Los Angeles Volunteer Monitoring and Education Project Final Report

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I. Introduction

Public concerns about water pollution have been rapidly increasing over past years in relation to both marine resources and public health. Two primary organizations are responsible for regulating water quality and environmental health, the United States Environmental Protection Agency (USEPA) and California State Water Resources Control Board (State Board). Current and existing status of funding and staffing for water quality monitoring has been at low levels throughout the various levels of government. Volunteer water quality monitoring groups have become important partners in assisting public agencies in the assessment of water quality trends. In addition, these volunteer groups have expanded individual and public education and awareness of water quality trends. This is true throughout the State and especially in the Santa Monica Bay watersheds of the Los Angeles region.

Regulations controlling the effluent of point-source pollution mainly from sewage treatment systems have significantly reduced impacts on receiving water. Non-point source pollution from runoff, both in dry and wet weather, is now the area of major concern. These sources are much more difficult to both monitor and to correct potential problems. Any significant reduction in non-point source run-off will probably be due to both changes in regulations (through government action) and in changes in public behavior (through education).

In the 1990's, Dominic Gregorio began the Marine Monitoring program at the Southern California Marine Institute (SCMI). SCMI has been actively involved with its partners in the Los Angeles Volunteer Monitoring Steering Committee since 1995. The steering committee membership, while varying somewhat over the years, has included representatives from the State Board and Los Angeles Regional Water Quality Control Board (Regional Board), City of Calabasas, Heal the Bay, Santa Monica BayKeeper, Algalita Marine Research Foundation, Cabrillo Marine Aquarium, Friends of the Los Angeles River (FoLAR), Resource Conservation District (RCD) of the Santa Monica Mountains, SurfRider, Huntington/Seal Beach chapter, Divers Involved Voluntarily in Environmental Rehabilitation and Safety (DIVERS), SurfRider, Long Beach chapter and other local volunteer organizations and high school groups. SCMI's role on this committee has included providing training, coordination, and quality assurance and quality control to the Region's volunteer monitoring groups. These citizen volunteer monitoring groups have been working and collaborating with SCMI to collect high quality water monitoring data. SurfRider, Long Beach chapter, was initially very active with the project, but participation has decreased over time. FoLAR and the Bolsa Chica Conservancy are two of the more recent additions to the program.

SCMI has long realized the value of volunteers in conducting water quality monitoring. Between 1995 and 1997 SCMI was funded through the Santa Monica Bay Restoration Project Public Involvement and Education (PIE) program to provide an Environmental Monitoring Program (EMP) to schools in the Los Angeles Region. In 1998, SCMI continued to provide EMP education through funding from the University of Hawaii Sea Grant Youth for Environmental Service (YES) program. EMP monitoring efforts were also continued through SCMI's citizen monitoring program supported by Ocean Fund of Royal Caribbean and Celebrity Cruise Lines (1999-2001). The initial test kits used in this project were purchased with funding from these various programs, especially funds from the Ocean Fund and SCMI. These test kits

were distributed and loaned to various volunteer monitoring groups. A few of the organizations purchased their own kits. Equipment bought under this grant was for the purpose of updating and enhancing existing test kits.

In 1999 and thereafter, citizen monitoring efforts in the Los Angeles region were conducted according to the Southern California Volunteer Monitoring Quality Assurance Project Plan (QAPP). This plan was prepared by the Los Angeles Volunteer Monitoring Steering Committee in 1998 and approved by Vance Fong (EPA Region 9), Bill Ray (State Board), Gwen Starrett (State Board), Heather Trim (Regional Board), and Dominic Gregorio (SCMI). This QAPP was used during most of the project, until the current version was accepted at the end of the project. New equipment was purchased and distributed to the volunteer groups in March 2001. The new equipment was evaluated and the QAPP was modified to include specifications for the new methods. After internal and external scientific review, a revised QAPP was submitted to the Regional Board in March 2003 and accepted at the end of the project.

The purpose of the Los Angeles Volunteer and Monitoring and Education project was to continue to provide training, conduct quality assurance and quality control, coordinate the various volunteer groups, and evaluate existing volunteer monitoring programs in the Los Angeles Region's watersheds. Initial work began in the fall of 2000 and a nine-month extension was granted due to the addition of the Compendium review.

Project Goals and Objectives

This project has attempted to solve the problem of coordination between various volunteer water quality monitoring groups. Many volunteer monitoring organizations exist in the Los Angeles Region. Through this project and previous cooperation between SCMI and volunteer monitors, there are about 20 groups (including high schools) that have monitored in the past or are currently doing so. However, there has been little or no coordination between these organizations regarding sampling methods, parameters, sampling locations, and data sharing. Education and coordination between all citizen monitors and regulatory agencies is necessary to provide valuable data and to maximize the results of monitoring efforts.

Goals:

- To provide an illustrated field guide for sampling and analysis performed by volunteer citizens. The field guide is patterned after the proven model used for the Heal the Bay Stream Team Field Guide. In addition to its value as a reference to volunteer monitors, this field Guide is an educational resource that will be available to participating schoolteachers.
- To encourage and increase public involvement and to maximize data quality from citizens in volunteer monitoring programs. The Contractor (SCMI) provided training, guidance, field consultations, and quality assurance sessions open to all of the region's volunteer monitoring organizations.
- To expand and coordinate seasonal water monitoring "snapshot" efforts. The existing volunteer monitoring effort within Los Angeles Region was restructured and expanded in order to assess and report water quality on the same day in all the watersheds, which include: Los Angeles River watershed, San Gabriel River watershed, Dominguez Channel watershed,

and Santa Monica Bay Watershed Management Area (WMA). Several snapshot events were performed during this project.

- To assist groups in data entry and transmittal, thereby assisting the Regional Board staff in their water quality assessment and TMDL efforts. All credible data collected by participating volunteer groups and the lead agency, in all of the local watersheds, was compiled on a computer database and was transmitted to the Regional Board electronically on CD at the completion of the project.
- To increase public awareness and stewardship of our water resources, thereby altering behavior and reducing negative practices that contribute to polluted runoff. In training several new volunteer monitoring leaders, stewardship of water resources was emphasized and will subsequently be used and promoted to others by those trained.
- To recommend revisions to the Southern California Volunteer Monitoring Quality Assurance Project Plan (QAPP). The QAPP was revised to include specifications for new methods and equipment being used in the Region.
- To complete review of the Clean Water Team's Compendium. The Compedium was reviewed for scientific merit and to assess its usefulness to citizen monitors.

Current coordinating organizations and agencies include staff from the State Board, the Regional Board, Heal the Bay, Santa Monica BayKeeper, Friends of the Los Angeles River, SurfRider Foundation, Algalita Marine Research Foundation, Cabrillo Marine Aquarium, Bolsa Chica Conservancy, DIVERS, and other local volunteer organizations.

II. Accomplishments

Through the tasks in the scope of work for this contract, SCMI has provided new resources for volunteer monitors, coordinated and encouraged monitoring plans and snapshots, trained volunteer monitoring leaders, reviewed the State Board Clean Water Team Compendium, assessed the quality of volunteer monitoring data, revised the QAPP, evaluated volunteer groups, performed data review and upload, and administered and managed the project. All of these accomplishments have served to increase community awareness and stewardship of the Region's water resources by citizen monitors. These accomplishments are explained in more detail in the following sections.

Provided New Resources for Volunteer Monitors

The first resources that SCMI provided to volunteer monitors were the test kits and equipment to perform water quality monitoring. The initial test kits used in this project were purchased from various SCMI projects, contracts, grants, and from SCMI internal funds. These test kits were distributed to various volunteer monitoring groups as a long-term loan prior to the start of this 319(h) grant. A few of the organizations purchased their own kits. These (initial) kits were distributed to volunteer citizen organizations, most of which have continued to participate in the water-quality monitoring as part of this project. These organizations include:

- Algalita Marine Research Foundation
- Cabrillo Marine Aquarium (provided their own kit)
- DIVERS

- Heal the Bay
- Santa Monica Baykeeper
- Surfrider, Long Beach chapter
- SurfRider, Huntington/Seal Beach chapter

The 1998 QAPP approved by the State Board and Regional Board was based on this earlier test kit. Funds from the present grant were used to update these initial kits. The following new instruments were purchased (Table 1) and distributed to the above groups in March 2001.

Table 1: New Equipment ordered with 319h grant funds

New Equipment	Quantity
Lamotte 2020 Turbidimeter	6
Lamotte Dissolved Oxygen meter with probe, 3 membranes, 50 ft. cable	6
Lamotte waterproof conductivity meter	6
Smart Colorimeter w/4 tubes and A/C adapter	6

In addition, other equipment already owned by SCMI was used in the volunteer monitoring programs including pH meters, dissolved oxygen modified Winkler titration kits, refractometers, Secchi disks, and Forel-Ule color scales. A few of the tests (copper, phenols, etc.) are used only by a few of the groups. A complete list of all of the reagent-based kits and other equipment in the current water quality monitoring kit can be found in Appendix 1. Changes and updates to the initial monitoring kits are discussed briefly below.

Dissolved Oxygen. The initial kits measured dissolved oxygen (DO) by the Winkler titration method (chemical). This method is still a valid technique (it is the standard method) and should still be used to calibrate the DO meters. The DO meters were purchased to make field measurements quicker and for ease of use by volunteer citizen monitors.

Nutrient analyses using the Colorimeter. Nutrient analyses in the earlier kits used a color-comparator. The comparator technique estimates the nutrient concentration by comparing the sample value (color caused by a chemical reaction) to a color scale. This method is difficult due to its subjectivity and is compromised by different light conditions and different personnel. The colorimeter solves most of these problems. It is basically a simplified spectrophotometer. The specific wavelength of light is "dialed" by selecting the nutrient test to be run and the results (absorbance) are converted to PPM by an algorithm in the unit.

Turbidimeter. The turbidimeters (or nephelometers) use the amount of light penetration through a water sample to determine the turbidity. Turbidity was estimated before by transparency measurements using the Secchi disk. Turbidimeters are much more accurate and usable in flowing streams, although some groups still use the Secchi disk, which is a long-accepted method for open ocean environments and lakes.

Conductivity meter. The initial kits came with another type of conductivity meter (TDS Testr 20). The new digital read-out Lamotte CON-5 meters are more accurate and easier to use.

They also compensate for temperature and subsequent changes on conductivity. One problem with these conductivity meters, however, is their inability to measure the conductivity of salt water. Salt water is outside of the range of the conductivity meters, so dilutions must be done. Dilutions increase the possible error in measuring this parameter.

