coherent summaries of data and information appropriate for different stakeholders is conducted by database management and website maintenance efforts, information dissemination through printed quarterly newsletters, fact sheets, briefing papers, oral presentations, and annual reports. Although much effort is being expended by RMP to satisfy all stakeholders, the environmental community has reported that it is not yet aware of how to make use of the RMP-generated data and information. Thus, RMP must intensify its education and outreach efforts, or should partner with organizations that possess these strengths. The latter is the preferred solution. RMP should also add a representative of the environmental community to its Steering Committee.

Progress in Assessing Biological Effects

One of the goals for this Panel was to evaluate the RMP's progress in assessing biological effects of the chemicals it monitors. It is clear that the RMP has been successful and indeed a "showcase" for toxics monitoring in the area, if not the country. The Program participants should be congratulated for that achievement. It has been recognized, however, that the Program needs to move from the relatively simple documentation of the presence and concentrations of toxicants in the environment to the more difficult description of the effects of those substances on various beneficial uses and species of interest. While it is interesting to know what toxicants are present, it is essential to know if and how those toxicants are affecting organisms in the system, and how they are affecting human health either directly or through seafood consumption. The Program has made some important strides in this direction (e.g., a major Seafood Consumption Study and the five-year Exposure and Effects Pilot Study), but the Panel recommends greater emphasis in this area.

Several of the stakeholders interviewed by the Panel underscored the importance of generating more bio-effects information. Representatives of the Regional Water Quality

Control Board, for example, suggested that they were interested in bringing more and better bio-effects studies into the Program. The Panel also notes that the Program has already started down the road to do some bio-effects work. The staff report on this topic stated: “Since the 1997 Review the RMP has implemented several actions towards addressing biological exposure and effects of contaminants in the Estuary.”

Probably the most significant effort to date has been the development of the Exposure and Effects Pilot Study (EEPS) in 2001. This Work Group-run study has the potential to produce useful information and should be pursued diligently. In fact, it may be reasonable to divert money from other parts of the RMP to expand this effort. The Five-Year Work Plan is being implemented for this Study, but it is not clear if the Study is on schedule. Further, most of the tasks are described as “collect and analyze for chemistry and hatchability.” This is a good first start, but more individual and population effects should be studied.

The Exposure and Effects Work Group is divided into several advisory subgroups, covering birds, toxicity, and seals. Given their biological importance and importance as a beneficial use, it is important to have a fishery subgroup.

The Exposure and Effects Pilot Study is a new study and seems to be on the right track to providing useful bio-effects information, but it is too early to judge. The staff report describing this effort uses phrases such as, “will evaluate,” “it is hoped that,” “ideas,” “could look at,” “can study,” and “possible test species.” All of these qualifiers demonstrate that the Program is in the early formative stages of implementing this effort. A survey of over 40 scientists was conducted. Their advice on where to place the emphasis in assessing biological effects was a good early step.

The bottom line with respect to the bio-effects efforts of the RMP program is that EEPS has made a good start, but much remains to be done to develop and maintain a meaningful biological effects program. Staff need to make explicit the questions they are trying to answer, or the hypotheses they are trying to test, and to be sure that the data they plan to collect will provide the information needed to answer those questions. They also need to make explicit how the resulting information will be integrated into the broader ongoing activities in the region (i.e., the Regional Water Quality Control Board, regulatory activities, and the Interagency Ecological Program field programs). The significant task of securing more funding for bio-effects studies is daunting, but the Program should put serious effort into this task, even if it means reallocation of existing resources. This Panel believes this is a priority.

Opportunities, Conclusions and Recommendations

Our overall assessment is that the RMP is technically sound and meeting its present goals. The Program has responded well to the suggestions made by the 1997 Review Panel and our suggestions for technical improvements to the RMP are minor.

