WORKPLAN FOR THE

THE SOUTHERN CALIFORNIA BIGHT

PILOT PROJECT

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TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND AND RATIONALE FOR THE PROJECT

The Southern California Bight (SCB; Figure I-1) is an important and unique ecological resource. Pelagic and benthic fishes and invertebrates are abundant in the coastal waters. The mainland shelf is also an important migratory route and foraging area for many marine mammals and birds, including at least three endangered bird species. More than 500 species of fish and 1,500 species of invertebrates occur in the Southern California Bight, which is the northern end of the San Diego Biogeographic Province (Briggs 1974). Shallow-water organisms in the bight are warm-temperate species whereas those north of Point Conception (and on the outer islands in the bight) are cold-temperate species of the Oregonian Province. Many of the species typical of Southern California are seldom found north of Point Conception.

The mainland shelf is an important economic resource. It is used for recreation (boating, diving, swimming, surfing), commercial and recreational fisheries, municipal and industrial wastewater discharge, oil extraction, commercial ship traffic, and recreational boating (NRC 1990a). Fifteen municipal wastewater treatment facilities, 8 power generating stations, 10 industrial treatment facilities, and 18 oil platforms discharge to the open coast (California State Water Resources Control Board 1991, unpubl. data). Los Angeles/Long Beach Harbors are among the busiest commercial ports in the world and San Diego Harbor has one of the largest US Naval facilities in the country. About 40,000 pleasure boats are docked in 13 coastal marinas (NRC 1990a).

The SCB extends from Point Conception, California, to Cape Colnett, Baja California, Mexico. The bight is bounded offshore by the main flow of the California Current and the Patton Escarpment, a submerged ridge that is the outer boundary of the Southern California Continental Borderland. The California Current forms a large counter clockwise eddy in the SCB; the northward flowing limb along the mainland shelf is known as the Southern California Counter Current. The borderland consists of offshore islands, banks, ridges, submarine canyons, deep basins, and a narrow mainland shelf, which averages about 3 km in width (range 1-20 km) (Emery 1960). Elsewhere in the United States, the shelf may be 10 to 200 times wider. The narrowness of the mainland shelf off Southern California makes it particularly susceptible to the effects of human activities.

Nearly 15 million people live in coastal Southern California (NRC 1990a). The population increased 36% (4 million) since the early 1970s and is expected to increase by about 20% (3 million) by 2010 (SCCWRP 1973, NRC 1990a). About 73% of the population is concentrated along the central coast in Los Angeles and Orange counties; much of the remaining population lives in the San Diego-Tijuana area to the south (Hoffman *et al.* 1992). The effect of the population on the coastal environment has been profound. For example, 75% of the bays and estuaries have been dredged and filled and converted into harbors and marinas (Horn and Allen 1985).

FIGURE I-1
Map of the Southern California Bight.

Local, state,TA and federal agencies monitor the status and trends of environmental quality and natural resources of the mainland shelf in the SCB. The municipal, power plant, and industrial dischargers are required to monitor their effluent and the receiving waters in accordance with National Pollutant Discharge Elimination System (NPDES) permits issued by the US Environmental Protection Agency (EPA), Region IX, the Regional Water Quality Control Boards, or both. These permits require the discharger to comply with the California Ocean Plan and the Federal Clean Water Act, which set water quality standards for effluent and receiving waters. The dischargers conduct monitoring programs to assess compliance with their permits and the assessments are documented quarterly by each discharger.

Each year, millions of dollars are spent monitoring the water quality of the coastal marine environment. Some of this information has played a significant role in management decisions in the SCB. For example, high levels of coliform bacteria in the surf zone in Santa Monica Bay in the 1940s and 1950s prompted the extension of municipal wastewater outfalls into deeper water offshore (Garber and Wada 1988). Although the compliance monitoring programs provide useful information, they address small-scale, discrete questions, not bightwide questions of regional interest. The sampling designs, parameters, methods, sampling frequency, and QA protocols for the compliance monitoring programs differ significantly among the dischargers. Even if the data from these programs were integrated, it would not be sufficient to provide a regional assessment of environmental quality. Compliance monitoring programs do not meet all of the needs of resource managers who must develop management strategies for the SCB.

Integrated regional status and trends monitoring in the SCB would enable resource managers to assess the cumulative effects of anthropogenic inputs to the mainland shelf. Recent reports by the National Research Council (NRC 1990a,b) laid the foundation for development of a regional monitoring program in the SCB by pointing out the lack of standardized sampling methods, survey designs, and reporting requirements. Development of regional monitoring would encourage participating agencies to adopt common sampling design and methods, which would facilitate comparisons among the many programs in the region. Resource managers would have the data to evaluate the relative influence of the various anthropogenic inputs to the region. Ultimately, this would allow resource managers to select the most cost-effective management strategies.

The mainland shelf off Southern California has been monitored for more than 20 years and there is a history of cooperative surveys among the organizations participating in this project. However, the level of interest in regional monitoring and the spirit of cooperation in Southern California are higher now than at any time in the past two decades. The Southern California Coastal Water Research Project (SCCWRP); US EPA, Region IX; the California State Water Resources Control Board (SWRCB); the Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards; and the four largest municipal wastewater discharge agencies in Southern California have been exploring ways to develop a regional monitoring program. SCCWRP conducted several regional reference surveys (Word and Mearns 1979, Thompson *et al.* 1987, 1992) at the request of the municipal wastewater dischargers. SCCWRP also initiated efforts in 1993 to standardize monitoring methods in the SCB. The Santa Monica Bay Restoration Project (SMBRP), part of the US EPA, National Estuary Program, is exploring ways to develop comprehensive monitoring for Santa Monica Bay. To achieve the full benefit of this spirit of cooperation and willingness to change current monitoring programs, these activities must be coordinated and integrated around a set of clearly defined management objectives and monitoring questions.

The US EPA, Environmental Monitoring and Assessment Program (EMAP) provides a framework for establishing regional monitoring in the SCB. EMAP is a national, interagency monitoring program that measures biological responses to environmental stress in terrestrial, aquatic, and marine ecosystems, including estuaries and near-coastal systems. The probability-based sampling design and standardized methods developed for EMAP can provide estimates of the ecological status and trends in a region with known statistical confidence. Although EMAP was developed to address management questions on national and large regional scales, its flexible sampling design can be applied to smaller regions like the SCB. In addition, the emphasis on interagency participation encourages cooperation among the local, state, and federal monitoring programs operating within a region and results in improved data and reduced cost for all participants.

According to EPA's original plans, EMAP activity on the West Coast was to begin in 1995 or 1996 with sampling in the estuaries and coastal waters of the California Province (Cape Mendicino to Baja California). The EMAP sampling design would include about 100 samples in the province with approximately half of them in the SCB. The high level of interest in regional monitoring among environmental managers and municipal wastewater dischargers in Southern California prompted EMAP to begin its activity on the West Coast earlier than originally scheduled. By coordinating and building upon regional interest and effort, EMAP will have an opportunity to test its design and indicators in an open coastal system at a higher level of effort than originally planned. In addition, the agencies in Southern California will be assisted in their efforts to coordinate and integrate monitoring in the SCB to produce more useful and cost-effective data. The proposed Southern California Bight Pilot Project will be the largest regional survey of environmental conditions attempted on the mainland shelf in the SCB. It will capitalize on the interest and cooperation existing in Southern California and leverage the resources available in current monitoring programs to develop an integrated and coordinated regional monitoring program that addresses the needs of the participating local, state, and federal agencies.

B. PURPOSE OF THE PROPOSED PROJECT

The Southern California Bight Pilot Project (SCBPP) will use the monitoring methods of the local publicly owned treatment works (POTWs) and the EMAP survey grid design to provide synoptic information about the ecological condition of reference areas and wastewater and stormwater discharge areas on the mainland shelf in the bight. The SCBPP will evaluate the EMAP assessment approach as an alternative to the fixed site design of existing compliance monitoring programs. The SCBPP will also test the POTW and EMAP indicators in an open coastal environment and it will test indicators specific to the SCB that have not been used before.

The SCBPP will include three major parts:

1) An assessment of the current environmental status of the mainland shelf in the Southern California Bight;

2) An evaluation of a demonstration compliance monitoring program based on EMAP assessment methods; and

3) An evaluation of indicators and elements of EMAP sampling design for use in the nearshore and offshore marine environments.

The first element in the SCBPP will provide information to support management decisions for allocating resources, and for controlling pollution and its effects in the Southern California Bight. It will address the following questions:

1) What is the extent and magnitude of ecological change on the mainland shelf in the Southern California Bight?

2) Is the degree of change similar throughout the Southern California Bight, or is it more severe in particular areas?

3) Can the change be associated with identifiable sources of pollution, such as municipal wastewater outfalls, rivers, or harbors? Are the associations the same throughout the Southern California Bight? If not, what associations are most important in each area?

The second element of the SCBPP also will contribute to management decision-making by determining whether a compliance monitoring program based on EMAP sampling design would be more efficient and provide better information than existing monitoring programs. The demonstration compliance monitoring program will compare data from the EMAP survey design with data collected from an existing compliance monitoring program. This element will help managers determine whether the EMAP approach can be incorporated into compliance monitoring programs and whether compliance monitoring data can be comparable to data from probability-based, bightwide surveys.

The third element of the SCBPP will evaluate indicators developed by EMAP and the agencies in Southern California, and the applicability of the EMAP survey design to an open coastal environment. Several EMAP indicators developed for use in Atlantic estuaries will be tested for effectiveness on the mainland shelf in the Southern California Bight and compared to measures used in local NPDES marine monitoring programs.

C. ANTICIPATED BENEFITS OF THE PROJECT

The SCBPP is a collaborative effort among the Environmental Monitoring Division of the City of Los Angeles; County Sanitation Districts of Los Angeles County; County Sanitation Districts of Orange County; the Metropolitan Wastewater Department of the City of San Diego; the Southern California Coastal Water Research Project ; US EPA Region IX; the Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards; the California State Water Resources Control Board; US EPA, EMAP; and the Santa Monica Bay Restoration Project of the US EPA, National Estuary Program.

The primary beneficiaries of the SCBPP will be the environmental managers and scientists of the cities and counties of Southern California, the state of California, US EPA, Region IX, and US EPA. The SCBPP is the first opportunity for environmental managers and scientists to design and implement regional monitoring in the Southern California Bight, and test a new approach to compliance monitoring. The SCBPP will evaluate the EMAP approach as the potential framework for a regional monitoring program that coordinates, integrates, and standardizes existing NPDES compliance monitoring programs among the local POTWs.

