Los Angeles River Watershed Monitoring Program

Quality Assurance Project Plan

Prepared by

Council for Watershed Health

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&

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June, 2020

1. **Group A Elements: Project Management**
   1. **Title & Approval Sheets**

**Quality Assurance Project Plan**

PROJECT: Los Angeles River Watershed Monitoring Program (LARWMP)

DATE: June, 2020

RESPONSIBLE Aquatic Bioassay & Consulting Laboratories

ORGANIZATION: 29 N. Olive St.

Ventura, CA 93001

**APPROVAL SIGNATURES**

Grant Organization

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Yareli Sanchez, Project Director Date

Council for Watershed Health

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Karin Wisenbaker, QA Officer Date

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Rizalina Hamblin, EMD QA Officer Date

City of Los Angeles, Bureau of Sanitation

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Raphael Mazor, LARWMP Technical Workgroup Date

SCCWRP

Funding Organizations

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Farhana Mohamed, Acting Division Manager, EMD Date

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Stephen Walker, Assistant Public Works Director Date

City of Burbank, Department of Public Works

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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:

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1. **PROJECT/TASK ORGANIZATION**
   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, annual summary report 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  Heal the Bay |
| 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 |
| 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. 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).

Weston Solutions Laboratories will conduct bioassessment sampling for the LADPW.

* 1. Quality Assurance Officer Role

Karin Wisenbaker will be the QA Officer. Ms. Wisenbaker’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. Wisenbaker will work with field and laboratory managers by communicating all QA/QC issues contained within this QAPP.

Ms. Wisenbaker will also review and assess all procedures during the life of the contract against QAPP requirements. Ms. Wisenbaker will report all findings to Scott Johnson, including all requests for corrective action. Ms. Wisenbaker 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 Wisenbaker to Yareli Sanchez (Project Director).

* 1. 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.

|  |  |  |  |
| --- | --- | --- | --- |
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* 1. Organizational Chart and Responsibilities

Figure 1. Organization chart

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1. PROBLEM DEFINITION / BACKGROUND
   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 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 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.

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](http://watershedhealth.org/)).

* 1. 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.

1. Project/Task Description
   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, except for 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;
* Monitoring includes four randomly selected sites and six revisit sites, with two of the six revisit sites sampled annually for a 5 year period;
* Monitoring occurring in the late spring summer, which includes bioassessment and water chemistry; and
* Measures of physical habitat characteristics collected coincident with bioassessment, including both the SWAMP Bioassessment Procedures (2016) 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; and
* Classify sites as improving, degrading, or stable.