Volunteer monitoring groups recently added to the program have been, and are continuing to be, trained by SCMI. Their equipment is, in some instances, different from that described above. In these cases, their equipment is inter-calibrated with the equipment used in the SCMI kits. These newer organizations include:

- Bolsa Chica Conservancy (borrowed an SCMI colorimeter only; the rest of their equipment is their own)
- Friends of the Los Angeles River (own their own kits, some equipment from different companies)

In addition to new equipment, all participating volunteer groups are to be provided with a copy of the Freshwater and Marine Team Field Guide to explain methods for using all equipment supplied. This task was subcontracted to Heal the Bay for completion and the bound copies were received on October 13, 2003. Heal the Bay was already familiar with most of the equipment used, and added a few more equipment types that other organizations utilize.

The Field Guide provides information on habitats, environmental problems, and monitoring protocols in unaltered freshwater streams, lakes, channelized rivers, estuaries, and the marine environment. Heal the Bay provided information on unaltered freshwater streams and the appropriate monitoring equipment, and SCMI provided information on marine and coastal ecology, water problem issues, and conventional oceanographic monitoring equipment such as horizontal and vertical water samplers, Secchi disk, Forel-Ule color scale, refractometer, and the modified Winkler dissolved oxygen kit. All methods currently in use by volunteer monitors in the Region are described step-by-step, and safety and sampling procedures are explained. Organizations can pick and choose which methods to keep in their copy depending on their program. The Field Guide will serve as a training tool for volunteer leaders and will standardize methods used by all groups in the Region. It can also be updated as equipment or testing methods improve or additional parameters are added.

SCMI has also provided replacement reagents to volunteer groups when they are found to be out of date.

Coordinated and Encouraged Monitoring and Snapshots

Most groups that are currently monitoring had either a quarterly or monthly sampling regimen that has been followed, but some groups need more direction as far as regular sampling is concerned (see Table 2). Groups that do monthly sampling tended to have more consistent data submittal. Those that sampled quarterly or irregularly would only sample when a snapshot was organized. Snapshot days should be more frequent to achieve this objective.

Table 2. Summary of Monitoring Design

Parameter	Heal the Bay, type & frequency	Santa Monica Bay Keeper, type & frequency	Surfrider type & frequency	Algalita, type & frequency	CMA, type & frequency	DIVERS, type & frequency	Bolsa Chica, type & frequency
Temperature	F, M	F, X	F, M	F, X	F, M	F, M	F, W
Dissolved Oxygen	F, M	F, X	F, M	F, X	F, M	F, M	F, W
PH	F, M	F, X	F, M	F, X	F, M	F, M	F, W
Conductivity (fresh water) or Salinity (marine)	F, M	F, X	F, M	F, X	F, M	F, M	F, W
Turbidity/ Transparency	F, M	F, X	F, M	F, X	F, M	F, M	N/A
Ammonia	L, M	L, X	L, M	L, X	L, M	L, M	L, S
Nitrate	L, M	L, X	L, M	L, X	L, M	L, M	L, S
Ortho-Phosphate	L, M	L, X	L, M	L, X	L, M	L, M	L, S
Bacteria	L, M	L, X	L, X, P	L, X, P	P, X	P, X	P, S
Odor and Visual Observations	F, M	F, X	F, M	F, X	F, M	F, M	F, W

Codes for Table 3:
Type: F: field analysis, L: in-house lab analysis, P: sample only, send to outside professional lab
Frequency: W: weekly, M: monthly, S: seasonal, X: irregular
N/A: parameter not sampled

Due to several staff changes throughout the duration of this contract and difficulties in coordinating groups, the number of snapshots completed were less than anticipated. In 2001, four snapshots were completed, three of which were coordinated by Santa Monica BayKeeper. Santa Monica Baykeeper did snapshots on January 9, 2001 (for the first flush), April 7, 2001, and September 15, 2001. Other groups participated in the Great American Secchi Dip-in scheduled from June 30-July 15, 2001.

In 2002, two snapshots were completed. A citizen monitoring Snapshot day was coordinated and conducted on April 6, 2002. Six volunteer monitoring groups (Santa Monica BayKeeper; SurfRider Long Beach; SurfRider, Huntington/Seal Beach; DIVERS; Bolsa Chica Conservancy; and Cabrillo Marine Aquarium) participated. Some groups also participated in the National Water Quality Monitoring Day on October 18, 2002. This was the first country-wide water quality monitoring event and was scheduled to celebrate the anniversary of the Clean Water Act.

In 2003, four snapshots were completed. SCMI's Seasonal Bacteria study, which is a Supplemental Environmental Project (SEP) through the Regional Water Quality Control Board, has proved a useful tool to get volunteer groups to participate in snapshots. For the study, 5 sampling dates per year will be completed. Volunteer groups were involved in collecting samples and other ancillary measurements either at planned sites, or sites of their choosing. On our sampling date of February 4, 2003, Don Schultz of SurfRider, Huntington/Seal Beach and Bolsa Chica Conservancy collected additional bacterial samples and conventional water quality parameters from areas of their interest. Linda Chilton of Cabrillo Marine Aquarium, Reni Schimmoeller of University of Southern California, and Martin Carreon of DIVERS collected at one of our scheduled sample sites. Bacterial samples were later processed for SurfRider, Huntington/Seal Beach for one of their projects in the end of March.

Statewide Coastal Snapshot Day was coordinated for and completed on May 17, 2003. The following volunteer groups participated and added additional sites: Cabrillo Marine Aquarium, Algalita Marine Research Foundation, Heal the Bay, Santa Monica BayKeeper, Bolsa Chica Conservancy, SurfRider Long Beach and Seal Beach/Huntington Beach, DIVERS, and several others in different areas. Santa Monica BayKeeper helped organize the Los Angeles County groups and Orange County CoastKeeper organized the Orange County groups. In addition to the 10 sampling sites analyzed for SCMI's Seasonal Bacteria Study, four sites were analyzed for Algalita Marine Research Foundation, three sites were analyzed for DIVERS, and one extra site was analyzed for Cabrillo Marine Aquarium for coliforms and E. coli. Two sites were also analyzed for nutrients for SurfRider, Long Beach.

Volunteer groups were informed about the Great North American Secchi Dip-In. This monitoring event can be held anytime between June 28, 2003-July 13, 2003. FoLAR and Cabrillo Marine Aquarium have decided to use June 28th as their sampling date, so we suggested that as many groups as possible sample on this date. SurfRider, Huntington/Seal Beach collected bacterial samples as well on their sampling date of July 2, 2003. DIVERS also participated on July 13, 2003. The Regional Water Quality Control Board had lab processing money left over during this time period, so SCMI, through Erick Burres' suggestion, took advantage of these analyses. On June 30, 2003, SCMI collected samples from the Seasonal Bacteria sites as well as 10 additional sites in LA Harbor for analysis for PCBs, pesticides, metals, nutrients, and VOCs. Heal the Bay and Santa Monica BayKeeper also took advantage of this offer by sampling on June 29th and June 30th.

On August 6, 2003, another snapshot was held in conjunction with SCMI's Seasonal Bacteria Study. Don Schultz of SurfRider, Huntington/Seal Beach collected additional bacterial samples and conventional water quality parameters from five additional sites. Linda Chilton of Cabrillo Marine Aquarium collected a water sample from Cabrillo Beach/Inner N.

Although National Monitoring Day was past the end date for this contract, some groups did participate in it on October 18, 2003.

Trained Volunteer Monitoring Leaders

A total of 5 training sessions were held for water quality monitors (1 additional session was held due to available time and money). Training included instructions on how to use each piece of equipment, calibration procedures, and QAPP data quality objectives. Volunteers participating in each training session were evaluated on their performance with each instrument or test kit in the lab and at a field station (usually Fish Harbor, adjacent to SCMI). In addition, training was held as match for the following topics: the Seasonal Bacteria Study, Coastal Ecology Day, and California Statewide Coastal Snapshot Day. The training sessions held and numbers of volunteers that participated are detailed in the table below.

Training	**Date**	**Number of volunteers**
Volunteer Monitoring Training Session #1	July 14, 2001	3

Coastal Ecology Day Training	November 7, 2001	103
Volunteer Monitoring Training Session #2	January 12, 2002	4
Volunteer Monitoring Training Session #3	March 28, 2002	7
Seasonal Bacteria Study Training	January 22, 2003	7
Coastal Ecology Day Training	April 2, 2003	7
Statewide Coastal Snapshot Day (used SCMI facility)	March 10, 2003	14
Statewide Coastal Snapshot Day (used SCMI facility)	March 11, 2003	13
Volunteer Monitoring Training Session #4	April 5, 2003	9
Volunteer Monitoring Training Session #5	August 13, 2003	9

Reviewed the Draft State Board Clean Water Team Compendium

SCMI was asked to complete a review of the Clean Water Team's (CWT) Compendium of water quality resources for volunteers as an addition to the contract. Overall, the CWT Compendium was easy to understand and adequately explained scientific concepts and requirements for a non-technical audience. Citizen monitors should be able to use this framework as a starting off point for their own field guides and it will take some of the guesswork out of complicated subjects such as quality assurance. The step-by-step Standard Operating Procedures (SOPs) will prove a valuable reference for monitors starting out and those that need review. The SOPs are clearly written and scientifically correct in most cases. Some of the text should be changed to make it more reader friendly for the general audience. Also, a different page numbering system was suggested for ease of use. More detail should also be provided in some subjects such as TMDL generation and use. This compendium is a well thought out, comprehensive guide that will serve as a useful tool for citizen monitors. The inclusion of an Information Paper and a Fact Sheet is very useful. The included tables provide excellent summaries of the methodology and applications of each measurement. These information papers and fact sheets are successful in explaining scientific concepts to the general reader. Also, extremely useful is the Practical Advice and Tips Section (4.0), which provides the monitor valuable insights into measurement expectations, quality control, and important issues about standards.

In addition, the added sections written by other agencies and organizations were found to be suitable for citizen monitoring groups and useful for those looking for more than the conventional monitoring program. The collected materials in the appendix give the user a reference to other programs, methods of monitoring, funding sources, EPA sources, as well as the Guidelines for Citizen Monitors which adds additional information on visual assessment, flow, and sediment as well as examples of a QAPP. The appendix rounds out a wealth of knowledge available for the citizen monitor.

This compendium, along with the Field Guide, will provide volunteer monitors with a plethora of resources for their monitoring programs, and will keep the information that they use as accurate as possible.