The data produced by the SCBPP will be valuable to the managers of the municipal wastewater dischargers and the regulatory agencies. The municipal wastewater dischargers regularly compare the results of their compliance monitoring to reference conditions in the Southern

California Bight. The SCBPP will be the largest probability-based survey of the mainland shelf in Southern California in the last three decades and will provide unbiased information with which to assess municipal wastewater and stormwater discharge areas, and reference conditions. Analyses of the data produced by the SCBPP will also help to identify management priorities, suggest appropriate strategies for addressing environmental problems, and provide statistically rigorous baseline information about water and sediment quality for measuring the effects of management actions.

The SCBPP will also be the first step in implementing a comprehensive monitoring program for Santa Monica Bay. The Santa Monica Bay Restoration Project is required to develop a monitoring program as part of their Comprehensive Conservation and Management Plan. The sampling design, indicator evaluations, protocol development, QA procedures, and information managment used in the SCBPP, as well as the cooperation among the participating agencies, will help in developing the SMBRP monitoring program and ensure that it is compatible with the larger, bightwide monitoring program. The Santa Monica Bay segment of the SCBPP will demonstrate the benthic and water quality components of the SMBRP comprehensive monitoring program.

The SCBPP will provide short-term and long-term benefits for EMAP. In the short-term, EMAP will benefit from early testing and development of indicators designed specifically for the near-coastal environment. EMAP will also learn about operating in an open coastal environment with unique deep-water logistical and pollution concerns. In the long-term, the intensification of EMAP-type sampling in the SCB will provide more data and increased confidence in estimates of ecological condition in the California Province, and the new EMAP nested sampling scheme developed specifically for the SCBPP will be useful in other habitats and provinces. EMAP will also derive long-term benefits from cooperating with organizations that have more than 20 years of experience in monitoring on the mainland shelf off Southern California. The data, information, and experience available by participating in the SCBPP will facilitate development of new EMAP programs for other coastal marine provinces.

A secondary benefit of the SCBPP will be data-sharing, communication, and an integrated approach to ecosystem monitoring. The proposed study has already established communication among the participants regarding research objectives, design approaches, study methods, indicator development, quality assurance protocols, and information management. The SCBPP has and will continue to stimulate and strengthen cooperation among the participating monitoring, research, and regulatory agencies. Ultimately, it will improve environmental monitoring, research, and decision-making in the Southern California Bight.

II. TECHNICAL APPROACH FOR ASSESSMENT

A. OVERVIEW OF THE APPROACH

The goal of the Southern California Bight Pilot Project (SCBPP) is to develop and implement an integrated and coordinated regional environmental monitoring program. The SCBPP will provide synoptic information about the ecological condition of the mainland shelf in the Southern

California Bight and it will evaluate the utility of the EMAP assessment approach as an alternative design for compliance and regional monitoring programs.

The SCBPP will improve upon current monitoring efforts in the SCB in three ways. First, it will provide estimates of the ecological condition of the soft-bottom benthic community on the mainland shelf for all areas of the bight. The existing receiving water monitoring programs of the POTWs are spatially limited; some areas in the bight are intensively sampled, while large expanses are not sampled at all. The POTW programs address small-scale, discrete questions arising from point source discharges, not bight-wide processes. We have learned a lot from the compliance monitoring programs, but the existing monitoring system is unable assess cumulative and larger-scale environmental problems. As a result, it is difficult to draw conclusions about the status of the bight as a whole and about whether the beneficial uses of the marine environment are being protected. Environmental managers must know the extent and distribution of environmental modification throughout the bight if they are to develop effective management strategies for the region. That information can come from regional monitoring. Regional monitoring will also provide a baseline against which to assess the effects of specific point and nonpoint sources or unanticipated future contamination (e.g., oil or hazardous material spills).

The second way that the SCBPP will improve upon current monitoring is by implementing a probability-based sampling design for data collection. This design will ensure unbiased estimation of ecological condition, which is not possible when sampling sites are pre-selected as in the present POTW monitoring programs in the SCB. The probability-based sampling design will also allow investigators to calculate confidence intervals for estimates of condition. Confidence intervals will provide managers with full knowledge of the strengths or weaknesses of the data upon which their decisions will be based.

The probability-based sampling design is that it will allow investigators to estimate the area (i.e., number of hectares) of the system in which ecological conditions are different from reference areas, which is the primary goal of the SCBPP. The emphasis on areal estimates is a departure from the present approach to environmental monitoring by the POTWs, which estimates the average condition near an outfall and compares it to the average condition in a reference area. Estimating the areal extent of environmental modifications will provide a more direct assessment of the current status. For example, describing the average concentration of dissolved oxygen in the bight as 5.7 ppm provides less usable information for environmental managers than does identifying the 12% of the bight that fails to meet water quality standards. Estimating the areal extent of environmental modifications in the bight will provide more information about trends over time. If some areas improve and others worsen, the average condition might not change. But, by estimating the areal extent of modification, investigators will be able to develop an area-weighted function that highlights changes in the distribution of altered environmental conditions rather than obscuring them.

The third improvement is that the SCBPP will use a uniform set of indicators and sampling methods. The probability-based sampling design provides a framework for integrating data into a comprehensive regional assessment; however, the validity of this assessment depends on the comparability of the data produced. To ensure that each participant in the project will produce comparable data, the SCBPP has developed and documented in a series of manuals, standard field and laboratory methods and quality assurance protocols. The standardization of methods will not only ensure that all data collected for the SCBPP can be integrated, but will also provide a foundation upon which to build further regional monitoring efforts. The success of the SCBPP will provide the impetus and the tools for implementing regional monitoring in the Southern California Bight.

The assessment of ecological conditions in the SCB will be based on the benthic community and will be measured by a common group of indicators (Table II-1). The characteristics of the benthic community are reliable indicators of ecological condition

in the SCB (Thompson *et al.* 1987, 1992). Benthic organisms are relatively sedentary and cannot easily escape adverse conditions (Gray 1982); therefore benthic

TABLE II-1

Indicators that will be measured during the SCBPP.

- Dissolved oxygen
- Temperature
- Salinity
- Transmissivity
- Benthic invertebrate assemblages
- Sediment characteristics
- Sediment contamination
- Sediment toxicity
- Demersal fish assemblages
- Demersal fish gross pathology
- Demersal fish bioaccumulation v Marine debris

assemblages are good indicators of local conditions. Benthic assemblages are taxonomically and trophically diverse, and individuals within these assemblages have a wide range of physiological tolerances and respond to multiple types of stress (Pearson and Rosenberg 1978, Boesch and Rosenberg 1981). The life span of benthic organisms is sufficiently long for assemblages to display population and community level responses to environmental stress. Benthic assemblages integrate environmental conditions that existed during the weeks and months before sampling. Such integrated information about ecological condition cannot be obtained from point samples of water quality.

The SCBPP will collect measures of habitat condition, contaminant exposure, biological response, and human use. Collecting measurements of contaminant exposure with measurements of biological response allows investigators to identify statistical associations between altered ecological conditions and particular

environmental stresses. While statistical associations do not conclusively identify the cause of the response, associations are valuable for establishing priorities for further investigations. The statistical associations may also contribute to developing efficient regional strategies for protecting or improving the environment by identifying the predominant types of stress in the system.

B. SAMPLING DESIGN

The sampling design for this project is an extension of EMAP's protocol for sampling the estuaries of the Louisianian Province (Summers *et al.* 1993). A hexagonal grid was randomly placed over a map of the sampling area, a subsample of hexagons was chosen from this population, and one sample was obtained at a randomly selected site within each grid cell. The hexagonal grid structure ensures systematic separation of the sampling sites, which maximizes the ability to develop spatial statistics (e.g., kriging), while the random selection of sites within grid cells ensures an unbiased estimate of ecological condition.

The objectives of the SCBPP involved several design requirements that made it necessary to extend the base EMAP design. First, several areas of the SCB were identified as subpopulations of interest (Table II-2); each subpopulation needed a sufficient number of samples to describe them as separate entities with acceptable statistical confidence. The precision goal for SCBPP was to develop estimates such that the 95% confidence interval was no larger than 10% of the area in the subpopulation. If samples from the subpopulation can be classified as either "reference" or "changed," then the samples come from a binomial population and the

TABLE II-2
Subpopulations of interest in the SCBPP.

- 1) Three geographic zones in the SCB: northern (Pt. Conception to Pt. Dume), central (Pt. Dume to Dana Pt.), and southern (Dana Pt. to Mexico);
- 2) Three depth zones on the mainland shelf: shallow (10-25 m), mid-depth (25-100 m), and deep (100-200 m);
- 3) The areas around the outfalls of the four largest POTWs treated cumulatively;
- 4) The areas within 3 km of the 11 largest rivers and storm drains treated cumulatively;
- 5) Santa Monica Bay; and
- 6) The area around Hyperion 5-mile outfall.

confidence intervals for estimates of percent of the subpopulation can be approximated. To obtain a 95% confidence interval that is no larger than 10% of the area for a binomial population

with p = 0.2 requires about 40 samples (Figure II-1). **FIGURE II-1**

95% confidence intervals about an estimate of percent of area changed

as a function of sample size (US EPA Region III *et al.* 1993).

The second design requirement had to do with logistics. Because fish collections are logistically more difficult than benthic and water column sampling, and because contaminant analyses of fish tissues and sediment toxicity testing are quite expensive, fish sampling and sediment toxicity tests will be conducted at a lower intensity, and with a smaller set of subpopulations of interest, than for the other indicators. The subpopulations of interest for the fish assemblage, fish pathology, and human use indicators are limited to the three geographic zones, the three depth zones, and the cumulative POTW outfall area. The subpopulations of interest for fish tissue contaminants and sediment toxicity are the cumulative outfall area and the rest of the bight. Thus, the sampling design for all of the indicators needed to be nested (i.e., fish

tissue samples will be collected at a subset of the sites where the fish assemblage will be measured, and the fish assemblage will be measured at a subset of sites where the benthic assemblage will be measured).

Third, because the level of sampling effort for the SCBPP was determined by available resources, the allocation of effort among the different indicators and subpopulations had to be tightly controlled. The SCBPP is a cooperative project among a number of organizations and was based on the assumption that no participant will be obligated to provide more sampling and analytical effort than is required by their NPDES monitoring programs for the summer quarter.