Our biggest concern is that program must continue to evolve to ensure its long-term viability. During its first ten years, the Program has provided a description of spatial and temporal distributions of water and sediment chemical quality along the axis of the Estuary. This has been new information that has been helpful to all parties involved, but additional years of data collection will add increasingly smaller value towards a spatial description. Over time, the Program will add trends information to its portfolio, but trends are slow to develop, and it is difficult to sustain a multi-million dollar per year program on slowly developing patterns.

We recommend that the RMP undertake two sets of activities to enhance its portfolio and develop a greater continuing need for the Program. The first is to increase the number of applications in which RMP data are used. The second is to collect new types of data. These two sets of activities are related, as selected new data types will enhance the number of possible applications.

Increasing Data Applications

The most important potential application of RMP data for its sponsors is the TMDL process. RMP data have provided a foundation for some 303(d) listings and TMDL development, but this appears to have been accomplished largely on an *ad hoc* basis. To enhance the value of the RMP to the TMDL process, the Panel recommends that the RMP create a formal relationship with CEP, which is providing scientific support for TMDL implementation. That relationship might include setting aside a portion of the annual sampling effort towards special studies that link RMP data to the TMDLs. It might also include an official recognition of the RMP as CEP's primary data collector, with potential commitments towards additional funding through the CEP linked to RMP expansion. One challenge, though, is to ensure that any such relationship leverages, rather than replaces, the current RMP objectives.

A second application for RMP data, which is somewhat related to TMDLs and 303(d) listings, is establishment of thresholds for evaluating all of the types of data collected by the RMP. The greatest opportunity of this type in the short term is in sediment quality guidelines. The State of California is preparing to develop sediment quality objectives that will drive 303(d) listings and required sediment cleanup activities. SFEI needs to become actively involved in that development process and the RMP needs to ensure that it is collecting the proper types of data to support scientifically valid criteria for application in San Francisco Bay.

Beyond this specific activity, the Panel recommends that the RMP endeavor to develop standards or guidelines for all types of data that it collects. Accepted guidelines exist for many types of RMP data, such as water quality objectives, screening values for fish tissue, and TMDL targets for mercury and PCBs in water, sediment, and fish. However, accepted guidelines do not exist for all types of RMP data. While trends information is interesting, its value increases exponentially when trends can be interpreted in the context of agreed-upon thresholds. A challenge for the RMP is that standards often are developed at the state-wide level and RMP has so far been primarily a local program. To achieve this objective, the RMP will need to enhance its interaction with the State Water Resources Control Board, as well as with other major monitoring entities in the state.

Development of the Surface Water Ambient Monitoring Program (SWAMP) by the State Water Resources Control Board may provide a forum for reaching both of these groups. The Regional Board also emphasizes the development of site-specific objectives as targets for the Bay in the TMDL process, and it is important that the RMP continue to provide the best possible foundation for these guidelines. RMP staff should also consider the set of standardized water quality data elements for chemical and microbiological analytes formally approved in 2001 by the Federal Advisory Committee on Water Information.

A final recommended area of expansion is a technical addition. RMP is currently monitoring about 25 PAH compounds in sediments and water. However, they lack quite a few alkylated PAHs that characterize oil and fuel. NOAA's National Status and Trends Program reports about 44 compounds, including enough alkylated ones so that the sources of PAHs can be roughly fingerprinted to oil or combustion. We rely on the alkylateds to help fingerprint sources and to separate oil types and weathering processes. The Panel recommends that the reportable PAHs be expanded to include perhaps an additional 20-25 alkylated compounds and homologs.

New Data Types

The Panel recommends that the RMP place more emphasis on assessing biological effects. Biological effects are the endpoint most relevant to beneficial uses and are the critical parameter for most decisions that will be made with RMP-type data. The RMP has made a good start with its Exposure and Effects Pilot Study, but has yet to define a process for evaluating which of these pilot efforts are of sufficient value to be incorporated as long-term operational aspects of the RMP. One of the impediments is that the RMP has not yet made decisions about whether, or what percentage of, its existing funds should be reallocated towards new measures. The Panel recommends that a relatively high percentage of funds (perhaps as high as 50%) be allocated toward inclusion of biological measurements. The loss in power for assessing trends in chemical constituents will be small in comparison with the value added to the chemical data by having corresponding biological information.

