Los Angeles River Watershed Monitoring Program

Quality Assurance Project Plan

Prepared by

Los Angeles & San Gabriel Rivers Watershed Council

700 N. Alameda St., Los Angeles, CA 90012

&

Aquatic Bioassay & Consulting Laboratories

29 N Olive St., Ventura, CA 93001

April 2012

1.0 Group A Elements: Project Management

1.1 Title & Approval Sheets

Quality Assurance Project Plan

PROJECT: Los Angeles River Watershed Monitoring Program (LARWMP)

DATE: April, 2012

RESPONSIBLE ORGANIZATION: Aquatic Bioassay & Consulting Laboratories
29 N. Olive St.
Ventura, CA 93001

APPROVAL SIGNATURES

Grant Organization

Grant Organization

Kristy Morris, Project Director
Council for Watershed Health — Date: 8.7.2012

Scott Johnson, Project Manager
Aquatic Bioassay & Consulting Laboratories — Date: 4-24-2012

Karin Patrick, QA Officer
Aquatic Bioassay & Consulting Laboratories — Date: April 24, 2012

Mahesh Pujari, EMD QA Officer
City of Los Angeles, Bureau of Sanitation — Date: 4/27/2012

Raphael Mazor, LARWMP Technical Workgroup
SCCWRP — Date: 4/17/2012

Funding Organizations

Mas Dojiri, EMD Division Manager
City of Los Angeles, Bureau of Sanitation — Date: 5/3/12

~~Daniel Rynn,~~ ALAN CRUZ
City of Burbank, Department of Public Works — Date: 8/9/12

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DISTRIBUTION LIST

The final Quality Assurance Project Plan (QAPP) will be kept on file at Council for Watershed Health (CWH) offices and can be downloaded from the LARWMP program page http://watershedhealth.org/dataandreference/Document.aspx?search=38. The following individuals will receive copies of the approved QAPP and any subsequent revisions:

Name, Affiliation, Contact Information	Project Title
Kristy Morris Council for Watershed Health 700 N. Alameda St. Los Angeles, CA 90012 kristy@watershedhealth.org (213) 229-9960	Project Director
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Gerry McGowen City of Los Angeles Environmental Monitoring Division 12000 Vista del Mar, Pregerson Building 4th Floor Playa del Rey, CA 90293 Gerald.mcgowen@lacity.org 310 648 5611	EMD Laboratory Manager/ QC Officer
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LA Regional Board

3.0 PROJECT/TASK ORGANIZATION

3.1 Involved Parties and Roles.

Council for Watershed Health (CWH) is a 501(c)(3) non-profit organization working cooperatively with community groups, government agencies, business and academia to solve environmental issues in the Los Angeles River Watershed. The mission of the Council is to facilitate an inclusive consensus process to preserve, restore, and enhance the economic, social, and ecological health of watersheds through education, research, and planning. As the lead agency in this project, CWH will oversee and administer the sample collection, analysis of samples, data management, all report preparation and the maintenance of contracts with the Cities of Los Angeles and Burbank.

Other agencies participating in the program, either through provision of in kind services, budgetary support or participation on the Los Angeles River Watershed Monitoring Program (LARWWMP) Workgroup includes:

Agency
Arroyo Seco Foundation
City of Burbank
City of Downey
City of Los Angeles
Friends of the Los Angeles River
Las Virgenes Municipal Water District (LVMWD)
Los Angeles County Department of Public Works
Los Angeles & San Gabriel Rivers Watershed Council (CWH)
Los Angeles Regional Water Quality Control Board
San Gabriel & Lower Los Angeles Rivers & Mountains Conservancy
Southern California Coastal Water Research Project (SCCWRP)
U.S. Environmental Protection Agency (USEPA)
U.S. Forest Service

In addition to these workgroup members, invited experts provided valuable information and advice on a number of key issues.

Aquatic Bioassay and Consulting Laboratories (Aquatic Bioassay) is the lead consultant on this project, responsible for project management, organization of sample collection, analysis of samples and data, quality assurance (QA), assisting with the coordination of stakeholder groups, reporting to the LARWMP Workgroup, and

ensuring the timely completion of all electronic data submittal products and the annual summary report. In addition, Aquatic Bioassay will collect bioassessment, water and sediment samples, and analyze bioassessment samples. Scott Johnson will be the Project Manager for this study and has established a project team for planning and conducting the study (Table1, Figure 1).

Several agencies will be providing field sampling and analytical services to the project including the City of Los Angeles' Environmental Monitoring Division (CLA EMD) and the Los Angeles Department of Public Works (LADPW).

IIRMES Laboratories, located at California State University at Long Beach, will perform water, sediment, and tissue chemistry analyses for some constituents during the monitoring program. Rich Gossett (QC officer) will oversee these analyses.

Weston Solutions Laboratories will conduct bioassessment, water, and CRAM sampling for the LADPW.

3.2 Quality Assurance Officer Role

Karin Patrick will be the QA Officer. Ms. Patrick's role is to establish the quality assurance and quality control (QA/QC) procedures found in this QAPP as part of the sampling and analysis procedures. Ms. Patrick will work with field and laboratory managers by communicating all QA/QC issues contained within this QAPP.

Ms. Patrick will also review and assess all procedures during the life of the contract against QAPP requirements. Ms. Patrick will report all findings to Scott Johnson, including all requests for corrective action. Ms. Patrick may stop all tasks, including those conducted by Aquatic Bioassay, Weston, CLA EMD Labs, and IIRMES Labs if there are significant deviations from required practices or if there is evidence of a systematic failure. Pertinent QC issues will be communicated by Scott Johnson or Karin Patrick to Kristy Morris (Project Director).

3.3 Persons Responsible for QAPP Update and Maintenance.

Changes and updates to this QAPP may be made after a review of the evidence for change by the Project Director, Project Manager, QA Officer, and Technical Workgroup Representative. The Project Manager will be responsible for making the changes, submitting drafts for review, preparing a final copy, and submitting the final for signature.

Table 1. (Element 4) Personnel responsibilities.

Name	Organizational Affiliation	Title	Contact Information
Kristy Morris	CWH	Project Director	Tel: 213 229 9960 FAX: 213 229 9952 kristy@watershedhealth.org
Scott Johnson	Aquatic Bioassay	Project Manager, Biology Lab & Field Sampling	Tel: 805 643 5621 x11 FAX: 805 643 2930 scott@aquabio.org
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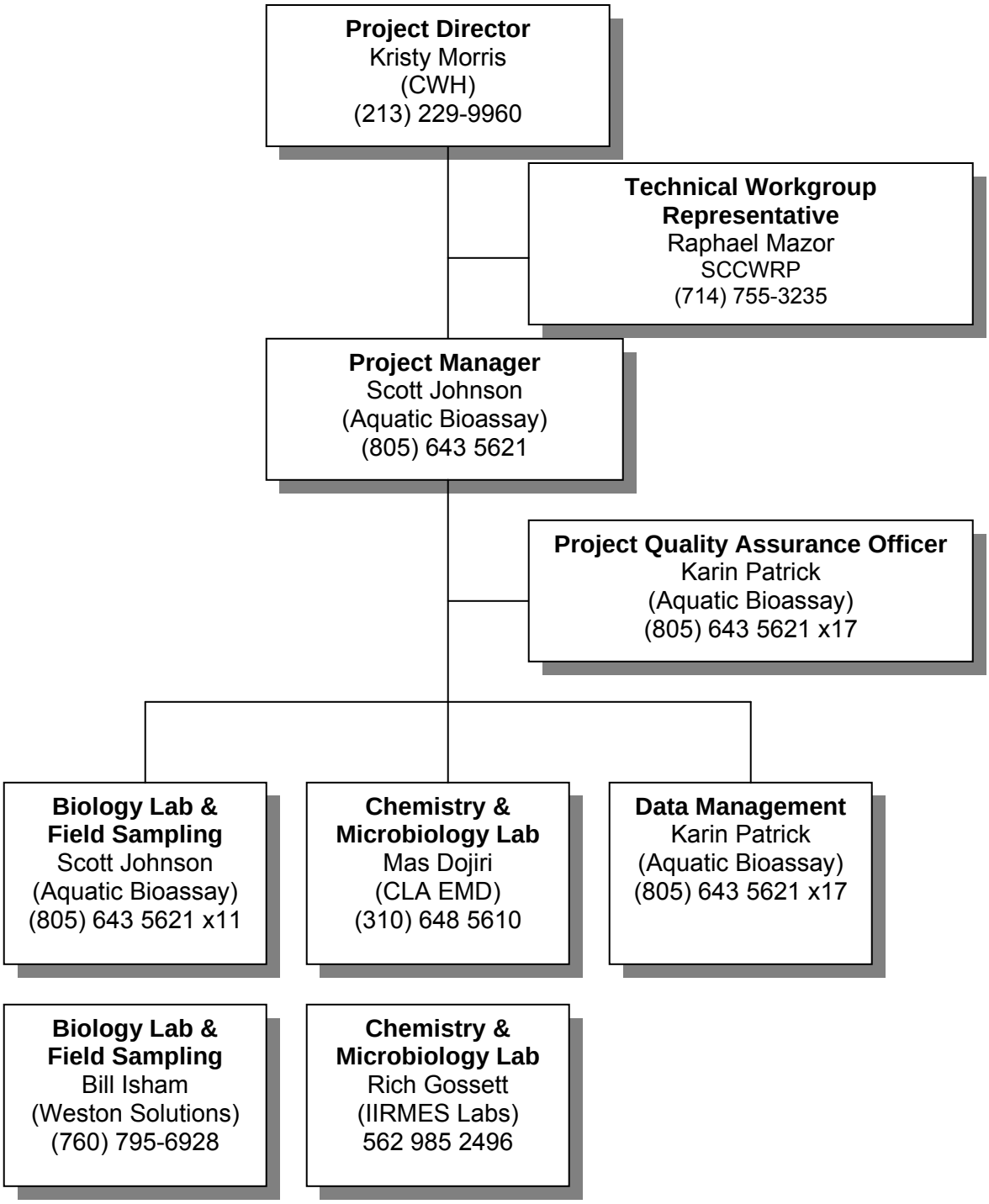
Bill Isham	Weston Solutions	Biology Laboratory	Tel: 760 795 6928 FAX: 760 931 1580 Bill.isham@westonsolutions.com

3.4 Organizational Chart and Responsibilities

Figure 1. Organization chart



4.0 PROBLEM DEFINITION / BACKGROUND

4.1 Problem Statement

The development of a watershed-wide monitoring program for the Los Angeles River is a direct response to a NPDES permit requirement established by the Los Angeles Regional Water Quality Control Board (LARWQCB) for the City of Los Angeles' Los Angeles-Glendale and Donald C. Tillman Water Reclamation Plants, for the Burbank Water Reclamation Plant, and for Las Virgenes Municipal Water District's (LVMWD) Tapia Treatment Plant. For purposes of discussion, this program is termed the Los Angeles River Watershed Monitoring Program (LARWMP). This requirement stemmed, not from any specific contamination problem or discharge condition, but instead from a broader desire by LARWQCB staff for more information on the environmental conditions for the entire length of the Los Angeles River, integrated information about ambient conditions across the watershed as a whole, and about patterns and trends in those conditions. This was a natural response to the growing awareness that watersheds involve habitats, physical features, and processes (both human and natural) that stretch across typical regulatory and management boundaries and are not well captured by current compliance monitoring programs. The regional monitoring design proposed here can be seen as a watershed-scale counterpart to existing larger-scale regional monitoring efforts in the southern California region (e.g., the state's Surface Water Ambient Monitoring Program (SWAMP), the Stormwater Monitoring Coalition's (SMC) regional watershed assessment program, U.S. EPA's Western Environmental Monitoring and Assessment Program (EMAP), and the Southern California Bight Regional Monitoring that attempt to address questions and concerns about regional condition and trends. The program presented here parallels the program recently implemented for the San Gabriel River Watershed in its intent to incorporate local and site-specific issues within a broader watershed-scale perspective.

The LARWMP is designed to complement and/or coordinate with the State Water Resources Control Board's SWAMP effort in the Los Angeles River watershed and with the related SMC southern California watershed assessment program. This includes both the coordination of sampling effort and the use of consistent field sampling and laboratory analysis methods. In addition, the proposed program uses tools developed by the State Water Board's Surface Water Ambient Monitoring Program (SWAMP) and the Southern California Wetlands Recovery Project for the regional assessment of biologic conditions in streams and channels, as well as monitoring design approaches developed by the SMC's model stormwater monitoring program (SCCWRP technical report #419, ftp://ftp.sccwrp.org/pub/download/PDFs/419_smc_mm.pdf).

The LARWMP Workgroup identified a subset of the beneficial uses in the region's Basin Plan that served as the central focus for the proposed regional monitoring design. These beneficial uses relate primarily to habitat conditions and to recreational uses of the watershed and include the following:

Beneficial use	Q1: Stream condition	Q2: Unique areas	Q3: Discharges	Q4: Safe to swim	Q5: Safe to eat fish
Warm freshwater habitat	X	X	X		
Cold freshwater habitat	X	X	X		
Estuarine habitat		X	X		
Wildlife habitat	X	X	X		
Water Contact recreation				X	
Commercial, sport fishing					X

The LARWMP Workgroup articulated five core management questions, related to the priority beneficial uses:

- Question 1: What is the condition of streams in the watershed?
- Question 2: Are conditions at areas of unique interest getting better or worse?
- Question 3: Are receiving waters near discharges meeting water quality objectives?
- Question 4: Is it safe to swim?
- Question 5: Are locally caught fish safe to eat?

These questions reflect specific concerns about different aspects of the Los Angeles River watershed and the impacts of human activities on these. For each question, the LARWMP describes a monitoring design, including its overall approach and rationale, indicators to be measured, recommended monitoring sites and frequencies, and expected data products. The LARWMP also identifies recommended modifications to some existing efforts that would bring them into line with the proposed regional program. The monitoring program document can be obtained from CWH's website (http://watershedhealth.org).

4.2 Decisions or Outcomes

The objective of this monitoring program is to assess the status of five key Los Angeles River watershed beneficial uses that include: the condition of stream health, areas of unique interest, adherence of receiving waters near discharges with water quality objectives, water contact recreation, and fish consumption. The data generated by this monitoring program will be used to assess the condition of each of these beneficial uses over time, so that watershed managers can make decisions regarding the preservation of resources that are found to be unimpaired and the development of best management practices (BMPs) where resources are found to be impaired.

5.0 PROJECT/TASK DESCRIPTION

5.1 Work Statement and Produced Products

Aquatic Bioassay shall be responsible for the performance of the work as set forth herein below and for the preparation of products and a final report as specified in the LARWMP Program Document. Aquatic Bioassay shall promptly notify the CWH Program Manager of events or proposed changes that could affect the scope, budget, or schedule of work performed under this Agreement. Unless otherwise specified in the Agreement, all deliverables shall be provided to the Program Manager, Contract Manager, and members of the LARWMP Workgroup.

The monitoring program can be divided into three main components:

Core monitoring includes long-term monitoring, intended to track compliance with specific regulatory requirements or limits, to conduct ongoing assessments, or to track trends in certain important conditions over time. Thus, core monitoring generally occurs at fixed stations that are sampled routinely over time.