These design objectives were accomplished by enhancing the EMAP grid 7x7x7-fold, placing a point within each hexagon, and randomly selecting the desired number of sampling points for each subpopulation of interest for the design with the highest number of samples (water quality, sediments, benthos). Randoms subsamples of these sampling points were then selected to produce the nested designs for the fish assemblage and fish tissue indicators. The 7x7x7 enhancement, which yields hexagons with an area of about 1.85 km2, was selected because it ensures a minimum of approximately 40 random points in each subpopulation.

To maintain the spatial dispersion of points on the grid for all of the designs, subsampling was conducted in a systematic manner. Systematic selection was accomplished by developing a hierarchical numbering system and a spatial address for each of the hexagons in the grid. The address scheme was developed by picking one of the hexagons near the center of the study area and linking it with the six adjacent hexagons to form a cluster of seven hexagons, or a *hexal*. The seven hexagons were numbered starting in the center with 0, and proceeding up and clockwise (Figure II-2). Construction of the addressing system continued by surrounding the hexal just formed with six other hexals of the same shape (Figure II-3). This time, however, the seven components of the hexal are themselves hexals rather than hexagons. This pattern of a central figure surrounded by six identical figures can be continued indefinitely. The

FIGURE II-2 Hexal produced by joining adjacent hexagons.

resulting figures have interlocking shapes, so that they fit together leaving no spaces. At each stage, the figures are numbered in the same manner: the central figure is numbered 0, and the other six are numbered in sequence by moving up and clockwise. This numbering scheme produced a hierarchical numbering system and a spatial address for each hexagon. The highest order digit corresponded to the highest order hexal, the next digit specified a hexal within the high-order hexal, and so on down to the low order digit which specified a hexagon.

The subsample was chosen by placing the hexagons along a number line in the order given by the hierarchical numbering system. Each hexagon was assigned a unit length on the line, and then the hexagons were subsampled using a systematic sample with a random start. The selection interval was the ratio of the required sample size to the number of hexagons on the line. This

procedure selected a random point *r* between 0 and 1, the length of the selection interval.
FIGURE II-3

Order of joining seven adjacent hexals. That point falls in the unit length associated with some hexagon, and the random point in that hexagon becomes a sample point. Subsequent points and hexagons were selected at equal intervals (*i*) along the line at r+i, r+2i, r+3i and so on. Nested subsamples were selected by joining the selected hexagons, and repeating the process to get the required number of samples for that level (Figure II-4).

FIGURE II-4 Sample selection scheme for nested design.

There are 264 sampling sites on the mainland shelf in the SCB (Table II-3). Appendix 1 contains the maps of the sampling sites. Appendix 2 contains the coordinates for each sampling site, the types of samples that will be collected there, and who will collect the samples. [This information is also contained in the *SCBPP Field Operations Manual* (Southern California Bight Pilot Project 1994).] Sampling will occur between July 11 and August 26, 1994. The summer index period was chosen because the indicators are expected to be stable, pollution stress is expected to be highest, and contaminant exposure is expected to be greatest. Late summer is also the index period in the EMAP provinces on the Atlantic and Gulf coasts.

C. SAMPLE COLLECTION METHODS

<u>Water Column</u>

A Sea-bird CTD (SBE 9 or SBE 25) will be used to measure a continuous water column profile of temperature, salinity, dissolved oxygen, and transmissivity with depth at each of the sampling stations (SCBPP Field Operations Manual, Southern California Bight Pilot Project 1994).

<u>Sediment</u>

A 0.1 m2 modified Van Veen grab will be used to collect sediment samples for physical and chemical measurements, infaunal analyses, and sediment toxicity (Stubbs *et al.* 1987). Samples for infaunal analyses will be processed on the boat. Sediment samples will be collected from the top 2 cm for grain size, chemical analyses, and sediment toxicity and placed in clean containers. Samples for grain size, and toxicity will be stored on ice; samples for chemical analyses will be frozen (SCBPP Field Operations Manual, Southern California Bight Pilot Project 1994).

TABLE II-3

Sample sizes in the subpopulations for the three sampling designs in the SCBPP.

	Water Quality, Chem, Benthos	Fish Trawls	Bioaccumulation, Sediment Toxicity
Total	264	140	78
Northern	81	49	22
Central	123	40	34
Southern	60	51	22
10-25 m	65	36	15
25-100 m	138	60	44
100-200 m	61	44	19
Santa Monica Bay	84	26	19
POTW Total	76	39	39
Hyperion	34	14	14
JWPCP	8	3	3
CSDOC	11	7	7
Point Loma	23	15	5
Stormwater Total	37	7	3

Trawling

A semi-balloon otter trawl with 7.6-m headrope length and a 1.3 cm cod-end mesh will be used to collect epibenthic invertebrates and demersal fish (Mearns and Stubbs 1974, Mearns and Allen 1978). Trawls will be towed for 10 min at 0.8-1.0 m/s along depth isobaths (*SCBPP Field Operations Manual*, Southern California Bight Pilot Project 1994).

D. SAMPLE PROCESSING METHODS

Benthic Infauna

Sediment samples will be washed through a 1.0 mm stainless steel screen on the boat, placed in a container, and "relaxed" in a solution of MgSO4 (Epsom salts) and seawater. After 30 min, the sample is fixed with 10% borax-buffered formalin and returned to the laboratory. The samples will then be rinsed with water to remove formalin and stored in 70% ethanol until sorted (*SCBPP Field Operations Manual*, Southern California Bight Pilot Project 1994).

Demersal Fish and Benthic Epifauna

The trawl catch, including debris, will be sorted on deck into containers. All fish and most invertebrates will be identified to species; species that cannot be identified in the field will be returned to the lab for identification. A list of pertinent field guides can be found in the *SCBPP Field Operations Manual* (Southern California Bight Pilot Project 1994). Board-standard length will be measured on bony fishes and total length will be measured on cartilaginous fishes(wingspan for rays). All fish will be counted (except for large catches of single species), measured to the nearest centimeter, and examined for external pathologies; fish with pathologies and voucher specimens will be fixed on the boat and returned to the laboratory. Macroinvertebrates in the trawl catch will not be measured (*SCBPP Field Operations Manual*, Southern California Bight Pilot Project 1994).

Biomass of individual fish and macroinvertebrates will be measured to the nearest 0.1 kg with a spring scale and a tare bucket with holes in the bottom. Small species with few individuals will be measured together to provide a composite biomass. Biomass from all fish and invertebrate species will be used to estimate the total biomass of the catch and of each species (*SCBPP Field Operations Manual*, Southern California Bight Pilot Project 1994).

The target species of fish for bioaccumulation (Table II-4) will be sorted from the trawl catch, placed in plastic bags, frozen on dry ice or in a freezer, and sent to SCCWRP each week. The debris will be quantified by category (*SCBPP Field Operations Manual*, Southern California Bight Pilot Project 1994).

Sediment Chemistry

Each agency will analyze a list of sediment parameters that are common to the participating agencies and occur on the NOAA Status and Trends list of contaminants (Table II-5). Metals in sediments will be analyzed by ICPMS or atomic absorption spectrophotometry after sample digestion. Mercury will be analyzed by cold vapor technique. Metals in tissues will be analyzed by modifications of the above procedures. Organic compounds in sediments and tissues will be extracted with solvents and cleaned to remove interfering substances. PAHs will be analyzed by GC/MS or HPLC. Organochlorine pesticides and polychlorinated biphenyls will be analyzed by GC/ECD.

TABLE II-4 Target species of fish for bioaccumulation measurements.
Common Name Scientific Name

- Longfin sanddab *Citharichthys xanthostigma*
- Pacific sanddab *Citharichthys sordidus*
- Hornyhead turbot *Pleuronichthys verticalis*
- California scorpionfish *Scorpaena guttata*
- Dover sole *Microstomus pacificus*
- Speckled sanddab *Citharichthys stigmaeus*
- White croaker *Genyonemus lineatus*
- English sole *Pleuronectes vetulus*

E. DATA ANALYSIS AND INTERPRETATION

Analyses for the SCBPP will address the questions of greatest interest to environmental managers and scientists to aid them in developing management strategies for the coastal marine environment in the Southern California Bight. The critical questions will fall into two general categories:

1) Ranking spatial subpopulations (e.g., comparing the spatial extent of contamination on the inner, middle, and outer mainland shelf), and

2) Ranking types of pollution exposure (e.g., comparing the spatial extent of organic contamination that exceeds some critical value to the spatial extent of inorganic contamination that exceeds some critical value).

Most of the analyses will fall in the first category since the sampling design was enhanced for specific spatial and geographic subpopulations. For example, the SCBPP will compare the ecological conditions of the benthic community near the POTW outfalls with conditions in other areas of the bight. Because the design is probability-based, and the inclusion probability of each sampling site is known, outfall areas can be compared with a variety of other sampled areas, such as the bight as a whole, or with a geographic subpopulation (e.g., central bight), or with a specific depth zone (e.g., mid-shelf throughout the bight).

Most questions to be addressed in SCBPP analyses will be similar to: "What percent of the area of a specific subpopulation differs from reference conditions with respect to the selected indicators?" These questions will be approached in two steps. The first step will be to develop cumulative distribution functions (CDF) that describe the range of values of each parameter in each subpopulation. CDFs provide essential information about the central tendency (e.g., median) and extreme values of indicators

TABLE II-5 Sediment chemical contaminants that will be measured during the SCBPP.<
<u>CONVENTIONAL MEASUREMENTS</u>

- sediment grain size
- total organic carbon

<u>SELECTED POLLUTANTS</u>

- <u>Metals</u> <u>Base Neutral Extractables/PAHs</u>
- antimony acenaphthene
- arsenic acenaphthylene
- cadmium anthracene
- chromium benzo(a)pyrene
- copper benz(a)anthracene
- lead benzo(b)fluoranthene
- mercury benzo(k)fluoranthene
- nickel benzo(ghi)perylene
- selenium chrysene
- silver dibenz(a,h)anthracene
- zinc fluoranthene
- fluorene
- indeno(1,2,3-cd)pyrene
- naphthalene

- phenanthrene
- pyrene

Organic Compounds

Pesticides PCBs

- DDT Aroclor-1242
- o,p'-DDT (2,4'-DDT) Aroclor-1254
- p,p'-DDT (4,4'-DDT) Aroclor-1260
- o,p'-DDE (2,4'-DDE) Congeners1 8, 18, 28, 29, 44, 50, 52,
- p,p'-DDE (4,4'-DDE) 66, 77, 87, 101, 104, 105, 118,
- o,p'-DDD (2,4'-DDD) 126, 128, 138, 153, 154, 170, 180,
- p,p'-DDD (4,4'-DDD) 187, 188, 195, 201, 206, 209<
- Aldrin<
- -Chlordane
- Dieldrin
- Endosulfan
- Endrin
- Heptachlor
- Heptachlor epoxide
- Hexachlorobenzene
- Lindane
- Mirex
- Trans-nonachlor

1Congeners will be measured on a subset of sediment samples

in a single summary graph. The second step will be to select the critical value that can be used to classify the condition of the subpopulations of interest.