Assessed the Quality of Volunteer Monitoring Data

A total of 5 Quality Assurance sessions were held (1 additional session was held due to available time and money) in order to assess the quality of volunteer monitoring sampling protocols and data submitted. In addition, SCMI participated in the QA/QC sessions held by the Statewide Coastal Snapshot Day coordinators and a QA/QC put on by Orange County CoastKeeper (OCCK) for the same event. Bolsa Chica, DIVERS, and SurfRider, Huntington/Seal Beach also attended OCCK's QA/QC session. All groups attended at least one QA/QC, with most attending several.

SCMI, Heal the Bay, and Santa Monica BayKeeper also participated in the Bight '03 intercalibration between laboratories for bacterial parameters sponsored by SCCWRP. This intercalibration compared our lab procedures against several governmental and private labs and validated the incorporation of bacterial samples into the suite of parameters tested by volunteers.

The QA/QC sessions held and numbers of volunteers that participated are detailed in the table below.

QA/QC Session	**Date**	**Number of Volunteers**
QA/QC Session #1	July 14, 2001	3
QA/QC Session #2	November 11, 2001	9
QA/QC Session #3	April 12, 2002	8
QA/QC Session #4	October 12, 2002	6
QA/QC session for Statewide Coastal Snapshot day	March 11, 2003	13
QA/QC Session #5	March 15, 2003	10
QA/QC Session by OCCK	April 30, 2003	8
Bight '03 laboratory intercalibration	June 10, 2003	2 groups + SCMI

SCMI has compiled all of the QA/QC data from the sessions from 2001-present (See Appendix 2). The highlighted lines failed for either precision or accuracy. A QA/QC checklist used to determine these failures is found in Appendix 3. The data points associated with these failures were not included in the consolidated database. Most of the problems were with nutrients, so considering there was some problems with the standards, the QA data was relatively good. If a volunteer group failed for accuracy in a certain parameter at a QA/QC session, the results for a month prior to the failure were omitted from the database. For several failures, no data was submitted during that time period, so there was no effect on the database.

These results highlight the importance of organizations participating in QA/QC sessions and proper calibration for each sampling event. At most times, each group followed proper calibration and QA procedures and had accurate results. It is essential for participation in these sessions in case measurements get off track.

Revised the QAPP

Initially, citizen monitoring efforts in the Los Angeles region were conducted according to the Southern California Volunteer Monitoring Quality Assurance Project Plan (QAPP). This plan was prepared by the Los Angeles Volunteer Monitoring Steering Committee in 1998 and approved by Vance Fong (EPA Region 9), Bill Ray (State Board), Gwen Starrett (State Board), Heather Trim (Regional Board) and Dominic Gregorio (SCMI). This QAPP was in use during most of the project, until the revised QAPP was accepted in October 2003. New equipment was purchased for this grant to update the quality of the tests and to make it easier for citizen monitors to use. This equipment was distributed to the volunteer groups in March 2001. This new equipment was evaluated and the QAPP was modified. After internal and external scientific review, a revised QAPP was submitted to the Regional Board in March 2003 and accepted at the end of the project.

Evaluated each group

During each training session and QA/QC session, volunteers were evaluated and instructed on calibration procedures and field methods. General field methods were also observed at some sampling dates throughout the contract (with Heal the Bay on April 8, 2002 and January 26, 2003).

In depth field consultations were done with most citizen monitoring groups. Most of these evaluations were done near the end of the contract to assess effectiveness after all of the training and QA/QC sessions were held. For each evaluation, SCMI brought out field equipment to test the same parameters tested by each group in the field. If water samples were taken back to the lab for further testing (i.e., nutrients, turbidity, or bacteria), SCMI also took a split sample of water for these tests. Calibration and field and lab methods were also commented on. Team effectiveness and cooperation between volunteers was also observed. For all groups, field methods and observational reports were very thorough and teamwork was observed. Each group did calibrations regularly before each sampling date. The following paragraphs detail more specific comments relating to each group.

SurfRider, Huntington/Seal Beach had an evaluation done on July 22, 2003 at their site at the San Gabriel River Bridge in Seal Beach. There are a few areas where their results did not match SCMI's within the parameters of the QAPP: water temperature and pH. Water temperature was measured with a DO meter, so it was suggested that the manual be checked for a way to calibrate temperature, if this hasn't been done recently. For pH, one possible reason for this difference was that the pH buffer they were using was prepared a few weeks before. SCMI recommended mixing up a new buffer for each time that the meter is calibrated.

DIVERS had an evaluation done at their Laguna Beach site during their monthly sampling date of July 26, 2003. Only dissolved oxygen did not match SCMI's result within the parameters of the QAPP. This was due to an expired bottle of sodium thiosulfate. All other parameters and protocols were followed extremely well.

FoLAR had an evaluation done at their L.A. River at Gage Street site on August 12, 2003. All of their measurements were within the parameters of the QAPP, except for

temperature measured by thermometer. The thermometer read higher than SCMI's, which may have been caused by its metal casing conducting heat.

Santa Monica BayKeeper had an evaluation done on four sites sampled in Marina Del Rey on August 2, 2003. Only temperature and pH was measured in the field, in addition to visual observations. All measurements were within the parameters of the QAPP. SCMI also did splits on 5 bacteria samples (the four sites from Marina Del Rey and one storm drain). For the bacterial lab tests, our labs did vary from each other beyond the 95% confidence intervals described by IDEXX. Angie Bera did suspect that Santa Monica BayKeeper's incubator for Enterococcus may have been off for this sampling event.

Splits for bacteria and nutrients were completed for Heal the Bay on September 9, 2003. Only one of the nutrient samples had results out of the QAPP ranges of comparison. Fortunately, it was the sample for which Heal the Bay completed lab splits. Since the lab splits came out within the right range, this difference may just be variations in the samples we tested. For the bacterial lab tests, our labs did vary from each other beyond the 95% confidence intervals described by IDEXX. For Total Coliforms, three samples varied out of the 95 % confidence interval range. For E. coli, two samples varied out of the 95% confidence interval range. For Enterococcus, three of our samples varied out of range. For one of these sites, SCMI's split did not come within range either, so there may be a matrix effect or it just may be a highly variable sample. Most of the results were slightly below or above the 95% confidence intervals for SCMI's results, but not by very much in most cases. Since these were field splits, we may just be seeing natural variation.

Bolsa Chica Conservancy had an evaluation done on September 26, 2003. Only one parameter did not match SCMI's within the parameters of the QAPP: dissolved oxygen. The discrepancy in these measurements is easy to explain, however. For salinity, the detection limit for refractometers is 1 ppt. Although the salinity measurement was within the parameters of the QAPP, measuring dissolved oxygen with a meter requires entering the salinity in order to take a measurement. The dissolved oxygen was slightly lower than SCMI's due to the difference in entered salinity. If the dissolved oxygen measurement is assumed to be between our two measurements, the dissolved oxygen results did lie within the 10% required by the QAPP.

Cabrillo Marine Aquarium was not evaluated in the field due to difficulty of scheduling. Their sampling has been evaluated in the past and is overseen by several technical staff at the aquarium, however, and their techniques are efficient and accurate. Their success at QA/QC sessions can be seen by the amount of usable data entered (more valid chemistry data was collected by Cabrillo Marine Aquarium than any other group [see next section]).

SurfRider, Long Beach and Algalita have not been evaluated recently due to lack of consistent sampling programs.

Performed Data Review and Upload

Data was reviewed and entered into SCMI's Excel database until May of 2003, when all data was transferred over to the consolidated Access database for increased accuracy, efficiency,

and data manageability. Larry Cooper at SCCWRP was instrumental in helping accomplish this task, and this database is now comparable with SCCWRP's and Santa Monica BayKeeper's data management system. Heal the Bay and Santa Monica BayKeeper keep up their own databases. Heal the Bay's data has been downloaded from their website and added to the consolidated database, and Santa Monica BayKeeper's data (which includes a massive amount of data from storm drains) is available through Angie Bera.

The consolidated database includes all data collected since June 17, 1998 (the date of the first signed QAPP). Data is separated into tables for chemistry data, microbiology data, and ancillary visual observations. Physical data, such as temperature, color, and turbidity is also found within the chemistry data table. Additional historical data is also located in separate tables in the Access database. Other tables in the database include information on monitoring stations, standards used by SCMI, and instruments used by various organizations. Another table shows the data records that were omitted due to QAPP constraints, questionable stations, and expired microbiology reagents. The criteria used for omitting data can be found in the Data Acceptability Criteria page (Appendix 4). The QA Batch and calibration tables are still being developed, so QA data (precision, accuracy, and completeness) is located in an Excel spreadsheet (Appendix 2). The database contains 95% of the data attempted due to QA omissions, well within the 80% objective under the QAPP. Tables found in Appendix 5 outline statistics of the water quality testing program by category (Table 5.1), parameter (Table 5.2), and group (Table 5.3). By group, Cabrillo Marine Aquarium has collected the most chemistry results during the time period of this grant, and Heal the Bay has collected the most microbiology results (Santa Monica BayKeeper may exceed the microbiology numbers, but their data is not at our disposal).

Data sheets and copies of the Excel database have been transmitted to the Regional Board, but due to their database not being operational, data has not been submitted electronically monthly as originally planned. The complete database is submitted on CD along with this report.

Averages of chemical parameters and microbiological parameters that were measured at least 5 times at the same station were calculated and can be found in separate tables in the Access database. In averaging the microbiological data, for results that were < 10, the value was calculated as 10 MPN/100mL, and for results that were greater than the detection limit, the lowest number known was used (i.e. if answer was >24,196 MPN/100mL, 24,196 was used). A summary of the highest and lowest averages found for each parameter is located in Appendix 5, Table 5.4.

Administered and Managed the Project

Under Project Administration and Management (Task 1), several difficulties were encountered and overcome to complete this project. These difficulties can be broken down into three categories: (a) working with volunteer groups, (b) staff changes at SCMI, and (c) staff changes at the Regional Board and differing instructions and the paper work dealing with the administration of the grant via the Regional Board and State Board.

A. Volunteer Groups

Volunteer groups are just that: volunteers that spend their time to assist in an outside project. These individuals have families, lives, and jobs outside of the volunteer activities. As such, it is often difficult to schedule activities, maintain communications, coordinate activities, and get in contact with people. Maintaining interest is also a major concern. Conversely, many volunteers are dedicated, excited, and wonderful with which to work. But, it does take time to coordinate. We thank them for their participation, dedication and enthusiasm.

B. SCMI Staff

SCMI staff changes, especially in the project director's position, created problems in continuity, knowledge, background, and enthusiasm. The project was well organized at the start by Dominic Gregorio, and Kerry Flaherty (project director from January 2003-end of the contract) taking over near the end brought things together. It was also necessary to make the project director position a full-time staff member.