Regional monitoring includes cooperative studies that provide a larger-scale view of conditions and can be used to assess the cumulative results of anthropogenic and natural effects on the environment. Regional monitoring also helps to place particular impacts in perspective by comparing local results (i.e., core monitoring) to the breadth and depth of human impacts and natural variability found throughout a larger region.

Special projects include specific targeted studies included as adaptive elements within core or regional monitoring designs. These are shorter-term efforts, with a specified beginning, middle, and end, intended to extend or provide more insight into core monitoring results, for example, by investigating the specific sources that may be contributing to a receiving water problem.

The regional program focuses primarily on core monitoring and regional monitoring priorities, leaving special projects, at this point, as the responsibility of the individual program partners.

Question 1: What is the Condition of Streams in the Watershed?

In overview, the monitoring design recommended to address such questions has the following elements:

- A randomized, or probabilistic, sampling scheme that includes the entire watershed, with the exception of ephemeral streams, down to the upper boundary of the estuary
- The watershed is treated as a single stratum, with subpopulations, intended to ensure a representative distribution of sampling sites, defined for the upper watershed streams dominated by natural flows, the Los Angeles River mainstem

(including the Western Burbank Channel) dominated by treatment plant flows, and tributaries in the lower watershed dominated by urban runoff
- Sampling conducted at 10 sites in the first year and then continued with ten random sites newly selected in each subsequent year
- Combining the 15 first-year sites with the 15 SWAMP sites sampled in 2005 to constitute an initial 30-site assessment of the watershed
- Monitoring occurring in the spring and structured around the triad approach, which includes bioassessment, aquatic toxicity, and water chemistry
- Measures of physical habitat characteristics collected coincident with bioassessment, including both the SWAMP Bioassessment Procedures (2007) method and the California Rapid Assessment Method (CRAM)

The types of data products resulting from this monitoring design and appropriate for answering Question 1 may include several deliverables:

- Cumulative frequency distribution plots of key individual indicators or metrics and of synthesized triad results or condition scores
- Estimates of the stream reach miles in the watershed above/below benchmarks of interest for key indicators and for synthesized triad results
- Maps of the areal distribution of monitoring sites in the watershed above/below benchmarks of interest for key indicators and for synthesized triad results
- Estimates of difference in status between the upper and lower watershed, and between the mainstem and tributaries
- Trends over time in the estimates of watershed condition

Question 2: Are Conditions at Areas of Unique Interest Getting Better or Worse?

The component of the regional monitoring program to address these questions is intended primarily as a trend monitoring effort and has the following three recommended elements:

- For high value / high risk sites in the freshwater portion of the watershed:
  - A fixed design that focuses on a small number (e.g., 5 – 10) of specific locations and minimally impacted sites
  - An emphasis on habitat conditions rather than water quality
  - Sampling will take place in the spring to coordinate with monitoring for Question 1
  - Monitoring will be structured around the CRAM approach
- For the estuary:
  - A fixed design including one site representative of overall estuary conditions
  - An emphasis on water quality and sediment quality
  - Sampling of conventional water quality parameters at a quarterly frequency
  - Annual sampling of a broader list of water quality parameters
  - Annual sampling of the State Board's Sediment Quality Objectives (SQO) triad of sediment chemistry, sediment toxicity, and benthic infauna

- For confluence sites where major tributaries enter the mainstem:
  - A fixed design that focuses on four specific locations
  - Monitoring based on the triad of bioassessment, water quality, and aquatic toxicity
  - Sampling will take place in the spring to coordinate with monitoring for Question 1

Several types of data products resulting from this monitoring design are appropriate for answering Question 2:

- For high value / high risk sites in the freshwater portion of the watershed:
  - Site-by-site summaries of the quantitative scoring of CRAM attributes and trends in these over time
  - Site-by-site comparisons of CRAM attributes between high value / high risk and minimally impacted sites
  - Site-by-site interpretations and conclusions of habitat status and trends
- For the estuary:
  - Graphical and map-based descriptions of temporal patterns of descriptive water mass characteristics (e.g., temperature, salinity)
  - Graphical and map based descriptions of temporal patterns of sediment chemistry, sediment toxicity, and benthic infaunal community structure (sediment triad)
  - Evaluation of sediment triad data with reference to the pending statewide Sediment Quality Objectives
- For confluence sites:
  - Descriptions of water quality conditions (e.g., conventional chemistry, total metals, organophosphate pesticides)
  - Comparisons across sites of water quality conditions
  - Trend plots and maps of changes in measures of condition over time.

Question 3: Are Receiving Waters Near Discharges Meeting Water Quality Objectives?

In overview, the monitoring design recommended to address such questions has the following elements:

- Water chemistry monitoring at a regular frequency above and below each major discharge point
- Toxicity testing on a regular frequency above and below each major discharge point
- Bioassessment monitoring on a regular frequency below each major discharge point
- Expanded bioassessment monitoring above each major discharge point if the downstream bioassessment results are below the range expected for that habitat type

Several types of data products resulting from this monitoring design are appropriate for answering Question 3:

- Site-by-site summaries of each sampled data type (tables and figures of individual measurements and relevant averages)
- Site-by-site interpretations and conclusions based on synthesized results (narrative conclusions, decision trees specifying adaptive responses to monitoring results)
- Comparisons across sites for each sampled data type (tables highlighting differences, cumulative frequency distributions, maps)
- Comparisons across sites for synthesized results (narrative conclusions, decision trees, cumulative frequency distributions, maps)
- Trend plots over time of increases / decreases in parameters of interest

Question 4: Is It Safe to Swim?

This information could be used by Los Angeles County Department of Health Services (LACDHS) to help manage health risk and by the LARWQCB to assess progress toward meeting water quality objectives both at the watershed scale and within selected reaches of the river. There is currently only limited monitoring at locations where recreational use most commonly occurs. Monitoring at sentinel sites will be conducted by the regional monitoring program. Monitoring at inland recreation areas could be conducted in cooperation with volunteer agencies and/or with the County Department of Health Services. Beach monitoring is conducted by the City of Long Beach.

In overview, the monitoring design developed to address such questions has three main elements:

- A focus on sites with the highest observed swimming use
- Weekly monitoring during the swimming season at sentinel sites, including the head of the estuary, to assess average levels of indicator bacteria throughout the watershed
- Use of *E. coli* as the bacteria indicator species

Several types of data products resulting from this monitoring design are appropriate for answering Question 4:

- Weekly, site-by-site measures of bacterial indicator values
- Comparisons of bacterial indicator values with relevant standards or objectives on spatial and temporal scales that match sampling scales as closely as possible (e.g., data tables or charts that highlight exceedances)
- Site-by-site and regional trends over time in the numbers of exceedances
- Ability to adopt new indicators and new methods as they are approved

Question 5: Are Locally Caught Fish Safe to Eat?

In overview, the monitoring design recommended to address such questions has several elements:

- Initial two-year pilot program to provide the basis for a long-term monitoring design
- Sample annually in summer
- Focus on one or two locations (lakes, rivers, estuary) each year where fishing is most frequent
- Focus on fish species most commonly caught and consumed at each site
- Focus on the chemicals (mercury, DDTs, and PCBs) ingested with California's sport fish that contribute the greatest human health risk

Several types of data products are appropriate for answering Question 5:

- Site-by-site muscle tissue concentration estimates of key chemical contaminants in commonly consumed fish species
- Site-by-site measures of the frequency with which such tissue concentrations exceed advisory levels and/or critical thresholds of potential human health risk
- Trends over time in both tissue concentrations and the frequency of exceedances of advisory levels and critical thresholds

5.2 Constituents to be Monitored and Measurement Techniques

Water, sediment, and tissue chemistry; water and sediment toxicity; marine and freshwater bioassessments; and bacteria will be used to measure the condition of beneficial uses in the watershed. We will use existing USEPA, SWAMP, and Southern California Regional Monitoring protocols.

Table 2. (Element 6) Analytical constituents and method requirements.

Analyte	Method	Units	Reporting Limit
Conventional Water Chemistry			
Temperature	Probe	^{o}C	-5
pH	Probe	None	NA
Specific Conductivity	Probe	mS/cm	2.5
Dissolved Oxygen	Probe	mg/L	N/A
Salinity	Probe	ppt	N/A
Water Chemistry: freshwater			
Alkalinity as CaCO3	SM 2320 B	mg/L	10
Hardness as CaCO3	SM 2340 B	mg/L	1.32
Suspended Solids	SM 2540 D	mg/L	3
Nutrients			
Ammonia as N	EPA 350.1	mg/L	0.1
Nitrate as N	EPA 300.0	mg/L	0.1
Nitrite as N	EPA 300.0	mg/L	0.1
TKN	EPA 351.2 (1° Method) or SM4500-NH3 C (2° Method)	mg/L	0.1
Total Nitrogen	Calculated	NA	NA
Total Organic Carbon	SM 5310 C	mg/L	0.1
Dissolved Organic Carbon	SM 5310 C	mg/L	0.1
OrthoPhosphate as P	SM 4500-P E	mg/L	0.1
Phosphorus as P	SM 4500-P E	mg/L	0.1
Major Ions			
Chloride	EPA 300.0	mg/L	1.0
Sulfate	EPA 300.0	mg/L	1.0
Silica	SM 4500-Si D	mg/L	0.1
Metals			
Arsenic	SM 3114B	ug/L	1
Cadmium	EPA 200.8	ug/L	0.2
Chromium	EPA 200.8	ug/L	0.5
Copper	EPA 200.8	ug/L	0.5
Iron	EPA 200.8	ug/L	50
Lead	EPA 200.8	ug/L	1
Mercury	SM 3112 B	ug/L	0.2
Nickel	EPA 200.8	ug/L	1

Lead	EPA 200.8	ug/L	1
Selenium	SM 3114 B	ug/L	1
Zinc	EPA 200.8	ug/L	1
Organics			
Organophosphorus Pesticides	EPA 625	ng/L	2-16
Pyrethroids Pesticides	EPA 625 NCI	ng/L	0.005-0.01
Water Toxicity: Freshwater			
Chronic *Ceriodaphnia dubia*: primary test organism	EPA 821/R-02-013	% Survival, %reproduction	N/A
Chronic *Hyallela azteca*: secondary test organism if conductivity is > 2,500 µS/cm	EPA 821/R-02-013m	% Survival	N/A
Taxonomy: Freshwater			
Benthic Macroinvertebrate	SWAMP (2007), SAFIT STE	Count	NA
Qualitative Algae	SWAMP, In Development	Count	NA
Quantitative Diatom	SWAMP, In Development	NA	NA
Quantitative Algae	SWAMP, In Development	NA	NA
Habitat Assessments: Freshwater			
Freshwater Bioassessments	SWAMP (2007)	NA	NA
Freshwater Algae (collected in conjunction with bioassessments)	SWAMP (2010)	NA	NA
California Rapid Assessment Method (CRAM)	Collins et al., 2008	NA	NA
Water Chemistry: Estuary Seawater			
Alkalinity as CaCO3	SM 2320 B	mg/L	10
Hardness as CaCO3	SM 2340 B	mg/L	1.32
Suspended Solids	SM 2540 D	mg/L	3
Dissolved Solids	SM 2540 C	mg/L	37
Nutrients			
Ammonia	SM 4500-NH3 B&C; EPA 350.1	mg/L	0.1
Nitrate	EPA 300.0 or EPA 353.2	mg/L	0.1
Nitrite	EPA 300.0 or EPA 353.2	mg/L	0.1
TKN	EPA 351.2 (1° Method) or SM4500-NH3 C (2° Method)	mg/L	0.1
Dissolved Organic Carbon	SM 5310 C	mg/L	0.1
Total Organic Carbon	SM 5310 B	mg/L	0.1
OrthoPhosphate as P	SM 4500-P E	mg/L	0.1
Phosphorus as P	SM 4500-P E	mg/L	0.1
Metals			
Arsenic	SM 3114 B	mg/L	1
Cadmium	EPA 200.8 or 200.7	mg/L	0.2
Chromium	EPA 200.8 or 200.7	mg/L	0.5
Copper	EPA 200.8 or 200.7	mg/L	0.5
Iron	EPA 200.8 or 200.7	mg/L	50
Lead	EPA 200.8 or 200.7	mg/L	0.5
Mercury	SM 3112 B	mg/L	0.2
Nickel	EPA 200.8 or 200.7	mg/L	1
Selenium	SM 3114 B	mg/L	1
Zinc	EPA 200.8 or 200.7	mg/L	1

Organics			
Organophosphorus Pesticides	EPA 625	µg/L	0.002-0.016
Pyrethroid Pesticides	EPA 625-NCL	µg/L	0.002-0.005
Sediment Chemistry: Estuary			
Sediment Particle Size (% fines)	SM 2560 D	um	<2000->0.2
Metals			
Arsenic	EPA 6010 B	mg/Kg dw	1
Cadmium	EPA 6010 B	mg/Kg dw	1
Chromium	EPA 6010 B	mg/Kg dw	1
Copper	EPA 6010 B	mg/Kg dw	1
Iron	EPA 6010 B	mg/Kg dw	100
Lead	EPA 6010 B	mg/Kg dw	0.5
Mercury	EPA 7471 A	mg/Kg dw	0.01
Nickel	EPA 6010 B	mg/Kg dw	2
Selenium	EPA 6010 B	mg/Kg dw	1
Zinc	EPA 6010 B	mg/Kg dw	2
Nutrients			
Total Kjeldahl Nitrogen (TKN)	EPA 351.2; SM4500-N ORG B	mg/Kg dw	0.5
Total Organic Carbon	SM 5310 B	mg/Kg dw	0.05
Phosphorus as P	SM 4500-P E	mg/Kg dw	0.05
Organics			
Organochlorine Pesticides (DDTs)	EPA 8081A	µg/Kg dw	1.7-83.3
Polychlorinated Biphenyl (PCBs)	EPA 8082	µg/Kg dw	0.5
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 8270C	µg/Kg dw	1.7
Sediment Toxicity: Estuary			
Chronic *Eohaustorius* sp. (sediment) 10 day survival	EPA 600/R-94/025	% survival	N/A
Chronic *Mytilus* Sediment Water Interface	EPA 600/R-95-136m	% development	N/A
Taxonomy: Sediment			
Infauna	SCCWRP (2008)*, SCAMIT STE	N/A	N/A
Habitat Assessments: Estuary			
California Rapid Assessment Method (CRAM)	Collins et al., 2008	NA	NA
Tissue Chemistry: Fish			
Percent Lipids	Bligh, E.G. and Dyer ,W.J. 1959.	%	NA
Metals			
Mercury	EPA 7471A	mg/kg ww	0.02
Selenium	EPA 6010B	mg/kg ww	0.25
Organics			
Organochlorine Pesticides (DDTs)	EPA 8081A	µg/kg ww	1.7-83
Polychlorinated Biphenyl (PCBs)	EPA 8082	µg/kg ww	2
Indicator Bacteria			
Total Coliform and E. coli	SM 9223 B	MPN/100mL	10
Enterococcus	SM 9230 D (21st ed. on line)	MPN/100mL	10

* Southern California Regional Monitoring Program, 2008 Field and Laboratory Operating Procedures, SCCWRP.

Project Schedule

Table 3. (Element 6) Project schedule.