A second area of potential expansion should be towards measuring water column contaminant concentrations of biologically available contaminants. These measurements are most appropriately accomplished on a pilot scale initially, as the techniques for measuring water column contaminants and the context for interpreting them, are less well developed at this time. The Program has done a good job measuring biologically available copper in the water column.

The RMP should also seek to incorporate process studies that provide greater understanding of how conditions have changed or are likely to change in the future. This is a different type of measurement than the RMP has made in the past, tending to be shorter term and with a greater research emphasis. The Panel does not believe that the RMP should conduct these studies themselves, but should create partnerships that leverage the core Program. The most likely way to enhance the Program in this manner is to partner with academic researchers and prepare grant applications for third party funding. RMP monitoring provides a wonderful platform on which to build additional studies and should be attractive to funding from organizations such as NSF. These kinds of studies will provide continual infusion of new ideas into the Program and enhance funding agency interest for years to come. The RMP should foster cooperative interactions that lead to such Program enhancements, particularly with third party funding.

Other Conclusions and Recommendations

Trust in the RMP, and in SFEI as its implementer, is high. Management of the Program is transparent and inclusive, although the addition of a representative of the environmental community to the Steering Committee is recommended. Participants who once viewed the Program as a tax burden now understand its value and make financial contributions more willingly.

SFEI was formed to implement the RMP. It has done so with great success. To continue to be successful, SFEI needs to continue to grow in scope and stature and have an image that is greater than the RMP. This continued growth in stature is important for the identity of the Institute as well as its image. The “identity” can be defined as what those close to an organization believe its distinguishing features are, while its “image” can be defined as what others less familiar with an institution believe its distinguishing features are. SFEI’s identity is larger than its image. Potential pathways of growth could include:

- Extend the RMP “model” up into the Delta and even farther upstream.
- A unifying and expansive theme for SFEI such as “contaminants: their sources, pathways, effects, and management, to reduce impairments to beneficial uses to acceptable levels.” This would require greater emphasis on non-point sources.

The RMP needs to continue its transition from a data-collection focus towards synthesis of those data and transformation into informational products that will aid decision-

making. There are several activities that should aid in accomplishing that: (1) RMP participating organizations should empower SFEI to broaden their role beyond data collection coordinator for the RMP, to data integrator for San Francisco Bay, in which RMP data is an important asset, (2) Foster a more formal relationship between SFEI and the CEP, which is filling the integrator role for TMDL activities, (3) Enhance Regional Board participation in the RMP and in SFEI, including adding the Executive Officer to the Steering Committee. SFEI and the RMP are presently limiting their interactions to a subset of the Regional Board departments.

The Bay Area is highly balkanized, and the solution to nearly every new issue/opportunity has been to create a new program or institution. SFEI needs to identify its special/unique niche within the community of Bay Area research organizations, and exploit it to the fullest. It is the Panel's belief that that niche is where science, management, and policy intersect. Activities that are keys to exploiting that niche include:

- Timely transformation of data into information to meet the needs of different stakeholder groups
- Identifying, describing, and explaining environmental trends
- Development of periodic report cards on the quality of the Bay
- Integration/synthesis of data and information from all relevant sources to address specific environmental management issues
- Convening, structuring, and facilitating forums to explore policy options and to evaluate the options without becoming an advocate for any of them

All of these activities and strategies are already strengths of SFEI and further development could make SFEI "the place" to go in the Bay Area for "scientific information about the Bay." Once this niche has been identified and endorsed by RMP and SFEI management and governance, SFEI needs to market itself aggressively and creatively. The private and public goals need to be lofty if they are to attract attention and philanthropic support.