To create the CDFs, a binary response will be determined for each sample at each X-axis interval. Selection probabilities for each site, and joint selection probabilities for pairs of sites, will be calculated based on the survey design. Horvitz-Thompson estimation will be applied to the data to obtain unbiased estimates of the mean response and standard error of the response using the following formulae:

Based on the CDFs, areas within subpopulations will be classified as meeting or not meeting reference conditions by identifying threshold values for each indicator. Selecting threshold values allows managers to identify percent of the area that may be a concern. Long and Morgan (1990) effects range-low (ER-L) values will be the threshold for contaminants. The benthic invertebrate assemblage data will be converted to a linearly scaled index similar to the index created for EMAP-E (Weisberg *et al.* 1992), and a threshold will be established. The benthic invertebrate assemblage will also be compared to the threshold determined from the "reference envelope" approach (SCCWRP and EcoAnalysis 1993).

Although selecting threshold values from the CDF is an important activity, consensus is often lacking about where to set the threshold. Developing CDFs for each subpopulation will allow managers to assess and redefine the threshold values easily when the thresholds used in the proposed analyses are questioned.

III. QUALITY ASSURANCE

A quality assurance (QA) program is an important part of any environmental monitoring project. A carefully planned quality assurance program ensures that the data collected are scientifically valid, comparable, and adequate to meet the goals of the study. QA is particularly important for large monitoring projects involving many participants because different field crews and laboratories frequently have difficulty producing comparable data (NRC 1990b). Often this happens because field crews are not adequately trained in the collection methods, and the comparability of laboratories and processing methods is not evaluated (Taylor 1987).

A QA program is especially important for the SCBPP because of the widely distributed implementation of the project. Four POTWs, SCCWRP, and two contractors will collect samples, and at least six different laboratories will process the samples. Consequently, several laboratories will perform the same functions, such as chemical analyses, sorting of sediment samples, and identifying benthic organisms. Maintaining consistency in field and laboratory operations and ensuring data comparability will be critical to the success of the SCBPP.

The goal of the *SCBPP QA Plan* (Southern California Bight Pilot Project 1994) is to ensure that the data generated by the participants are comparable. This goal will be achieved through a combination of common methods and performance based standards. Where common methods have been agreed upon by the participants in the SCBPP, QA/QC measurements will assure that methods are applied consistently. Where performance based standards are appropriate, QA/QC measurements will be used as a measure of performance. Appropriate QA/QC procedures for each of the program components (e.g., field operations, water quality, sediment and tissue chemical analyses, benthic and demersal fish analyses) have been established by the SCBPP Steering Committee. The QA/QC procedures are detailed in the *SCBPP QA Plan* (Southern California Bight Pilot Project 1994).

A. GENERAL APPROACH TO QUALITY ASSURANCE

The QA program for the SCBPP consists of two distinct but related activities: quality assurance and quality control. Quality assurance includes design, planning, and management activities conducted prior to implementation to ensure that the appropriate kinds and quantities of data are collected. The goals of quality assurance are to ensure that: 1) standard collection, processing, and analytical techniques are applied consistently and correctly; 2) the number of lost, damaged, and uncollected samples are minimized; 3) the integrity of the data are maintained and documented from sample collection to entry into the data record; 4) all data are comparable; and 5) that results can be reproduced.

Quality control (QC) activities are implemented during the project to evaluate the effectiveness of the QA activities. QC activities ensure that measurement error and bias are identified, quantified, and accounted for or eliminated if practical. QC activities include internal and external checks. Internal QC checks include repeated measurements, internal test samples, independent methods to verify findings, and standard reference materials. External QC checks include exchanging samples among laboratories for reprocessing to test comparability of results, independent performance audits, and periodic proficiency examinations.

Because of the distributed implementation of the SCBPP, the QA program will emphasize quality assurance activities. The abilities of the laboratories that process samples from existing POTW compliance monitoring programs are well established and acceptable for the SCBPP. QA activities, therefore, have focused on developing a common field manual and documenting the comparability of laboratory methods. Training of field and laboratory personnel is focused on communicating goals and objectives of the project as well any modifications in methods or procedures that have been made to ensure comparability of the data. The purpose of training is to verify that all participants can implement the procedures in a consistent manner with comparable proficiency. Quantitative measures of the overall effectiveness of training have been identified to translate QA activities, such as communication and training, into QC activities, such as performance audits and proficiency examinations. These quantitative measures are measurement quality objectives (MQOs).

B. MEASUREMENT QUALITY OBJECTIVES

For each measurement process, MQOs establish acceptable levels of uncertainty. MQOs address the major components of data quality: representativeness, completeness, precision, accuracy, and comparability. Data comparability, or "the confidence with which one data set can be compared to another" (Stanley and Verner 1985), is a primary concern in the SCBPP. Comparability of reporting units and calculations, database management processes, and interpretative procedures must be ensured if the overall goals of the SCBPP are to be achieved; furthermore, SCBPP data must be comparable with EMAP data to facilitate data sharing.

Specific MQOs for precision and accuracy, the most readily quantifiable components of data quality, have been identified to ensure that data produced by the field crews and laboratories will be comparable. Accuracy is the difference between the measured value of an indicator and its true or expected value, which represents an estimate of systematic error or net bias. Precision is the degree of mutual agreement among individual measurements and represents an estimate of random error (Kirchner 1983, Hunt and Wilson 1986, Taylor 1987). Accuracy and precision estimate the total error or uncertainty associated with a measurement. Standard, quantitative MQOs for accuracy and precision will ensure that individual data sets are free of any crew- or laboratory-specific bias and that random error is consistent across data sets (Table III-1). Accuracy and precision goals for SCBPP indicators cannot be defined for all parameters because of the nature of the measurements. For example, accuracy measurements are not possible for toxicity testing, sample collection activities, and fish pathology measurements. Measurement of accuracy and precision in sediment toxicity

TABLE III-1

Measurement Quality Objectives for SCBPP indicators and data.

Indicators	Accuracy1	Precision	Completeness
	Water Quality		
salinity	0.5 ppt	NA	90%
temperature	1oC	NA	90%
dissolved oxygen	0.5 mg/L	NA	90%
Sediment grain size	NA2	20%	90%
Total organic carbon	15%	20%	90%
	Sediment contaminants		
organics	30%	30%	90%
inorganics	20%	30%	90%
Sediment toxicity	NA	NA	90%
	Benthic infauna		
sample collection	NA	NA	90%
sorting	5%	NA	90%
counting	10%	NA	90%

identification	10%	NA	90%
biomass	NA	10%	90%
	Demersal fish		
sample collection	NA	NA	90%
counting	10%	NA	90%
identification	5%	NA	95%
length	5 mm	NA	90%
biomass	NA	10%	90%
gross pathology	NA	NA	90%
Contaminants in fish	30%	30%	90%

1percent error

2not applicable

testing would require the use of reference materials with a known level of toxicity that is stable during storage. Suitable reference materials for sediment toxicity are not available.

An MQO for completeness was defined for the SCBPP. Completeness is a measure of the proportion of the expected, valid data (i.e., data not associated with a criterion of potential unacceptability) that is actually collected during a measurement process. The MQO for completeness in the SCBPP is 90% for each measurement process. The sampling design for the SCBPP is sufficiently redundant to absorb the loss of up to 10% of the samples without compromising the goals of the program, provided that the lost samples are not concentrated in a single subpopulation of interest. Redundancy was incorporated at this level because monitoring programs of this size typically lose as many as 10% of samples due to logistical difficulties or failure to achieve quality control criteria.

C. QUALITY ASSURANCE

Establishing MQOs is of little value if the proper quality assurance activities are not undertaken to ensure that the objectives will be met. Quality assurance in the SCBPP will be achieved by:

- Developing a common field manual;
- Documenting that laboratory methods are consistent with the MQOs; and
- Implementing training workshops so that participants are familiar with methods and and are able to achieve the MQOs.

The effectiveness of quality assurance efforts will be measured by quality control activities that fall into two categories:

- routine QC checks coordinated by each laboratory or field crew's internal QA Officer, and
- performance audits conducted by the SCBPP QA Officer or designee

The goal of these activities is to quantify accuracy and precision, but, most importantly, they will be used to identify problems that need to be corrected as data sets are generated and assembled.

C.1. Field Manual and Quality Assurance Project Plan

Participants in the SCBPP use similar methods in their existing compliance monitoring programs; however, the methods vary slightly among organizations. Common methods will eliminate this variability and ensure comparability of data among organizations. However, this is not always practical and, in many cases, performance based standards may be more appropriate. An *SCBPP Field Operations Manual* (Southern California Bight Pilot Project 1994) was prepared to standardize data collection in the field. A common laboratory manual was not feasible for the SCBPP because each of the participating laboratories has established operating procedures that comply with conditions in their discharge permits. Comparability of laboratory efforts will be ensured through compliance with the requirements in the *Quality Assurance Project Plan* (QAPP; Southern California Bight Pilot Project 1994), which identifies performance based standards and the appropriate level of QA/QC.

Manuals were prepared by the field, laboratory, and QA/QC coordinators who worked with the appropriate personnel from each of the participating agencies to establish the appropriate procedures for the SCBPP. Potential problems identified in the preparation and review of these manuals were resolved by consensus. Copies of the manuals were distributed to all participants. The manuals are the basis for training workshops and a reference for field and laboratory personnel during sample collection and processing.

The field manual provides detailed descriptions of all procedures for sample collection and field analyses. The manual also identifies criteria for acceptable samples and conditions under which samples need to be recollected. This ensures that all data are collected in a similar manner by all field crews. Areas covered in the field manual include:

- Navigation and positioning;
- Deployment of the CTD;

- Collection of sediment samples for grain size, chemistry, infauna and toxicity;
- Deployment of bottom trawls;
- Shipboard analyses of fish, epibenthic invertebrates, and debris;
- Shipboard information management; and
- Sample tracking.

