Quality Assurance Project Plan

For

Lake Elsinore Water Quality Assessment Monitoring Study

Prepared by: Pavlova Vitale, Environmental Scientist

Organization Implementing the Study: Santa Ana Regional Water Quality Control Board

Prepared on: April 8, 2003

Last Updated on:

Approvals:

Pavlova Vitale 4/23/03

Pavlova Vitale, Project Manager - Santa Ana Regional Water Quality Control Board

4/17/03

William Ray, Quality Assurance Program Manager – SWRCB

Richard Gossett, Laboratory Director - CRG Marine Laboratories, Inc.

Michael Machuzak, Laboratory Manager – Aquatic Bioassay and Consultants, Inc.

Project Management

Distribution List

Copies of the approved QAPP and any subsequent revisions will be distributed to the following parties:

Orange County Coast Keeper
CRG Marine Laboratories
Aquatic Bioassay and Consultants
State Water Resources Control Board

A copy of the approved QAPP will also be kept in the Lake Elsinore WQA study file at the Regional Water Quality Control Board for reference and will be made available to the public upon request.

Project Organization

The overall goal of the Lake Elsinore WQA study is to obtain scientifically valid data to assess the water quality in Lake Elsinore. This also provides an opportunity for public outreach including:

- Educating the public about the water quality impacts to Lake Elsinore from anthropogenic activities and encouraging pollution prevention practices;
- Educating the public about the water quality assessment (Clean Water Act Section 305 (b) reports); and
- Encouraging stewardship of the area.

In order to carry out the goal and objectives of this study, the Regional Board will be working with various agencies and contractors including Aquatic Bioassay and Consultants, CRG Marine Laboratories, and the Coast Keeper to carry out the monitoring program. The following outlines the roles of each of the participating parties in this monitoring study:

- Santa Ana Regional Water Quality Control Board's Role:

- Obtain the necessary permits to access the sampling sites and collecting samples
- Collect samples per protocols specified by the Quality Assurance Plan for Bight '98 and the laboratories participating in this study
- Ensure that all necessary chain of custody forms are completed prior to surrendering samples to the laboratory
- Obtain the necessary funding to carry out the study
- Coordinate with all parties involved in the study
- Coordinate with the laboratories conducting analyses for data reporting and payment of analytical services.
- Provide the core monitoring design for the study (list of the sampling sites, list of indicators, map of the study area depicting the sampling sites, etc)

- Provide Petite Ponar grab sampler
- Provide water quality analyzer for water column profiles
- Coordinate with the laboratories for analysis of samples
- Coordinate with the laboratories to obtain data from the analyses

- Coast Keeper's Role:

- Organize community volunteers.
- Assemble informational pollution prevention material for the volunteers
- Coordinate meetings and training sessions with the volunteers
- Provide a registered boat with an A frame and winch

- CRG Marine Laboratory's Role:

- Provide training to regional board staff and volunteers for collection of samples
- Provide the necessary containers, preservatives, chain-of-custody forms for the samples.
- Oversee the sample collection.
- Transport the samples to the laboratory for processing.
- Analyze the samples for sediment and water column chemistry.
- Analyze the data.
- Compile the data and write a report on the conclusions of the study.
- Provide the Regional Board with electronic and hard copies of the data, perform data analyses and provide a written report
- Project Personnel and Roles-

NAME	PROJECT ROLE
Richard Gossett	Project Manager
Misty Borja	QA Officer
Emiko Kobayashi	Trace Organics
Pat Hershelman	Trace Metals
Moy Yahya	Bacteriology

- ABC Laboratory's Role:

