Watershed Assessment for the Santa Ana Region for FY 03-04 through FY 08-09

1. Long-term (5 year) Plan:

The goal of the Surface Water Ambient Monitoring Program for the next five years in the Santa Ana Region is to determine the percent area of a given water body that meets water quality standards. Each water body has been pre-selected by Regional Board staff and the sampling points have been pre-determined by a statistician using a randomized sampling design (see Table 1). These water bodies will be sampled during wet and dry seasons to allow for comparisons of water quality between these two periods. Furthermore, these water bodies will be re-sampled every five years to determine if over all water quality has changed.

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

Table 1: Monitoring Objectives for each fiscal year

Fiscal Year:	Water Bodies to be Monitored:	Beneficial Uses:	Monitoring Objective:
2000-01	Anaheim Bay and Huntington Harbor	Anaheim Bay: contact and non-contact recreation; navigation; biological habitat of special significance; wildlife habitat; rare, threatened or endangered species habitat; fish spawning; and marine habitat Huntington Harbor: Navigation; contact and non contact recreation; wildlife habitat; rare, threatened or endangered species habitat; fish spawning; and marine habitat	Are aquatic populations , communities protected? Does the water quality meet the non- body contact beneficial use? Does the water quality meet the body contact beneficial use?
2001-02	Completion of Anaheim Bay, and Huntington Harbor and beginning of sampling work for Lake Elsinore	Lake Elsinore: body contact and non-body contact recreation, warm fresh water habitat, and wildlife habitat	Does the water quality meet the body contact, non body contact , and habitat beneficial uses?

Fiscal Year:	Water Bodies to be Monitored:	Beneficial Uses:	Monitoring Objective:
2002-03	Completion of Lake Elsinore and beginning of Canyon Lake sampling work	Canyon Lake: Municipal water supply, agricultural water supply, ground water recharge, body contact and non-body contact recreation, warm water habitat, and wild life habitat.	Does the water quality meet the body contact, non-body contact and habitat beneficial uses? Does the water quality meet the municipal water supply beneficial use?
2003-04	Completion of Canyon Lake and beginning of Big Bear Lake sampling work	Big Bear Lake: Municipal water supply; agricultural water supply; ground water recharge; body contact and non-body contact recreation; warm water habitat; rare, threatened or endangered species habitat; and wild life habitat.	Does the water quality meet the body contact, non- body contact, and habitat beneficial uses? Does the water quality meet the municipal water supply beneficial use?
2004-05	Completion of Big Bear Lake sampling work, beginning of sampling design for streams in the Santa Ana Region	N/A	N/A
2005-06	Beginning of sampling work in streams	Streams:	
2006-07	End of sampling work in streams, beginning of sampling work in Anaheim Bay and Huntington Harbour	See above	
2007-08	Completion of sampling work in Anaheim Bay and Huntington Harbour, beginning of sampling work in Lake Elsinore	See above	
2008-09	Completion of sampling work in Lake Elsinore and beginning of	See above	

Fiscal Year:	Water Bodies to be Monitored:	Beneficial Uses:	Monitoring Objective:
	sampling work in Canyon Lake		
2009-10	Completion of sampling work in Canyon Lake beginning of sampling work in Big Bear Lake	See above	
2010-11	Completion of sampling work in Big Bear Lake and beginning of sampling work in streams	See above	

2. Annual Plan: Canyon Lake Water Quality Assessment Monitoring Study

Introduction:

During fiscal years 00-01 SWAMP funds were utilized to study Anaheim Bay and Huntington Harbour and data analyses is currently under way. Lake Elsinore was studied during fiscal years 01-02 and 02-03. This document describes the monitoring study that will be implemented in Canyon Lake using SWAMP funds allocated to the Santa Ana Region during fiscal year 03-04.

Canyon Lake:

Canyon Lake was constructed in 1928 by the installation of the Railroad Canyon Dam in the San Jacinto River. As a result Canyon Lake is sometimes known as the Railroad Canyon Reservoir. It is located about 1 mile upstream of Lake Elsinore and water spilled from Canyon Lake is a main source of water for Lake Elsinore. Canyon Lake is a small reservoir with an approximate area of 383 acres. Due to the dam and its upstream position relative to Lake Elsinore, Canyon Lake intercepts a variety of contaminants such as nutrients, and sediment.