- RMP and SFEI staff should describe the RMP's institutional framework and its planning and decision-making processes in an accessible and understandable format to the interested public. This description should provide examples of programmatic planning and decision-making, and how RMP information has been used in the evolution of the Program and in external environmental decision-making.
- RMP staff should develop a description of the consensus-based process used in RMP planning and decision-making that has been traditionally used in the Program. They should also codify a procedure to resolve conflict when consensus-based decisions cannot be achieved, describing the circumstances under which it would be applied and the criteria used to determine its success. We were told that at times votes are taken, but did not find a written statement of the

conditions that “trigger a vote” and whether a decision in those circumstances is based on a simple majority or on some other metric.

- Like every good board, the SFEI Board should review its membership to ensure that the appropriate areas of interest and “expertise” are all represented and by people at the correct levels. The Board may need greater diversity and intellectual capital if SFEI is to continue to grow in scope and stature.
- RMP should place more emphasis on the biological effects of the contaminants it monitors and on the biological effects of other stressors on the system. Biological effects is the endpoint most relevant to beneficial uses, which is the critical parameter for most decisions that will be made with the RMP, and other environmental monitoring data. The RMP has made a good start with the Exposure and Effects Pilot Study, but has not yet defined a process for evaluating which of these pilot efforts are of sufficient value to be incorporated as long-term operational aspects of the RMP. This effort needs to be funded properly even if it means reallocation of existing resources. We estimate that the effort needs to be funded at least at the \$500,000/year level on a sustained basis.
- RMP and SFEI should pursue public outreach primarily through alliances with existing organizations that specialize in public outreach, e.g. Lawrence Hall of Science, the Exploratorium, etc.
- SFEI no longer has a “Science Advisory Committee” or a “Policy Advisory Committee.” Perhaps these should be re-created.
- RMP and CEP: RMP leadership should monitor and manage the relationship with the Clean Estuary Partnership and nurture a closer collaboration.
- There should be greater emphasis within RMP and SFEI on the importance of publishing in the referenced literature and there should be a formal institutional policy for the review of drafts before submission to journals. Publication is important for establishing credibility and at present it seems to occur primarily as a result of individual investigator initiative. The Program needed to focus on data collection during the first 10 years, but it now needs to increase emphasis on interpretation. A portion of the budget should be allocated to encourage scientific peer-reviewed publication of RMP findings.
- The RMP planning process is presently seen as transparent and unbiased, but that important perception would be protected and enhanced by adding a member of the non-profit environmental community to the Steering Committee. This would increase trust by the environmental community and add transparency to an important constituency group.

- The SFEI/RMP should enhance its linkages with universities. The RMP is presently focused primarily on status and trends with a lesser emphasis on describing the processes that led to past conditions, or will lead to future ones. The RMP monitoring provides a wonderful platform on which to build additional studies that could address these processes through funding from other organizations such as NSF. The RMP should foster cooperative interactions that would lead to those Program enhancements with funding from other sources. Senior members of SFEI and RMP scientific staff should seek to have adjunct appointments at the region's leading academic institutions.
- The RMP should enhance its interaction with similar monitoring programs and activities occurring in other parts of the California. This should include inter-calibration with other regions to ensure data comparability and involvement in data collection/interpretation that affects state policies. In particular, the state is preparing to develop sediment quality objectives that will affect 303(d) listings and cleanup levels. The SFEI should be actively involved in such efforts. The greatest impact of the RMP for its participating organizations could be in how it influences decisions made at the state level, but that will only happen if its interactions outside of San Francisco Bay increase.

In summary, the 2003 Program Review Panel is enthusiastic about the RMP—what it has done, what it is doing, and what it can become in the future. It is clearly one of the best coastal environmental monitoring programs in the nation. To remain one of the best, it must continue to evolve. That evolution is coupled tightly to the evolution of SFEI as an important coastal research institution regionally, nationally, and even globally.