The *SCBPP Quality Assurance Project Plan* provides the quality assurance and quality control requirements for all aspects of data collection from field sampling to laboratory analyses to information management. The QAPP also includes the appropriate laboratory procedures and/or performance standards to ensure that the data are comparable and of high quality. Areas covered in the QA plan include:

- Water quality measurements (CTD);
- Measurements of macrobenthic community structure;
- Measurements of fish community structure and pathology;
- Analysis of chemical contaminants in sediments and fish tissues;
- Sediment toxicity testing; and
- Information management.

The *SCBPP Field Operations Manual* (Southern California Bight Pilot Project 1994) contains the field data sheets that will be used during the project. The field data sheets ensure that all of the groups record the appropriate data. Data generated by the participating laboratories will be submitted in standard transfer formats that are being developed for the SCBPP. The use of standard field data sheets and file transfer formats ensures that measurement units are comparable and that all groups use common taxonomic nomenclature. Standard data sheets and formats will also expedite data entry and minimize transcription errors.

C.2. Training

Proper training of field and laboratory personnel is a critical aspect of quality assurance. The field and laboratory personnel participating in the SCBPP have extensive experience in conducting marine monitoring programs; therefore, training will focus on consistency of data collection. Training, particularly for field crews, will ensure that all personnel understand the goals and sampling design. Sampling crews will need to make decisions in the field, such as what to do if a site cannot be sampled (e.g., rock substrate prevents use of the benthic grab). The *SCBPP Field Operations Manual* addresses situations likely to arise during the SCBPP and it identifies who in the SCBPP management structure should be consulted for advice regarding situations that are not covered in the manual. The most efficient way to guaranty that field crews make wise choices, however, is to ensure that they understand the goals of the program.

Reference collections for fish taxonomy, fish pathology, and invertebrate taxonomy will be established and made available to crew members for verification during the project. Each participating group will submit specimens to the SCBPP field or laboratory coordinators to establish the reference collections. These collections will also help identify differences in current practices.

Field crews will demonstrate proficiency in the following areas:

- Checking sampling equipment before deployment;
- Locating stations using the navigation system;
- Using all the sampling gear;
- Entering data on field data sheets; and
- Identifying fish species and fish pathology.

The abilities of each of the participating chemistry laboratories will be documented before the project begins. This will include documenting the methods and the method detection limits. Performance may also be assessed by the ability of the laboratories to meet the MQOs on blind samples provided by the QA officer or his designee.

The list of soft-bottom invertebrates developed by the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT 1994) will be used to standardize taxonomic nomenclature for benthic analyses. Taxonomists from the participating laboratories are required to participate in special SCAMIT/SCBPP workshops prior to the sampling period that focus on the taxonomy of groups requiring particular review to promote uniform treatment in the survey. Pre-survey workshops will consider nemertea, platyhelminths, and other groups. The workshops will provide training, pooling of regional resources, and designation of local expert(s) to be called upon for assistance during sample analysis. After sample analysis has begun, SCAMIT/SCBPP workshops will continue at least monthly to address taxonomic problems arising during analysis of the SCBPP samples. The series of SCAMIT/SCBPP workshops will culminate in a synoptic review of the data set compiled from all of the laboratories, and investigation of possible inconsistencies revealed in that process.

D. QUALITY CONTROL

The goal of quality control is to quantify accuracy and precision, and most important, to identify problems that need to be corrected as data are generated. The effectiveness of quality assurance efforts will be measured by two types of quality control activities:

- Routine QC checks coordinated by the laboratory or field crew internal QA Officer, and
- Performance audits conducted by the SCBPP QA Officer or designee.

D.1. Routine QC Checks

Field and laboratory crews will perform routine QC checks daily or weekly as specified in the SCBPP Field Operations and Laboratory manuals (Table III-2). Routine QC checks will identify problems with personnel or instrumentation at an early stage so that problems can be corrected, and data corruption, or the cost of reprocessing, can be minimized.

For benthic macroinvertebrates, sorting and taxonomic identification will be evaluated on a routine basis (Table III-2). Each technician's efficiency at sorting organisms from sediment and debris will be evaluated through an independent re-sort by an experienced technician. A minimum of 10% of the samples sorted by each technician will be re-sorted; the minimum acceptable sorting efficiency is 95%. If sorting efficiency falls below this level, all samples in the failed batch will be re-sorted.

Each taxonomist's accuracy at identifying organisms will be checked by a senior taxonomist. A minimum of 10% of the samples processed by each laboratory will be checked. Re-identification will be conducted at a participating laboratory other than that which originally analyzed the samples. Samples for re-identification are selected randomly from each lab's assigned set of samples and randomly re-distributed to the other three laboratories. Results are reported on standardized re-identification sheets. The minimum acceptable accuracy for identification and enumeration is 90%. If results fall below this level, all samples in the failed batch will be re-identified and counted. If efficiency is 90-95%, the taxonomist will be advised and species identifications will be reviewed as part of continuous training. All results will be documented in a QC logbook maintained in the laboratory.

The performance-based SCBPP QA program for analytical chemistry laboratories consists of an initial demonstration of laboratory capability (e.g., performance evaluation) and an ongoing demonstration of capability (Table III-2). Prior to the analysis of samples, each laboratory must demonstrate proficiency by: submitting written protocols for the analytical methods that will be used for sample analysis to the Lab Coordinator for review; calculating method detection limits for each analyte; establishing an initial calibration curve for all analytes; and demonstrating acceptable performance on a known or blind accuracy-based material. Following a successful first phase, the laboratory must demonstrate its continued capabilities by: participating in an on-going series of interlaboratory comparison exercises; repeated analysis of Certified Reference Materials; calibration checks; and analysis of laboratory reagent blanks and fortified samples.

Field and laboratory personnel will be apprised routinely of their performance on quality control samples. Corrective action resulting from a failed QC check will depend on the magnitude of the problem. Warning and control criteria will guide the corrective action (Table III-3). Exceeding a warning criterion will require only rechecking calculations or measurement processes; exceeding a control criterion will require reprocessing all samples processed since the last QC check. Personnel who repeatedly exceed warning or control criteria will be prohibited from handling SCBPP samples until they are retrained.

D.2. Performance Audits

Field and laboratory audits will be performed by the SCBPP QA Officer, the QA Specialists, or a designee of the QA Officer. Whereas routine QC checks ensure accuracy within a laboratory, performance audits ensure consistency across all participating field crews and laboratories. Each crew and laboratory will be audited at least once during the project.

Field QC audits will verify field crew compliance with the sampling protocols in the SCBPP Field Operations Manual. If an auditor observes a deviation from the field manual, the auditor will bring it to the attention of the crew chief; auditors are not empowered to demand corrective action or interfere with sampling activities. In the case of unresolved differences between the auditor and the crew chief, the Field Coordinator (Jim Allen) will be notified as soon as possible. Only the Field Coordinator has the authority to require corrective action. Field crews will be audited for proper sampling technique, correct identification of acceptable samples, sample processing, and data entry.

The QA Officer or his/her designee will perform laboratory performance audits by introducing performance evaluation samples as part of the laboratory audit. Performance evaluations during the project will verify that laboratories are maintaining the levels of precision and consistency demonstrated during proficiency examinations.

Each field crew and laboratory will be responsible for establishing and maintaining a reference (or voucher) collection of identified taxa. This collection will be used to verify identifications, provide consistency in the training of new taxonomists, and help resolve any taxonomic problems that may occur during the project. During performance audits, representative samples of each reference collection will be reviewed by a taxonomic expert to ensure accuracy and consistency among all the laboratories.

TABLE III-2

Type and frequency of recommended Quality Control measures for the SCBPP. QC = quality control; MQO = Measurement quality objective; NA = not applicable.

INDICATOR	QC	FREQUENCY	MQO
Salinity	Field calibration	Daily	Accuracy of 0.5 ppt
Temperature	Field calibration	Daily	Accuracy of 1oC
Dissolved oxygen	Field calibration	Daily	Accuracy of 0.5 mg/L
pH	Field calibration	Daily	Accuracy of 0.2 pH units
Grain size	Duplicate splits	10% of samples	10% Precision
Sediment contaminants	Duplicate analyses	10% of samples	Accuracy and precision 30% for organics 15% for metals
Benthic sorting	Resort sample	10% of samples	95% Accuracy
Benthic identification and enumeration	Recount and ID sorted animals	10% of samples	90% Accuracy
Fish identification	Field audit	At least once	95% Accuracy
Fish abundance	Field audit	At least once	90% Accuracy
Fish length and biomass	Field audit	At least once	10% Precision
Fish pathology	Lab verification	All fish exhibiting pathology	NA

E. QUALITY ASSURANCE OF DATA MANAGEMENT ACTIVITIES

The QA/QC protocols for data management will focus on the correction or removal of erroneous values and of inconsistencies that damage the integrity of the database. A systematic numbering system was developed to identify individual samples, sampling events, stations, shipments, equipment, and diskettes. Hard copies

TABLE III-3

Warning and control limits for quality control samples.

Analysis Type	Recommended Warning Limit	Recommended Control Limit
Method Blanks (organic and inorganic)	1-3 times MDL	Less than 3 times MDL
Matrix Spikes	Not specified	50-120%
Laboratory Control Sample		
Organic	80%-120%	70%-130%
Inorganic	90%-110%	85%-115%
Laboratory Duplicate		
(organic and inorganic)		30% relative difference
Ongoing Calibration		
(organic and inorganic)		15% of the initial calibration
Standard Reference Material		
Organic	80%-120%	70%-130%
Inorganic	90%-110%	85%-115%

of all field data sheets are mandatory; these can be either hand-written or print outs from the field computer system (use of the computer system is optional). Data entered in the electronic forms will be checked automatically by the software, which provides a warning when data do not fall in the expected range. The hard copy of data from the computer system will be checked against the original by the crew chief to identify mismatches and correct keypunching errors.

At the end of the field sampling period, the original field data sheets for water quality, sediment, benthos, and fish sampling activities, and a diskette of the data, will be mailed (or hand carried or transferred electronically) to SCCWRP for compilation before forwarding on to Region IX. Each participating agency should maintain a copy of the field data sheets.

When data are transferred electronically, communication protocols (e.g., Kermit software) will be used that check the completeness and accuracy of the transfer. When data are transferred by floppy disk or tape, the group sending the data will specify the number of bytes and the names of the transferred files. These data characteristics will be verified upon receipt of the data. If the file can be verified, it will be incorporated into the database; otherwise, new files will be requested. Whenever feasible, a hard copy of all data will be provided with transferred files.