Canyon Lake is Y shaped. One of its legs receives runoff from Salt Creek and has a mean depth of approximately 7 feet deep. The water that drains into Salt Creek includes runoff from residential, open space and agricultural landuses. The rest of Canyon Lake receives runoff from the San Jacinto River and has an approximate mean depth of 30 feet (40-45 feet in depth near the dam). The watershed that drains to the San Jacinto River includes urban, agricultural, and open space landuses. According to the Santa Ana Region's 1995 Basin Plan the beneficial uses designated for Canyon Lake are body contact and non-body contact recreation, warm fresh water habitat, and wildlife habitat, ground water recharge, municipal water supply, agricultural water supply. The benthic

infauna survey component of this study will provide information on the types of habitat that Canyon Lake currently supports.

Canyon Lake was included on the 1998 Clean Water Act Section 303(d) list of impaired water bodies due to excessive nutrients and pathogens. Limited amount of data is available to identify the percent area of Canyon Lake 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.

Existing Data Review:

Analyses of existing water quality data indicate that total and fecal coliform concentrations periodically exceed the Santa Ana Region's Basin Plan water quality objectives for lakes and streams. Total and fecal coliforms are indicators of pathogens in the water column. The source of these coliforms to Canyon Lake is not clear, however; data indicates that high concentrations frequently coincide with large storm events, although recreators may also be an important source of coliform and pathogens to the lake. Currently, TMDL monitoring activities are underway to determine the sources and loadings of bacteria to Canyon Lake. Therefore, this monitoring study will not include a bacteria component.

Focus of Work

This study focuses exclusively on determining the percent area of Canyon Lake that meets the standards or thresholds. The beneficial use that will be studied through this water quality assessment will be warm fresh water habitat (toxicity, chemistry and benthic infauna). A map of the study area is included in Appendix B. Body contact and non- body contact recreation will be studied through the pathogen TMDL currently under way. Tributaries to Canyon Lake are currently being studied during the source analyses of the TMDL process.

Study Design and Objectives

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

The objectives of this monitoring study are:

- Define the extent (percent of area) and magnitude of deviation from thresholds as these relate to beneficial uses and water quality objectives.

- 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 the ambient water quality at Canyon Lake with the ambient water quality at Lake Elsinore and Big Bear Lake (studies in Lake Elsinore are in the sampling preparation stages and scheduled to begin in August 2002 and studies in Big Bear Lake are to be done in later years).

Sampling will take place in February and August 2004. These months were chosen to represent ambient water quality during both the wet and dry seasons. Sampling in February will allow us to determine the ambient water quality in the wet season after storm events have occurred. The sampling date for February 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 60 sites in Canyon Lake (thirty sites per strata). Table 3 lists the sampling sites in Canyon Lake. The sampling sites were selected using stratified-random sampling design with a spatially systematic component. Thirty sites were allocated per strata to ensure that the 95% confidence interval is no larger than 15% of the sub-population area assuming about 20% impairment.

Sampling sites were selected randomly, rather than by investigator pre-selection, to ensure representative sampling. The number of sites for Canyon Lake exceeds the original 30 sites per strata 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 element was accomplished by 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. In the field, the stations will be located by using a hand held GPS unit.

Indicators

The Canyon Lake Water Quality Assessment Study will measure multiple indicators (Table 1) 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, and
- The indicators known or suspected to be exceeded in Canyon Lake.

Beneficial Use	Regional Monitoring Objectives[1]	Category	Indicator
Aquatic Life	11, 12, 13, 14, 15, 16, and 17	Biological response[2]	Total Chlorophyll
			Benthic infauna (organisms that live in sediment.)
			Sediment toxicity
			Water column toxicity
Aquatic Life		Pollutant exposure	Acid volatile - sulfides/simultaneously & extracted metals
			Debris
			Organic and inorganic sediment chemistry
			Total organic carbon
			Nutrients
			Turbidity
Aquatic Life		Habitat	Dissolved oxygen
			Sediment grain size and gradations
			Water temperature
			Electrical conductivity
			Salinity
			Hydrogen sulfide
			Ammonia

Sampling and Analyses Methods

Uniform sampling and analytical methods will be conducted throughout Canyon Lake. Toxicity data will be correlated with chemistry and benthic infauna data for sediments and with chemistry for water column samples.