Appendix A

BRIEF BIOGRAPHICAL SKETCHES OF PANEL MEMBERS

Robert Berger

Mr. Robert Berger is retired from East Bay Municipal Utility District with over 24 years experience in surface water and drinking water quality in his work with EBMUD and as an environmental consultant. He was a member of the Water Environment Research Foundation's Research Council for 6 years, chairing the Council for the last two. He served as a delegate to the FACA-chartered (Environmental Monitoring) Methods Data Comparability Board chaired by EPA/USGS, and chaired the Water Quality Committee of the Association of Metropolitan Sewerage Agencies for 7 years.

John Conomos

Dr. John Conomos is the Interim Director of the Bay-Delta Science Consortium in Menlo Park, California. He is Scientist emeritus of the U. S. Geological Survey, where he spent 32 years as Research Scientist, Regional Research Hydrologist, and then Regional Hydrologist for the Western Region (nine western states and the Trust Territories of the South Pacific) of the Geological Survey's Water Resources Division. He has published more than 60 scientific papers describing his studies of estuarine processes occurring in the San Francisco Bay system, and has edited two books devoted to interdisciplinary scientific investigations of the San Francisco Bay and Delta.

Perry L. Herrgesell

Dr. Perry Herrgesell is the Chief of the California Department of Fish and Game's Central Valley Bay Delta Branch. He participates in policy development, implements department policies and programs, and provides policy guidance for numerous programs within the Bay-Delta estuary. His position recommends and implements department policies and procedures relating to the conservation and protection of the biological and natural resources affected by the state's water development projects, and other fish and wildlife activities within the San Francisco/Sacramento-San Joaquin estuary. Dr. Herrgesell provides advice to the Director, the Resources Agency, and the Governor's Office on issues relating to water quality and quantity, and maintenance and restoration of fish and wildlife resources in the estuary. Dr. Herrgesell has been with the Department for thirty years and in addition to his current position, has held positions in Long Beach as a water quality biologist and as an Environmental Services Supervisor in Stockton.

Alan J. Mearns

Dr. Alan Mearns is an Ecologist and Senior Staff Scientist with the Hazardous Materials Response Division of the National Oceanic and Atmospheric Administration in Seattle, Washington. His team and colleagues around the U.S. provide support to the U.S. Coast Guard during spills of oil and hazardous materials. He continues research on

the recovery of Prince William Sound following the 1989 Exxon Valdez Oil spill. During the 1980's Dr. Mearns leads a NOAA team conducting an in-depth review of historical contaminant trends around the U.S. coastal zone. During the 1970s he was leader of the Biology Division at the Southern California Coastal Water Research Project. He has served on various boards and panels including the 1993 National Research Council Committee on Wastewater Management in Coastal Urban Areas. He has published over 200 papers and technical reports on pollution and pollution trends in the U.S. coastal zone. He received a 1992 Department of Commerce Silver Medal for work on the Exxon Valdez spill and numerous letters of gratitude from civic leaders for work on national and international oil spills. Dr. Mearns has been involved with the Aquatic Habitat Institute, SFEI, and the RMP since their inception, most recently serving as a member of the SFEI Board of Science Advisors as well as the RMP Five-Year Review team.

Jerry R. Schubel, Chair

Dr. Jerry Schubel is the President and CEO of the Aquarium of the Pacific in Long Beach, California. He is President emeritus of the New England Aquarium, and spent 20 years as the Dean and Director of the University of Stony Brook's Marine Sciences Research Center. He has published more than 200 scientific papers, and has written, or edited, five books. He serves on the National Research Council's Marine Board, is Chair of the National Sea Grant Advisory Panel, and is on the U.S. National Committee for the Census of Marine Life. He has had extensive experience in San Francisco Bay starting with the San Francisco Bay National Estuary Project and including chairing the two NOAA science panels for the proposed expansion of SFO, the National Science Panel for the South Bay Salt Pond Restoration, and chair of the Regional Monitoring Program review panel for the San Francisco Estuary Institute.