Project Task	Start	End
Project Management		
Technical Workgroup Meeting	Sept-11	Aug-12
Monthly Status Reports	Sept-11	Aug-12
QAPP	Sept-11	Apr-12
Site Reconnaissance		
Map Review and Preliminary Selection of Randomized Sites	Jan-12	Jan-12
Site Reconnaissance	Feb-12	Mar-12
Secure Entry Permits	Mar-12	Mar-12
Present Finalized Station List to TAC	May-12	May-12
Bacteria Testing		
Sentinel & Swimming Sites	May-12	Sept-12
Estuary Site	Oct-11	Sept-12
Fish Tissue Sampling		
Field Sampling	Aug-12	Aug-12
Preliminary Findings	Dec-12	Dec-12
Watershed Monitoring Sampling		
Estuary		
Water & Sediment Chemistry; Toxicity; Benthic Infauna	May-12	July-12
Lower Watershed		
Water Chemistry; Toxicity; Bioassessment; CRAM; Algae	May-12	July-12
Upper Watershed		
Water Chemistry; Toxicity; Bioassessment; CRAM; Algae	May-12	July-12
Mainstem		
Water Chemistry; Toxicity; Bioassessment; CRAM; Algae	May-12	July-12
Laboratory Analyses		
Chemistry		
Water & Sediment	May-12	Oct-12
Tissue	Aug-12	Nov-12
Toxicity Testing: Water & Sediment	May-12	Oct-12
Taxonomy		
Benthic Macroinvertebrates	May-12	Feb-13
Benthic Infauna	May-12	Mar-13
Data Management, Analysis & Reporting		
Data Management	May-12	May-13
Draft Report	May-13	July-13
Annual Report Finalized	July-13	Aug-13

5.3 Geographic Setting

The Los Angeles River watershed encompasses western and central portions of Los Angeles County. It is bounded by the San Gabriel, Santa Susana, and Santa Monica Mountains to the north and west, the San Gabriel River to the east, and the Pacific Ocean to the south. The Los Angeles River's headwaters originate in the Santa Monica, Santa Susana, and San Gabriel Mountains and the river terminates at the San Pedro Bay/Los Angeles and Long Beach Harbor complex, which is semi-enclosed by a 7.5 mile breakwater. The river's tidal prism/estuary begins in Long Beach at Willow Street and runs approximately three miles before joining with Queensway Bay (Figure 2).

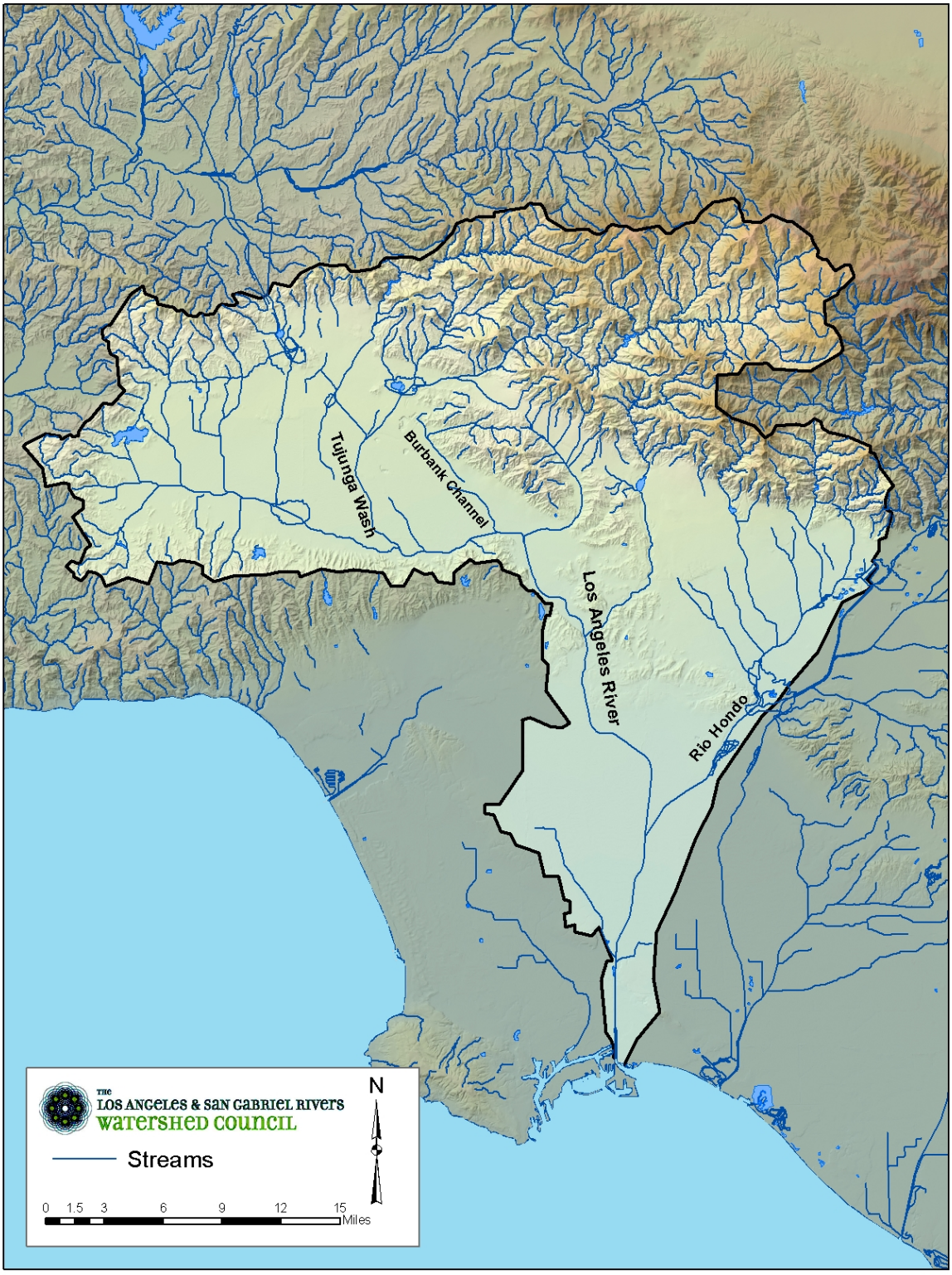


Figure 2. Study watersheds.

5.4 Constraints

The randomized design portion of the program is constrained by the ability of the contractors to access sites located on private, federal and state lands that do not allow public access. To resolve this issue, the team will review the locations of randomly selected sites prior to the initiation of sampling and begin work to secure the necessary access permits. If entry approval to a site cannot be obtained, the site will be dropped in favor of a more accessible site.

Sampling at both sentinel and random sites is dependent on the presence of flowing water. During drought years, sites normally thought to be perennial may not flow past mid-spring. As a result, fall site reconnaissance may reveal flow at some sites that will be dry when revisited during the spring sampling survey. In addition, the sampling criteria for the SMC includes a provision that sites have perennial flow (year round) or at a minimum have flow through the end of September. This provision could limit the number of regionally representative sites that might be sampled during the spring survey each year. The LARWMP Workgroup has determined that the SMC sampling criteria will be adhered to where possible.

The bioaccumulation portion of the program is constrained by the availability of targeted fish species in the required size classes. To resolve this issue, the team will adaptively sample so that when the targeted species are not available, other reasonable species will be collected. The list of taxa collected will be presented to the LARWMP Workgroup for review before chemical analyses are conducted.

6.0 QUALITY OBJECTIVES AND CRITERIA

Data Quality Objectives (DQOs) are quantitative and qualitative statements that specify the tolerable levels of potential errors in the data (U. S. EPA, 2000) and ensure that the data generated meet the quantity and quality of data required to support the study objectives. The DQOs focused on five aspects of data quality: completeness, precision, accuracy, representativeness, and sensitivity (Table 3). These DQOs address the sampling and laboratory analysis phases for producing chemistry, toxicity, bacterial and biological data. Each data quality category is described below. Numerical DQOs for field and laboratory analyses are listed in Table 4. Corrective actions are described in Section 13.3.

Table 4. Program measurement and analyses types with associated DQOs.

Measurement or Analyses	Type Applicable Data Quality Objective
Field Measurements	Accuracy, Completeness
Bacterial Analyses	Precision, Presence/Absence, Completeness
Trace Metals Analyses	Accuracy, Precision, Recovery, Completeness
Synthetic Organic Analyses	Accuracy, Precision, Recovery, Completeness
Organics Sediment Analyses	Accuracy, Precision, Recovery, Completeness
Conventional Analyses	Accuracy, Precision, Recovery, Completeness
Flow	Completeness
Toxicity	Accuracy, Precision, Completeness
Benthic Macroinvertebrates	Accuracy, Precision, Completeness
Benthic Infauna	Accuracy, Precision, Completeness
Habitat Assessments	Completeness

6.1 Quantitative Objectives

6.1.1 **Accuracy** describes how close the measurement is to its true value. Accuracy is the measurement of a sample of known concentration and comparing the known value against the measured value.

6.1.1.1 Field Measurements: The accuracy of in-situ field measurements listed in Table 4 is described by the manufacturer of the instrument. To achieve accuracy in in-situ field measurements (e.g. pH, DO, and EC) during this program the field probes will be calibrated before and after every sampling event. Calibration records will be stored as a hard copy and these calibration records are maintained by the laboratory conducting the field measurements. To achieve accuracy of flow measurements, the flowmeter will be used in accordance with manufacturer's instructions and standard methods outlined by the USGS.

6.1.1.2 Laboratory Measurements (chemistry): The accuracy of laboratory measurements will be checked by performing tests on Quality Control Standards (QCs) prior to and/or during sample analysis at the contract

laboratories. Quality Control Samples (QCs) containing a known concentration of each analyte are purchased from a certified outside reputable source or may also be prepared by a professional partner, e.g., a commercial or research laboratory. The concentration of the standards will be unknown to the analyst until after measurements are determined.

6.1.1.3 Bacteria: Accuracy criteria for bacterial testing will be based on presence/absence testing rather than numerical limits owing to the difficulty in preparing solutions of known bacterial concentration.

6.1.1.4 Toxicity Testing: The reliability of toxicity testing results depends on the quality of test organisms, testing conditions and the expertise of laboratory personnel. For each test organism there are numerous test conditions and reference toxicant criteria that must be met before the result can be accepted. A brief description of the criteria used to ensure the quality of toxicity test results are provided below. More detailed summaries can be found in the USEPA protocols for *Ceriodaphnia dubia* (EPA/821/R/02012), *Menidia beryllina* (EPA/821/R/02012), *Mytilus californianus* (EPA/600/R-95/136) and *Eohaustorius* sp. (EPA/R-94/025).

6.1.1.5 Biological Assessments: Accuracy criteria for the sorting and identification of benthic macroinvertebrates are based on criteria established by the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) and the Southern California Regional Watershed Monitoring Program (SMC) QAPP. Sample sorting accuracy requires a resort of 10% of all samples by a senior lab technician who determines if a 95% sorting efficiency is met. Taxonomic identification accuracy is accomplished through an audit of 10% of all samples by an outside laboratory or expert who determines if the samples meet a 90% enumeration and identification efficiency.

6.1.1.6 Physical habitat and CRAM Assessments: Accuracy criteria for the qualitative assessment of physical habitat conditions and CRAM assessments are based on the field staff training and ability to pass annual field audits. The lead field staff conducting these assessments is required to have participated in formal training classes administered by the California Department of Fish and Game (CADF&G) and SWAMP. Observations collected by field teams are audited each year by CADF&G for physical habitat and SWAMP for CRAM.

6.1.2 **Precision** describes how well repeated measurements agree. The precision objectives apply to duplicate and split samples taken during field sampling and laboratory analysis. In accordance with protocols described by SWAMP, these field and laboratory splits are two grab samples collected in rapid succession or two aliquots from the same composite sample, respectively.

6.1.2.1 During field sampling, duplicate samples will be collected at ten percent of the sampling sites (1 per sampling event for 10 sites) to evaluate the

precision of the sampling technique and to assess short-term environmental variability at the sample site.

6.1.2.2 For each laboratory analysis, one sample is analyzed in duplicate at the rate of one per sample batch, or 1 in 20 samples, whichever is more frequent to demonstrate the precision of the analytical measurement. The relative percent difference between the measured sample and split/ duplicate sample is used to qualify the precision of the measurement (Equation 1).

$$RPD = \left| \frac{(X_1 - X_2)}{(X_1 + X_2)/2} \right| * 100$$

Where:

X_1: is the concentration of the original sample

X_2: is the concentration of the duplicate sample

For most chemical constituents listed in Appendix B, Table 5 (pg 87) below, the RPD between duplicate samples should not exceed 25%.

6.1.2.3 The precision objectives for toxicity testing apply to laboratory reference toxicant tests and USEPA DMR studies. Reference toxicant results for each species should fall within ± 2 standard deviations (SD) of the mean of the preceding 20 tests. A reference toxicant test is run with each batch of test samples.

6.1.3 **Recovery** is the accuracy of an analytical test measured against a known analyte addition to a sample. The recovery of a sample can vary widely depending on the matrix (e.g. freshwaters vs brackish water), therefore matrix spike and matrix spike duplicates are used to demonstrate the performance of the method in a particular medium. The **matrix spike** sample is prepared by adding a known concentration of an analyte to a replicate sample at a concentration at least ten times the Method Detection Limit (MDL).

Recovery =

$$\% \text{ Recovery} = \left| \frac{(X_1 - X_2)}{X_3} \right| * 100$$

Where:

X_1 : is the concentration of the spiked sample

X_2: is the concentration of the original (unspiked) sample

X_3: is the concentration of the spike added

6.1.4 Matrix spikes and matrix spike duplicates will be analyzed at a frequency of one pair per sample batch, or one in 20 samples, whichever is more frequent. The DQO for the recovery of most constituents listed in table 5 is between 75%-

125% and recoveries outside of this acceptable range indicate an analytical process that is not being performed adequately for that analyte. In this case, attempt to correct the problem (prepare batch again, by dilution, change spike concentration, etc.) and reanalyze the samples and the matrix spikes. If the matrix spike problem cannot be corrected, qualify the results for the analyte as "high' of 'low' bias due to matrix interference.

6.1.5 **Field Blanks** demonstrate that sampling procedures do not result in contamination of the environmental samples. Field blanks will be prepared and analyzed for chemistry and toxicity samples collected as part of the SMC Regional laboratory and field audits. Field blanks will consist of laboratory-prepared blank water processed through the sampling equipment using the same procedures used for environmental samples. If any analytes of interest are detected at levels greater than the Reporting Limit (RL) for the parameter, the sampling crew should be notified so that the source of contamination can be identified (if possible) and corrective measures taken prior to the next sampling event.

6.1.6 **Laboratory Blanks** are performed to demonstrate that the analytical procedures do not result in sample contamination. Laboratory blanks will be prepared and analyzed by the contract laboratory at a rate of at least one for each analytical batch. Method blanks will consist of laboratory-prepared blank water processed along with the batch of environmental samples. The laboratory blank should be prepared and analyzed before analysis of the associated environmental samples. If the result for a single method blank is greater than the MDL, or if the average blank concentration plus two standard deviations of three or more blanks is greater than the RL, the source(s) of contamination shall be corrected, and the associated samples shall be reanalyzed.