- Sediment Chemistry:

  Chemical analyses of the sediment samples provide an assessment of chemical deposition. Sediment chemistry will allow us to determine the concentrations of chemicals that are present and their bioavailability. (If these chemicals are not in bioavailable form then they are of no biological concern). Sediment samples will be collected from the top 2cm using a Petite Pulnar grab sampler. A list of the analyses that will be performed on the sediment samples is on Table 3. Sediment chemistry samples will be collected and analyzed in February and August 2004.

- Sediment Toxicity:

[1] The number refers to the monitoring objective discussed previously under regional monitoring approaches. Please see page 13 for an explanation of the numbers.
[2] While the assessment of invasive species is not a focus of SWAMP, these organisms will very likely be identified when biological community measurements are made.

Sediment toxicity will allow us to determine if there is a direct impact to the exposure of the chemicals found in the sediment. Sediment samples for toxicity analyses will be collected from the top 2cm using a Petite Pulnar grab sampler. *Hyallela azteca* and *Chironomous tentans* sediment bioassays will be conducted on the 60 sediment samples collected in February and August 2004 from Canyon Lake. The endpoint of the test is survival and growth after a 28 - day exposure to the sediment sample.

- Benthic Infauna:

  Benthic infauna (organisms that live in the sediment) are an important part of the marine food web. They generally reside in one location for most of their life and are chronically exposed to sediment contaminants. Consequently, benthic infauna are excellent indicators of environmental water quality. Samples for infauna analyses will be taken using a Petite Pulnar grab sampler. The benthic infauna analyses will consist of sorting and taxonomic identification, to the species level, of the organisms found in the sediment. The sediment samples will be collected using a Petite Pulnar grab sampler and sieved in the field to 1.0 mm. The benthic infauna samples will be collected in February and August 2004. In absence of a reference condition for Canyon Lake, the benthic infauna data will be used to compare one season to another and for comparison with future benthic infauna analyses.

- Water Column Chronic Toxicity:

Water column samples will be collected using a water-column depth integrator sampler. *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornatum* survival and reproduction/growth toxicity tests will be performed on undiluted samples collected from Canyon Lake in February and August 2004. The chronic toxicity analyses will include all required reference toxicant testing on the three species listed above. The endpoints for these analyses are as follows:

Species Tested	End point of Analyses
Ceriodaphnia dubia	(7±1 or 6-8) day survival and reproduction
Selenastrum capricornatum	96 hour growth
Pimephales promelas	7 day survival and growth

- Water Column Field Measurements:

  As stated above, the interaction between the water column and the sediment results from changes in physical parameters such as pH, dissolved oxygen, and temperature. Therefore, it is important to measure these parameters during the sampling activities. A YSI 6920 multi-parameter probe will be used to measure pH, dissolved oxygen, temperature, pH, salinity, bottom depth, turbidity, total suspended solids, and chlorophyll a. The multi-parameter probe will be calibrated the same day as the sampling activities. These measurements will be taken in February and August 2004.

Responsible Parties

The overall goal of this study is to obtain statistically significant data that is scientifically valid to assess the water quality in Canyon Lake. There is also an opportunity for public outreach including:

1) educating the public about the water quality impacts to the bay and harbor from anthropogenic activities,
2) informing the public of the water quality assessment report, and
3) 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 ABC Laboratories, CRG Marine Laboratories to carry out the monitoring program. The following outlines the roles of each of the participating parties in this monitoring study:

Participants in this water quality source analyses monitoring program include Regional Water Quality Control Board staff who will collect the samples and conduct the field measurements, City of Canyon Lake and Elsinore Valley Municipal Water District staff who will facilitate entrance to the lakes for collection of samples.

- 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 statewide-SWAMP QAPP.
  - 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 State Water Resources Control Board and the Department of Fish and Game and CRG Marine Laboratories and ABC Laboratories for data analyses and payment of analytical services.
  - Obtain Petite Pulnar grab sampler.