**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; and
  + Monitoring will be structured around the CRAM approach.
* For confluence sites where major tributaries enter the mainstem or sites with special concerns:
  + A fixed design that focuses on four specific locations;
  + Monitoring based on the triad of bioassessment, and water quality; and
  + 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; and
  + Site-by-site interpretations and conclusions of habitat status and trends .
* For confluence sites:
  + Descriptions of water quality conditions (e.g., conventional chemistry, total metals, organophosphate pesticides);
  + Comparisons across sites of water quality conditions; and
  + 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; and
* 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); and
* 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 Public Health (LACDPH) 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; and
  + 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; and
* 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; and
* 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.
  1. 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 | oC | -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 |
| Turbidity | SM 2130 B | NTU | 0.3 |
| Total Suspended Solids | SM 2540 D | mg/L | 2 |
| 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 |
| Metals (Dissolved) |  |  |  |
| Arsenic | EAP 200.8 | ug/L | 1 |
| Cadmium | EAP 200.8 | ug/L | 0.2 |
| Chromium | EAP 200.8 | ug/L | 0.5 |
| Copper | EAP 200.8 | ug/L | 0.5 |
| Iron | EPA 200.7 | ug/L | 20 |
| Lead | EAP 200.8 | ug/L | 0.5 |
| Mercury | SM 3112 B or EPA 7470 A | ug/L | 0.2 |
| Nickel | EAP 200.8 | ug/L | 1 |
| Selenium | EAP 200.8 | ug/L | 1 |
| Zinc | EAP 200.8 | ug/L | 1 |
| 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 | 2 |
| Total Dissolved Solids | SM 2540 C | mg/L | 28 |
| 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 B | mg/L | 0.5 |
| Total Organic Carbon | SM 5310 B | mg/L | 0.5 |
| OrthoPhosphate as P | SM 4500-P E | mg/L | 0.1 |
|  |  |  |  |
| Phosphorus as P | SM 4500-P E | mg/L | 0.1 |
| Metals (Total & Dissolved) |  |  |  |
| Arsenic | EPA 200.8 or 200.7 | 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 | EPA 200.8 or 200.7 | mg/L | 1 |
| Zinc | EPA 200.8 or 200.7 | mg/L | 1 |
| Organics |  |  |  |
| 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 | 5 |
| Lead | EPA 6010 B | mg/Kg dw | 0.5 |
| Mercury | EPA 7471 A | mg/Kg dw | 0.02 |
| 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 | 20 |
| 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 | 0.5-20 |
| Polychlorinated Biphenyl (PCBs) | EPA 8082 | µg/Kg dw | 0.2 |
| Polynuclear Aromatic Hydrocarbons (PAHs) | EPA 8270C | ug/Kg dw | 300-3300 |
| **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. | % | 0.05 |
| Metals |  |  |  |
| Mercury | EPA 7471A | mg/kg ww | 0.02 |
| Selenium | EPA 6010B | mg/kg ww | 1 |
| Organics |  |  |  |
| Organochlorine Pesticides (DDTs) | EPA 8081A | µg/kg ww | 0.5 |
| Polychlorinated Biphenyl (PCBs) | EPA 8082 | µg/kg ww | 0.5-20 |
| **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-19 | Aug-20 |
| Monthly Status Reports | Sept-19 | Aug-20 |
| QAPP | Sept-19 | Apr-20 |
| Site Reconnaissance |  |  |
| Map Review and Preliminary Selection of Randomized Sites | Jan-20 | Mar-20 |
| Site Reconnaissance | Feb-20 | Mar-20 |
| Secure Entry Permits | Feb-20 | Mar-20 |
| Present Finalized Station List to TAC | May-20 | May-20 |
| Bacteria Testing |  |  |
| Sentinel & Swimming Sites | May-20 | Sept-20 |
| Estuary Site | Oct-19 | Sept-20 |
| Fish Tissue Sampling |  |  |
| Field Sampling | Apr-20 | Jun-20 |
| Preliminary Findings | Dec-20 | Dec-20 |
| Watershed Monitoring Sampling |  |  |
| Estuary |  |  |
| Water & Sediment Chemistry; Toxicity; Benthic Infauna | Apr-20 | Aug-20 |
| 8Urban |  |  |
| Water Chemistry; Bioassessment; CRAM; Algae | Apr-20 | Aug-20 |
| Natural |  |  |
| Water Chemistry; Bioassessment; CRAM; Algae | Apr-20 | Aug-20 |
| Effluent |  |  |
| Water Chemistry; Bioassessment; CRAM; Algae | Apr-20 | Aug-20 |
| Laboratory Analyses |  |  |
| Chemistry |  |  |
| Water & Sediment | Apr-20 | Dec-20 |
| Tissue | Jun-20 | Dec-20 |
| Toxicity Testing: Sediment | Aug-20 | Aug-20 |
| Taxonomy |  |  |
| Benthic Macroinvertebrates | Apr-20 | Feb-21 |
| Data Management, Analysis & Reporting |  |  |
| Data Management | Apr-20 | May-21 |
| Draft Report | May-21 | July-21 |
| Annual Report Finalized | July-21 | Aug-21 |
|  |  |  |

* 1. 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).