C. Regional Board and State Board: different instructions from different administrators

The changes in staff at SCMI and the many different project directors at the Regional Board resulted in mass confusion in what was wanted from a reporting and invoicing point of view. The instructions from the Regional Board project managers would often reverse an instruction from a previous manager. And then, the budget officer at the State Board would reverse at decision made at the local level. This was eventually worked out, but it took an unbelievable amount of time. Better communications and instructions from the start of the project would have been very helpful.

The double level of reporting and approving made the whole process difficult. We would recommend that this be discontinued. Either (1) allow the local board representatives to make decisions and approve invoices or (2) have all done by the State Board representative(s). We believe that this process was difficult at all three of the levels, with the Regional Board representative being caught in the middle, and possibly not understanding either side completely.

III. Recommendations

Through this grant, many lessons have been learned and can be translated into valuable recommendations for future efforts in coordinating volunteer monitoring groups. These recommendations can be divided into those for quality assurance and quality control of volunteer data, for volunteer monitoring training, on equipment, and for entering and assessing data.

Recommendations for Quality Assurance/Quality Control of Volunteer Data

There are a few dedicated groups that have consistently participated in QA/QCs, but to make a more comprehensive Los Angeles volunteer monitoring network, more groups need to be recruited. SCMI's role has always been to act as a mentor and trainer for established groups and their participants. Recruiting new member groups would be an area that should be explored in the future to facilitate more participation in QA/QCs.

Many trends were noticed during the QA/QC sessions. There are basically three categories of volunteer groups that we work with: (1) self-sufficient groups, (2) groups that still need some assistance, and (3) groups that need active involvement by SCMI in their monitoring programs. These designations depend on how long the group has been monitoring and on how successful the group has been in retaining trained volunteers. Heal the Bay and Santa Monica BayKeeper (Group 1) are the most self-sufficient of the groups, and basically only need to participate in the QA/QC sessions to check their calibrations and equipment. They have their own training programs, have larger volunteer programs, and have been able to retain several trained volunteers. SurfRider, Huntington/Seal Beach; DIVERS; Cabrillo Marine Aquarium; and Bolsa Chica Conservancy (Group 2) have set monitoring programs and sites, but still need assistance when it comes to calibrating equipment and meeting QAPP objectives. These groups also have a smaller volunteer base for monitoring. Friends of the LA River (FoLAR); Algalita Marine Research Foundation; and SurfRider, Long Beach (Group 3) still need direction from SCMI in their monitoring programs. FoLAR has just recently received and started using their water quality equipment. Their sites are set and several monitoring dates have been completed since receiving their equipment, but a monitoring scheme and QA Plan hasn't been finished yet. Algalita does not regularly sample sites, but does participate in snapshot days and QA/QC sessions. Because of this irregularity in sampling, reagents are often expired when checked at QA/QC sessions, and equipment is frequently out of calibration. SurfRider, Long Beach previously had a very active volunteer monitoring program, but has recently become less involved. They have returned most of their monitoring equipment, but did participate in Coastal Snapshot Day (May 17, 2003).

The self-sufficient groups (Group 1) are highly effective in collecting large amounts of highly accurate data. These groups follow their own strict calibration and QA procedures. These groups should still participate in intercalibrations with other groups to show their accuracy and check their procedures against others. Organizations in Group 2 have the capacity to collect accurate data on a small scale. These organizations still need assistance when it comes to training and quality control procedures. Organizations in Group 3 need to be closely monitored for accuracy in their data. As long as assistance is given where it is needed and QA/QC sessions are attended, accurate data can be easily discerned from unusable data. Also, continued intercalibrations and QA/QCs are necessary to provide quality data to the Regional Board.

Another recommendation relating to QA/QC includes checking standards that volunteer groups use to calibrate their equipment on a regular basis. A survey done after the March 15, 2003 QA/QC session revealed that some groups were using expired standards to calibrate their equipment. SCMI has offered to order standards for the groups, but they must keep track of the expiration dates themselves. Another problem that was identified had to do with the use of different types of standards for calibration. For example, turbidimeters calibrated to Cole-Palmer standards (Heal the Bay) had different read outs than those calibrated to the LaMotte AMCO standards made specifically for the Turbidimeter 2020 that the groups use. LaMotte technical assistance verified that the LaMotte standards are certified standards and correct for inherent differences in the meter. SCMI's suggestion to the volunteer groups in this case is to always calibrate with the standards made for the particular meter.

Evaluations have also served as a great way to refresh monitors on proper procedures in a more intimate setting. Comments about quality assurance measures were easier to broach and implement when in the process of monitoring. We have found that each volunteer group evaluated seemed to feel that their efforts were validated by having SCMI evaluating them at their own sites proving a vested interest in their monitoring program. It was also great to see how each group has its own set procedures and quality checks in the field.

Recommendations for Volunteer Monitoring Training

One of the more difficult tasks in training new volunteers is actually finding people to train. There are a few dedicated volunteer leaders in each member group that complete most of the sampling, so once they are trained, it is hard to find additional interest. SCMI's role has always been to act as a mentor and trainer for established groups and their participants. If only a limited amount of new volunteers are being recruited, our training sessions are very small. Recruiting new member groups would be an area that should be explored in the future to facilitate more participation in training.

Those groups that do not sample on a regular basis should be retrained at least once a year, and groups that are frequently sampling should attend QA/QCs to stay current and attend additional trainings when needed. The Field Guide will help keep previously trained volunteers current in the proper procedures as well.

Recommendations on Equipment

Many of the tests that volunteers do not use regularly (e.g., phenols and nutrient chemicals) had reagents that were expired. The volunteers were told to turn in their old reagents for disposal, and a survey was done on what types of equipment and tests were actually still being used regularly. The nutrient color comparator reagents were also requested back for disposal or storage due to their similarity to the colorimeter reagents. Some groups still do use the nutrient color comparator kits instead of the colorimeter test because of their ease of use in the field. Reagent kits that will be kept include the Modified Winkler Test for dissolved oxygen and the reagents for the colorimeter. Those groups that still use the nutrient color comparators may still order these tests for their own programs.

The reagents used for colorimeters (specifically those that contain mercury and cadmium) were discussed, and volunteer groups were reminded to bring that specific waste to SCMI for proper disposal. For organizations in Groups 2 and 3, this service is extremely valuable, and many of these volunteer groups would not be able to complete these tests without SCMI to dispose of waste chemicals.

When equipment such as the dissolved oxygen meters, pH meters, turbidimeters, and conductivity meters were checked for accuracy, and calibration was done at the QA/QC sessions, there is a definite impression that SCMI or other technical advisors should keep a close eye on volunteer use of this equipment. Using the manuals and appropriate calibration schedules must be strongly emphasized if volunteer groups are to be in charge of these types of meters. The

addition of meters to the volunteer monitoring programs increased the precision with which parameters were measured. When used properly, the dissolved oxygen meters, pH meters, conductivity meters, and turbidimeters yield very accurate and reliable results. The new Lamotte CON-5 meters bought through this grant are more accurate and easier to use, but the inability to measure conductivity in salt water makes them unacceptable for use by those groups monitoring ocean and estuarine sites. Salt water is outside of the range of the conductivity meters, so dilutions must be done. Dilutions increase the possible error in measuring this parameter, and SCMI does not recommend that this be done. Refractometers were used in most cases when the conductivity was too high for the meters, but this method is not as precise as a conductivity meter. New and more expensive conductivity meters that measure the range of conductivity of seawater should be researched and bought to solve this problem.

Recommendations for Entering and Assessing Data

During the project, it was difficult to obtain data from member groups on a consistent and prompt basis. After requesting data, a backlog would then ensue after obtaining data all at once from member groups. A vehicle for submitting data more promptly, such as a website or by email, would be one alternative. Other common problems with data sheets included omitting necessary data, putting down the wrong units, or not writing down the calibration data. As long as the person reviewing the data is diligent, these types of errors can be corrected easily, and if the data is received promptly, the collector can be called for verification. Despite these minor problems, most of the data received under this project is usable, and with a completeness value of 95%, volunteer monitors are proving to be a very cost-effective and efficient way to amass water quality data.

IV. Summary

Though it has been challenging to train and provide quality assurance to volunteer monitoring groups, SCMI believes that volunteer monitoring is a valid way for the State and Regional Boards to collect quality data in a cost effective way. Most of the data points collected by the volunteer monitoring groups participating in this grant were of a quality acceptable by the parameters of the QAPP. This usability is prefaced by the need for an overseeing organization such as SCMI to make sure that the proper quality assurance procedures are being rigorously followed. For groups with fewer resources, such as money for standards, waste disposal, or quality assurance tests, SCMI's role has proved to be a valuable asset by validating their data and providing assistance in other aspects of their programs. SCMI has been rewarded by obtaining a valuable data set to analyze water quality trends and the pleasure of working with such dedicated volunteers. This mutually beneficial relationship will serve to provide quality ambient water quality data to the Regional and State Boards. This ambient water quality monitoring data will serve to assist in Total Maximum Daily Load (TMDL) development and implementation.