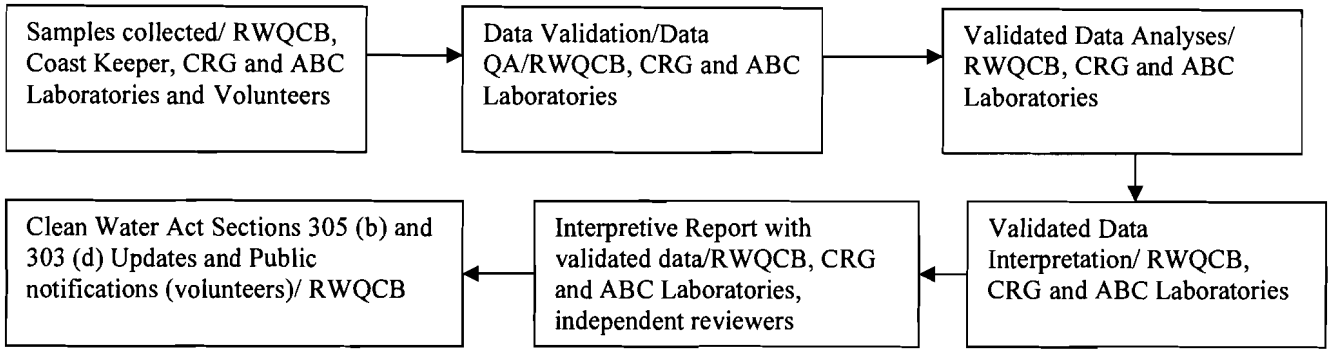
- Provide training to regional board staff and volunteers for collection of samples.
- Provide the necessary containers, preservatives, chain of custody forms for the samples.
- Oversee the sample collection.
- Transport the samples to the laboratory for processing.
- Analyze the samples for water column and sediment toxicity, and benthic infauna.
- Provide the Regional Board with an electronic and hard copies of the data, perform data analyses and provide a written report
- Project Personnel and Roles-

NAME	PROJECT ROLE
Scott Johnson	Project Manager
Michael Machuzak	QA Officer
Phil Ramirez	Toxicity
Scott Johnson	Benthic Ecology

- Volunteers:

- Record data
- Label the sample bottles
- Assist in sample collection

The following flow chart describes the data management flow:



Problem Definition/Background

Lake Elsinore is located approximately 60 miles southeast of Los Angeles and approximately 22 miles south of the City of Riverside. The lake is located within the city of Lake Elsinore in Riverside County, and is a natural low point of the San Jacinto River and its drainage basin. The total drainage basin of the San Jacinto River watershed is approximately 782 square miles. The local tributary area to the lake is approximately 47 square miles.

Lake Elsinore is a shallow lake, its depth ranging from a few feet to approximately 20 feet. Current monitoring data indicates that the lake is well mixed, except during the brief periods of daily stratification. According to the Santa Ana Region's 1995 Basin Plan the beneficial uses designated for Lake Elsinore are body contact and non-body contact recreation, warm fresh water habitat, and wildlife habitat.

Lake Elsinore was included on the 1998 Clean Water Act Section 303(d) list of impaired water bodies for unknown toxicity, low dissolved oxygen, turbidity, and observed algae blooms. Limited amount of data is available to identify the percent area of Lake Elsinore affected by these stressors or to identify additional stressors. The sources of these stressors are currently being studied through the TMDL process. A comprehensive monitoring program is needed to determine the percent area of the lake that meets the water quality objectives and / or beneficial uses in the receiving water bodies in the Santa Ana Region. In the past, monitoring programs

used to prepare the water quality assessments have used sampling and analytical protocols that did not address large-scale questions of the entire water body. Some of these questions involve defining the number of acres, or percent of acreage of that water body that meets a water quality objective (threshold). This type of monitoring program design, defining the percent area meeting a threshold, was used offshore, Anaheim Bay, Huntington Harbor and other bay/harbor regions of Southern California. The monitoring design is a stratified-random sampling design with a spatially systematic component. This design randomly allocates sample sites throughout the water body of interest resulting in an unbiased representation of water quality. Stratification within the water body enables us to compare one sub-region (sub-population or stratum) to another. Consequently, the study design was chosen for the assessment of ambient water quality in the Lake Elsinore.

The goal of this study is to provide the information necessary to adequately assess ambient water quality in Lake Elsinore and to provide a baseline for future studies.

Project/Task Description and Schedule:

Study Design and Objectives:

The overall goal of the study is to attain a comprehensive and current assessment of water quality in Lake Elsinore.