6.1.7 **Sensitivity and Method Detection Limits** - The Method Detection Limit is the lowest detectable concentration for the instrument, chemical procedure, or equipment. This is important because it can never be determined if a pollutant was not present, only that it was not detected. Sensitivity refers to the detectable differences in concentration for test instruments and is therefore represented in the number of decimal places. The desired method detection limits and sensitivity of field and Laboratory measurements are described by SWAMP for some analytes such as the metals copper and iron, and for total and fecal coliforms. For other analytes, the Target Reporting Limits are provided by the analytical laboratory and represent the lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated, analytical conditions (i.e. the lower limit of quantitation). The reporting level for acute toxicity tests is dependent on the sample dilutions tested. In this study, we will be using 100% sample compared to a laboratory dilution water control. Therefore, results could be reported from 0 to 100% survival.

6.2 Qualitative Objectives

6.2.1 **Completeness** is the fraction of planned data that must be collected in order to fulfill the statistical criteria of the project. There are no statistical criteria that require a certain percentage of data. However, it is expected that 95% of all measurements could be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems. We will determine completeness by comparing the number of measurements we planned to collect compared to the number of measurements we actually collected that were also deemed valid. An invalid measurement would be one that does not meet the sampling methods requirements and the data quality objectives. Completeness results will be checked quarterly. This will allow us to identify and correct problems.

6.2.2 **Comparability** of the data can be defined as the similarity of the data generated by different monitoring programs and is important for the utility of the data in the state database. To ensure the comparability of data collected in this monitoring program to other regional and statewide datasets, all sampling and analytical procedures follow standard protocols such as those described by SWAMP. Additionally, comparability of analytical data is addressed by analysis of certified reference materials.

Before modifications can be made to the methods described in this QAPP, or alternative or additional methods are developed, technical advisors will evaluate and review the effects of the potential modification. It will be important to address their concerns about data quality before proceeding with the monitoring program.

6.2.3 **Representativeness** can be described as the degree to which the environmental data generated by monitoring program accurately and precisely represent the actual environmental conditions and this should be carefully addressed in the overall design of the program. Specifically, assuring the representativeness of the data is addressed primarily by selecting appropriate locations, methods, times, and frequencies of sampling for each environmental parameter, and by maintaining the integrity of the sample after collection. Examples of potential problems resulting from poor program design include samples that are taken in a stream reach that does not describe the area of interest, samples that are taken in an unusual habitat type (e.g. a stagnant backwater instead of in the flowing portion of the creek), or samples that are not analyzed or processed appropriately, causing conditions in the sample to change (e.g., water chemistry measurements are not taken immediately).

6.3 Specialized Training or Certifications

6.3.1 Field Sampling

Aquatic Bioassay and Weston Solutions field staffs have completed all applicable training to conduct bioassessment, toxicity, water quality, bacteriological and fish tissue field sampling. Field crew members for the LARWMP have the following training or certifications:

6.3.1.1 Lead field personnel have bachelors or masters degrees in Biology and over five years of experience conducting similar sampling programs.

6.3.1.2 Field crew members have attended bioassessment field and laboratory workshops provided by the California Department of Fish and Game. These workshops included training on physical habitat condition methods.

6.3.1.3 Crew members have attended training conducted by SCCWRP on the California Rapid Assessment Program (CRAM) for wetland and riparian habitats.

6.3.2 Laboratory Analysis

Each of the participating laboratories hold certifications through the State of California's, Environmental Laboratory Accreditation Program (ELAP) for the areas of testing that they are responsible for including chemistry, toxicity, bacteriology, and taxonomy.

6.3.2.1 The EMD, IIRMES Labs, Aquatic Bioassay, and Weston Solutions have participated in interlaboratory calibration studies conducted by the SMC for chemistry (IIRMES and EMD), toxicity (Aquatic Bioassay and EMD), and bacteriology (EMD and Aquatic Bioassay).

6.3.2.2 Benthic macroinvertebrate identifications are conducted by taxonomists who are members and active participants in the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) and adhere to the identification guidelines specified in the Taxonomic Rules and Standard Taxonomic Effort (STE) documents.

The Aquatic Bioassay and IIRMES Labs QA officers provide training to their respective personnel and details of the training are described in their respective Standard Operating Procedures (SOPs) and QA Program Documents.

During the duration of the LARWMP, as training and certification are required, the QC officers for each laboratory (EMD, Aquatic Bioassay, IIRMES Labs and Weston Solutions) will coordinate training of project personnel. The program QC officer (Karin Patrick) will be responsible for ensuring that personnel for each laboratory have received training.

SOPs for field, laboratory, and data management tasks will be developed and updated on a regular basis in order to maintain procedural consistency.

6.4 Training and Certification Documentation

Each laboratory maintains records of their training. Those records can be obtained, if needed, through the Project or Laboratory Directors.

6.5 Training Personnel

EMD, Aquatic Bioassay, IIRMES Labs, and Weston Solutions maintain rigorous field and laboratory training programs based on written, oral, and performance-based guidelines. Training and performance are also evaluated on an ongoing basis based, in part, on the QA parameters defined in this plan. SOPs for field, laboratory, and data management tasks have been developed and will be updated on a regular basis in order to maintain procedural consistency (see Appendices). The maintenance of an SOP Manual will provide project personnel with a reference guide for training new personnel, as well as a standardized information source that personnel can access.

To ensure consistent and comparable field techniques, this study will include pre-survey field training and in-situ field audits on an annual basis.

7.0 DOCUMENTS AND RECORDS

The hardcopy documents generated by this project will be stored at each of the participating laboratories (EMD, Aquatic Bioassay, IIRMES Labs, and Weston Solutions) for the duration of the contract (Table 6). Field worksheets, chains of custody, laboratory bench sheets, QA/QC documentation, and data results will be available for review by the Project QC Officer (Karin Patrick) upon request.

Persons responsible for maintaining records for this project are as follows. Karin Patrick will maintain all sample collection, sample transport, chain of custody, field analyses forms, all records associated with the receipt and analysis of samples analyzed for all parameters, and all records submitted by EMD, IIRMES Labs and Weston Solutions. The EMD and IIRMES Labs QC officers will maintain records for water, sediment, and tissue chemistry, and bacteriology chains-of-custody and bench sheets. Weston Solutions and Aquatic Bioassay will maintain records for bioassessment sampling and taxonomic identifications. Aquatic Bioassay will maintain field and laboratory records for fish tissue bioaccumulation sampling. All agencies and laboratories will make their records available to the Project Director, QC Officer, and Project Manager upon request. Scott Johnson will oversee the actions of these persons and will arbitrate any issues relative to records retention and any decisions to discard records.

All field results will be recorded at the time of completion, using standardized field data sheets. Data sheets will be reviewed for outliers and omissions before leaving the sample site. Chain-of-custody forms will be completed for all samples before leaving each sampling site. Data sheets and chains-of-custody will be stored by Aquatic Bioassay and Weston Solutions in hard copy form for five years from the time the study is completed. The directory where electronic files are stored will be backed up immediately to a mirrored hard drive and backed up nightly.

All data from this project will be made publicly available after approval by the CWH. The final electronic version of the database will be maintained by CWH. Release of data to the public will be in electronic formats only and will include comprehensive documentation. This documentation will include database table structures (including table relationships) and lookup tables used to populate specific fields in specific tables. Release to the public will also include QA classifications of the data (i.e., flags, as appropriate) and documentation of the methods by which the data were collected (metadata). Data will be released to the general public once a final report documenting the study has been prepared.

Table 5. (Element 9) Document and record retention, archival, and disposition information; Db = database.

	Identify Type Needed	Retention	Archival	Disposition
Station Occupation Log	Notebook	Paper	Notebook; Db	5 years
	Field data sheet	Paper	Notebook; Db	5 years
Sample Collection Records	Chain of Custody	Paper	Notebook	5 years
Analytical Records	Lab notebooks	Paper	Notebook	3 years
	Lab Results QA/QC	Paper and electronic	Notebook; Db	5 years
	Electronic data file	Electronic	Db	10 years
Data Records	Data Entry	Electronic	Db	Indefinite
Assessment Records	QA/QC assessment	Paper and electronic	Document	Indefinite
	Final Report	Paper and electronic	Document	Indefinite

8.0 SAMPLING PROCESS DESIGN

The sampling and analysis design for the program is divided into five components based on the five questions developed by the LARWMP Workgroup to address the status of beneficial uses in the watershed (Table 7). The design approaches range from a fully randomized, probabilistic design to address stream condition, to a two year pilot study focusing on fixed sites at popular fishing locations to address bioaccumulation issues.

Table 6. (**Element** 10). Number and frequency of sample sites.

Question	Approach	Sites	Indicators	Frequency
Q1: Stream condition	Randomized design for streams in entire watershed, except 1st and 2nd order streams	10 new each year	Triad: bioassessment, water chemistry, toxicity, pHab, riparian habitat	Annually, in spring
Q2: Unique areas	Fixed stations in estuary and freshwater	12 in freshwater • 8 critical habitat • 4 confluence of tribs/mainstem 1 in estuary	Freshwater: • Riparian habitat • Triad: bioassessment, water chemistry, toxicity, riparian habitat Estuary: • Conventional water quality • Full suite water quality • Sediment chemistry, toxicity, infauna based on SQO's	Annually, in spring Annually, in spring Quarterly Annually Annually
Q3: Discharges	Improve coordination Improve efficiency Reduce overlap			
Q4: Safe to swim	Focus on high-use areas	• 6-10 swimming sites • 9 sentinel sites • 15 beach sites	• *E. coli* • Total, fecal coliform, entero • Total, fecal coliform, entero	• Weekly May 1 to Sept 30 • Weekly May 1 to Sept 30 • Weekly year-round
Q5: Safe to eat fish	2-yr pilot study Focus on: • Frequently fished sites • Commonly caught species w/in SWAMP guidelines • High-risk chemicals	3 lakes, 2 river, 1 estuary	Commonly caught fish at each location Mercury, DDTs, PCBs	Annually in July and August

9.0 SAMPLING METHODS

9.1 *SITE CHARACTERIZATION*

The Los Angeles River watershed encompasses western and central portions of Los Angeles County. It is bounded by the San Gabriel, Santa Susana, and Santa Monica Mountains to the north and west, the San Gabriel River to the east, and the Pacific Ocean to the south. The Los Angeles River's headwaters originate in the Santa Monica, Santa Susana, and San Gabriel Mountains and the river terminates at the San Pedro Bay/Los Angeles and Long Beach Harbor complex, which is semi enclosed by a 7.5 mile breakwater. The river's tidal prism/estuary begins in Long Beach at Willow Street and runs approximately three miles before joining Queensway Bay.

The 824 sq. mi. watershed contains a wide diversity of land uses. Approximately 324 sq. mi. of the watershed is open space or forest. Below the mountains, the river flows through highly developed residential, commercial, and industrial areas. From the Arroyo Seco, north of downtown Los Angeles, to its confluence with the Rio Hondo, the river is bordered by rail yards, freeways, and major commercial development. Below the Rio Hondo, the river flows through industrial, residential, and commercial areas, including major refineries and petroleum products storage facilities, major freeways, rail lines, and rail yards serving the Ports of Los Angeles and Long Beach. While most of the river in the developed portion of the watershed is lined with concrete, the unlined bottoms of the Sepulveda Flood Control Basin and the Glendale Narrows provide areas of riparian habitat important for both their ecological and recreational value. In addition, Compton Creek, just before its confluence with the Los Angeles River, supports a wetland habitat. The river is hydraulically connected to the San Gabriel River watershed through the Whittier Narrows Reservoir via the Rio Hondo (normally only during high-storm flows).

9.2 *RANDOM SITE SELECTION*

The probabilistic sampling design for the LARWMP is based on a random draw of all the unique stream reaches in the Los Angles River Watershed. The random draw of sites is conducted by SCCWRP as part of the larger SMC regional monitoring program, which requires sampling at six sites in each of 15 watersheds in southern California each year. As a result, the data generated by the LARWMP will be directly comparable to sites throughout the southern California region. Each year ten new random sites are selected from the draw list. The ten LARWMP sites are divided into three sub-regions: natural, urban and effluent. The subset of six sites that are part of the SMC program are divided into three sub regions: open, urban, and agricultural. Each year the list of random sites in the Los Angeles River Watershed are sorted by their draw order and sub-region.

The goal is to find 10 sites where samples can be successfully collected in one day. Site reconnaissance is conducted based on protocols developed by the CDF&G and SWAMP. In brief, each site is evaluated using topographic maps, GIS, and Google Earth Pro. When possible, people familiar with the sampling location are interviewed in person or by phone. A site reconnaissance visit to each site is required to ensure the site can be sampled. The following criteria are general guidelines for accepting or rejecting a site:

1. Is the site within the watershed boundaries?
2. If private or public land, can entry permits be obtained?
3. Is the site "safely" accessible?
4. Is there flowing water?
5. Can the site be sampled in one day?
6. Can sample holding times be met considering the time necessary to get them to a laboratory to begin processing?

9.3 *WATER AND SEDIMENT CHEMISTRY AND BACTERIOLOGICAL SAMPLING*

Sampling for the LARWMP requires the collection of water samples for chemistry, toxicity and bacteria, using clean methods developed by the EPA and modified by SWAMP and the SMC for use in the southern California region. In addition, bottom sediment samples are collected annually by EMD from the Los Angeles River estuary using methods developed by the Southern California Bight Regional Monitoring Program (SCBRMP 2008). Sample containers and preservatives are identified in Table 7. Sampling standard operating procedures (SOPs) may be obtained by contacting the sampling/analysis laboratory (Appendix A).

The sampling coordinator has responsibility for assessing the safety of sampling teams. A two-person team will conduct all sampling, and the sampling team will have access to a cellular phone to alert rescue agencies should an accident occur. A satellite paging device is carried by the sampling crew when visiting remote sites. Sampling will be postponed if the sampling team determines that the conditions are unsafe.

Failure to collect a sample due to safety concerns or technical issues will be promptly reported to the Project Manager, who will determine if any corrective action is needed and make arrangements to collect a replacement sample (if possible). The QA Officer will document sampling failures and the effectiveness of corrective actions. Should field equipment fail, it will be repaired or replaced as soon as possible.

9.4 BIOASSESSMENT

9.4.1 Collection and Analysis of Benthic Macroinvertebrates (BMIs)

Sampling requires the manual collection of composite benthic macroinvertebrate (BMI) samples using a D-shaped kick net at eleven transects (15 meters apart) along a 150 meters reach. The BMI samples are collected using the reach-wide benthos technique. Physical habitat assessments specified by SWAMP are also collected to assess stream habitat conditions. The complete sampling SOP entitled, *Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California* (Ode et al. 2007), appears at:

http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_bioassessment_collection_020107.pdf

In the laboratory, sorting and identification of BMIs is conducted based on protocols established by SWAMP in conjunction with the SMC TAC and SCCWRP.

BMIs for the LARWMP are identified to Level 2 specified by the Southwest Association of Freshwater Invertebrate Taxonomy (SAFIT). The SAFIT List of Freshwater Macroinvertebrate Taxa from California and Adjacent States including Standard Taxonomic Effort (STE) Levels can be found at:

http://www.safit.org/ste.html

Sample containers and preservatives are identified in Table 7.