V. Appendices

Appendix 1: Complete List of Equipment used by Citizen Monitors

Appendix 2: QA/QC data

Appendix 3: QA/QC Checklist

Appendix 4: Data Acceptability Criteria

Appendix 5: Summary tables of data collected

Appendix 6: Map of Volunteer Sampling Stations

Appendix 1: Complete List of Equipment used by Citizen Monitors

Complete List of Equipment being used by participating citizen monitoring groups		
TEST	**CODE**	**REAGENT/EQUIPMENT**
Nutrients	1919	Colorimeter
Ammonia Nitrogen	3978-H	Salicylate Ammonia #1
	7457-D	Salicylate #2
	7458-C	Salicylate #3
	O699	Spoon, 0.1 g
	O727	Spoon, 0.15
	O354	Pipet, 1.0 mL
Copper	T-3808-H	Copper tabs
Nitrate Nitrogen	V-6278-H	Mixed Acid Reagent
	V-6279-C	Nitrate Reducing re.
D.O.	1905	D.O. meter
D. O. kit	4167-G	Mang. Sulf. Soln.
	7166-G	Alk. Pot. Iod. Azide
	6141WT-G	Sulfuric Acid
	29180	Sample Tube
	28570	Cap
Phenols	7825-C	Aminoantipyrine
	7826-G	Ammonium Hdrx. Soln
	7827-H	Potassium Ferricyanide
	O699	Spoon, 0.1 g
	O352	Pipet, plain
	O354	Pipet, 1.0 mL
Phosphate	V-6282-H	Phosphate Acid Rgnt
	V-6283-C	Phosphate Reducing
	O354	Pipet, 1mL
	O699	Spoon, 1 g
Conductivity	5-0039	Conductivity meter
Salinity	5-0020	Refractometer
Turbidity	1799	Turbidimeter
Color	5907	Forel-Ule color comparator
pH	5-0010	pH meter
	5-0011	pH electrode
	3985-H	buffer 10
	3984-H	buffer 7
	3983-H	buffer 4
Temperature	1066	Thermometer

Appendix 2: QA/QC Data

(see excel spreadsheet QAQC 319)

Southern California Marine Institute
QA/QC Session Results

Group	Date	Instrument ID	Parameter	Units	Standard	Result Rep 1	Result Rep 2	Result Rep 3	Average	Std dev	Precision objective	Precision	Meets Precision?	Accuracy objective	Accuracy	Meets Accuracy?	Comments
Algalita	11/3/2001	COL-SCMI-02	Ammonia N	ppm	2	3	3		3	0	within 0.2	0	pass	within 0.2	0.5	fail	
Algalita	11/3/2001	EC-SCMI-01	conductivity	µS/cm	15	12.9	12.9		12.9	0	within 10%	0%	pass	within 10%	-14%	fail	Calibrated to 15
Algalita	4/12/2002	EC-SCMI-01	conductivity	µS/cm		38.8	36.8	43.3	39.63333333	3.32916406	within 10%	5.0462574%	pass	within 10%	#DIV/0!	#DIV/0!	Calibrated to 15
Algalita	3/15/2003	EC-SCMI-01	conductivity	µS/cm	6668	6680	6720	6680	6693.333333	23.0940108	within 10%	0.5976096%	pass	within 10%	0.379924%	pass	First reading 5760, calibrated for these results
Algalita	11/3/2001	DOM-SCMI-01	Dissolved O2	mg/L	8.6	8.2	8.2		8.2	0	within 10%	0%	pass	within 10%	-4.651163%	pass	
Algalita	11/3/2001	DOW-SCMI-01	Dissolved O2	mg/L	8.6	8.2	8.2		8.2	0	within 10%	0%	pass	within 10%	-4.651163%	pass	
Algalita	4/12/2002	DOM-SCMI-01	Dissolved O2	mg/L					#DIV/0!	#DIV/0!	within 10%	#DIV/0!	#DIV/0!	within 10%	#DIV/0!	#DIV/0!	Turned in to Karin, not working
Algalita	4/12/2002	DOW-SCMI-01	Dissolved O2	mg/L	8.3	7.7	7.7		7.7	0	within 10%	0%	pass	within 10%	-7.228916%	pass	
Algalita	3/15/2003	DOM-SCMI-01	Dissolved O2	mg/L	8.65	8.64	8.56	8.6	8.6	0.04	within 10%	0.9302326%	pass	within 10%	-0.578035%	pass	
Algalita	3/15/2003	DOW-SCMI-01	Dissolved O2	mg/L	8.65	8.8	8.9	8.9	8.866666667	0.05773503	within 10%	1.1278195%	pass	within 10%	2.504817%	pass	
Algalita	4/12/2002	COL-SCMI-02	Nitrate N	ppm	2	2.2	2.2		2.2	0	within 0.2	0	pass	within 0.2	0.1	pass	
Algalita	4/12/2002	COL-SCMI-02	Phosphate	ppm	1	0.5	0.5		0.5	0	within 0.2	0	pass	within 0.2	-0.5	fail	
Algalita	11/3/2001	TB-SCMI-11	Temperature	C	23	23	23		23	0	within 0.5	0	pass	within 0.5	0	pass	
Algalita	4/12/2002	TB-SCMI-11	Temperature	C	19.5	19.5	19.5		19.5	0	within 0.5	0	pass	within 0.5	0	pass	
Algalita	3/15/2003	TB-SCMI-11	Temperature	C	21.5	22	22		22	0	within 0.5	0	pass	within 0.5	0.023255814	pass	
Bolsa Chica	4/12/2002	COL-SCMI-08	Ammonia N	ppm	1	1	1		1	0	within 0.2	0	pass	within 0.2	0	pass	
Bolsa Chica	4/12/2002	DOM-BCC-01	Dissolved O2	mg/L	8.65	8.7	8.82	8.86	8.793333333	0.08326664	within 10%	1.3646702%	pass	within 10%	1.6570328%	pass	
Bolsa Chica	4/12/2002	COL-SCMI-08	Nitrate N	ppm	2	1.87	2		1.935	0.09192388	within 0.2	0.067183463	pass	within 0.2	-0.0325	pass	
Bolsa Chica	4/12/2002	PHEL-BCC-01	pH		8	8	8	8	8	0	within 0.2	0	pass	within 0.2	0	pass	
Bolsa Chica	4/12/2002	COL-SCMI-08	Phosphate	ppm	1	0.99	0.99		0.99	0	within 10%	0%	pass	within 10%	-1%	pass	
Bolsa Chica	4/12/2002	REF-BCC-01	salinity	ppt	36	37			37	#DIV/0!	within 1ppt	1	nap	within 1ppt	0.027777778	pass	
Bolsa Chica	4/12/2002	TB-BCC-01	Temperature	C	22.5	22.2	21.7		21.95	0.35355339	within 0.5	0.022779043	pass	within 0.5	-0.02444444	pass	
Cabrillo Marine Aquarium	11/3/2001	COL-CMA-01	Ammonia N	ppm	2	2.2	2.25		2.225	0.03535534	within 0.2	0.02247191	pass	within 0.2	0.1125	pass	
Cabrillo Marine Aquarium	4/12/2002	COL-CMA-01	Ammonia N	ppm	1	1.41	1.37	1.4	1.393333333	0.02081666	within 0.2	0.028708134	pass	within 0.2	0.393333333	fail	
Cabrillo Marine Aquarium	10/12/2002	COL-CMA-01	Ammonia N	ppm	2	1.84	1.9	1.9	1.88	0.03464102	within 0.2	0.031914894	pass	within 0.2	-0.06	pass	
Cabrillo Marine Aquarium	3/15/2003	COL-CMA-01	Ammonia N	ppm	2.14	2.38	2.42	2.44	2.413333333	0.0305505	within 0.2	0.016574586	pass	within 0.2	0.127725857	pass	
Cabrillo Marine Aquarium	11/3/2001	DOM-CMA-01	Dissolved O2	mg/L	8.4	8.62	8.7		8.66	0.05656854	within 10%	0.9237875%	pass	within 10%	3.0952381%	pass	
Cabrillo Marine Aquarium	4/12/2002	DOM-CMA-01	Dissolved O2	mg/L	8.3	7.42	7.4	7.43	7.416666667	0.01527525	within 10%	0.2696629%	pass	within 10%	-10.64257%	fail	
Cabrillo Marine Aquarium	10/12/2002	DOM-CMA-01	Dissolved O2	mg/L	8.7	8.43	8.48	8.4	8.436666667	0.04041452	within 10%	0.5926511%	pass	within 10%	-3.02682%	pass	Will check membrane
Cabrillo Marine Aquarium	11/3/2001	COL-CMA-01	Nitrate N	ppm	1	1.7	1.24		1.47	0.32526912	within 0.2	0.31292517	fail	within 0.2	0.47	fail	
Cabrillo Marine Aquarium	4/12/2002	COL-CMA-01	Nitrate N	ppm	2	1.76	1.64	1.69	1.696666667	0.06027714	within 0.2	0.070726916	pass	within 0.2	-0.15166667	pass	
Cabrillo Marine Aquarium	10/12/2002	COL-CMA-01	Nitrate N	ppm	1	0.64	0.74	0.73	0.703333333	0.05507571	within 0.2	0.142180095	pass	within 0.2	-0.29666667	fail	New chemicals on order