Erroneous numeric data will be identified by range checks, filtering algorithms, and comparisons to lists of correct values established by experts. The EPA ODES data management system provides well established QA/QC procedures that include computerized error checking (range checks and format errors) and an independent review by a qualified database manager. When data fall outside an acceptable range, they will be flagged in a report for the SCBPP Quality Assurance Officer. Flagged data sets will be reviewed by the QA specialist for that data type (i.e., CTD, chemistry, benthos, fish trawl, or toxicity). The QA specialist will assess the quality of the data based on criteria in the QA plan and prepare a QA abstract for the data set.

IV. INFORMATION MANAGEMENT

A. OVERVIEW OF APPROACH

The SCBPP is based on the principle of partnership; all participating agencies will have equal and complete access to the data collected during the project. Historically, each agency has collected and managed its own data. Consequently, there are as many different information management systems in Southern California as there are participating agencies. Furthermore, the agencies have not developed standard protocols or formats for transferring information among themselves.

To resolve these difficulties, the SCBPP will develop and implement an Information Management System (IMS) with a, integrated, uniform, and well-documented database, and standardized protocols and formats for information transfer. The IMS will integrate field and laboratory data, and support program logistics and sample tracking. It will also implement information QA/QC and make available the EMAP analytical tools for data analyses. A detailed description of the IMS is presented in the *SCBPP Information Management Plan* (Hall *et al.* 1994).

To facilitate communication and information exchange, the Information Management Officer (Robert Hall) recommended that the participating agencies be linked by electronic communication (Internet e-mail). The IMS will provide Internet and modem access to the SCBPP database and will allow the users to perform statistical, spatial, and temporal data analyses. An Internet bulletin board was created at US EPA, Region IX to provide communication among all project participants.

B. SYSTEM DESCRIPTION

The Information Management System for the SCBPP is located at the US EPA Region IX Geographic Information System (GIS) Laboratory. The IMS and bulletin board reside on a UNIX workstation that will hold the project database and act as a link to project participants. The Data Base Management System (DBMS) designed for this project will allow project participants to use their computer systems to access the data. The IMS hardware and software will be linked to other databases within the region and to the EMAP-Estuaries database in Narragansett, RI.

The IMS will use an existing EPA, Region IX Data General Avion 400 Workstation running AT&T UNIX Operating System (OS). The data will be stored in Oracle DBMS version 7.0 with SQL-Net and running Forms version 4.0. Project members will be able to access the Oracle DBMS by modem or the Internet from their computers. Project members have accounts and disk space on the workstation. Project members accessing the data from DOS or Apple machines will automatically be connected to the DBMS through the Character Mode user interface. The IMS will allow project participants to use the data and software on the EPA computer, or the project participant can download the data for use on their computer system.

The EPA GIS programs ARC/INFO and ARCVIEW will be available for use along with a variety of GIS coverages developed specifically for Southern California. Specialized software from SCBPP, EPA, and EMAP-Estuaries will be evaluated and added as becomes available for use. To support the system, EPA Region IX has provided computer system maintenance and a half-time database administrator to the Pilot Project.

C. DATABASE DEVELOPMENT

The flow of data from the field crews and laboratories to the final SCBPP database is shown in Figure IV-1. The data will be generated by the field crews and laboratories and they will subject it to their internal QA/QC procedures and enter it into their existing data management systems. The field crews and laboratories will then send the data to SCCWRP where it will be tracked and compiled. These data will be sent to the QA Specialists for their review and then returned to SCCWRP. SCCWRP will ship copies of the data on disk, paper copies of data sheets, and chain of custody forms to the Information Management Officer (IMO) at US EPA, Region IX. The IMO will consolidate and archive the data onto the Region IX computer.

A copy of the data will be sent to a contractor for submission into Ocean Data Evaluation System (ODES) according to the ODES QA/QC procedures; these procedures will be used to check the data for errors. Errors will be flagged and the data will be sent to the IMO who will send it to the appropriate QA Specialist. The QA Specialist will deal with the flagged data and produce the supporting documentation (meta data) for the database and the QA/QC abstract.

A final version of the integrated dataset and supporting documentation will be stored in the Oracle v7.0 database on the US EPA, Region IX UNIX computer system. The SCBPP will also submit a copy of the integrated dataset and supporting documentation to ODES. In addition, a contractor will be funded to program the cumulative distribution function and variance tools for

SCBPP participants, who will be **FIGURE IV-1**

Flow of the data and information during the SCBPP.

able to access and analyze the data on ODES and/or the US EPA, Region IX UNIX computer system, or download the data to their systems.

D. REDUNDANCY (BACKUPS)

All files in the SCBPP IMS will be backed up regularly. At least one copy of the entire database will be maintained off-line on magnetic tape to enable the information management team to reconstruct it if one system is destroyed or incapacitated. For the field data, all information will be recorded on paper data sheets as well as on an electronic medium. All information stored on the US EPA, Region IX computer will have daily incremental backups performed on all files that have been changed. In addition, backups of all SCBPP directories and intermediate files will be performed weekly and monthly in the event of a complete loss of the US EPA, Region IX GIS facility.

All original files will be saved on-line for at least two years, after which the files will be permanently archived. Archiving of data will be on an on-line optical disk, and one magnetic tape copy that will be kept off-line. All original files, especially those containing the raw field data, will be read only (i.e., write and delete privileges will be removed from these files).

E. DOCUMENTATION AND RELEASE OF DATA

Comprehensive documentation of information relevant to users of the SCBPP IMS will be maintained and updated as necessary. Most of this documentation will be accessible in on-line databases that describe and interact with the system. The documentation will include a database dictionary, access control, and database directories (including directory structures), code tables, sample tracking, and data availability.

A limited number of personnel will be authorized to make changes to the SCBPP database. All changes will be carefully documented and controlled by the IMO. Databases accessible to outside authorized users will be available in read only form. Access to data by unauthorized users will be limited through the use of standard UNIX security procedures. Information on access rights to all SCBPP directories, files, and databases will be provided to potential users.

The release of data from the SCBPP IMS will occur on a graduated schedule. Different classes of users will be given access to the data only after it has passed a quality assurance review. Each group will use the data on a restricted basis, under explicit agreements with the Pilot Project Committee. The following four groups are defined for access to SCBPP data:

1. The SCBPP participants, including the information management team, the data analysis and reporting coordinators and liaisons, the field and laboratory coordinators, the Project Manager, QA Coordinator, and field crew chiefs.

2. EMAP-Estuaries ERL-Narragansett personnel, ERL-Gulf Breeze personnel, NOAA EMAP-E personnel, and EMAP quality assurance personnel.

3. EMAP data users - All other tasks groups within EPA, NOAA, and other federal, state, and municipal agencies.

4. General Public - University personnel and the research community.

Prior to release at level IV (general public), all files will be checked and/or modified to assure values contain the appropriate number of significant figures so the data do not imply greater accuracy than was measured. This is especially important in summary files where additional figures beyond the decimal point may have been added by a statistical program during manipulation. The Quality Assurance Coordinator will determine the appropriate number of significant figures for each measurement.

Request for premature release of SCBPP data will be submitted to the Information Management Team through the Project Manager. The IMO and QA Coordinator, in consultation with the Project Manager, will determine if the data can be released. The final authority on the release of all data is the SCBPP Project Manager.

F. FIELD DATA ENTRY SYSTEM

The US EPA, EMAP-Estuaries is assisting the SCBPP in developing a computerized field data entry system for logging field samples, sample tracking, and data management activities. Use of the field data entry system by SCBPP participants is optional. Hard copies of field data sheets are mandatory for the field sampling program; the original field data sheets will be archived at SCCWRP. An electronic version of the field data sheets and associated data will archived on the UNIX computer at US EPA, Region IX.

V. LOGISTICS PLAN

The goal of the SCBPP is to develop and implement an integrated and coordinated POTW monitoring program. The SCBPP is an excellent opportunity to demonstrate that the existing monitoring programs can be integrated and coordinated. Consequently, the field collections and laboratory analyses for the SCBPP will be a joint effort among four POTWs, SCCWRP, and two contractors. The number of participating field crews and laboratories complicates the logistics. The logistics are further complicated by the variety of sample types that will be collected, and the fact that the agency collecting the sample may not analyze it. To reduce potential errors and misunderstandings, the field and laboratory coordinators drafted a logistics plan for the SCBPP (Appendix 2).

The logistics plan for the SCBPP brings together the field, laboratory, QA/QC, and information management elements developed during the planning phase. It provides participating field and laboratory personnel with a concise overview of procedures from sample collection to data storage. The SCBPP Logistics Plan:

1. Identifies the field effort for each of the participating agencies (station location, and the number and types of samples collected at each station);

2. Identifies the samples each agency will analyze and the samples that will be shipped to another location for analysis;

3. Identifies chain-of-custody requirements and procedures for tracking samples; and

4. Identifies data submission requirements.

Samples for water quality (CTD), sediment characteristics (CHN, grain size), sediment chemistry (trace metals and organics), and benthic invertebrate assemblages will be collected from 264 sites in the SCB (Tables V-1 and V-2). Samples for fish and epibenthic invertebrate assemblages and marine debris will be collected from 140 sites. And samples for fish bioaccumulation and sediment toxicity will be collected from 78 sites.

For the field sampling, the project area was divided into five subregions from north to south and each POTW was assigned one subregion in the area of their existing compliance monitoring program. The contractor was assigned the subregion from Pt. Dume to Pt. Conception. The area that a POTW would sample was determined by the total amount of stations in its existing compliance monitoring program, and amount of time it would take to travel to the farthest stations, collect the samples, and return to their home port each day. A list of the samples that each agency will collect during the Pilot Project is provided in Appendix 2.

Sediment chemistry samples were allocated according to the followingplan. First, each agency will retain all of the samples that are within their respective outfall areas. All of the samples outside of the outfall areas, and from the northern SCB, were randomly distributed to either the City of Los Angeles Environmental Monitoring Division (CLSEMD), County Sanitation Districts of Orange County Environmental Services Laboratory (CSDOC-ESL), and Coast-to-Coast Analytical (C2C) (Appendix 2). **TABLE V-1**
Type and number of samples that will be collected by the agencies participating in the SCBPP.