9.4.2 Collection and Analysis of Attached Algae

Sampling requires both the quantitative and qualitative collection of algae (diatoms and filamentous algae) from sand, cobble, and bedrock substrate types. Samples are collected simultaneously with the benthic macroinvertebrate samples from the substrate located immediately upstream of the location of the D-kick net. The sampling and laboratory SOP is based on, *Incorporating Bioassessment Using Freshwater Algae into California's Surface Water Ambient Monitoring Program (SWAMP)* (Fetscher and McLaughlin 2008; SWAMP Technical Report 563). This document can be found at:

http://www.swrcb.ca.gov/water_issues/programs/swamp/docs/reports/563_periphyton_bioassessment.pdf

Sample containers and preservatives are identified in Table 7. Appropriate pre-cleaned sample containers will be used.

9.5 *CALIFORNIA RAPID ASSESSMENT METHOD (CRAM)*

Sampling requires the assessment of wetlands and riparian zones. CRAM assesses the condition of a wetland or riparian zone using visual indicators in the field. It includes the assessment of hydrologic connectivity, buffer zone condition, vegetative community conditions and streambed quality. For complete CRAM protocol information go to: www.cramwetlands.org

9.6 FISH TISSUE BIOACCUMULATION

Sampling requires the manual collection of fish using a beach or hand seine, hook and line or electric shock fishing. Strategies for target species, numbers of species per composite, constituent list and fish size criteria are based on guidelines in "General Protocol for Sport Fish Sampling and Analysis" (2005 CA OEHHA) and can be found at:

http://oehha.ca.gov/fish/pdf/fishsampling121406.pdf

Threshold advisories limits for fish tissue contamination can be found in "*Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in California Sport Fish*, June 2008" (http://www.oehha.ca.gov/fish.html).

Sample containers and preservatives are identified in Table 7. Appropriate pre-cleaned sample containers will be used.

9.7 *LABORATORY WATER TOXICITY TESTING*

Sampling requires the manual collection of grab water samples using a one-gallon wide-mouth carboy at each of the monitoring locations. The complete sampling SOP compiled by Aquatic Bioassay is discussed in Section 10.3. Laboratory testing for freshwater samples will be conducted using the *Ceriodaphnia* 7-day acute and chronic tests. *Hyalella* will be substituted for *Ceriodaphnia* when conductivity is >2,500 uS/cm. Sample containers and preservatives are identified in Table 7. Appropriate pre-cleaned sample containers will be used.

Laboratory procedures, and links to the most recent methods for the tests are as follows:

Ceriodaphnia dubia:

- *Chronic* Ceriodaphnia*: Short-Term Methods For Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, EPA/821/R-02/013.*

Hyalella azteca:

- *Chronic* Ceriodaphnia*: Modification of Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, EPA/821/R-02/013M.*

  Url: http://www.epa.gov/waterscience/methods/wet/disk3/

9.8 *LABORATORY SEDIMENT TOXICITY TESTING*

Sampling requires the manual collection of grab sediment samples using a grab sampling device and a one-gallon wide-mouth carboy at each of the monitoring locations. The complete sampling SOP compiled by Aquatic Bioassay is discussed in Section 10.3. Laboratory testing for estuary sediment samples will be conducted using the *Mytilus* SWI test. Sample containers and preservatives are identified in Table 7. Appropriate pre-cleaned sample containers will be used.

Laboratory procedures, and links to the most recent methods for the *Mytilus sp.* test is as follows:

- Mytilus *SWI test (method by Anderson and Hunt, 1996. in a Book assembled by Ostrander, Gary K. 1996. Techniques in Aquatic Toxicology. CRC Press. ISBN 156670149X, 9781566701495) and (EPA Method adapted from: Short-Term Methods For Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms EPA/600/R-95/136.*

  Url: http://www.epa.gov/waterscience/methods/wet/disk1/)

- Eohaustorius*: Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods, EPA/600/R-95/025.*

  Url: http://www.epa.gov/waterscience/cs/library/marinemethod.pdf

10.0 Sample Handling and Custody

Samples will be collected and transferred to the analytical laboratories within the holding times specified in Table 7. To provide for proper tracking and handling of the samples, documentation will accompany the samples from the initial collection to the final identification and analysis.

All bottles will be labeled with station ID, sample date, sample time, and field replicate. Field data sheets and chains-of-custody will accompany the collection of samples.

All samples will be marked with a unique number to track their analysis. These identification labels will also be entered directly onto field and laboratory data sheets. All observations recorded in the field, as well as information recorded in processing all field samples in the laboratory, will be tracked using these identification labels.

The SOP details the procedures for submitting samples to the Project laboratories. These procedures reinforce the use of proper sample containers, chain-of-custody procedures, and unique station codes and sampling agency identifiers.

Table 7. (Element 11) Sample handling.

Analyte	Bottle Type/Size	Preservative	Maximum Holding Time
Taxonomy			
Benthic Macroinvertebrates	½ G HDPE Plastic Wide-Mouth	95% Ethanol; Transfer to 70 % ethanol in the lab	5 years
Benthic Infauna	½ G HDPE Plastic Wide-Mouth	10% Buffered Formalin; Transfer to 70 % Ethanol	5 years
Algae Collection: Diatoms	50 mL plastic centrifuge tube	10% buffered formalin	28 days
Algae Collection: Algae	50 mL plastic centrifuge tube	25% Glutaraldehyde	28 days
Algae: Qualitative	Whirl-Pac	4 °C	2 weeks
Toxicity			
Eohaustorius (sediment)	2 L wide mouth HDPE plastic	4 °C	14 days
Mytilus (sediment/water interface)	3 L wide mouth HDPE plastic	4 °C	48 hours

Water Chemistry			
General Chemistry			
Alkalinity as $CaCO_3$	250 mL HDPE Plastic	4 °C	14 days
Hardness as $CaCO_3$	250 mL HDPE Plastic	4 °C, HNO_3 to pH <2	6 months
Total Suspended Solids	250 mL HDPE Plastic	4 °C	7 days
Ash Free Dry Mass	Filtered in field onto 0.7 µm glass fiber filter	-20 °C	28 days
Chlorophyll a	Filtered in field onto 0.7 µm glass fiber filter	-20 °C	28 days
Nutrients			
Ammonia as N	250 mL HDPE Plastic	4 °C, (1+1) HNO_3 to pH <2	28 days
Total Organic Carbon	40 mL glass	4 °C, acidify to pH <2 with HCl or H_2SO_4	28 days
Dissolved Organic Carbon	40 mL glass	4 °C	28 days
Nitrate as N, Nitrite as N, Orthophosphate	300 mL HDPE Plastic	4 °C	48 hours
Phosphorous as P	300 mL HDPE Plastic	4 °C	28 days
Kjeldahl Nitrogen, Total	500 mL amber glass	4 °C	28 days
Metals			
As, Cd, Cr, Cu, Fe, Pb, Ni, Zn	250 mL HDPE plastic	4 °C ; HNO_3 to pH <2 w/in 48 hours	6 months after filtration and acidification
Mercury	250 mL HDPE plastic	0.5 % HCl to pH w/in 48 hours	6 months after filtration and acidification
Ions			
Chloride, Sulfate	1 L HDPE Plastic	4 °C	28 days
Silica	300 mL HDPE Plastic	Acidify with (1+1) HNO_3 to pH <2	6 months
Organics		4 °C	7 days/40 days
Organophosphorous	1 L amber glass	4 °C; ph 5-9	7 days (sample extraction)/ 40 days

Pyrethroid	1 L amber glass	4 °C; ph 5-9	14 days (sample extraction)/ 40 days
Sediment Chemistry			
General Chemistry			
Kjeldahl Nitrogen, Total	250 mL glass	4 °C; freeze at -20 °C as soon as possible	1 year
Phosphorus as P	250 mL glass	4 °C; freeze at -20 °C as soon as possible	6 months
Total Organic Carbon	250 mL glass	4 °C; freeze at -20 °C as soon as possible	1 year
Metals			
As, Cd, Cr, Cu, Fe, Hg, Pb, Ni, Zn	250 mL glass	4 °C; freeze at -20 °C as soon as possible	1 year
Organics			
Organophosphorus, Organochlorine, PCBs, PAHS	250 mL glass	4 °C; freeze at -20 °C as soon as possible	1 year
Grain Size	Whirl-Pac	4 °C	1 year
Tissue			
Metals			
Se, Hg	250 mL glass	4 °C within 24 hours; then freeze -20 °C	1 year
Organics			
Organochlorine, PCBs	250 mL glass	4 °C within 24 hours; then freeze -20 °C	1 year

11.0 ANALYTICAL METHODS

11.1 Field Analysis Methods

Field measurements will have the accuracy as indicated in Table 5 (Element 7).

11.2 Laboratory Analysis Methods

Laboratory measurements will have the accuracy as indicated in Table 5 (Element 7).

11.3 Sample Disposal

After analysis, including QA/QC procedures, sample disposal will follow laboratory protocols. Portions of the bioassessment samples will be retained including unsorted samples (1 year), sorted remnants (5 years), identified sample partitioned into taxa groups (5 years), and a reference collection (indefinitely).

11.4 Corrective Action

Corrective action is taken when an analysis is deemed suspect for some reason. These reasons include exceeding accuracy ranges (chemistry); not meeting test acceptability criteria or control chart criteria (toxicity); not meeting blank checks (bacteriology); and/or problems with sorting and identification (bioassessments). The corrective action will vary on a case-by-case basis, but at a minimum involves the following:

- A check of procedures.
- A review of documents and calculations to identify possible errors.
- Correction of errors based on discussions among analysts.
- A complete re-identification of the bioassessment sample.
- A re-analysis of the sample extract, if sufficient volume is available, to determine if results can be improved.
- A complete reprocessing and re-analysis of additional sample material, if sufficient volume is available and if the holding time has not been exceeded.
- Re-training of staff to ensure the action is not repeated.

The field and laboratory coordinators each have systems in place to document problems and make corrective actions. All corrective actions will be documented to the Project Manager.

Chemistry and toxicity testing laboratories will be required to provide a three-week turnaround on all deliverables. The deliverable package will include hard copy and Electronic Data Deliverable (EDD). The hard copy will include standard narratives identifying any analytical or QA/QC problems and corrective actions, if

any. The following QA/QC elements will be included in the data package: sample collection, extraction, and analysis dates and times, results of method blanks or controls, summary of analytical accuracy, summary of analytical precision, and reporting limits. The electronic data files will contain all information found in the hard copy reports submitted by the laboratories. Individual data sets will be submitted as either Microsoft Excel® workbook files or as Microsoft Access® database files.

12.0 QUALITY CONTROL

Samples for QA/QC will be collected both in the field and in the lab. Field QA/QC samples are used to evaluate precision due to sampling bias or field variability. Field QA/QC samples include field duplicates and travel blanks. Lab QA/QC samples are used to evaluate the analytical process for precision and accuracy. Internal laboratory QC checks will include:

- Bioassessments: sample re-sorts and re-identification
- Toxicity: acceptable laboratory controls and reference toxicant test results
- Bacteriology: acceptable laboratory blank and positive controls
- Chemistry: method blanks, laboratory control materials, duplicates, matrix spikes, instrument calibrations, and internal standards

12.1 Field Sampling Quality Control

QA/QC activities for sampling processes include the collection of field duplicates for bacterial and chemical testing, and field checks by sampling staff (see Table 12). In order to monitor the sampling process, the Aquatic Bioassay QA Officer will randomly observe sampling processes and compare the actual actions against the sampling SOP. Daily field briefings will be held prior to the initiation of work to ensure that field staffs are aware of the days sampling objectives and any method issues they might face.

Laboratory results will validate cleanliness of equipment. If contamination of sample by field or equipment occurs during the sampling, the contaminated sample will be discarded.

12.2 Field Duplicates

Field duplicates help quantify potential bias associated with sampling activities. Field duplicates are comprised of a replicate sample taken at 10% of the programs sites. Each result will be recorded along with the average of the two results, the difference between the largest and smallest result, and the percent difference between the largest and smallest result. The percent difference will be calculated as follows.

Relative Percent Difference (RPD) = 100 * (Largest-Smallest) / Average

There are no specific criteria for field duplicate precision, but results with an RPD of ± 25% are generally considered acceptable.

12.3 Bioassessment Sample Re-sorting

Sample re-sorting is used to quantify the sorting accuracy of the laboratory. Once samples are sorted, a laboratory leader will re-sort the sample remnants to

ensure that all organisms have been removed. The acceptable accuracy limit for re-sorts is ≥95% (Table 5). Percent sorting accuracy is calculated as:

- Percent Sorting Accuracy = [(number of organisms in re-sort *100)/ number of organisms in original sort]

12.4 Bioassessment Sample Identification

Sample re-identification is used to quantify the identification and enumeration accuracy of the laboratory. Once samples are identified, 10% of all samples will be sent to a second biologist at the CA Department of Fish and Games Aquatic Bioassessment Laboratory (ABL) who will re-identify the sample to ensure that all organisms have been accurately identified and enumerated. The acceptable accuracy limits for identification is ≥95% (Table 5). Percent identification and enumeration accuracy are calculated as:

- Percent Identification Accuracy = [(number of organisms misidentified)/ number of organisms in original ID]*100

- Percent Enumeration Accuracy = (number of organisms in re-identification/number of organisms enumerated in original sample)*100

Identification discrepancies between the laboratories are discussed and resolved by the biologists. The final dataset is modified to reflect the agreed upon resolution.

12.5 Toxicity

- The survival of test organisms in laboratory control water must be at least 90% for acute and 80% for chronic toxicity tests to be considered valid.

- Reference toxicant results must be within ± 2 standard deviations of the average of the previous 20 tests.

- All test acceptability conditions must be within specified limits.

12.6 Bacteriology

- Reagent blank samples must be below detection (<10 MPN/100 mL) for all samples for tests to be valid.

- Positive controls must be within specified ranges for the associated tests to be valid.

12.7 Chemistry

A batch is defined as a group of 20 or fewer samples of similar matrix, processed together under the same conditions and with the same reagents. QC samples are associated with each batch and are used to assess the validity of the sample analyses. Control limits can be found in Table 5 of this document. Each batch must include the following QC checks:

- Method Blank- A method blank is a sample that contains no analyte of interest. For solid matrices, no matrix is used. The method blank serves to measure contamination associated with processing the sample within the laboratory.

- Laboratory Control Material (LCM) or Certified Reference Material (CRM) - A LCM or CRM is a sample with a matrix similar to the client samples that contains analyte of interest at known or certified concentrations. It is used to determine the accuracy of the results based on the comparison of the measured concentration with the true value. For analytes that are greater than 10 times the MDL, the acceptable percent recovery is presented in Appendix B, Table 11.

- Duplicate Analyses- Duplicate analyses are samples that have been split and processed within a single batch. They are used to determine the precision of the results based on the percent relative difference (% PRD) between the two sets of results. Control limits for % PRD are presented in Appendix B, Table 11.

- Matrix Spike/Matrix Spike Duplicates (MS/MSD) - MS/MSD are samples of similar matrix to the client's samples that are spiked with a known amount of analyte. Spike recovery measures the effect of interferences caused by the sample matrix and reflects the accuracy of the determination. The spike level should be at least ten times the MDL. The duplicate spike may be used to determine the precision of the analytical results similar to Section 7,1

- Initial Calibration- Initial calibration is performed by analyzing standards of known levels of concentration. The lowest level should be less than or equal to ten times the MDL and the remaining levels should represent the entire range of expected concentrations in the samples.

- Calibration Verification- When a calibration curve is not performed for each run, a calibration verification is performed with a standard from preferably a second source, to verify that the instrument is still operating within the original calibration curve.