The objectives of this monitoring study are:

- Define the extent (percent of area) and magnitude of deviation from thresholds.
- Describe and depict spatial gradients of contaminants
- Determine seasonal relationships (i.e. dry vs. wet seasons)
- Assess the relationship between biological responses and contaminant exposure
- Compare Lake Elsinore with other Lakes in the Region

Sampling will take place in April and August 2003. These months were chosen to represent ambient water quality during both wet and dry seasons. Sampling in April will allow us to determine the ambient water quality in the wet season after storm events have occurred. The sampling date for April will be chosen so that it does not coincide with a storm event, or immediately after a storm event so that the data will represent a period of time when the indicators are expected to remain stable (ambient water quality).

This monitoring study will involve sampling 30 sites in Lake Elsinore. As stated above, the sampling sites were selected using stratified-random sampling design with a spatially systematic component.

Water Quality Indicators:

The Lake Elsinore Water Quality Assessment Study will measure multiple indicators at each site to relate contaminant exposure with biological response, and habitat conditions. These indicators were selected based on the following:

- The overall objectives of the study,
- The beneficial uses and the water quality objectives listed in the 1995 Basin Plan for the Santa Ana Region,
- The indicators for which a threshold is available

Indicator	Sediment	Water Column
Benthic Infauna Taxonomy	✔	
Toxicity	✔	✔
Aluminum	✔	
Arsenic	✔	
Cadmium	✔	
Chromium	✔	
Copper	✔	
Iron	✔	
Lead	✔	
Manganese	✔	
Mercury	✔	
Nickel	✔	
Silver	✔	
Zinc	✔	
Acenaphthene	✔	
Acenaphthylene	✔	
Anthracene	✔	
Benz[a]anthracene	✔	
Benzo[a]pyrene	✔	
Benzo[b]flouranthene	✔	
Benzo[e]pyrene	✔	
Benzo[g,h,i]perylene	✔	
Benzo[k]flouranthene	✔	
Biphenyl	✔	
Chrysene	✔	
Dibenz[a,h]anthracene	✔	
Flouranthene	✔	
Flourene	✔	
Indeno(1,2,3-c,d)pyrene	✔	
Naphthalene	✔	
Perylene	✔	
Phenanthrene	✔	
Pyrene	✔	
2,6-Dimethylnaphthalene	✔	
1-Methylnaphthalene	✔	
2-Methylnaphthalene	✔	

Indicator	Sediment	Water Column
1-Methylphananthrene	✔	
1,6,7-Trimethylnaphthalene	✔	
Total PAH	✔	
Total Chlordane	✔	
PCB Congeners (41)	✔	
Total PCB	✔	
Total DDT	✔	
4,4'-DDT	✔	
2,4'-DDT	✔	
4,4'-DDD	✔	
2,4'-DDD	✔	
4,4'-DDE	✔	
2,4'-DDE	✔	
Dachtal	✔	
Salinity		✔
Bottom Depth		✔
Light Transmission (turbidity)		✔
Total Suspended Solids		✔
Oxygen Saturation		✔
Bacteria		✔
Visual inspection for sheen (oil & grease)		✔
Total Organic Carbon	✔	
Grain size	✔	
Acid Volatile Sulfides and simultaneously extracted metals (SEM)	✔	
Percent Solids	✔	
Dissolved Oxygen (vertical profile)		✔
pH (vertical profile)		✔
Temperature (vertical profile)		✔
Chlorophyll a (vertical profile)		✔
Specific conductance (vertical profile)		✔

Data Quality Objectives and Criteria for Laboratory Analyses (chemistry):

QA/QC PARAMETER	METALS		ORGANICS	
	DQO	Success	DQO	Success
Holding times	6 months	100%	6 months	100%
Sample loading	15 samples/batch	100%	15 samples/batch	100%
Instrument calibration check frequency	2 times/batch	100%	2 times/batch	100%
Instrument calibration accuracy	<25%/analyte	90%	<25%/analyte	90%
CRM Frequency	1/batch	100%	1/batch	100%
CRM Accuracy	80-120% of cert value	80%	80-120% of cert value	80%
CRM Precision	<30% RSD	80%	<30% RSD	80%
Blank Frequency	1/batch	100%	1/batch	100%
Blank Accuracy	No analyte>3 MDL	100%	No analyte>3 MDL	100%
MS/MSD Frequency	1/batch	100%	1/batch	100%
MS/MSD Accuracy	50-120%	80%	50-120%	80%
MS/MSD Precision	<30% RSD	80%	<30% RSD	80%
Laboratory Dulpicates	1/batch	100%	1/batch	100%