	NUMBER OF SAMPLES TO BE COLLECTED		
Agency	**CTD, Sediment Chemistry, Benthos**	**Fish Trawls**	**Fish Bioaccumulation, Sediment Toxicity**
CLAEMD1	74	21	15
CSDLAC2	28	14	8
CSDOC3	41	27	15
CSDMWD4	40	29	18
Contractor	81	49	22
Total	264	140	78

City of Los Angeles, Environmental Monitoring Division

2County Sanitation Districts of Orange County

3County Sanitation Districts of Orange County

4City of San Diego Metropolitan Wastewater Department

All benthic infaunal samples will be retained by the agency that collects them except for some of the samples collected by CLAEMD and all of the samples collected by the contractor in the northern SCB. Eleven of the CLAEMD samples plus the 81 samples from the northern SCB were randomly distributed among County Sanitation Districts of Los Angeles County (CSDLAC), Marine Ecological Consultants (MEC), and the City of San Diego Metropolitan Wastewater Department (CSDMWWD) (Appendix 2).

Each sample will be identified and tracked with a unique 10-digit log number. The field crews will be responsible for assuring that all sample collection and preservation requirements listed in the *SCBPP Field Operations Manual* and *SCBPP Quality Assurance Project Plan* are achieved. Each POTW will retain a predetermined set of the samples for analysis (Appendix 2). The remaining samples from the POTWs and the contractor will be sent to SCCWRP within one week of collection along with a copy of the field data sheets and the chain-of-custody forms. Each laboratory will be responsible for proper storage of samples until they can be transmitted to SCCWRP along with copies of the field data sheets and the chain-of-custody forms.

For samples analyzed in the laboratory, each agency will submit sample tracking information, copies of field data sheets, tabulated results, and associated meta-data (describing methods and MDLs) to the Laboratory Coordinator (Rich Gossett).

Each agency will submit the data as a package within a specified time after collection and/or analysis. Information (raw data files) will be submitted on diskette along with copies of the data sheets (field collections) to SCCWRP, who will track the information, submit it to the QA Specialists for QA review, and then submit it to the Information Management Officer (IMO). Each submission will be accompanied by a cover letter that links the file names to log numbers, number of files, file names and file size.

The IMO will acknowledge receipt of the data and collate the information. The IMO will have a contractor compile the information into a database using the ODES QA/QC process (error checking) and the ODES format. The compiled database will be passed to the QA Specialists for resolution of QA problems and for preparation of the QA abstract. The IMO will ensure that the QA abstract and data flags are incorporated into the database(s).

VI. PROJECT MANAGEMENT

Effective project management is a vital component in the success of any environmental monitoring project. This is especially true when the project requires coordinating the efforts of many diverse groups to produce data that are reliable and comparable. The Southern California Bight Pilot Project will involve 12 local, state, and federal agencies (Table VI-1). The participants in the SCBPP include regulators and

TABLE V-2
Type and number of samples that will be analyzed by the agencies participating in the SCBPP.

	NUMBER OF SAMPLES TO BE ANALYZED							
Agency	**CTD**	**Benthos**	**GrainSize**	**CHN**	**SedChem**	**Trawls**	**FishChem**	**Tox**
CLAEMD[1]	74	63	--	--	73	21	--	--
CSDLAC[2]	28	42	--	--	16	14	--	--
CSDOC-ESL[3]	41	--	--	--	97[8] --	39	--	
CSDOC-CC[4]	--	--	--	--	78	--	--	--
CSDOC-MEC[5]	--	75	--	--	--	27	--	--

CSDMWD[6]	40	84	264	--	40	29	--	--
SCCWRP[7]	--	--	--	264	--	--	39	39[9]
Contractor[1]	81	--	--	--	--	49	--	--
Contractor[2]	--	--	--	-- --	--	--	39	
Total	264	264	264	264	264	140	78	78

1City of Los Angeles, Environmental Monitoring Division
2County Sanitation Districts of Orange County
3County Sanitation Districts of Orange County-Environmental Services Laboratory
4County Sanitation Districts of Orange County-Coast-to-Coast Analytical Laboratory
5County Sanitation Districts of Orange County-MEC Analytical Systems, Inc.
6City of San Diego, Metropolitan Wastewater Department
7Southern California Coastal Water Research Project
840 are split samples from other laboratories
9SCCWRP will do 50% of the sediment bioassays and 100% of the interstitial water bioassays
regulated dischargers with diverse goals and interests.

The SCBPP is the first significant attempt to develop integrated regional monitoring throughout the Southern California Bight; it has already required considerable coordination to define mutual objectives, develop a sampling design, and agree upon standard methods. Continued coordination is vital to the success of the SCBPP and to evaluating the feasibility of regional monitoring in Southern California.

The coordination of the project will be the responsibility of the Southern California Coastal Water Research Project (SCCWRP; Figure VI-1). SCCWRP is a joint powers agency formed in 1969 to study the effects of wastewater discharge and other anthropogenic inputs on the ecology of the Southern California Bight. It is governed by a nine-member Commission composed of representatives from the four

TABLE VI-1

Agencies participating in the Southern California Bight Pilot Project.

Southern California Coastal Water Research Project

Environmental Monitoring Division, Bureau of Sanitation, Los Angeles

County Sanitation Districts of Los Angeles County

County Sanitation Districts of Orange County

Point Loma Treatment Facility, Metropolitan Wastewater Department, San Diego

US EPA, Region IX

Los Angeles Regional Water Quality Control Board

Santa Ana Regional Water Quality Control Board

San Diego Regional Water Quality Control Board

California State Water Resources Control Board

US EPA, Office of Research and Development, EMAP

Santa Monica Bay Restoration Project, US EPA, National Estuary Program

largest POTWs in Southern California and from federal, state, and local regulatory agencies with responsibilities for wastewater discharge. In 1992, the SCCWRP Commission endorsed the concept of regional monitoring (Resolution 92-3) and charged SCCWRP to facilitate and coordinate a regional monitoring effort.

Dr. Jeffrey N. Cross, Executive Director of the Southern California Coastal Water Research Project is the Project Manager. He will provide overall guidance and direction.

Mr. Terrence Fleming, Project Officer at U.S. EPA, Region IX, is the QA Officer and is responsible for directing the QA components of the project. He will review the manuals, assist with training, conduct proficiency tests and audits, and summarize the QA information.

Dr. James Allen, Regional Monitoring Coordinator at SCCWRP, is the Field Coordinator. He will oversee the administrative and technical components of field operations. He will coordinate the schedule and logistics of field sampling; determine equipment sharing needs; write procedures manuals; develop sample storage and transfer protocols; develop data sheets and a tracking system; implement training programs; and work with the QA Officer and Information Management Coordinator.

Mr. Richard Gossett, Chemistry Laboratory Supervisor at County Sanitation Districts of Orange County, is the Laboratory Coordinator. He will oversee the administrative and technical components of laboratory analyses. He will coordinate the schedule and logistics of laboratory analyses; write procedures manuals; develop data sheets and a tracking system; implement training programs; and work with the QA Officer and Information Management Coordinator.

Robert Hall, US EPA, Region IX, is the Information Management Officer. He will coordinate the schedule and logistics of data reporting and management; develop data transfer formats and protocols; write procedures manuals; and work with the QA Officer and the Data Analysis and Reporting Coordinators.

Dr. Mary Bergen, director of the Benthic Laboratory at SCCWRP, and Dr. James Allen, Regional Monitoring Coordinator at SCCWRP, are the Data Analysis and Reporting Coordinators. They will be responsible for coordinating the various groups addressing the different assessment questions with the data collected during the pilot. They will also be responsible for collating and editing the various portions of the report written by these groups.

Each of the coordinators is supported by a technical representative of the agencies and organizations participating in the SCBPP (Table VI-2). The coordinators will be responsible for overseeing all technical effort in their project areas, and for soliciting and compiling the comments of all members of their technical support groups. The coordinators will act as liaisons for maintaining communication and consensus among project participants throughout the further development and implementation of the SCBPP. Such distributed coordination provides a mechanism for ensuring that the interests of all SCBPP participants are recognized and considered; it also creates a forum for constructive resolution of any conflicts that may arise during the course of the project. Finally, distributed coordination of the technical areas of the project will ensure that the abilities and expertise available from the diverse participants in the SCBPP are exercised to the fullest advantage throughout the project.

The project will be supported by a steering committee composed of representatives of the participating agencies and other individuals whose technical and programmatic expertise will provide project guidance (Table VI-2). The steering committee ensures that the SCBPP is a multi-agency effort and that decisions are achieved through consensus. The steering committee will also review all documents before they are released.

TABLE VI-2 Southern California Bight Pilot Project Participants

PROJECT MANAGER	Dr. Jeffrey N. Cross -- SCCWRP
STEERING COMMITTEE	Co-Chairs
	Dr. Jeffrey N. Cross -- SCCWRP1
	Dr. Stephen B. Weisberg -- VERSAR
Members	
	Dr. M. James Allen -- SCCWRP
	Gordon Anderson -- Santa Ana RWQCB2
	Dr. Mary Bergen -- SCCWRP
	Dr. John H. Dorsey-- CLAEMD3
	Terrence Fleming -- US EPA, Region IX
	Robert Grove -- Southern California Edison Company
	Janet Hashimoto -- US EPA, Region IX
	Dr. Irwin Haydock -- CSDOC4
	Mark Helvey -- NOAA5
	Dr. Rainer Hoenicke/ Patricia Velez -- SMBRP, National Estuary Program6
	Michael Lyons -- Los Angeles RWQCB
	John Mitchell -- CA Stormwater Quality Task Force

Peter Otis/ Liz Carolan -- San Diego RWQCB
Janet K. Stull -- CSDLAC7
Dr. Kevin Summers -- US EPA ORD/EMAP
Patricia Vainik -- CSDMWD8
Craig Wilson -- CSWRCB9

TASK COORDINATORS AND AGENCY LIAISONS

QUALITY ASSURANCE

Coordinator

Terrence Fleming -- US EPA, Region IX

Liaisons

Steve M. Bay -- SCCWRP
Don Cadien -- CSDLAC
James Cowan -- CSDOC
Aurora S. Elayda -- CLAEMD
Elly Gabrielian -- CSDLAC
Ron Velarde -- CSDMWWD
Steve Meyer -- CSDMWWD
Dave W. Montagne -- CSDLAC

Specialists

Dr. M. James Allen -- SCCWRP (Trawl Fish)
Steve M. Bay -- SCCWRP (Toxicity)
Don Cadien -- CSDLAC (Trawl Invertebrates)
Richard Gossett -- CSDOC (Chemistry)
Dave W. Montagne -- CSDLAC (Benthos)
Richard Santangelo -- CSDOC (CTD)
Harold H. Stubbs -- SCCWRP (Field)
Ron Velarde -- CSDMWWD (Trawl Invertebrates)