- Internal Standard- An internal standard is a non-target analyte, that is added to samples and QC checks after the preparation of the sample, just prior to analysis. It is used to compensate for variations in the instrument response from one sample to the next.

- Recovery Surrogate- A recovery surrogate is a non-target analyte or analytes that are added to the sample prior to processing. It is used to indicate the extraction efficiency and instrument variation from sample to sample.

Table 8. (Elements 14 and 16) Quality Control

Analyte	Quality Control	Instrument Calibration
Water Column Samples		
pH	Two point calibration, plus general maintenance and calibration practices	Calibration at the start of each sample run.
Conductance	One point calibration, plus general maintenance and calibration practices.	
DO		
Temperature	Annual comparison with a NIST thermometer, plus general maintenance and calibration practices.	
Temperature	Blanks – Laboratory and field blanks. No detectable amount of substance in blanks. Frequencies – Accuracy, precision, recovery, and blanks at 1 in 20 (5%) with at least one in every batch. All QA/QC procedures and criteria specified by selected method.	External calibration with 3 – 5 standards covering the range of sample concentrations prior to sample analysis. At low end, the lowest standard at or near the MDL. Linear regression $r^2 \leq 0.995$. Calibration verification every 20 samples after initial calibration. Standard source different that that used for initial calibration. Recovery 80% - 120%.
Organics in Water		External calibration with 3 – 5 standards covering the range of sample concentrations prior to sample analysis. At low end, the lowest standard at or near the MDL. Linear regression $r^2 \leq 0.995$ or RSD < 10%. Calibration verification every 10 samples after initial calibration. Standard source different that that used for initial calibration. Recovery 85% - 115%.
Metals in Water		External calibration with 3 – 5 standards covering the range of sample concentrations prior to sample analysis. At low end, the lowest standard at or near the MDL. Linear regression $r^2 \leq 0.995$. Calibration verification every 20 samples after initial calibration. Standard source different that that used for initial calibration. Recovery 90% - 110%
Toxicity Testing	Control organisms perform within acceptance criteria for each test.	Stock organisms tested using reference toxicants for each batch of tests. Current test must fall within ± 2 SD of last 20 combined reference toxicant tests.

Bacteria indicators	Field and sterility checks (laboratory blanks) no detectable amounts or less than 1/5 of sample amounts for field blanks. Frequency – accuracy at 1 per culture medium or reagent lot. Precision at 1 in 10 (10%) with at least one per batch. All QA/QC procedures found in *Standard Methods* (18th, 19th, or 20th editions) section 9020 and in the selected analytical method including confirmation practices.	Follow the requirements of *Standard Methods* (21st edition) section 9020.
Sediment Samples		
Nutrients in Sediment	Blanks – Laboratory and field blanks. No detectable amount of substance in blanks. Frequencies – Accuracy, precision, recovery, and blanks at 1 in 20 (5%) with at least one in every batch. All QA/QC procedures and criteria specified by selected method.	External calibration with 3 – 5 standards covering the range of sample concentrations prior to sample analysis. At low end, the lowest standard at or near the MDL. Linear regression $r^2 \leq 0.995$ Calibration verification every 10 samples after initial calibration. Standard source different that that used for initial calibration. Recovery 90% - 110%
Organics in Sediment		
Metals in Sediment	Blanks – Laboratory and field blanks. No detectable amount of substance in blanks. Frequencies – Accuracy, precision, recovery, and laboratory blanks at 1 in 20 (5%) with at least one in every batch. Field blanks – initial demonstration. No further blanks collected if no detectable amount. Otherwise blanks collected at 5% of samples. All QA/QC procedures and criteria specified by selected method.	
Total organic carbon in sediment and sediment grain size	Blanks – no detectable amount or <30% of lowest sample. Frequency – Accuracy for TOC every 15 samples; Precision one per batch; LCM for TOC 1 in 20 (5%) with at least one per batch.	Follow manufacturer's requirements for TOC analyzer. Check weights for balances.

13.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

13.1 Analytical Instruments

13.1.1 *Sample Equipment Cleaning Procedures*

Equipment used for sample collection such as sample bottles and manual and automated samplers will be cleaned according to the specific procedures documented for each analytical method. Clean sample containers will be provided by the laboratories performing the analyses.

The cleaning procedures for equipment used to collect water quality samples are specific for each analytical approach. Standard conventional parameters typically require cleaning of the equipment with Alconox, followed by de-ionized (DI) water rinse, followed by a hydrochloric acid rinse (20% HCl) and then another DI water rinse. Sampling equipment is triple rinsed with site water in the field before collecting the sample water.

New Zealand mud snails are an invasive gastropod that was found in some southern California watersheds since 2005. Field crews need to ensure their equipment, waders, and gloves have been decontaminated prior to sample collection to ensure mud snails are not spread to stream systems in the watershed. Prior to sampling, boots need to be scrubbed with a stiff brush and desiccated in the sun. A concentrated solution of Quat 128 can be used to ensure no snails are present before drying. If Quat 128 is used, it is imperative that the equipment is rinsed with clean water and that none of the rinse water escapes to the environment. When appropriate, equipment may be placed in the freezer at Aquatic Bioassay and frozen over night for use the next day.

13.1.2 *Water Quality Probe Maintenance*

The multi-parameter probes (YSI 556) used by all field teams should be maintained according to the manufacturer instructions so as to assure that the meter and probes are properly functioning during each sampling event. This will include routine replacement of the batteries (and carrying back-up batteries in the field), inspection of the probe, meter, and cable for damage, and properly cleaning and storing the probes in between uses.

13.1.3 *Analytical Instrument and Equipment Testing Procedures and Corrective Actions*

Testing, inspection, maintenance of analytical equipment used by the contract laboratory, and corrective actions are documented in the Quality

Assurance manuals for each analyzing laboratory. Laboratory QA Manuals are made available for review at the analyzing laboratory.

14.0 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

14.1 Laboratory and Analytical Equipment

All laboratory equipment is calibrated based on manufacturer recommendations and accepted laboratory protocol. Aquatic Bioassay, IIRMES and EMD labs maintain calibration practices as part of the method SOPs. Aquatic Bioassay maintains calibration practices as part of the method SOPs. The Aquatic Bioassay QA Officer has reviewed these practices and finds them to be in conformance with the SWAMP requirements.

14.2 Field Instruments

Calibration of the multi-parameter probe (YSI 556) used for measurement of field are performed as described by the manufacturer and the SOP (Appendix A). The multi-meter should be calibrated prior to sampling and on completion of sampling that day. This will provide for an assessment of the "drift" of the meter over the sampling period. With the exception of DO, all parameters will require a two-point calibration, using laboratory-certified standards that bracket the expected values to be measured. Typical field instrument calibration procedures are as follows:

13.2.1 Temperature calibration is factory-set and requires no subsequent calibration. However, temperature is checked annually using a NIST-certified thermometer.

14.2.1 Calibration for pH measurement is accomplished using two standard buffer solutions, 7 and 10.

14.2.2 Calibration for dissolved oxygen measurements is accomplished using 100% air saturation as specified by the manufacturer.

15.0 INSPECTION/ACCEPTANCE FOR SUPPLIES AND CONSUMABLES

Glassware, sample bottles, and collection equipment will all be inspected prior to their use. Supplies will be examined for damage as they are received. The following supplies will receive additional checks as follows.

Table 9. (Element 17) Inspection/acceptance testing requirements for consumables and supplies.

Project-Related Supplies / Consumables	Inspection / Testing Specifications	Acceptance Criteria	Frequency	Responsible Individual
Pre-cleaned sample bottles	Open bottle	Lids on bottles screwed on	100%	Field personnel
Lab glassware	Dirty	Clean	100%	EMD/ IIRMES Labs
Bomb samplers	Leakage/dirty	Works properly, clean	Prior to survey	Aquatic Bioassay

16.0 NON-DIRECT MEASUREMENTS

The data reports for this study will cite and include monitoring data collected during previous years for this project. These data were collected in accordance with SWAMP protocols. Data collected from other studies in the area will be cited in the monitoring report and used for comparative purposes. The data sets have met all QA requirements consistent with this study.

17.0 DATA MANAGEMENT

The management of bioassessment data will be initiated with the use of field and laboratory data sheets. Analytical results will be compiled in SWAMP-compatible electronic formats by each responsible laboratory and verified by the CWH and Aquatic Bioassay. EMD, IIRMES Labs, and Weston Solutions will submit completed data sets electronically in SWAMP compatible formats to the CWH and Aquatic Bioassay after QC checks have been completed. The Aquatic Bioassay Project Manager will receive and review data QC reports from the Aquatic Bioassay Data Manager who will screen all internally and externally generated for the following major items:

- A 10 percent check between data provided by the laboratory.
- Conformity check between the chain-of-custody forms and laboratory reports
- A check for laboratory data report completeness
- A check for typographical errors on the laboratory reports
- A check for suspect values (outliers)
- A check for duplicates

The laboratories will provide data in electronic format. The required form of the SWAMP-compatible electronic submittals will be provided to the laboratories to ensure the files can be imported into the project database with a minimum of editing. The data will be managed in Aquatic Bioassay's project database, which has a relational structure and is compatible for incorporation into the SWAMP database.

Following the initial screening, a more complete QA/QC review process will be performed, which will include an evaluation of analytical accuracy and precision. Accuracy will be evaluated by reviewing bioassay, chemistry, and bacteriology QC results; precision will be evaluated by reviewing field duplicates, and sample completeness will be evaluated by comparing results to chain-of-custody forms.

The finalized data sets will be submitted to the CWH in an Access database and to the SMC Regional Monitoring database in SWAMP formats located at SCCWRP.

Data will be stored on the Aquatic Bioassay network that is backed up nightly in-house. Back-up drives will be stored in a fire proof safe. Hard copies of field and lab data will be stored at Aquatic Bioassay for three years from project completion.

18.0 ASSESSMENTS AND RESPONSE ACTIONS

The Project Manager, will be responsible for the day-to-day oversight of the project. The Project QA Officer will conduct periodic reviews of the data and relay any problems to the Project Manager.

If an audit reveals any discrepancy, Aquatic Bioassay's QA Officer will discuss the observed discrepancy with the appropriate person responsible for the activity (see organization chart). The discussion will begin with whether the information collected is accurate, what were the cause(s) leading to the deviation, how the deviation might impact data quality, and what corrective actions might be considered.

The QA Officer has the power to halt all sampling and analytical work by the EMD, Aquatic Bioassay, IIRMES Labs, or Weston Solutions if the deviation(s) noted are considered detrimental to data quality.

19.0 REPORTS TO MANAGEMENT

The status of data collection during this project will be reported by the Project Manager to the Contract Manager on a monthly basis beginning October 1st of each year and continuing until the completion of the current contract. A draft final project report will be filed no later than September of each year. The Project QA Officer has complete access to the Project Manager on an ongoing basis. Any QA deviations will be detailed in the sample event summary report and draft/final report.

Table 10. (Element 21) QA management report

Report	**Due by**
Monthly progress reports	September 1st, 2010 and monthly thereafter
Sample event summary	Included in the monthly reports
Draft final report for review	July of each year
Final Report	August of each year

20.0 DATA REVIEW, VERIFICATION, AND VALIDATION

Laboratory validation and verification of the data generated is the responsibility of the laboratory. The laboratory manager will maintain analytical reports in a database format, as well as all QA/QC documentation for the laboratory.

Aquatic Bioassay will review all data packages received for adherence to the Data Quality Objectives (DQOs) set forth in this QAPP. Chain-of-custody forms will be reviewed to ensure adherence to collection, transport, and receipt requirements, including test initiation within the required holding time. Toxicity data will be evaluated for completeness, adherence to test methodology, passing acceptability criteria, choice of appropriate statistical methods, and proper reporting.

If results fail to meet any DQO, the Project Manager and or the QA Officer will flag them for further review. Batch QA samples will be reviewed to determine the potential cause for failure to meet the DQO. If the cause cannot be readily ascertained, reserve samples will be reanalyzed (if within the designated holding times). If subsequent analyses meet the DQO, the samples will be deemed acceptable.

If samples fail to meet the DQOs a second time or the cause of the failure cannot be identified and rectified, the data will be excluded from inclusion in the study results. All rejected data will be retained in the project database, and qualified as "rejected". The ultimate decision of whether to accept or reject a data point will be made by the Project Manager in consultation with the QA Officer.

If the analysis for more than 10% of any given analyte fails to meet the DQOs, the Project Manager and QA Officer shall meet to discuss the appropriateness of the DQO and any potential modifications. All proposed modifications of DQOs shall be reviewed by the QA Officer at the Regional Water Quality Control Board.

Laboratories will conduct a 50 percent raw data audit before delivering results to the final program database held by Aquatic Bioassay. If their error rate is greater than 5%, a 100% raw data audit will be triggered.

21.0 VERIFICATION AND VALIDATION METHODS

Data collected in the field will be validated and verified by the field coordinator. The laboratory maintains chain-of-custody and sample manifests.

Laboratory validation and verification of the data generated is the responsibility of the laboratory. The laboratory supervisor will maintain analytical reports in a database format, as well as all QA/QC documentation for the laboratory.

The Project Manager and Project QA Officer are responsible for oversight of data collection and the initial analysis of the raw data obtained from the field and the laboratory. The Project Manager's responsibilities also include the generation of rough drafts of monthly and final reports. The Project Manager has final oversight on the submission of monthly and final reports.

Reconciliation and correction of any data that fails to meet the project DQOs will be done by the Project Manager in consultation with the QA Officer. Any corrections require a unanimous agreement that the correction is appropriate.

22.0 RECONCILIATION WITH USER REQUIREMENTS

For data that do not meet DQOs, management has two options:

1. Retain the data for analytical purposes, but flag these data for QA deviations.
2. Do not retain the data and exclude them from all calculations and interpretations.

The choice of option is the decision of the Project Manager and Project Director. If qualified data are to be used, then it must be made clear in the final report that these deviations do not alter the conclusions of the study.

Appendix A

Standard Operating Procedures

To request Standard Operating Procedures, please contact the following organizations responsible for sampling and/or laboratory analysis.