QA/QC PARAMETER	BACTERIA		TOC	
	DQO	Success	DQO	Success
Holding times	6 hours	100%	6 months	100%
Sample loading	20 samples/batch	100%	20 samples/batch	100%
Instrument calibration check frequency	N/A	100%	2 times/batch	100%
Instrument calibration accuracy	N/A	100%	<25%	100%
CRM Frequency	N/A	100%	1/batch	100%
CRM Accuracy	N/A	100%	85-115% of cert value	100%
CRM Precision	N/A	100%	<25% RSD	100%
Blank Frequency	N/A	100%	1/batch	100%
Blank Accuracy	N/A	100%	No analyte>3 MDL	100%
MS/MSD Frequency	N/A	100%	1/batch	100%
MS/MSD Accuracy	N/A	100%	75-125%	90%
MS/MSD Precision	N/A	100%	<30% RSD	90%
Negative or Positive Control	1/batch	90%	1/batch	90%
Laboratory Duplicates	1/batch	100%	1/batch	100%

Data Quality Objectives for Field Data:

QA/QC PARAMETER	PHYSICAL MEASUREMENTS (DO, PH, TEMP, SC)	
	DQO	Success
Completeness	90%	90%
Instrument calibration frequency	Twice each sampling day	100%

Data Quality Objectives and Criteria for Laboratory Analyses (benthic Infauna):

Identification of the benthic infauna will be at the genus and species level.

A voucher collection of specimens identified during these surveys will be maintained at Aquatic Bioassay. 10% of the total number of sorted samples will be subjected to an identification confirmation by the California Department of Fish & Game.

Data Quality Objectives and Criteria for Laboratory Analyses (toxicity):

Static non-renewal toxicity bioassays will be performed on the sediment samples using *Hyallela azteca* and *Chironomous tentans.* The endpoint of the tests will be survival and growth after a 10-day exposure to the sediment sample. All analyses will be performed in accordance with *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*, EPA 600/R-94/024, June 1994.

Static renewal chronic toxicity bioassays will be performed on the water column samples using *Ceriodaphnia dubia* and the endpoint of the analyses will be 7-8 day survival and reproduction and *Pimephales promelas* with an endpoint of analyses of 7-day survival and growth and *Selenastrum capricornatum* with and endpoint of analyses of 96-hour growth. All analyses will be performed in accordance with *Short-Term Methods For Estimating The Chronic Toxicity of Effluents and Receiving Water To Freshwater Organisms*, EPA-600-4-91-002, July 1994.

Data Quality Objectives and Criteria for Field Sampling (toxicity, chemistry, benthic infauna):

A boat will be required for sample collection activities. The boat captain will be an experienced boat handler, and will be certified as having been trained in the safe operation of the boat, preferably holding a captain's license, as well as well-versed in the safe and correct operation of on-board sample collection equipment and processes. The vessel itself shall contain all proper U.S. Coast Guard-required personal floatation devices and other safety gear, have current state registration, and be in good operation and maintenance condition.

The following will be followed during sample collection to ensure that the samples (water and sediment) collected are suitable for laboratory analyses:

- Water toxicity samples will be collected at mid depth of each sampling point.
- Water toxicity samples will be chilled and maintained at 4° C to inhibit microbial degradation, chemical transformations, and loss of highly volatile toxic substances.
- Water toxicity sample containers will be completely filled leaving no air space between the contents and lid to minimize loss of toxicity due to volatilization of toxic constituents.
- Water toxicity sample containers will be rinsed three times with source water before being filled with sample water.
- Sediment samples for toxicity, benthic infauna, and chemistry will be collected using a grab sampler (Petite Ponar). The grab sampler will be a minimum of ca. 2/3's full and the sample will be taken from the entire grab.