FIELD Coordinator

Dr. M. James Allen -- SCCWRP

Liaisons

Ann Dalkey -- CLAEMD
Dario W. Diehl -- SCCWRP
Joe C. Meistrell -- CSDLAC
Mike Mengel -- CSDOC
Dave W. Montagne -- CSDLAC
George Robertson -- CSDOC
Tim Rothans -- CSDMWWD

Harold H. Stubbs -- SCCWRP

Associates

Larry Cooper -- SCCWRP
Dr. Doug Diener -- MEC Analytical Systems, Inc.
Charles Phillips -- Science Applications International, Corp.
Tony Phillips -- CLAEMD

CTD User's Group

Group Leader

Richard Santangelo -- CSDOC

Group Members

Ann Dalkey -- CLAEMD
Dario Diehl -- SCCWRP
Ross Duggan -- CSDMWWD
Mike Kelly -- CSDMWWD
Joe Meistrel -- CSDLAC
Mike Mengel -- CSDOC
Mike Mullin -- CLAEMD
Dorothy Norris -- CSDMWWD
Diane O'Donohue -- CSDMWWD
George Robertson -- CSDOC
Tim Rothans -- CSDMWWD
John Shisko -- CLAEMD
Alex Steele -- CSDLAC
Fred Stern -- CSDLAC
Harold Stubbs -- SCCWRP

Trawl Methods Group

Group Leader

Dr. M. James Allen -- SCCWRP (Trawl Fish)

Group Members

Don Cadien -- CSDLAC (Trawl Invertebrates)
April Ford -- CSDLAC
Mike Kelly -- CSDMWWD
Steve Lagos -- CSDMWWD
Dave Montagne -- CSDLAC
Mike Mullin -- CLAEMD
Dean Pasco -- CSDMWWD
James Roney -- CLAEMD

Ron Velarde -- CSDMWWD (Trawl Invertebrates)

LABORATORY

Coordinator

Richard W. Gossett -- CSDOC

Liaisons

Aurora Elyada -- CLAEMD
Connie Lillis -- CSDLAC
Steve Meyer -- CSDMWWD
Farhana Mohammed -- CLAEMD
Dave W. Montagne -- CSDLAC
Charles Phillips -- Science Applications International, Inc.
Dave Tsukada -- SCCWRP
Ron Velarde -- CSDMWWD
Dr. Eddy Zeng -- SCCWRP

Chemistry Methods Group

Group Leader

Richard W. Gossett -- CSDOC

Group Members

Roger Baird -- CSDLAC
Elly Gabrielian -- CSDLAC
Theadore Heesen -- CSDLAC
Ruey Huang -- CLAEMD
Steve Meyer -- CSDMWWD
Lori McKinley -- CSDOC
Farhana Mohammed -- CLAEMD
Charles Phillips -- Science Applications International, Inc.
Parvaneh Shoja -- CLAEMD
Dr. Eddy Zeng -- SCCWRP

INFORMATION MANAGEMENT

Coordinator

Robert K. Hall -- US EPA, Region IX

Liaisons

Gordon Anderson -- Santa Ana RWQCB
Elizabeth Carolan -- San Diego RWQCB
Larry Cooper -- SCCWRP
Dario Diehl -- SCCWRP

Steve Fanizza -- CSDOC
April Ford -- CSDLAC
Nick Leonard -- CLAEMD
Michael Lyons -- Los Angeles RWQCB
Steve Meyer -- CSDMWWD
Rick Packard -- EcoAnalysis, Inc.
Paul Pau -- CLAEMD
Janet K. Stull -- CSDLAC
Chi-Li Tang -- CSDLAC
Lori Vereker -- CSDMWWD

ANALYSIS and REPORTING
Coordinators

Dr. Mary Bergen -- SCCWRP
Dr. M. James Allen -- SCCWRP

Liaisons

Dr. John H. Dorsey -- CLAEMD
George Robertson -- CSDOC
Janet K. Stull -- CSDLAC
Tim Stebbins -- CSDMWWD

Benthic Index Group
Group Leader

Dr. Mary Bergen -- SCCWRP

Group Members

Ann Dalkey -- CLAEMD
Dr. Doug Diener -- MEC Analytical Systems, Inc.
Michael Lyons -- Los Angeles RWQCB
Dave W. Montagne -- CSDLAC
George Robertson -- CSDOC
Robert Smith -- EcoAnalysis, Inc.
Tim Stebbins -- CSDMWWD
Janet K. Stull -- CSDLAC
Ron Velarde -- CSDMWWD
Dr. Stephen B. Weisberg -- VERSAR

Fish Index Group
Group Leader

Dr. M. James Allen -- SCCWRP

Group Members

Larry Cooper -- SCCWRP

Dr. Jeffrey N. Cross -- SCCWRP
Ann Dalkey -- CLAEMD
Dario Diehl -- SCCWRP
April Ford -- CSDLAC
Dr. Irwin Haydock -- CSDOC
Mike Kelly -- CSDMWWD
Dr. Stephen B. Weisberg -- VERSAR

FIGURE III-1

Management structure of the Southern California Bight Pilot Project. Project Manager *J. Cross SCCWRP*

Steering Committee

QA Officer ***T. Fleming EPA Region IX*** **Data Analysis and Reporting Coordinators**
M. Bergen SCCWRP
J. Allen SCCWRP

Field Coordinator *J. Allen SCCWRP*

Laboratory Coordinator
R. Gossett CSDOC

Information Management Officer
R. Hall EPA Region IX

1Southern California Coastal Water Research Project
2Regional Water Quality Control Board
3City of Los Angeles, Environmental Monitoring Division
4County Sanitation Districts of Orange County
5National Oceanic and Atmospheric Administration
6Santa Monica Bay Restoration Project
7County Sanitation Districts of Los Angeles County
8City of San Diego, Metropolitan Wastewater Department
9California State Water Resources Control Board

VII. SCHEDULE AND DELIVERABLES

Schedule Activity/Deliverable

July-August 1994 Sampling at sea

November 1994 CDFs for water quality and trawl fish

March 1995 CDFs for benthos and sediment chemistry

March-April 1995 QA and Logistics Report

June 1995 Draft Final Report

June 1995 Review and Evaluation Report of POTW compliance

monitoring

September 1995 Final Report and Recommendations

September 1995 Case study manuscript for a scientific journal

VIII. PROJECT BUDGET

The Southern California Bight Pilot Project will be a cooperative effort funded by the following organizations and agencies:

- US Environmental Protection Agency (EPA), Office of Research and Development (ORD) through Ecological Monitoring and Assessment Program (EMAP)
- US EPA, Region IX
- Environmental Monitoring Division, City of Los Angeles; County Sanitation Districts of Los Angeles County; County Sanitation Districts of Orange County; and Point Loma Treatment Facility of the Metropolitan Wastewater Department, City of San Diego (collectively known as POTWs)
- Southern California Coastal Water Research Project
- Santa Monica Bay Restoration Project, US EPA National Estuary Program
- Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards
- California State Water Resources Control Board

Together, these participants will provide a total budget of $2,513,000 (Table VIII-1). The POTWs will contribute the equivalent of $1,338,000 in the form of planning, management, field sampling, laboratory sample processing, quality assurance, data analysis, and reporting. This contribution will be "revenue neutral" with respect to the existing POTW annual monitoring budgets; no additional internal appropriations will be required for these participants to meet their commitments to the SCBPP. Maintaining revenue neutrality for the POTWs was a guiding principle in developing the budget for the SCBPP. Revenue neutrality ensures the support and cooperation of the organizations that currently perform most of the nearshore environmental monitoring in the Southern California Bight. Cooperation of the POTWs is the cornerstone of successful regional monitoring in the SCB.

SCCWRP will contribute the equivalent of $305,000 in the form of in-kind services for planning and management of the SCBPP, as well as field sampling, laboratory processing of chemistry samples, sediment toxicity testing, quality assurance, data analysis, and reporting. The contribution will come from internal resources.

The US EPA, Region IX will contribute the equivalent of $180,000 for planning and management, quality assurance, and data analysis and reporting. Approximately $100,000 of this contribution will be in the form of contract funds to fulfill project requirements that cannot currently be met through in-kind services of Region IX staff. The Region IX contribution also includes in-kind personnel support in the form of a QA Coordinator and Information Management Coordinator.

The Santa Monica Bay Restoration Project will contribute $167,000 in in-kind services and contract funds. The in-kind services will be in the form of general support for planning and management, quality assurance, data analysis, and reporting. The contract funds will be used for field sampling, laboratory sample processing, and data analysis and reporting for the design "enhancements" in Santa Monica Bay.

The US EPA, EMAP will contribute $500,000 to aid in developing regional monitoring in the Southern California Bight. EMAP funds are allocated for contract support for sampling, sample processing, and laboratory supplies. Sampling areas outside the geographic boundaries of existing POTW monitoring programs will require separate boats and crews. Processing of benthic and chemistry samples may require additional contract support, particularly for samples from sites north of Point Dume. EMAP funds will also be used to purchase laboratory and field supplies that are not available from the participating agencies.

The Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards will contribute the equivalent of $17,000 in in-kind services for planning and management, as well as quality assurance, data analysis, and reporting.

The California State Water Resources Control Board will contribute the equivalent of $6,000 in in-kind services for planning and management, as well as quality assurance, data analysis, and reporting.

TABLE VII-1

Budget for the Southern California Bight Pilot Project.

	EMAP	**SCCWRP**	**EPA IX**	**POTWS**
	In thousands of dollars			
Planning	12	70	70	73
Field Sampling				
Benthos	22			44
Fish	41			75

Equipment	20			40
Administration		30	10	60
Lab Processing				
Benthos	60			115
Grain size				19
Sediment Chemistry	40	40		358
Fish Tissue	25	25		154
Sediment Toxicity	80	40		
Information Management	100		50	200
Analysis and Reporting	100	100	50	200
Total	500	305	180	1338

	SMBRP	RWQCBS	SWRCB	TOTAL
	In thousands of dollars			
Planning	11	11	3	250
Field Sampling				
Benthos	9			75
Fish				116
Equipment				60
Administration				100
Lab Processing				
Benthos	25			200
Grain size				19
Sediment Chemistry	62			500
Fish Tissue				204
Sediment Toxicity				120
Information Management	50			400
Analysis and Reporting	10	6	3	469
Total	167	17	6	2,513

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APPENDIX A

LOCATION OF SAMPLE COLLECTION SITES FOR THE SCBPP

APPENDIX B

LOGISTICS PLAN FOR THE SCBPP