Cabrillo Marine Aquarium	3/15/2003	COL-CMA-01	Nitrate N	ppm	2.08	2.4	2.05	2.11	2.186666667	0.18717194	within 0.2	0.160060976	pass	within 0.2	0.051282051	pass	
Cabrillo Marine Aquarium	4/12/2002	PHEL-CMA-01	pH		8	7.9	7.9	7.9	7.9	0	within 0.2	0	pass	within 0.2	-0.0125	pass	
Cabrillo Marine Aquarium	10/12/2002	PHEL-CMA-01	pH		7	7	6.8	6.9	6.9	0.1	within 0.2	0.028985507	pass	within 0.2	-0.01428571	pass	
Cabrillo Marine Aquarium	3/15/2003	PHEL-CMA-01	pH		9	9.1	9.1	9.1	9.1	0	within 0.2	0	pass	within 0.2	0.011111111	pass	
Cabrillo Marine Aquarium	4/12/2002	COL-CMA-01	Phosphate	ppm	1	0.34	0.22	0.22	0.26	0.06928203	within 0.2	0.461538462	fail	within 0.2	-0.74	fail	
Cabrillo Marine Aquarium	10/12/2002	COL-CMA-01	Phosphate	ppm	2	2.56	2.7	2.14	2.466666667	0.29143324	within 0.2	0.056756757	pass	within 0.2	0.233333333	fail	
Cabrillo Marine Aquarium	3/15/2003	COL-CMA-01	Phosphate	ppm	1	1.03	1.02	1.03	1.026666667	0.0057735	within 0.2	0.00974026	pass	within 0.2	0.026666667	pass	
Cabrillo Marine Aquarium	10/12/2002	REF-CMA-01	salinity	ppt	36	35	35		35	0	within 1 ppt	0	pass	within 1 ppt	-0.02777778	pass	
Cabrillo Marine Aquarium	11/3/2001	TB-CMA-01	Temperature	C	24	24	24		24	0	within 0.5	0	pass	within 0.5	0	pass	
Cabrillo Marine Aquarium	4/12/2002	TB-CMA-01	Temperature	C	25.2	25.2	25.2		25.2	0	within 0.5	0	pass	within 0.5	0	pass	
Cabrillo Marine Aquarium	10/12/2002	TB-CMA-01	Temperature	C	22	21	22	22	21.66666667	0.57735027	within 0.5	0.046153846	pass	within 0.5	-0.01515152	pass	
DIVERS	4/12/2002	color comparator	Ammonia N	ppm	1	0.75	0.75		0.75	0	within 1	0	pass	within 1	-0.25	pass	
DIVERS	3/15/2003	color comparator	Ammonia N	ppm	2.14	1	1	1	1	0	within 1	0	pass	within 1	-0.53271028	pass	
DIVERS	11/3/2001	EC-SCMI-02	conductivity	µS/cm	15	16.7	16.7		16.7	0	within 10%	0%	pass	within 10%	11.333333%	fail	
DIVERS	4/12/2002	TDSM-SCMI-10	conductivity	µS/cm		50	50	50	50	0	within 10%	0%	pass	within 10%	#DIV/0!	#DIV/0!	
DIVERS	3/15/2003	TDSM-SCMI-10	conductivity	µS/cm	6668	50	50	50	50	0	within 10%	0%	pass	within 10%	-99.25015%	fail	
DIVERS	11/3/2001	DOM-SCMI-02	Dissolved O2	mg/L	8.65	8.2	8		8.1	0.14142136	within 10%	2.4691358%	pass	within 10%	-6.358382%	pass	
DIVERS	11/3/2001	DOW-SCMI-02	Dissolved O2	mg/L	8.65	8.4	8.2		8.3	0.14142136	within 10%	2.4096386%	pass	within 10%	-4.046243%	pass	
DIVERS	4/12/2002	DOM-SCMI-02	Dissolved O2	mg/L	8.3	7.75	7.58	8.15	7.826666667	0.29263174	within 10%	2.1720613%	pass	within 10%	-5.702811%	pass	
DIVERS	3/15/2003	DOM-SCMI-02	Dissolved O2	mg/L	8.7	9.4	9.4	9.4	9.4	0	within 10%	0%	pass	within 10%	8.045977%	pass	
DIVERS	3/15/2003	DOW-SCMI-02	Dissolved O2	mg/L	8.7	9.2	9.2	9.2	9.2	0	within 10%	0%	pass	within 10%	5.7471264%	pass	
DIVERS	11/3/2001	COL-SCMI-03	Nitrate N	ppm	1	1	1		1	0	within 0.2	0	pass	within 0.2	0	pass	
DIVERS	4/12/2002	color comparator	Nitrate N	ppm	2	1.5	1.5		1.5	0	within 1	0	pass	within 1	-0.25	pass	
DIVERS	3/15/2003	color comparator	Nitrate N	ppm	2.08	2	2	2	2	0	within 1	0	pass	within 1	-0.03846154	pass	
DIVERS	3/15/2003	COL-SCMI-03	Nitrate N	ppm	2.08	1.63	1.68	1.71	1.673333333	0.04041452	within 0.2	0.029880478	pass	within 0.2	-0.19551282	pass	
DIVERS	11/3/2001	PHEL-SCMI-09	pH		7	7	7	7	7	0	within 0.2	0	pass	within 0.2	0	pass	
DIVERS	4/12/2002	PHEL-SCMI-09	pH		7	6.9	6.9	6.9	6.9	0	within 0.2	0	pass	within 0.2	-0.01428571	pass	
DIVERS	3/15/2003	PHEL-SCMI-09	pH		9	9.5	9.5	9.5	9.5	0	within 0.2	0	pass	within 0.2	0.055555556	pass	Calibrated to 7, then readings were at 9
DIVERS	11/3/2001	COL-SCMI-03	Phosphate	ppm	1	1.75	1.75		1.75	0	within 0.2	0	pass	within 0.2	0.75	fail	
DIVERS	4/12/2002	color comparator	Phosphate	ppm	1	0.7	0.7		0.7	0	within 1	0	pass	within 1	-0.3	pass	
DIVERS	3/15/2003	color comparator	Phosphate	ppm	1	1	1	1	1	0	within 1	0	pass	within 1	0	pass	
DIVERS	11/3/2001	REF-SCMI-01	salinity	ppt	35	44			44	#DIV/0!	within 1ppt	1	nap	within 1ppt	0.257142857	pass	calibrated to 35
DIVERS	4/12/2002	REF-SCMI-01	salinity	ppt	36	36			36	#DIV/0!	within 1ppt	1	nap	within 1ppt	0	pass	calibrated to 35
DIVERS	3/15/2003	REF-SCMI-01	salinity	ppt	33.4	34	34		34	0	within 1ppt	0	pass	within 1ppt	0.017964072	pass	
DIVERS	11/3/2001	TB-SCMI-12	Temperature	C	22.5	22.5	22.5		22.5	0	within 0.5	0	pass	within 0.5	0	pass	
DIVERS	4/12/2002	TB-SCMI-12	Temperature	C	21.5	19.5			19.5	#DIV/0!	within 0.5	1	nap	within 0.5	-0.09302326	pass	
DIVERS	3/15/2003	TB-SCMI-12	Temperature	C	22	22	22		22	0	within 0.5	0	pass	within 0.5	0	pass	
FoLAR	11/3/2001	DOM-FoLAR-01	Dissolved O2	mg/L	8.4	8.27	8.32	8.29	8.293333333	0.02516611	within 10%	0.6028939%	pass	within 10%	-1.269841%	pass	
FoLAR	4/12/2002	DOM-FoLAR-01	Dissolved O2	mg/L	8.5	8.24	7.99	7.86	8.03	0.19313208	within 10%	3.113325%	pass	within 10%	-5.529412%	pass	
FoLAR	3/15/2003	DOM-FoLAR-01	Dissolved O2	% sat	100	101.5	100.3		100.9	0.84852814	within 10%	1.1892963%	pass	within 10%	0.9%	pass	
FoLAR	4/12/2002	PHEL-FoLAR-01	pH		8	8.4	8.3	8.3	8.333333333	0.05773503	within 0.2	0.012	pass	within 0.2	0.041666667	pass	Calibrated this session to 7 and 10
FoLAR	3/15/2003	PHEL-FoLAR-01	pH		9	9	9	9	9	0	within 0.2	0	pass	within 0.2	0	pass	
FoLAR	11/3/2001	TB-FoLAR-01	Temperature	C	24.5	23	23		23	0	within 0.5	0	pass	within 0.5	-0.06122449	pass	
FoLAR	4/12/2002	TB-FoLAR-01	Temperature	C	23.5	23.5	23.5		23.5	0	within 0.5	0	pass	within 0.5	0	pass	
FoLAR	3/15/2003	TB-FoLAR-01	Temperature	C	22.5	22.75	22.5		22.625	0.1767767	within 0.5	0.011049724	pass	within 0.5	0.005555556	pass	
FoLAR	11/3/2001	TDSM-FoLAR-01	Total dissolved solids			1	1	1	1	0	within 10%	0%	pass	within 10%	#DIV/0!	#DIV/0!	
FoLAR	4/12/2002	TDSM-FoLAR-01	Total dissolved solids	ppm		22	23	22	22.33333333	0.57735027	within 10%	4.4776119%	pass	within 10%	#DIV/0!	#DIV/0!	
FoLAR	3/15/2003	TDSM-FoLAR-01	Total dissolved solids	ppm	1167	917	664		790.5	178.898016	within 10%	32.00506%	fail	within 10%	-32.26221%	fail	don't understand data sheets, adjusted value to 1116?
FoLAR	4/12/2002	TUN-FoLAR-01	Turbidity	NTU	1	1.8			1.8	#DIV/0!	within 10%	100%	nap	within 10%	80%	fail	Calibrated and now reads 1.0 for 1.0 NTU
FoLAR	3/15/2003	TUN-FoLAR-01	Turbidity	NTU	1	0.6	0.6	0.6	0.6	1.0537E-08	within 10%	0%	pass	within 10%	-40%	fail	