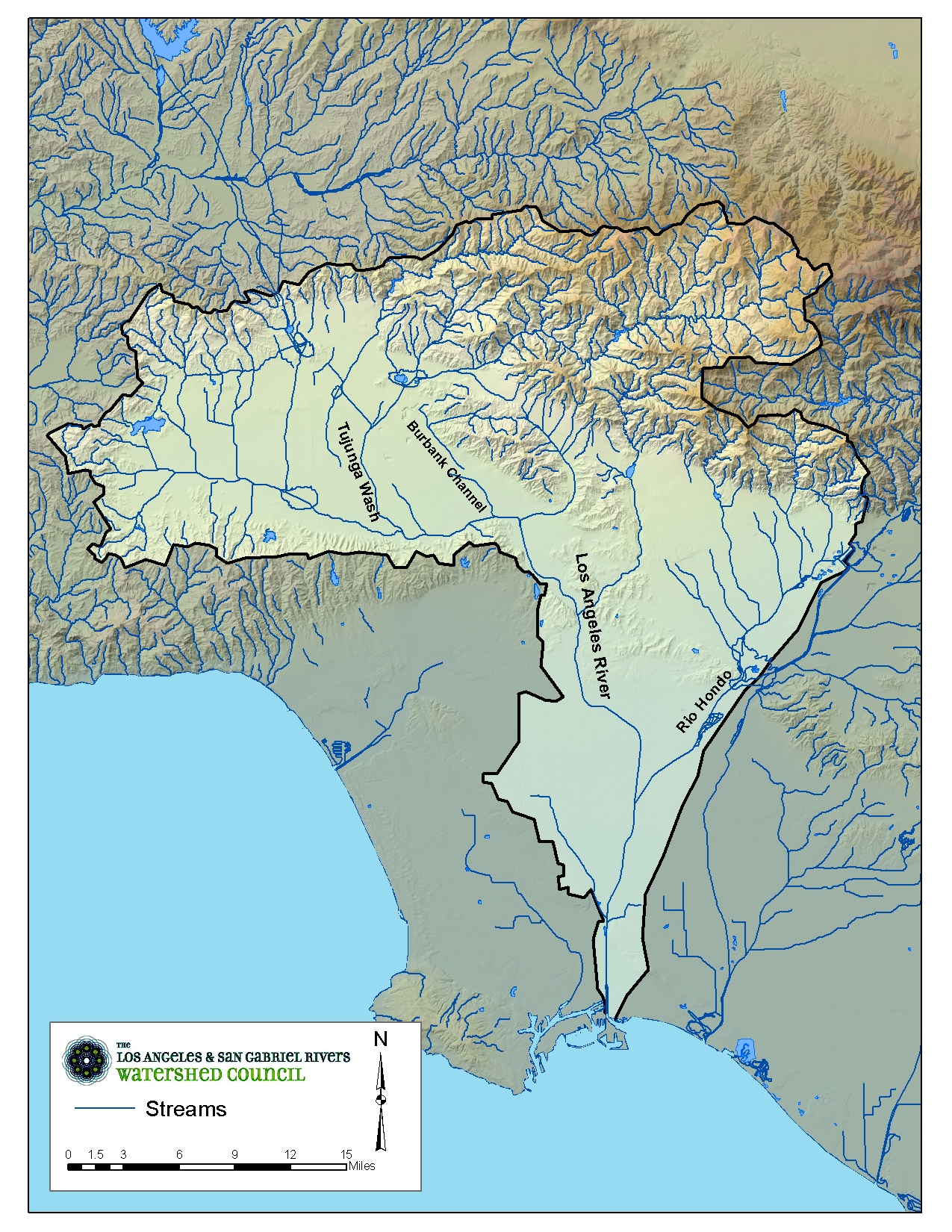


Figure 2. Study watersheds.

* 1. 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, random, and revisit 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. 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.

1. 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 4). 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 11. 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

* 1. **Quantitative Objectives**
     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.
        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 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.
        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.
        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.
        4. 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) the Southern California Regional Watershed Monitoring Program (SMC) QAPP and the SWAMP SOP. Sample sorting accuracy requires a resort of 10% of all samples by a senior lab technician who determines if a 90% 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.
        5. 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 Wildlife (CADF&W) and SWAMP. Observations collected by field teams are audited each year by the Southern California Coastal Water Research Project (SCCWRP) for physical habitat and CRAM.
     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.
        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.
        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).



Where:

*X1*: is the concentration of the original sample

*X2*: 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%.

* + - 1. 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.
    1. **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 = 

Where:

*X1*: is the concentration of the spiked sample

*X2*: is the concentration of the original (unspiked) sample

*X3*: is the concentration of the spike added

* + 1. 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 11 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, flag the results with an appropriate qualifier.
    2. **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. Laboratory 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 RL, the source(s) of contamination shall be corrected, and the associated samples shall be reanalyzed.
    3. **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 most analytes such as the metals, organics and 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.
  1. **Qualitative Objectives**
     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 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.
     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.

* + 1. **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).
  1. **Specialized Training or Certifications**
     1. Field Sampling

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

* + - 1. Lead field personnel have bachelors or masters degrees in Biology and over five years of experience conducting similar sampling programs.
      2. Field crew members have attended bioassessment field and laboratory workshops provided by the California Department of Fish and Wildlife. These workshops included training on physical habitat condition methods.
      3. Crew members have attended training conducted by SCCWRP on the California Rapid Assessment Program (CRAM) for wetland and riparian habitats.
    1. 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.

* + - 1. The EMD, Aquatic Bioassay, and Weston Solutions have participated in interlaboratory calibration studies conducted by the SMC for chemistry (EMD), and bacteriology (EMD and Aquatic Bioassay).
      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 CLAEMD, 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, and Weston Solutions) will coordinate training of project personnel. The program QC officer (Karin Wisenbaker) 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.

* 1. **Training and Certification Documentation**

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

* 1. **Training Personnel**

EMD, Aquatic Bioassay, 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.

1. Documents and Records

The hardcopy documents generated by this project will be stored at each of the participating laboratories (EMD, Aquatic Bioassay, 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 Wisenbaker) upon request.