Habitat Assessments/Sample Collection

- Site Reconnaissance

  Aquatic Bioassay & Consulting Laboratories
  Phone: (805)-643-5621
  Email: info@aquabio.org
  Website: www.aquabio.org

- Bioassessment

  SWAMP SOP
  Website: http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_bioassessment_collection_020107.pdf

  Aquatic Bioassay & Consulting Laboratories
  Phone: (805)-643-5621
  Email: info@aquabio.org
  Website: www.aquabio.org

  Weston Solutions
  Phone: (760) 795-6928
  Email: info@westonsolutions.com
  Website: http://www.westonsolutions.com

- CRAM

  California CRAM SOP
  Website: http://www.cramwetlands.org/documents/

  Aquatic Bioassay & Consulting Laboratories
  Phone: (805)-643-5621
  Email: info@aquabio.org
  Website: www.aquabio.org

- Water Collection

  Aquatic Bioassay & Consulting Laboratories
  Phone: (805)-643-5621
  Email: info@aquabio.org
  Website: www.aquabio.org

- Sediment Collection

Aquatic Bioassay & Consulting Laboratories
Phone: (805)-643-5621
Email: info@aquabio.org
Website: www.aquabio.org

- Fish Collection

California Department of Fish & Game
Phone: (805) 771-4162

Laboratory Analysis

- Chemistry

City of Los Angeles, EMD
Phone: (310) 648-5610
Email: mas.dojiri@lacity.org
Website: http://www.lacitysan.org/emd/index.htm

IIRMES Laboratories
Phone: (562) 985-2496
Email: richard.gossett@csulb.edu
Website: http://www.iirmes.org

- Bacteria

City of Los Angeles, EMD
Phone: (310) 648-5610
Email: Mas.Dojiri@lacity.org
Website: http://www.lacitysan.org/emd/index.htm

- Benthic Macroinvertebrate

SAFIT Standard Taxonomic Effort
Website: http://www.safit.org/ste.html

Aquatic Bioassay & Consulting Laboratories
Phone: (805) 643-5621
Email: info@aquabio.org
Website: www.aquabio.org

- Benthic Infauna

SCAMIT Standard Taxonomic Effort
Website: http://www.scamit.org/

City of Los Angeles, EMD
Phone: (818) 778-4216
Email: Ken.Franklin@lacity.org
Website: http://www.lacitysan.org/emd/index.htm

Toxicity

City of Los Angeles, EMD
Phone: (310) 648-5194
Email: info@aquabio.org
Website: http://www.lacitysan.org/emd/index.htm

Aquatic Bioassay & Consulting Laboratories
Phone: (805)-643-5621
Email: Stan.Asato@lacity.org
Website: www.aquabio.org

Appendix B

Data Quality Objectives for Each LARWMP Project Phase

Table 11. (Element 7) Data quality objectives for field and laboratory measurements.

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Field Water Quality Measurements								
Dissolved Oxygen	None	± 0.5 mg/L or 10%	N/A	1 point calibration	90%	ABC/Weston	N/A	mg/L
Temperature	None	± 0.5 °C or 10%	N/A	2 point calibration (Annually)		ABC/Weston	N/A	°C
Specific Conductivity	None	± 4 µs or 10%	N/A	1 point calibration		ABC/Weston	2.5	µS/cm
Salinity	None	N/A	N/A	N/A		ABC/Weston	N/A	ppt
pH	None	± 0.5	N/A	2 point calibration		ABC/Weston	N/A	pH units
General Chemistry: Freshwater								
Alkalinity as $CaCO_3$	Total	None	N/A	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	10	mg/L
Hardness as $CaCO_3$	Total					CLA EMD	1.32	mg/L
Total Suspended Solids	Total					CLA EMD	3	mg/L
Chlorophyll a	None	None	N/A	None	90%	SEM	2	$\mu g/cm^2$
Ash-Free Dry Mass	None					SEM	1	mg/cm^2
Nutrients: Freshwater								
Ammonia as N	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	0.1	mg/L
Dissolved Organic Carbon	None					CLA EMD	0.1	mg/L
Total Organic Carbon	None					CLA EMD	0.1	mg/L
Nitrate as N	None					CLA EMD	0.1	mg/L
Nitrite as N	None					CLA EMD	0.02	mg/L
OrthoPhosphate as P	None					CLA EMD	0.1	mg/L
Phosphorus as P	Total					CLA EMD	0.1	mg/L
Total Nitrogen (calculated)	None	N/A	N/A	N/A	90%	CLA EMD	N/A	mg/L
Total Kjeldahl Nitrogen	None	None	N/A	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	0.1	mg/L
Ions: Freshwater								
Chloride	None	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1.0	mg/L
Sulfate	None					IIRMES	1.0	mg/L
Silica	Total					IIRMES	0.5	mg/L
Metals: Freshwater								
Arsenic	Total & Dissolved	Reference Material (CRM, SRM or LCS) and Matrix Spike	75 -125% (70 - 130 % for Hg)	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1	µg/L
Cadmium	Total & Dissolved					CLA EMD	0.2	µg/L
Chromium	Total & Dissolved					CLA EMD	0.5	µg/L
Copper	Total & Dissolved					CLA EMD	0.5	µg/L
Iron	Total & Dissolved					CLA EMD	50	µg/L
Lead	Total & Dissolved					CLA EMD	0.5	µg/L
Mercury	Total & Dissolved					CLA EMD	0.2	µg/L
Nickel	Total & Dissolved					CLA EMD	1	µg/L
Selenium	Total & Dissolved					CLA EMD	1	µg/L
Zinc	Total & Dissolved					CLA EMD	1	µg/L
Pyrethroid: Freshwater								
Bifenthrin	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	IIRMES	0.002	µg/L
Cyfluthrin, Total	Total					IIRMES	0.002	µg/L
Cyhalothrin, Lambda, Total	Total					IIRMES	0.002	µg/L
Cypermethrin, Total	Total					IIRMES	0.002	µg/L
Deltamethrin	Total					IIRMES	0.002	µg/L
Esfenvalerate	Total					IIRMES	0.002	µg/L
Esfenvalerate/Fenvalerate, Total	Total					IIRMES	0.002	µg/L
Fenvalerate	Total					IIRMES	0.002	µg/L
Permethrin, Total	Total					IIRMES	0.005	µg/L
Permethrin-1	Total					IIRMES	0.002	µg/L
Permethrin-2	Total					IIRMES	0.002	µg/L

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Orthophosphate: Freshwater								
Bolstar	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	IIRMES	0.004	µg/L
Chlorpyrifos	Total		50 - 150%			IIRMES	0.002	µg/L
Demeton-s	Total		21 -128%			IIRMES	0.002	µg/L
Diazinon	Total		50 - 150%			IIRMES	0.004	µg/L
Dichlorvos	Total		50 - 150%			IIRMES	0.003	µg/L
Dimethoate	Total		50 - 150%			IIRMES	0.006	µg/L
Disulfoton	Total		16 - 118%			IIRMES	0.002	µg/L
Ethoprop	Total		50 - 150%			IIRMES	0.002	µg/L
Fenchlorophos	Total		50 - 150%			IIRMES	0.004	µg/L
Fensulfothion	Total		50 - 150%			IIRMES	0.002	µg/L
Fenthion	Total		50 - 150%			IIRMES	0.004	µg/L
Malathion	Total		50 - 150%			IIRMES	0.006	µg/L
Merphos	Total		50 - 150%			IIRMES	0.002	µg/L
Mevinphos	Total		50 - 150%			IIRMES	0.016	µg/L
Parathion, Methyl	Total		50 - 150%			IIRMES	0.002	µg/L
Phorate	Total		50 - 150%			IIRMES	0.012	µg/L
Tetrachlorvinphos	Total		50 - 150%			IIRMES	0.004	µg/L
Tokuthion	Total		50 - 150%			IIRMES	0.006	µg/L
Trichloronate	Total		50 - 150%			IIRMES	0.002	µg/L
Toxicity: Freshwater								
Chronic Ceriodaphnia dubia: primary test organism	N/A	Meets EPA control response standards; DMR intralab results w/in criteria	N/A	Ref Tox ± 2 SD of preceding 20 tests	90%	CLA EMD	N/A	Survival (%) & Reproduction (%)
Chronic Hyallela azteca: secondary test organism if conductivity is > 2,500 µS/cm	N/A	Meets EPA control response standards; DMR intralab results w/in criteria	N/A	Ref Tox ± 2 SD of preceding 20 tests	90%	ABC	N/A	Survival (%) & Biomass (mg/ind)
Bacterial Analysis: Freshwater								
E. Coli		Laboratory positive and negative cultures	80 - 120%	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	10	MPN/100 mL
Invertebrate Identifications: Freshwater								
Sampling	N/A	≤10 seconds of nominal Lat/Long (300 m radius)	N/A	Record coefficient of variation of biological measures for duplicate samples (no DQO), frequency of 5% or at least one per project.	90%	ABC/Weston	1.0 seconds Lat/Long	N/A
Sorting	N/A	Recount accuracy ≥95%. 10% frequency (external reference lab)	N/A	At least three grids or 25% of the total sample volume must be sorted.	Sorting efficiency ≥95%, 100 % frequency (internal) -Processing efficiency ≥99%, 100% frequency	ABC/Weston	N/A	N/A
Taxonomic ID	N/A	Taxa count error ≤5%. 10% frequency (external reference lab)	N/A	Random errors ≤ 2 taxa, 10% frequency (ref lab)	≥99% successful analysis of all sorted samples	ABC/Weston	SAFIT Level 2	Count
	N/A	Taxa ID error ≤5%. 10% frequency (external reference lab)	N/A	Systemic errors ≤ 2. 10% frequency (external reference lab)	≥99% successful analysis of all sorted samples	ABC/Weston	SAFIT Level 2	Count
	N/A	Individual ID error ≤5%. 10% frequency (external reference lab)	N/A	N/A	≥99% successful analysis of all sorted samples	ABC/Weston	SAFIT Level 2	Count

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
General Chemistry: Estuary Seawater								
Alkalinity as $CaCO_3$	Total	None	N/A	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	10	mg/L
Hardness as $CaCO_3$	Total					CLA EMD	1.32	mg/L
Total Suspended Solids	Total					CLA EMD	3	mg/L
Total Dissolved Solids	Total					CLA EMD	37	mg/L
Nutrients: Estuary Seawater								
Ammonia as N	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120 %	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	0.1	mg/L
Dissolved Organic Carbon	None					CLA EMD	0.1	mg/L
Total Organic Carbon	None					CLA EMD	0.1	mg/L
Nitrate as N	None					CLA EMD	0.1	mg/L
Nitrite as N	None					CLA EMD	0.1	mg/L
OrthoPhosphate as P	None					CLA EMD	0.1	mg/L
Phosphorus as P	Total					CLA EMD	0.1	mg/L
Total Nitrogen (calculated)	None	N/A	N/A	N/A	90%	CLA EMD	N/A	mg/L
Total Kjeldahl Nitrogen	None	None	N/A	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	0.1	mg/L
Metals: Estuary Seawater								
Arsenic	Total & Dissolved	Reference Material (CRM, SRM or LCS) and Matrix Spike	75 -125% (70 - 130 % for Hg)	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1	µg/L
Cadmium	Total & Dissolved					CLA EMD	0.2	µg/L
Chromium	Total & Dissolved					CLA EMD	0.5	µg/L
Copper	Total & Dissolved					CLA EMD	0.5	µg/L
Iron	Total & Dissolved					CLA EMD	50	µg/L
Lead	Total & Dissolved					CLA EMD	0.5	µg/L
Mercury	Total & Dissolved					CLA EMD	0.2	µg/L
Nickel	Total & Dissolved					CLA EMD	1	µg/L
Selenium	Total & Dissolved					CLA EMD	1	µg/L
Zinc	Total & Dissolved					CLA EMD	1	µg/L
Pyrethroid: Estuary Seawater								
Bifenthrin	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	IIRMES	0.002	µg/L
Cyfluthrin, Total	Total					IIRMES	0.002	µg/L
Cyhalothrin, Lambda, Total	Total					IIRMES	0.002	µg/L
Cypermethrin, Total	Total					IIRMES	0.002	µg/L
Deltamethrin	Total					IIRMES	0.002	µg/L
Esfenvalerate	Total					IIRMES	0.002	µg/L
Esfenvalerate/Fenvalerate, Total	Total					IIRMES	0.002	µg/L
Fenvalerate	Total					IIRMES	0.002	µg/L
Permethrin, Total	Total					IIRMES	0.005	µg/L
Permethrin-1	Total					IIRMES	0.002	µg/L
Permethrin-2	Total					IIRMES	0.002	µg/L
Orthophosphate: Estuary Seawater								
Bolstar	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	IIRMES	0.004	µg/L
Chlorpyrifos	Total		50 - 150%			IIRMES	0.002	µg/L
Demeton-s	Total		21 -128%			IIRMES	0.002	µg/L
Diazinon	Total		50 - 150%			IIRMES	0.004	µg/L
Dichlorvos	Total		50 - 150%			IIRMES	0.003	µg/L
Dimethoate	Total		50 - 150%			IIRMES	0.006	µg/L
Disulfoton	Total		16 - 118%			IIRMES	0.002	µg/L
Ethoprop	Total		50 - 150%			IIRMES	0.002	µg/L
Fenchlorophos	Total		50 - 150%			IIRMES	0.004	µg/L
Fensulfothion	Total		50 - 150%			IIRMES	0.002	µg/L

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Orthophosphate: Toxicity: Estuary Seawater (Continued)								
Fenthion	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%		IIRMES	0.004	µg/L
Malathion	Total		50 - 150%			IIRMES	0.006	µg/L
Merphos	Total		50 - 150%			IIRMES	0.002	µg/L
Mevinphos	Total		50 - 150%			IIRMES	0.016	µg/L
Parathion, Methyl	Total		50 - 150%			IIRMES	0.002	µg/L
Phorate	Total		50 - 150%			IIRMES	0.012	µg/L
Tetrachlorvinphos	Total		50 - 150%			IIRMES	0.004	µg/L
Tokuthion	Total		50 - 150%			IIRMES	0.006	µg/L
Trichloronate	Total		50 - 150%			IIRMES	0.002	µg/L
Bacteria Analysis: Estuary Seawater								
Total Coliform	None	Laboratory positive and negative cultures	80 - 120%	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	10	MPN/100 mL
E. Coli	None							
Enterococcus	None							
Grain Size: Estuary Sediment								
Sediment grain size	None	N/A	N/A	Laboratory Duplicate - RPD < 25%	90%	ABC	<2000 - >0.2	µm
Nutrients: Estuary Sediment								
Total Kjeldahl Nitrogen	None	None	N/A	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	0.5	mg/Kg dw
Phopsphorous as P	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	80 - 120%	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25%. RPD	90%		0.05	mg/Kg dw
Total Organic Carbon	None						0.05	% dw
Metals: Estuary Sediment								
Arsenic	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	75 -125% (70 - 130 % for Hg)	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1	mg/Kg dw
Cadmium	Total					CLA EMD	1	mg/Kg dw
Chromium	Total					CLA EMD	1	mg/Kg dw
Copper	Total					CLA EMD	1	mg/Kg dw
Iron	Total					CLA EMD	100	mg/Kg dw
Lead	Total					CLA EMD	0.5	mg/Kg dw
Mercury	Total					CLA EMD	0.01	mg/Kg dw
Nickel	Total					CLA EMD	2	mg/Kg dw
Selenium	Total					CLA EMD	1	mg/Kg dw
Zinc	Total					CLA EMD	2	mg/Kg dw
Organochlorine Pesticides: Estuary Sediment								
Aldrin	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1.7	µg/kg dw
Chlordane, cis-	Total		50 - 150%			CLA EMD	8.33	µg/kg dw
Chlordane, trans-	Total		50 - 150%			CLA EMD	8.33	µg/kg dw
DDD(o,p')	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
DDD(p,p')	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
DDE(o,p')	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
DDE(p,p')	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
DDT(o,p')	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
DDT(p,p')	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
Dieldrin	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
Endosulfan I	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
Endosulfan II	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
Endosulfan Sulfate	Total		50 - 150%			CLA EMD	1.7	µg/kg dw