Stephen Weisberg

Dr. Stephen Weisberg is Executive Director of the Southern California Coastal Water Research Project (SCCWRP) where he specializes in the design and implementation of environmental monitoring programs. He serves as chair of the Southern California Bight Regional Monitoring Steering Committee, which is responsible for developing integrated regional coastal monitoring for the Southern California Bight. He also serves on the Steering Committee for the U.S. Global Ocean Observing System (GOOS), the Alliance for Coastal Technology Stakeholder's Council, the State of California's Clean Beaches Task Force, the National Research Council Committee on Waterborne Pathogens and on Technical Advisory Committees for the University of Southern California Sea Grant Program, and the Southern California Wetlands Recovery Program. Dr. Weisberg received his undergraduate degree from the University of Michigan and his Ph.D. from the University of Delaware.

Appendix B

LIST OF INTERVIEWEES

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Appendix C

SUMMARY OF RECOMMENDATIONS OF 1997 REVIEW AND RESPONSES

Table 1. Part 1: Recommendations that suggest more fundamental activities to be undertaken by the RMP.

Recommendation	Responsible Party	Implementation Approach	Financial Impact	Progress and Comments
3b Document aims of the RMP	All	Agreement on roles and responsibilities of parties; definition of data needs/usage by parties	?	Objectives framework developed that documents aims of the Program as recommended; Roles and responsibilities agreed on in "Final RMP Pilot/Special Study Selection Procedure"
3c Expand core objectives/questions	All	Agreement on scope and direction of RMP; develop five year plan	?	Done – major changes to Program objectives implemented; Five year plan updated annually
3a Evaluate design issues	All	Definition of data needs/usage by parties; integration with other studies; statistical analyses	?	Design recommendations generated by several topical Workgroups; Workgroup recommendations integrated by Design Integration Workgroup; Fundamental changes to Status and Trends monitoring, including change from fixed station to spatially randomized sampling of water and sediment; Pilot and special studies explicitly linked to Program objectives and management questions

Table 1. Part 2: Recommendations for gradual implementation.

Recommendation	Responsible Party	Implementation Approach	Financial Impact	Progress and Comments
2a Integrate other data for holistic appraisal	SFEI; Reg. Bd., Subs	Develop study plan/work plan by RMP workgroup; new subcontract or increased effort by SFEI	substantial	Data integration subtask added to Program Management task; Mass budget model development: a major integration tool; Literature reviews performed under workgroup guidance; Non-RMP information integrated into <i>Pulse</i> ; Ten Year Synthesis Special Study in progress: a major data integration effort; Database development in support of integration
2b Assess sources; develop mass balance inventory	SFEI; Reg. Bd	Develop work plan by RMP workgroup; subcontract or increased effort by SFEI	substantial	Sources, Pathways, and Loadings Workgroup established; SPLWG has developed and implemented a long-term workplan; Field studies of loading from atmospheric deposition, small tributary loads, river loads; Contaminant Fate Workgroup established; Mass budget model developed for PCBs. Manuscript accepted for publication in ET&C;. Mass budget models in development for PAHs, and organochlorine pesticides
2c Define impacts on resources and beneficial uses	SFEI; Steering Comm; Reg. Bd	Develop work plan by RMP workgroup; increased effort by SFEI, RB, and SC	substantial	Exposure and Effects Workgroup and Pilot Study initiated; Advisory Panel for Workgroup established; Five year study plan developed with substantial Reg. Bd input; Studies initiated on multiple indicators of exposure and effect

Table 1. Part 2: Recommendations for gradual implementation (continued).