Southern California Marine Institute
QA/QC Session Results

Heal the Bay	3/15/2003	COL-SCMI-04	Ammonia N	ppm	2.14	2.25	2.25	2.25	2.25	0	within 0.2	0	pass	within 0.2	0.051401869	pass	
Heal the Bay	3/15/2003	EC-HTB-01	conductivity	mS/cm	6668	6700	6800	6700	6733.333333	57.7350269	within 10%	1.4851485%	pass	within 10%	0.979804%	pass	
Heal the Bay	3/15/2003	DOM-SCMI-03	Dissolved O2	mg/L	8.6	8.35	8.3	8.3	8.316666667	0.02886751	within 10%	0.6012024%	pass	within 10%	-3.294574%	pass	
Heal the Bay	3/15/2003	COL-SCMI-04	Nitrate N	ppm	2.08	2.15	2.19	2.21	2.183333333	0.0305505	within 0.2	0.018320611	pass	within 0.2	0.049679487	pass	
Heal the Bay	3/15/2003	PHEL-SCMI-10	pH		9	9	9	8.9	8.966666667	0.05773503	within 0.2	0	pass	within 0.2	-0.0037037	pass	
Heal the Bay	3/15/2003	COL-SCMI-04	Phosphate	ppm	1	0.99	0.98	0.98	0.983333333	0.0057735	within 0.2	0.010169492	pass	within 0.2	-0.01666667	pass	
Heal the Bay	3/15/2003	TUN-SCMI-03	Turbidity	NTU	1	1	1	1	1	0	within 10%	0%	pass	within 10%	0%	pass	
Surfrider Long Beach	11/3/2001	DOM-SCMI-04	Dissolved O2	mg/L	8.3	7.8	7.8		7.8	0	within 10%	0%	pass	within 10%	-6.024096%	pass	
Surfrider Long Beach	11/3/2001	DOW-SCMI-06	Dissolved O2	mg/L	8.6	5.2	5.2		5.2	0	within 10%	0%	pass	within 10%	-39.53488%	fail	
Surfrider Long Beach	10/12/2002	DOW-SCMI-06	Dissolved O2	mg/L	8.7	6.2	6.2		6.2	0	within 10%	0%	pass	within 10%	-28.73563%	fail	Expired Sodium Thiosulfate.. Buying new one
Surfrider Long Beach	11/3/2001	COL-SCMI-07	Nitrate N	ppm	1	1.6	1.6		1.6	0	within 0.2	0	pass	within 0.2	0.6	fail	
Surfrider Long Beach	4/12/2002	COL-SCMI-07	Nitrate N	ppm	2	2.66	2.62		2.64	0.02828427	within 0.2	0.015151515	pass	within 0.2	0.32	fail	
Surfrider Long Beach	10/12/2002	COL-SCMI-07	Nitrate N	ppm	2	1.63	1.73		1.68	0.07071068	within 0.2	0.05952381	pass	within 0.2	-0.16	pass	Changed mixed acid
Surfrider Long Beach	10/12/2002	PHEL-SCMI-12	pH		7	7.8	7.8		7.8	0	within 0.2	0	pass	within 0.2	0.114285714	pass	recalibrate
Surfrider Long Beach	11/3/2001	COL-SCMI-07	Phosphate	ppm	1	0.95	0.95		0.95	0	within 0.2	0	pass	within 0.2	-0.05	pass	
Surfrider Long Beach	4/12/2002	COL-SCMI-07	Phosphate	ppm	1	1.01	1		1.005	0.00707107	within 0.2	0.009950249	pass	within 0.2	0.005	pass	
Surfrider Long Beach	10/12/2002	COL-SCMI-07	Phosphate	ppm	2	1.86			1.86	#DIV/0!	within 0.2	1	nap	within 0.2	-0.07	pass	
Surfrider Long Beach	10/12/2002	REF-SCMI-03	salinity	ppt	36	36			36	#DIV/0!	within 1 ppt	1	nap	within 1 ppt	0	pass	
Surfrider Long Beach	11/3/2001	TB-SCMI-15	Temperature	C	23	23	23		23	0	within 0.5	0	pass	within 0.5	0	pass	
Surfrider Long Beach	4/12/2002	TB-SCMI-15	Temperature	C	21	21	21		21	0	within 0.5	0	pass	within 0.5	0	pass	
Surfrider Long Beach	10/12/2002	TB-SCMI-15	Temperature	C	22.5	22.5	22.5		22.5	0	within 0.5	0	pass	within 0.5	0	pass	
Surfrider, Huntington/Seal Beach	4/12/2002	COL-SCMI-06	Ammonia N	ppm	1	0.8	0.8	0.8	0.8	0	within 0.2	0	pass	within 0.2	-0.2	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	COL-SCMI-06	Ammonia N	ppm		0.5	0.5	0.5	0.5	0	within 0.2	0	pass	within 0.2	#DIV/0!	#DIV/0!	
Surfrider, Huntington/Seal Beach	3/15/2003	COL-SCMI-06	Ammonia N	ppm	2.14	2.38	2.47	2.47	2.44	0.05196152	within 0.2	0.036885246	pass	within 0.2	0.140186916	pass	
Surfrider, Huntington/Seal Beach	4/12/2002	TDSM-SCMI-14	conductivity	µS/cm		5830	5030	5030	5296.666667	461.880215	within 10%	15.103839%	fail	within 10%	#DIV/0!	#DIV/0!	
Surfrider, Huntington/Seal Beach	10/12/2002	EC-SCMI-03	conductivity	µS/cm		620	720		670	70.7106781	within 10%	14.925373%	fail	within 10%	#DIV/0!	#DIV/0!	
Surfrider, Huntington/Seal Beach	3/15/2003	TDSM-SCMI-14	conductivity	µS/cm	6668	5830	5030	5030	5296.666667	461.880215	within 10%	15.103839%	fail	within 10%	-20.56589%	fail	
Surfrider, Huntington/Seal Beach	11/3/2001	DOW-SCMI-05	Dissolved O2	mg/L	8.6	8.2	8.2		8.2	0	within 10%	0%	pass	within 10%	-4.651163%	pass	
Surfrider, Huntington/Seal Beach	4/12/2002	DOW-SCMI-05	Dissolved O2	mg/L	8.3	8.8	8.8	8.8	8.8	0	within 10%	0%	pass	within 10%	6.0240964%	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	DOM-SROC-01	Dissolved O2	mg/L	8.7	8.4	8.3	8.4	8.366666667	0.05773503	within 10%	1.1952191%	pass	within 10%	-3.831418%	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	DOW-SCMI-05	Dissolved O2	mg/L	8.7	7.5	8		7.75	0.35355339	within 10%	6.4516129%	pass	within 10%	-10.91954%	fail	
Surfrider, Huntington/Seal Beach	3/15/2003	DOM-SROC-01	Dissolved O2	mg/L	8.6	8.6	8.7	8.6	8.633333333	0.05773503	within 10%	1.1583012%	pass	within 10%	0.3875969%	pass	
Surfrider, Huntington/Seal Beach	3/15/2003	DOW-SCMI-05	Dissolved O2	mg/L	8.8	8.8	8.8	8.8	8.8	0	within 10%	0%	pass	within 10%	0%	pass	
Surfrider, Huntington/Seal Beach	4/12/2002	COL-SCMI-06	Nitrate N	ppm	2	2	2	2	2	0	within 0.2	0	pass	within 0.2	0	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	COL-SCMI-06	Nitrate N	ppm	1	1	1	1	1	0	within 0.2	0	pass	within 0.2	0	pass	
Surfrider, Huntington/Seal Beach	3/15/2003	COL-SCMI-06	Nitrate N	ppm	2.08	2.22	2.28	2.28	2.26	0.03464102	within 0.2	0.026548673	pass	within 0.2	0.086538462	pass	
Surfrider, Huntington/Seal Beach	11/3/2001	PHEL-SCMI-13	pH		7	23	23		23	0	within 0.2	0	pass	within 0.2	2.285714286	fail	need new batteries
Surfrider, Huntington/Seal Beach	4/12/2002	PHEL-SCMI-13	pH		7	7.5	7.4	7.4	7.433333333	0.05773503	within 0.2	0.013452915	pass	within 0.2	0.061904762	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	PHEL-SCMI-13	pH		7	7.8	6.6	6.9	7.1	0.6244998	within 0.2	0.169014085	pass	within 0.2	0.014285714	pass	
Surfrider, Huntington/Seal Beach	4/12/2002	COL-SCMI-06	Phosphate	ppm	1	0.1	0.1	0.1	0.1	0	within 0.2	0	pass	within 0.2	-0.9	fail	
Surfrider, Huntington/Seal Beach	10/12/2002	COL-SCMI-06	Phosphate	ppm		0.1	0.1	0.1	0.1	0	within 0.2	0	pass	within 0.2	#DIV/0!	#DIV/0!	
Surfrider, Huntington/Seal Beach	4/12/2002	REF-SCMI-02	salinity	ppt	36	35	35		35	0	within 1ppt	0	pass	within 1ppt	-0.02777778	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	REF-SCMI-02	salinity	ppt	36	35	35		35	0	within 1 ppt	0	pass	within 1 ppt	-0.02777778	pass	
Surfrider, Huntington/Seal Beach	3/15/2003	REF-SCMI-02	salinity	ppt	35.1	33.4			33.4	#DIV/0!	within 1ppt	1	nap	within 1ppt	-0.04843305	pass	
Surfrider, Huntington/Seal Beach	11/3/2001	TB-SCMI-10	Temperature	C	23	23	23		23	0	within 0.5	0	pass	within 0.5	0	pass	
Surfrider, Huntington/Seal Beach	4/12/2002	TB-SCMI-10	Temperature	C	25	24.5	24.5		24.5	0	within 0.5	0	pass	within 0.5	-0.02	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	TB-SCMI-10	Temperature	C	22.5	22.5	22.5		22.5	0	within 0.5	0	pass	within 0.5	0	pass	
Surfrider, Huntington/Seal Beach	3/15/2003	TB-SCMI-01	Temperature	C	21.5	21.6	21.5		21.55	0.07071068	within 0.5	0.004640371	pass	within 0.5	0.002325581	pass	
Surfrider, Huntington/Seal Beach	10/12/2002	TUN-SCMI-04	Turbidity	NTU	0.28	0.27	0.25	0.28	0.266666667	0.01527525	within 10%	7.5%	pass	within 10%	-4.761905%	pass	

Completeness of data for the collection period 1/1/2001-9/30/03

Parameter	Number of Valid Samples	Number of Invalid Samples due to QAPP*	Number of Invalid Samples due to unenterable data**	Number of Invalid Samples due to questionable stations	Number of Anticipated Samples	Percent Completed
Air Temperature	1205	0	0	29	1,234	97.65%
Ammonia Nitrogen	1,502	0	5	32	1,539	97.60%
Conductivity	424	0	5	6	435	97.47%
DO	1,794	23	6	48	1,871	95.88%
Forel-Ule	118	0	8	1	127	92.91%
Nitrate Nitrogen	1,503	52	7	36	1,598	94.06%
OrthoPhosphate	1,522	39	7	35	1,603	94.95%
pH	1,785	0	9	47	1,841	96.96%
Phenols	185	0	5	1	191	96.86%
Salinity	995	0	8	22	1,025	97.07%
Secchi	667	0	10	5	682	97.80%
Silicate	3	0	0	0	3	100.00%
TDS	21	0	0	0	21	100.00%
Transparency	3	0	0	0	3	100.00%
Turbidity	522	0	0	0	522	100.00%
Water Temperature	2,395	0	14	60	2,469	97.00%
Total Coliforms	211	0	18	7	236	89.41%
E. coli	210	0	13	7	230	91.30%
Enterococcus	680	0	0	6	686	99.13%
Coliforms (yes/no)	187	0	0	4	191	97.91%
Totals	**11,044**	**114**	**70**	**346**	**11,574**	**95.42%**

*Results for a parameter for which a participating group failed for accuracy in a QA/QC session were deleted for approximately a month before the failure. Parameters that were measured in inappropriate sampling sites were also deleted.

**Unenterable datasheets were either missing the date or the location. For bacterial analysis, unenterable data was also due to tests done with expired reagents (SurfRider, Huntington Beach/Seal Beach just wanted a general idea of the coliform data.)

Appendix 3: QA/QC Checklist

____ 1. Standards are within the expiration dates.

____ 2. Reagents are within the expiration dates.

The following readings are checked against standards:

____ 3. Temperature readings are within 0.5 degrees C for precision and accuracy.

____ 4. Dissolved oxygen (meter or winkler) readings are within 10% for precision and accuracy.

____ 5. pH meter readings are within 0.2 units for precision and accuracy.

____ 6. Conductivity meter readings are within 10% for precision and accuracy.

____ 7. Salinity meter readings are within 10% for precision and accuracy.

____ 8. Salinity (by refractometer) readings are within 1 ppt for precision and accuracy.

____ 9. Turbidity (by nefelometer) readings are within 10% for precision and accuracy.

____ 10. Transparency (by Secchi disk) readings are within 0.1 m for precision and accuracy.

____ 11. Turbidity (by dual tube optical) readings are within 5 JTUs for precision and accuracy.

____ 12. Ammonia Nitrogen (by colorimeter) is within 0.2 ppm (<2.0) or within 10% (>2) for precision and accuracy.

____ 13. Nitrate Nitrogen (by colorimeter) is within 0.2 ppm (<2.0) or within 10% (>2) for precision and accuracy.

____ 14. Orthophosphate (by colorimeter) is within 0.2 ppm (<2.0) or within 10% (>2) for precision and accuracy.

____ 15. Ammonia Nitrogen (by comparator) is within 0.5 ppm (<2.0) or within 1.0 ppm (>2) for precision and within 1.0 ppm for accuracy.