- Sediment samples for chemistry will be chilled and maintained at 4° C until delivered to the laboratory to inhibit microbial degradation and chemical transformations. Samples should be delivered to the laboratory within 48 hours and will be frozen at –20°C ± 2°C until processed by the laboratory.
- Sediment samples for chemistry will be filled leaving ca. 1-2cm of headspace to prevent the bottles from breaking when they are frozen.
- Water samples for bacteriology will be collected in pre-sterilized plastic bottles to the 100mL mark on the bottle ensuring that there is some head space in the bottle for mixing. Samples will be collected directly into the sample bottle without rinsing at ca. 10cm below the surface of the water either using a pole or a gloved hand.

Analytical Methods for the laboratory analyses

Analyses	Media	Analytical Method
PAHs, PCBs, and Chlorinated Pesticides by GCMS	Sediment	SW846 – 3545/8270
Metals by ICPMS	Sediment	SW846 – 3051/6020
Grain Size	Sediment	Plumb, 1981 or Laser Particle Counter
Acid Volatile Sulfides	Sediment	Plumb, 1981/SM4500-S2-D
Fecal, Total coliforms and Enterococci	Water	Standard Methods 9221 E, 9221B, Enterolert
Toxicity	Sediment	EPA Methods 100.1 and 100.2
Toxicity	Water	EPA Methods 1000.0, 1002.0, 1003.0
Benthic Identification	Sediment	California Lentic Procedure
DO, pH, Temp, SC, TDS, Total Chlorophyll	Water	Field measurement YSI 6920 probe

Special Training and Permits:

Training of Volunteers

Volunteers will be trained on safety awareness, and field collection methods. The training will take place at the Regional Water Quality Control Board's office in Riverside. All sampling equipment (*e.g.,* field instruments and field data equipment), and all pertinent sample collection protocols will be used extensively during "hands-on" training sessions (actual field sample collection trips). By the end of the sampling training trip(s), all crew members must demonstrate proficiency in all the required sampling activities, as certified by the Chief Scientist for the training session(s), as documented in training records developed and maintained for all SWAMP field and lab personnel.

Fish and Game Sample Collection Permit

This project requires a Scientific Collection Permit from the Department of Fish and Game because this project involves collecting benthic infauna. The permit will be available upon request at any time during the sampling activities.

Documents and Records:

The final result of implementing the Lake Elsinore WQA study is a report that will detail the findings and conclusions of the study. Consequently, proper documentation of each activity dealing with the generation of data and the interpretation of data is crucial. Documentation of each activity will take place as follows:

1. QAPP Updates

Revisions to this QAPP must be reviewed and approved by the same persons reviewing and approving this version. Any revisions cannot be implemented until the revised QAPP is approved. To ensure that all parties involved in the Lake Elsinore WQA study have the most current version of this QAPP, each page of the QAPP will be marked on the upper right hand corner with the date and the words draft or final as applicable. The electronic file will also be stored on the C drive of the Project Manager's computer under Lake Elsinore WQA and the file will be renamed each time a correction is made to include the date of the correction on the file name. In addition, the project manager will be responsible for updating the QAPP.

2. Sample Collection Records

At each sample collection location field data sheets will be completed immediately after the sample has been collected and prior to moving to another sampling location. The field data sheet will contain the names of each person collecting and processing the samples, dates and times of the sampling events, the unique sample number and sampling site number, a description of the sampling equipment and sampling methods used, climactic conditions, any other observations related to the sampling event, and signature of the person completing the field data sheets. The benthic infauna samples require that the organisms be placed in relaxing solution for a specific amount of time prior to sending them to the laboratory. The field data sheet will then include the amount of time the organisms were in relaxing solution and the amount of relaxing solution placed in the container. The field data sheet format that will be used is included in Appendix A

3. Sample Labels

Each sampling container used will have two labels (only for benthic infauna samples). One label will be affixed to the face of the bottle and the second label will be placed inside the container after the sample has been placed in the container. Both of these labels will have the same information and will be completed in pencil at the time each sample is collected. The caps of each container will also be marked with similar information as the labels. The information on the labels and the caps will include:

Date of sample collection
Time of sample collection
Sample ID
RWQCB – 8
One of the following: Sed Chem, Sed Tox, Benthic ID, Water Tox,

The label that will be used for the Lake Elsinore WQA study is included in Appendix B.