- City of Canyon Lake's Role:

  - Facilitate entrance to Canyon Lake for sampling.

- SCCWRP's Role:

  - 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). This has already been provided.
  - Provide a repository for data storage

- 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 chemistry, and water column chemistry.

- 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.

- Volunteers:

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

- State Water Resources Control Board Volunteer Monitoring Coordinator:

  - Assist Regional Board staff in training sessions of volunteers and participate in the sampling activities as needed.

The following table depicts the working relationships pertaining to the study.

Task	Responsible Organization		
	SWRCB	RWQCB	Contractor
Develop contract(s) for monitoring services.	●	●	●
Identify water bodies or sites of concern and clean sites to be monitored.		●	
Identify site-specific locations with potential beneficial use impacts or un-impacted conditions that will be monitored.		●	
Decide if concern is related to objectives focused on location or trends of impacts.		●	

Task	Responsible Organization		
	SWRCB	RWQCB	Contractor
Select monitoring objective(s) based on potential beneficial use impact(s) or need to identify baseline conditions.		●	
Identify already-completed monitoring and research efforts focused on potential problem, monitoring objective, or clean conditions.		●	●
Make decision on adequacy of available information.		●	●
Prepare site-specific study design based on monitoring objectives, the assessment of available information, sampling design, and indicators.	● (Work Plan Review Role)	●	●
Implement study design. (Collect and analyze samples.)			●
Track study progress. Review quality assurance information and make assessments on data quality. Adapt study as needed.	● (Review Role)	●	●
Report data through SWRCB web site.	●	● (Coordination Role)	●
Prepare written report of data.	●	●	●

Equipment:

The boat necessary for the study will be equipped with a winch capable of handling the Petite Pulnar grab sampler. ABC Laboratories will supply the boat. The Petite Pulnar grab sampler will be used to collect the sediment samples for benthic infauna characterization, sediment chemistry, and sediment toxicity analyses. The water column samples will be collected using a depth integrator sampler that collects a composite sample of the water column. Field measurements of the water column will be taken by using a YSI 6920 multi-parameter probe. The probe will be calibrated the same day the measurements will be taken. Calibration date and measurements will be recorded in a waterproof field log. While on the boat, the locations will be verified by using a handheld GPS.

Chain of Custody and Field Methods

The Regional Board will be responsible for tracking all samples collected during the study. Chain of custody forms will be used to track each sample from the time it is collected to its final destination in the laboratory. The field crew will complete a chain of

custody form in duplicate for each set of samples to be transferred to the laboratory. This form will be signed by the crewmember transferring the samples. Subsequently, the laboratory staff member will sign the chain of custody form. A copy of the chain of custody form will be kept in the Regional Board Canyon Lake Water Quality Assessment 2004 File and the original will accompany the samples.

Quality Assurance and Quality Control

Quality assurance/quality control (QA/QC) is an important part of any environmental monitoring project. A carefully planned QA/QC program ensures that the data collected are scientifically valid and adequate to meet the goals of the study.

Quality assurance activities for the study include but are not limited to:

- Standardization of sample collection, processing, and analytical methods
- Training workshops for field personnel by CRG Laboratories and ABC Labs.
- Development of a QAPP that is consistent with the SWAMP QAPP.

The quality control activities are outlined below:

- CRG Marine Labs and ABC Labs staff will be present during the sample collection activities to ensure that the samples are collected in accordance with the state wide SWAMP QAPP protocols.

- Sample processing and analyses will follow the statewide SWAMP QAPP.

- In the laboratory, the quality control activities will consist of reference matrix samples, spiked samples laboratory duplicates and blanks at a frequency of 10% of all the batch of samples analyzed. Also, initial calibration verification and continuous calibration verification will be performed. The continuous calibration verification will be done at a frequency of 10% of the samples analyzed. Please see attachment C for method detection limits.

Data Management and Data Availability

All data will be entered into the database developed and designed for SWAMP via SCCWRP. Field and laboratory data will be reported to SCCWRP by CRG Marine Laboratories and ABC Laboratories for input into their database in accordance with the Bight '98 Information Management Plan. SCCWRP will store the data in the same database structure that was developed and used in the Bight '98 Monitoring Survey.