Recommendation	Responsible Party	Implementation Approach	Financial Impact	Progress and Comments
3g Use TSS measurements to define exceedances	SFEI; Subs	Develop study plan/work plan by RMP workgroup; new subcontract or increased effort by SFEI	substantial	Not implemented; Long-term monitoring of suspended solids concentration (SSC) has yielded many insights; Field studies implemented based on contaminant:SSC relationships
3i Test seasonality of RMP data	SFEI; Subs	Develop study plan/work plan by RMP workgroup; increased effort by SFEI and subs	substantial	Design Integration Workgroup examined seasonality and considered importance of this information; decision made to drop most seasonal sampling in order to provide better spatial characterization
3j Determine rates of particle burial	SFEI; Subs	Develop work plan by RMP workgroup; subcontract or increased effort by SFEI	substantial	This issue was examined in the PCB mass budget. Recent USGS studies indicate net erosion in the Bay. Rather than reducing concentrations, this represents a form of contaminant input and slows recovery of the Bay.

Table 1. Part 3: Recommendations expected to be implemented simply and directly.

Recommendation	Responsible Party	Implementation Approach	Financial Impact	Progress and Comments
2e Make RMP information more widely available	SFEI	WWW, publications, presentations	slight	Web site established - could be improved <i>Pulse of the Estuary</i> a major improvement RMP Newsletter distribution improved
3f Use more sophisticated data presentation	SFEI, Chapter authors	Evaluate presentation methods	slight	Progress embodied in <i>Pulse</i> Reevaluation needed with new Status and Trends design
4b Document fully the data management system	SFEI; Subs	Descriptive writing	slight	Comprehensive set of SOPs developed
4d Develop computer-assisted quality checks	SFEI	Software development	moderate	Partially done – room for improvement
4e Conduct recommended lab intercomparisons	SFEI; Subs	Expand intercomparison program	moderate	Current efforts include participation in SCCWRP intercomparison, PBDE exercise Room for improvement
4g Store data backups off site weekly	SFEI	Procure storage site	slight	Done
4h Provide for development of data management staff	SFEI	Courses; workshops	moderate	Done
4j Increase citation of contributions	SFEI	Descriptive writing	slight	Not implemented
4k Analyze citations of RMP data	SFEI	Accounting	slight	Not implemented
4l Analyze web site usage statistics	SFEI	Software added to web site	slight	Data are periodically compiled but not distributed
4m Develop specific list of PCB congeners	SFEI	Evaluate data	slight	Done
4n Describe laboratory analysis methods in more detail	SFEI; Subs	Descriptive writing	slight	Done
4o Describe accuracy measurements in more detail	SFEI; Subs	Descriptive writing	slight	Done
4p Automatically calculate derived values	SFEI	Software development	slight	Done

Table 1. Part 3: Recommendations expected to be implemented simply and directly (continued).

Recommendation	Responsible Party	Implementation Approach	Financial Impact	Progress and Comments
4q Add citation information to RMP Annual Report	SFEI	None	slight	Done
4r Word newsletter titles more judiciously	SFEI	None	none	Done
5a Clarify Regional Board responsibilities	Regional Board	Policy statement	none	Done (in “Final RMP Pilot/Special Study Selection Procedure”)
5b Request from Executive Officer for 5-year plan	Regional Board	Official letter	none	Five year plan is updated annually in the Annual Program Plan
6a Develop procedure for reviewing direct charges internal to SFEI	SFEI	Accounting	slight	Done
6b Define in-kind contributions from SFEI staff and contractors	SFEI	Evaluations; interviews, accounting	slight	Not implemented
6c Create technical/logistics manager	SFEI	Talent search	substantial	New RMP Associate Manager position fills this role
6d Schedule changes in contractors when possible at beginning of year	SFEI	Planning	slight	Done
6e Implement competitive bidding where possible	SFEI	Planning	slight	Done
6g Prepare Steering Committee agendas early	SFEI	Done	none	Done
7a Accept Five Year Review report and recommendations	Regional Board, Steering Committee	Done	none	Done