4. Chain of Custody Records

At the end of each sampling day, all the samples collected will be sent to the laboratory responsible for analyzing the samples. All samples will include a completed chain-of-custody form. The chain-of-custody form that will be used is attached in appendix C.

5. QC Sample Records:

QC records provided by the laboratories will be used to ensure that the data meets all the QC guidelines stated in this document. These records will be kept on file at the Santa Ana Regional Water Quality Control Board.

7. Corrective Action Records:

Any analyses not conforming to the QC guidelines in this document will be considered for retesting.

8. Data Verification Records:

All data generated will be reviewed against the QC guidelines prescribed in this document to ensure its validity. Data reviews and calculations will be documented and kept on file at the Santa Ana Regional Board. If the data passes all the QC checks, then the data will be used for analyses, interpretation and report writing.

Data Generation and Acquisition

Sampling Process Design:

The Lake Elsinore WQA study will involve collection of samples at 30 locations in Lake Elsinore. The sampling sites were selected using stratified-random sampling design with a spatially systematic component. A list of the sampling sites is included in Appendix D. These 30 sites were allocated to ensure that 95% confidence interval is no larger than 15% of the subpopulation area assuming about 20% impairment.

Sampling sites were selected randomly, rather than by investigator pre-selection, to ensure representative sampling. The number of sites in Appendix D exceeds the original sites by 50%. The reason for the increase is that it may not be possible to sample all of the randomly selected sites because of improper substrate type, depth restrictions, or dredging activities. To prevent an

unacceptable loss of statistical power due to lost samples the number of sites allocated was increased by 50%.

Although sites were selected randomly, a systematic component was added to the selection process to minimize clustering of sample sites. The systematic component was accomplished using an extension of the sampling design used in the Southern California Coastal Bight Pilot Project and in EPA's Environmental Monitoring and Assessment Program (EMAP). A hexagonal grid was placed over a map of the sampling area. The hexagonal grid structure ensures systematic separation of the sampling, while the random selection of sites within grid cells ensures an unbiased estimate of ecological condition.

Water bodies are complex systems. Sediments interact with the water column. The interaction includes deposition of heavy metals, organic chemicals, phosphorus and nitrogen into the bottom sediments. The interaction can also include re-suspension of these materials from the sediment into the water column. The interaction may take place as a result of changes in pH, dissolved oxygen, temperature, and wave patterns among others. This interaction may include the potential release of various forms of nitrogen, phosphorus, soluble metals, and organic materials such as pesticides into the water column. Sediments are also habitats for various organisms, which in turn are predated by higher organisms.

As a result of this interaction and to assess the overall water quality of Lake Elsinore, this study includes sampling and analyses of the sediment and the water column. In addition, the status of the organisms residing in the sediments will be investigated to gain an overall picture of the interaction between the water column and the sediments and help determine the impact on the sediment dwelling organisms. Comparison of the sediment chemistry, biology, and toxicity with water column measurements and toxicity consist of the weight of evidence approach to water quality assessment.

Throughout the study, two sampling periods will be used. Each sampling period will consist of 3 days to ensure that the proper number and types of samples are collected. The first time the samples are collected will be in August to represent dry season conditions in Lake Elsinore. The second time samples are collected will be in late April to represent wet season conditions in Lake Elsinore. The sampling sites will be located by using a dGPS unit accurate to the +/- meters. Once the sampling site has been located, the samples will be collected in order.

Sampling Methods:

Uniform sampling and analytical methods will be conducted throughout Lake Elsinore. The sampling method that will be used to collect the benthic infauna will be as described in the California Lentic Bioassessment Procedure. The sampling methods used to collect the sediment chemistry samples and sediment toxicity samples will follow the EPA procedures found in *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*, EPA 600/R-94/024, June 1994. The sampling methods used to collect the water column toxicity samples will follow the EPA procedures found in *Short-Term Methods For Estimating The Chronic Toxicity of Effluents and Receiving Water To Freshwater*

Organisms, EPA-600-4-91-002, July 1994. Toxicity data will be correlated with chemistry and benthic infauna data for sediments and with chemistry for water column samples.

Sampling methodologies specified in the Lake Elsinore Water Quality Assessment Study Sampling Field Plan will be followed to ensure that uniform and consistent methods are followed that will yield high quality of the data.