All data from this study will be available to the public via the Santa Ana Regional Water Quality Control Board's website (WWW.SWRCB.CA.GOV/RWQCB8).

Project Reporting

A water quality assessment report, in draft form, specific to Canyon Lake describing the conclusions of the study will be available through the Regional Board's website for review and comment. The reports will also be disseminated for peer review. The final report will address any comments received and will be available to the public through the Regional Board's website.

Deliverable Products:

The deliverable for this project will include the sample results in electronic format and in hard copy format from the analyses of sediment and water column samples from Canyon Lake and a report that will be prepared in conjunction with Regional Board staff for the interpretation of the data. Regional Board staff will submit the report with the findings to State Board SWAMP staff as a deliverable.

Sample Collection Dates and Laboratory Reporting:

The sampling dates for Canyon Lake will depend on the timeliness of the approval of the contract for this project. The desired sample collection dates are February and August 2004. The milestones for this study will include generation of a draft report (December 2004), peer review of the draft report (January 2004), finalizing the draft report (February 2004), and submittal of the draft report to the State Board and release of the report to the public (April 2004).

Budget:

The total cost for the Canyon Lake Water Quality Assessment Monitoring Study will be $336,600. Depending on the availability of funds and the possibility of using funds from the TMDL program, the study will be scaled to try to fit the available funding.

Indicators:

Indicator	Sediment	Water Column
Benthic infauna taxonomy	✔	
Toxicity	✔	✔
Arsenic	✔	
Cadmium	✔	
Chromium	✔	
Copper	✔	
Iron	✔	
Lead	✔	
Mercury	✔	
Nickel	✔	
Silver	✔	
Zinc	✔	
Acenaphthene	✔	

Indicator	Sediment	Water Column
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-Methylnapthalene	✔	
1-Methylphananthrene	✔	
1,6,7-Trimethylnaphthalene	✔	
LMW PAH's	✔	
HMW PAH/s	✔	
Total PAH/s	✔	
Chlordane	✔	
PCB Congeners	✔	
Total DDT	✔	
4,4'-DDT	✔	
2,4'-DDT	✔	
DDT	✔	
4,4'-DDD	✔	
2,4'-DDD	✔	
DDD	✔	
4,4'-DDE	✔	
2,4'-DDE	✔	
DDE	✔	
Salinity		✔
Bottom Depth		✔
Light Transmission (turbidity)		✔
Total Suspended Solids		✔
Oxygen Saturation		✔
Bacteria		✔
Visual inspection for sheen (oil & grease)		✔
Total Organic Carbon	✔	
Grain size	✔	

Indicator	Sediment	Water Column
Acid Volatile Sulfides and simultaneously extracted metals (SEM)	✔	
Percent Solids	✔	
Dissolved Oxygen (vertical profile)		✔
pH (vertical profile)		✔
Temperature (vertical profile)		✔
Chlorophyll a (vertical profile)		✔
Aluminum		
Manganese		
p'p' DDD		
p'p' DDE		
p'p' DDT		
dachtal		
Total chlordane		
Total PCB		
Specific conductance (vertical profile)		✔

3. Intra-agency and Interagency Coordination Activities:

Task	RWQCB Program	Outside Agency/Contractor
Water Contact and Non contact Recreation	TMDL program	N/A
Benthic Communities	SWAMP – Reg 8	
Sediment Chemistry	SWAMP – Reg 8	
Sediment Toxicity	SWAMP – Reg 8	
Water Column Toxicity	SWAMP – Reg 8	
Facilitiation of equipment	SWAMP – Reg 8	City of Canyon Lake, CRG Marine Labs and ABC Labs
Facilitation of crew	SWAMP – Reg 8, SWRCB Clean Water Team	
Data review and analyses	SWAMP – Reg 8	CRG Marine Labs, ABC Labs
Peer review of report		various

- TMDL – The sampling activities will coordinated with TMDL monitoring program to the extent possible to prevent duplication of work and maximize funding resources.
- Grant Projects – Regional Board staff will ensure that the priorities included in the grant priority list include as much as possible projects that will compliment the SWAMP monitoring projects.