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Organochlorine Pesticides: Estuary Sediment (Continued)								
Endrin	Total		50 - 150%			CLA EMD	2	µg/kg dw
Endrin Aldehyde	Total		33 - 138%			CLA EMD	1.7	µg/kg dw
Endrin Ketone	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
HCH, alpha	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
HCH, beta	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
HCH, delta	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
HCH, gamma	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
Heptachlor	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1.7	µg/kg dw
Heptachlor Epoxide	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
Methoxychlor	Total		34 - 143%			CLA EMD	7	µg/kg dw
Mirex	Total		50 - 150%			CLA EMD	1.7	µg/kg dw
Nonachlor, cis-	Total		50 - 150%			CLA EMD	8.33	µg/kg dw
Nonachlor, trans-	Total		50 - 150%			CLA EMD	8.33	µg/kg dw
Oxychlordane	Total		50 - 150%			CLA EMD	8.33	µg/kg dw
Toxaphene	Total		50 - 150%			CLA EMD	83	µg/kg dw
PCBs: Estuary Sediment								
PCB 003	Total					CLA EMD	0.5	µg/kg dw
PCB 008	Total					CLA EMD	0.5	µg/kg dw
PCB 018	Total					CLA EMD	0.5	µg/kg dw
PCB 027	Total					CLA EMD	0.5	µg/kg dw
PCB 028	Total					CLA EMD	0.5	µg/kg dw
PCB 029	Total					CLA EMD	0.5	µg/kg dw
PCB 031	Total					CLA EMD	0.5	µg/kg dw
PCB 033	Total					CLA EMD	0.5	µg/kg dw
PCB 037	Total					CLA EMD	0.5	µg/kg dw
PCB 044	Total					CLA EMD	0.5	µg/kg dw
PCB 049	Total					CLA EMD	0.5	µg/kg dw
PCB 052	Total					CLA EMD	0.5	µg/kg dw
PCB 056	Total					CLA EMD	0.5	µg/kg dw
PCB 056/060	Total					CLA EMD	0.5	µg/kg dw
PCB 060	Total					CLA EMD	0.5	µg/kg dw
PCB 064	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150 %	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	0.5	µg/kg dw
PCB 066	Total					CLA EMD	0.5	µg/kg dw
PCB 070	Total					CLA EMD	0.5	µg/kg dw
PCB 074	Total					CLA EMD	0.5	µg/kg dw
PCB 077	Total					CLA EMD	0.5	µg/kg dw
PCB 081	Total					CLA EMD	0.5	µg/kg dw
PCB 087	Total					CLA EMD	0.5	µg/kg dw
PCB 095	Total					CLA EMD	0.5	µg/kg dw
PCB 097	Total					CLA EMD	0.5	µg/kg dw
PCB 099	Total					CLA EMD	0.5	µg/kg dw
PCB 101	Total					CLA EMD	0.5	µg/kg dw
PCB 105	Total					CLA EMD	0.5	µg/kg dw
PCB 110	Total					CLA EMD	0.5	µg/kg dw
PCB 114	Total					CLA EMD	0.5	µg/kg dw
PCB 118	Total					CLA EMD	0.5	µg/kg dw
PCB 119	Total					CLA EMD	0.5	µg/kg dw
PCB 123	Total					CLA EMD	0.5	µg/kg dw

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
PCBs: Estuary Sediment (Continued)								
PCB 126	Total					CLA EMD	0.5	µg/kg dw
PCB 128	Total					CLA EMD	0.5	µg/kg dw
PCB 128/167	Total					CLA EMD	0.5	µg/kg dw
PCB 137	Total					CLA EMD	0.5	µg/kg dw
PCB 138	Total					CLA EMD	0.5	µg/kg dw
PCB 141	Total					CLA EMD	0.5	µg/kg dw
PCB 146	Total					CLA EMD	0.5	µg/kg dw
PCB 149	Total					CLA EMD	0.5	µg/kg dw
PCB 151	Total					CLA EMD	0.5	µg/kg dw
PCB 153	Total					CLA EMD	0.5	µg/kg dw
PCB 156	Total					CLA EMD	0.5	µg/kg dw
PCB 157	Total					CLA EMD	0.5	µg/kg dw
PCB 158	Total					CLA EMD	0.5	µg/kg dw
PCB 167	Total					CLA EMD	0.5	µg/kg dw
PCB 168	Total					CLA EMD	0.5	µg/kg dw
PCB 168/132	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150 %	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	0.5	µg/kg dw
PCB 169	Total					CLA EMD	0.5	µg/kg dw
PCB 170	Total					CLA EMD	0.5	µg/kg dw
PCB 174	Total					CLA EMD	0.5	µg/kg dw
PCB 177	Total					CLA EMD	0.5	µg/kg dw
PCB 180	Total					CLA EMD	0.5	µg/kg dw
PCB 183	Total					CLA EMD	0.5	µg/kg dw
PCB 187	Total					CLA EMD	0.5	µg/kg dw
PCB 189	Total					CLA EMD	0.5	µg/kg dw
PCB 194	Total					CLA EMD	0.5	µg/kg dw
PCB 195	Total					CLA EMD	0.5	µg/kg dw
PCB 198/199	Total					CLA EMD	0.5	µg/kg dw
PCB 200	Total					CLA EMD	0.5	µg/kg dw
PCB 201	Total					CLA EMD	0.5	µg/kg dw
PCB 203	Total					CLA EMD	0.5	µg/kg dw
PCB 206	Total					CLA EMD	0.5	µg/kg dw
PCB 209	Total					CLA EMD	0.5	µg/kg dw
PAHs: Estuary Sediment								
Acenaphthene	Total					CLA EMD	1.7	µg/kg dw
Acenaphthylene	Total					CLA EMD	1.7	µg/kg dw
Anthracene	Total					CLA EMD	1.7	µg/kg dw
Benz(a)anthracene	Total					CLA EMD	1.7	µg/kg dw
Benzo(a)pyrene	Total					CLA EMD	1.7	µg/kg dw
Benzo(b)fluoranthene	Total					CLA EMD	1.7	µg/kg dw
Benzo(e)pyrene	Total					CLA EMD	1.7	µg/kg dw
Benzo(g,h,i)perylene	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1.7	µg/kg dw
Benzo(k)fluoranthene	Total					CLA EMD	1.7	µg/kg dw
Biphenyl	Total					CLA EMD	1.7	µg/kg dw
Chrysene	Total					CLA EMD	1.7	µg/kg dw
Dibenz(a,h)anthracene	Total					CLA EMD	1.7	µg/kg dw
Dibenzothiophene	Total					CLA EMD	1.7	µg/kg dw
Dimethylnaphthalene, 2,6-	Total					CLA EMD	1.7	µg/kg dw
Fluoranthene	Total					CLA EMD	1.7	µg/kg dw

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
PAHs: Estuary Sediment (Continued								
Fluorene	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1.7	µg/kg dw
Indeno(1,2,3-c,d)pyrene	Total					CLA EMD	1.7	µg/kg dw
Methylnaphthalene, 1-	Total					CLA EMD	1.7	µg/kg dw
Methylnaphthalene, 2-	Total					CLA EMD	1.7	µg/kg dw
Methylphenanthrene, 1-	Total					CLA EMD	1.7	µg/kg dw
Naphthalene	Total					CLA EMD	1.7	µg/kg dw
Perylene	Total					CLA EMD	1.7	µg/kg dw
Phenanthrene	Total					CLA EMD	1.7	µg/kg dw
Pyrene	Total					CLA EMD	1.7	µg/kg dw
Trimethylnaphthalene, 2,3,5-	Total					CLA EMD	1.7	µg/kg dw
Toxicity: Estuary (Sediment)								
Eohaustorius sp.	N/A	Meets EPA control response standards; DMR intralab results	N/A	Ref Tox ± 2 SD of preceding 20 tests	90%	CLA EMD	N/A	Survival (%)
Mytilus Sediment Water Interface	N/A					ABC		Mortality/Normality (%)
Invertebrate Identifications: Estuary (Sediment)								
Sampling	N/A	≤10 seconds of nominal Lat/Long (300 m radius)	N/A	N/A	90%	ABC	1.0 seconds Lat/Long	N/A
Sorting	N/A	A minimum of 10% of all matriral will be resorted. Sorting accuracy within 5% (equivalent to 95% removal efficiency).	95 % Sorting Efficiency	N/A	90%	ABC	N/A	N/A
Taxonomic ID	N/A	Taxonomist must be an active participant in SCAMIT and the Southern California Bight infauna taxonomic analysis.	N/A	N/A	90%	ABC	SCAMIT	N/A
Metals: Fish Tissue								
Mercury	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	75 -125% (70 - 130 % for Hg)	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	0.02	mg/dry Kg
Selenium	Total					CLA EMD	0.05	mg/dry Kg
Lipids: Fish Tissue								
Lipid	Total	N/A	N/A	Laboratory Duplicate - RPD < 25%	90%	CLA EMD	0.05	%
Organochlorine Pesticides: Fish Tissue								
Aldrin	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1.7	µg/wet Kg
Chlordane, cis-	Total					CLA EMD	8.3	µg/wet Kg
Chlordane, trans-	Total					CLA EMD	8.3	µg/wet Kg
DDD(o,p')	Total					CLA EMD	1.7	µg/wet Kg
DDD(p,p')	Total					CLA EMD	1.7	µg/wet Kg
DDE(o,p')	Total					CLA EMD	1.7	µg/wet Kg
DDE(p,p')	Total					CLA EMD	1.7	µg/wet Kg
DDT(o,p')	Total					CLA EMD	1.7	µg/wet Kg
DDT(p,p')						CLA EMD	1.7	µg/wet Kg
Dieldrin						CLA EMD	1.7	µg/wet Kg
Endosulfan I						CLA EMD	1.7	µg/wet Kg
Endosulfan II						CLA EMD	1.7	µg/wet Kg
Endosulfan Sulfate	Total					CLA EMD	1.7	µg/wet Kg

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
Organochlorine Pesticides: Fish Tissue (Continued)								
Endrin	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
Endrin Aldehyde	Total		33 - 138%			CLA EMD	1.7	µg/wet Kg
Endrin Ketone	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
HCH, alpha	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
HCH, beta	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
HCH, delta	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
HCH, gamma	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
Heptachlor	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150%	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	1.7	µg/wet Kg
Heptachlor Epoxide	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
Methoxychlor	Total		34 - 143%			CLA EMD	6.7	µg/wet Kg
Mirex	Total		50 - 150%			CLA EMD	1.7	µg/wet Kg
Nonachlor, cis-	Total		50 - 150%			CLA EMD	8.3	µg/wet Kg
Nonachlor, trans-	Total		50 - 150%			CLA EMD	8.3	µg/wet Kg
Oxychlordane	Total		50 - 150%			CLA EMD	8.3	µg/wet Kg
Toxaphene	Total		50 - 150%			CLA EMD	83	µg/wet Kg
PCBs: Estuary Fish Tissue								
PCB 003	Total	Reference Material (CRM, SRM	50 - 150 %	Laboratory Duplicate and Matrix	90%	CLA EMD	2	µg/wet Kg
PCB 008	Total					CLA EMD	2	µg/wet Kg
PCB 018	Total					CLA EMD	2	µg/wet Kg
PCB 027	Total					CLA EMD	2	µg/wet Kg
PCB 028	Total					CLA EMD	2	µg/wet Kg
PCB 029	Total					CLA EMD	2	µg/wet Kg
PCB 031	Total					CLA EMD	2	µg/wet Kg
PCB 033	Total					CLA EMD	2	µg/wet Kg
PCB 037	Total					CLA EMD	2	µg/wet Kg
PCB 044	Total					CLA EMD	2	µg/wet Kg
PCB 049	Total					CLA EMD	2	µg/wet Kg
PCB 052	Total					CLA EMD	2	µg/wet Kg
PCB 056	Total					CLA EMD	2	µg/wet Kg
PCB 056/060	Total					CLA EMD	2	µg/wet Kg
PCB 060	Total					CLA EMD	2	µg/wet Kg
PCB 064	Total					CLA EMD	2	µg/wet Kg
PCB 066	Total					CLA EMD	2	µg/wet Kg
PCB 070	Total					CLA EMD	2	µg/wet Kg
PCB 074	Total					CLA EMD	2	µg/wet Kg
PCB 077	Total					CLA EMD	2	µg/wet Kg
PCB 081	Total					CLA EMD	2	µg/wet Kg
PCB 087	Total					CLA EMD	2	µg/wet Kg
PCB 095	Total					CLA EMD	2	µg/wet Kg
PCB 097	Total					CLA EMD	2	µg/wet Kg
PCB 099	Total					CLA EMD	2	µg/wet Kg
PCB 101	Total					CLA EMD	2	µg/wet Kg
PCB 105	Total					CLA EMD	2	µg/wet Kg
PCB 110	Total					CLA EMD	2	µg/wet Kg
PCB 114	Total					CLA EMD	2	µg/wet Kg
PCB 118	Total					CLA EMD	2	µg/wet Kg
PCB 119	Total					CLA EMD	2	µg/wet Kg
PCB 123	Total					CLA EMD	2	µg/wet Kg
PCB 126	Total					CLA EMD	2	µg/wet Kg

Table 11. (Continued)

Parameter	Fraction	Accuracy		Precision	Completeness	Laboratory	Target Reporting Limits	Units
		Requirements	Recovery					
PCBs: Estuary Fish Tissue (Continued)								
PCB 128	Total	Reference Material (CRM, SRM or LCS) and Matrix Spike	50 - 150 %	Laboratory Duplicate and Matrix Spike Duplicate - RPD < 25%	90%	CLA EMD	2	µg/wet Kg
PCB 128/167	Total					CLA EMD	2	µg/wet Kg
PCB 137	Total					CLA EMD	2	µg/wet Kg
PCB 138	Total					CLA EMD	2	µg/wet Kg
PCB 141	Total					CLA EMD	2	µg/wet Kg
PCB 146	Total					CLA EMD	2	µg/wet Kg
PCB 149	Total					CLA EMD	2	µg/wet Kg
PCB 151	Total					CLA EMD	2	µg/wet Kg
PCB 153	Total					CLA EMD	2	µg/wet Kg
PCB 156	Total					CLA EMD	2	µg/wet Kg
PCB 157	Total					CLA EMD	2	µg/wet Kg
PCB 158	Total					CLA EMD	2	µg/wet Kg
PCB 167	Total					CLA EMD	2	µg/wet Kg
PCB 168	Total					CLA EMD	2	µg/wet Kg
PCB 168/132	Total					CLA EMD	2	µg/wet Kg
PCB 169	Total					CLA EMD	2	µg/wet Kg
PCB 170	Total					CLA EMD	2	µg/wet Kg
PCB 174	Total					CLA EMD	2	µg/wet Kg
PCB 177	Total					CLA EMD	2	µg/wet Kg
PCB 180	Total					CLA EMD	2	µg/wet Kg
PCB 183	Total					CLA EMD	2	µg/wet Kg
PCB 187	Total					CLA EMD	2	µg/wet Kg
PCB 189	Total					CLA EMD	2	µg/wet Kg
PCB 194	Total					CLA EMD	2	µg/wet Kg
PCB 195	Total					CLA EMD	2	µg/wet Kg
PCB 198/199	Total					CLA EMD	2	µg/wet Kg
PCB 200	Total					CLA EMD	2	µg/wet Kg
PCB 201	Total					CLA EMD	2	µg/wet Kg
PCB 203	Total					CLA EMD	2	µg/wet Kg
PCB 206	Total					CLA EMD	2	µg/wet Kg
PCB 209	Total					CLA EMD	2	µg/wet Kg