____ 16. Nitrate Nitrogen (by comparator) is within 1.0 ppm for precision and accuracy.

____ 17. Orthophosphate (by comparator) is within 0.5 ppm for precision or within 1.0 ppm for accuracy.

____ 18. Total Coliform (IDEXX) results are within the 95% confidence limits for precision and within ½ an order of magnitude for a positive standard for accuracy.

____ 19. E. coli (IDEXX) results are within the 95% confidence limits for precision and within ½ an order of magnitude for a positive standard for accuracy.

____ 20. Enterococcus (IDEXX) results are within the 95% confidence limits for precision and within ½ an order of magnitude for a positive standard for accuracy.

Appendix 4: Data Acceptability Criteria

1. Field sheets contain complete information (i.e., date, station ID and description, calibration data, etc.).
Comments: *Very few datasheets were unusable due to no record of the date, station ID and description, or calibration data (see Completeness QA/QC spreadsheet).*

2. Observations/measurements do not contain any questionable data (i.e., check units, decimal places, etc.).
Comments: *The database was checked for simple errors such as decimal placement and improper units. Mistakes were checked against the original datasheets and corrected accordingly.*

3. Proper tests were used for the station type (i.e., salinity for ocean sites, etc.).
Comments: *Conductivity that was measured for saline sites was omitted from the final data set due to the low range available in the conductivity meters supplied. Dilutions made would affect the precision of the instrument.*

4. Group leader has participated in the most recent QA/QC session or has had a recent evaluation.
Comments: *All groups have participated in QA/QC sessions according to their sampling frequency and needs.*

5. Group reagents are within their expiration dates, and proper calibration procedures have been followed.
Comments: *All reagents that were expired were collected and discarded at QA/QC sessions. Any measurements known to have been made with these reagents were omitted.*

6. Group equipment has met precision objectives outlined in the QAPP.
Comments: *All data collected within a month before the QA/QC session where a group failed for precision was omitted from the database (see the Precision and Accuracy QA/QC spreadsheet).*

7. Group equipment has met accuracy objectives outlined in the QAPP.
Comments: *All data collected within a month before the QA/QC session where a group failed for accuracy was omitted from the database (see the Precision and Accuracy QA/QC spreadsheet).*

8. Completeness objectives on the data have been met as outlined in the QAPP.
Comments: *All parameters met completeness objectives.*

Appendix 5: Summary Tables of Data Collected

Table 5.1: General database statistics	
Category	**Number**
Water Chemistry Sampling sites	171
Microbiology Sampling sites	131
Parameters tested	20
Separate Testing dates	674
Volunteer groups/High Schools involved	18

Table 5.2: Number of Results by Parameter	
Parameter	**Number of Results in database**
tblVisualObservations	
Air Temperature	1205
Forel-Ule	118
tblChemistryResults	
Ammonia Nitrogen	1502
Conductivity	424
Dissolved Oxygen	1794
Forel-ule	61
Nitrate Nitrogen	1503
OrthoPhosphate	1522
pH	1785
Phenols	185
Salinity	995
Secchi depth	667
Silicate	3
Total Dissolved Solids	21
Water Temperature	2395
Transparency tube	3
Turbidity	522
tblMicrobiologyResults	
Coliform (yes/no)	187
Total Coliforms	211
E. coli	210
Enterococcus	680

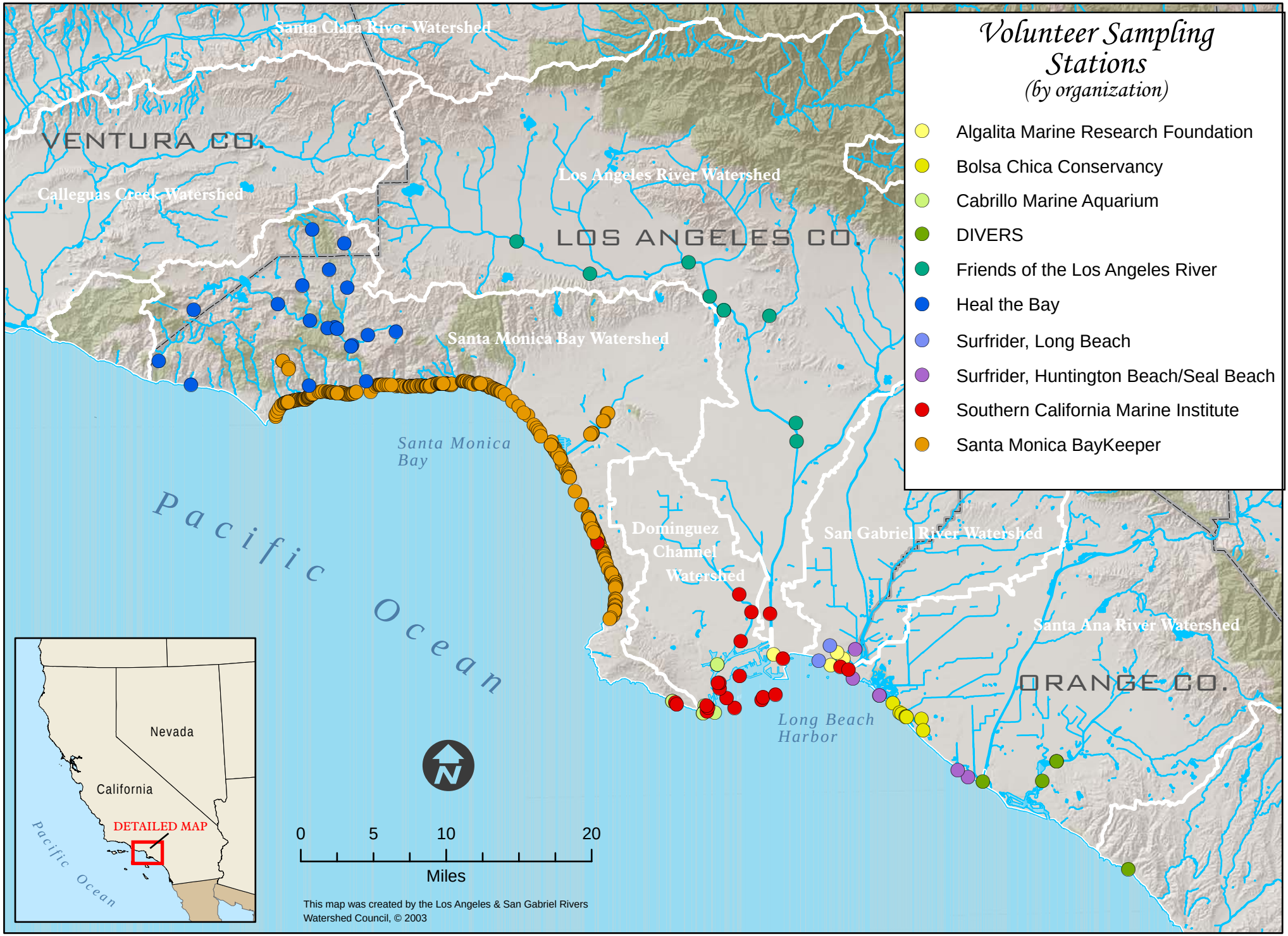
Table 5.3: Number of Chemistry and Microbiology Results by Organization		
Organization	**Number of Chemistry Results**	**Number of Microbiology Results**
Algalita Marine Research Foundation	74	18
Bolsa Chica Conservancy	188	25
City of Calabasas	1	
Cabrillo Marine Aquarium	5774	48
Cypress College	69	19
DIVERS	482	57
Friends of the LA River	136	56
Heal the Bay	3672	536
Jordan High School	36	
Los Alamitos High School	60	6
LAYES	30	
SurfRider, Long Beach	1053	139
Millikan High School	35	3
SurfRider, Huntington/Seal Beach	211	73
Pacific Palisades High School	236	13
Southern California Marine Institute	1086	168
Santa Monica BayKeeper*	100	54
San Pedro High School	73	13
Unknown/Individual	44	60

*This database does not include all of Santa Monica BayKeeper's data.

Table 5.4: Lowest and highest averages by parameter				
Parameter	**Station**	**Lowest Average**	**Station**	**Highest Average**
Water Temperature	Cold Creek Outlet	13.1 degrees Celcius	Bolsa Chica (Wintersberg/outer bay bridge	21.3 degrees Celcius
pH	Triunfo Creek and Arroyo Sequit	6.7	L.A. River at Willow St.	9.4
Conductivity	West Carlysle Creek Reference	510 uS/cm	San Gabriel River mouth	18,419.24 uS/cm
Salinity	storm drain at inner Cabrillo Beach	0.25 ppt	southern inner Cabrillo Beach	35.8 ppt
Dissolved Oxygen	Bolsa Chica (foot bridge, inner bay)	4.56 mg/L	Arroyo Sequit	14.1 mg/L
Secchi depth	Cabrillo saltmarsh	106 cm	one mile south of LA light	9.3 m
Turbidity	Several stations	0 NTU	Tapia R-11 Malibu Lagoon site	6.7 NTU
Ammonia Nitrogen	Several stations	< or = 0	storm drain at Pacific Street	1.68 ppm
Nitrate Nitrogen	Several stations	< or = 0	L.A. River/Rio Hondo	15.0 ppm
OrthoPhosphate	Several stations	< or = 0	storm drain at Pacific St.	2.6 ppm
Total Coliforms	Queen's Gate	41.8 MPN/100mL	L.A. River at Willow St.	20,782.6 MPN/100mL
E. coli	Colorado Lagoon	7 MPN/100mL	L.A. River at Willow St.	3,716.4 MPN/100mL
Enterococcus	downcoast of the Edison Plant	9.98 MPN/100mL	S.G. River mouth	702.3 MPN/100mL

Appendix 6: Map of Volunteer Sampling Stations

(see VolunteerSamplingStations.pdf)


Volunteer Sampling Stations
(by organization)
Algalita Marine Research Foundation
Bolsa Chica Conservancy
Cabrillo Marine Aquarium
DIVERS
Friends of the Los Angeles River
Heal the Bay
Surfrider, Long Beach
Surfrider, Huntington Beach/Seal Beach
Southern California Marine Institute
Santa Monica BayKeeper
Santa Clara River Watershed
VENTURA CO.
Calleguas Creek Watershed
Los Angeles River Watershed
LOS ANGELES CO.
Santa Monica Bay Watershed
Santa Monica Bay
Pacific Ocean
Dominguez Channel Watershed
San Gabriel River Watershed
Santa Ana River Watershed
ORANGE CO.
Long Beach Harbor
Nevada
California
DETAILED MAP
Pacific Ocean
0 5 10 20
Miles
This map was created by the Los Angeles & San Gabriel Rivers Watershed Council, © 2003

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