Persons responsible for maintaining records for this project are as follows. Karin Wisenbaker 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, and Weston Solutions. The EMD 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 |

1. 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 6). 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 | 4 new each year, 2 annual revisit, 4 revisit sites | Bioassessment, water chemistry, pHab, riparian habitat | Annually, in spring/summer |
| 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 * 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/summer  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 Labor Day * Weekly May 1 to Labor Day * Weekly year-round |
| Q5: Safe to eat fish | Focus on:   * Frequently fished sites * Commonly caught species w/in SWAMP guidelines * High-risk chemicals | LA watershed in lakes, rivers, and estuary | Commonly caught fish at each location  Mercury, DDTs, PCBs | Annually in July or August |

1. Sampling Methods
   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).

* 1. *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 four new random sites are selected from the draw list, four revisit sites are selected from previously sampled sites and two annual revisit sites are sampled for five years (2015 to 2020). The LARWMP sites are divided into three sub-regions: natural, urban and effluent.

The goal is to find sites where samples can be successfully collected in one day. Site reconnaissance is conducted based on protocols developed by the SMC. 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?
   1. *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 2013). 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.

* 1. BioassessmenT
     1. Collection and Analysis of Benthic Macroinvertebrates (BMIs) and Attached Algae

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. 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. Physical habitat assessments specified by SWAMP are also collected to assess stream habitat conditions. The complete sampling SOP entitled *Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (Ode *et al*., 2016) appears at:

<http://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/combined_sop_2016.pdf>

In the laboratory, sorting and identification of BMIs and benthic algae is conducted based on protocols established by SWAMP entitled *Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrates in California* (Woodard *et al.,* 2012) and *Standard Operating Procedures for Laboratory Processing, Identification, and Enumeration of Stream Algae* (Stancheva et al., 2015). These documents appear at:

<http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/bmi_lab_sop_final.pdf>

and

<https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/docs/sop_algae_lab_101315.pdf>

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 appears at:

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

Sample containers and preservatives are identified in Table 7.

* 1. *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](http://www.cramwetlands.org)

* 1. *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:

<https://oehha.ca.gov/media/downloads/fish/document/fishsamplingprotocol2005.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.

1. **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 CaCO3 | 250 mL HDPE Plastic | 4 °C | 14 days |
| Hardness as CaCO3 | 250 mL HDPE Plastic | 4 °C, HNO3 to pH <2 | 6 months |
| Total Suspended Solids | 250 mL HDPE Plastic | 4 °C | 7 days |
| Turbidity | 250 mL HDPE Plastic | 4 °C | 48 hours |
| 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) HNO3 to pH <2 | 28 days |
| Total Organic Carbon | 40 mL glass | 4 °C, acidify to pH <2 with HCl or H­2SO4 | 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 |
| Ions |  |  |  |
| Chloride, Sulfate | 1 L HDPE Plastic | 4 °C | 28 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 for 14 days; 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 |

1. Analytical Methods
   1. Field Analysis Methods

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

* 1. **Laboratory Analysis Methods**

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

* 1. **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).

* 1. **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.

1. 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;
* Bacteriology: acceptable laboratory blank and positive controls; and
* Chemistry: method blanks, laboratory control materials, duplicates, matrix spikes, instrument calibrations, and internal standards.
  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. 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.

* 1. 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.

* 1. 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 ≥90% (Table 11). Percent sorting accuracy is calculated as:

* Percent Sorting Accuracy = [(number of organisms in re-sort \*100)/ number of organisms in original sort]
  1. 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 ≥90% (Table 11). 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.

* 1. **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.
  1. **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 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 r2 < 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 r2 < 0.99 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 r2 < 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* (21st edition) 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. 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 r2 < 0.995  Calibration verification every 10 samples after initial calibration. Standard source different that that used for initial calibration. Recovery 90% - 110% |
| Metals in Sediment | Blanks – Laboratory. 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. |
| Organics in Sediment | Blanks – Laboratory. 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. | EPA 8270 C. 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 r2 < 0.995  Calibration verification every 10 samples after initial calibration. Standard source different that that used for initial calibration. Recovery 90% - 110%  EPA 8180 A & 8082. External calibration with a minimum of 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 r2 < 0.99 or RSD < 20%  Calibration verification every 20 samples after initial calibration. Standard source different than that that used for initial calibration. Alternative source Recovery 80 – 120%, continuous calibration verification Recovery 85 – 115% |

1. Instrument/Equipment Testing, Inspection, and Maintenance
   1. **Analytical Instruments**
      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 dried for 48 hours, placed in 140 deg F water for 5 minutes, or frozen for 8 hours.

* + 1. *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.

* + 1. *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.

1. Instrument/Equipment Calibration and Frequency
   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.

* 1. **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.

* + 1. Calibration for pH measurement is accomplished using two standard buffer solutions, 7 and 10.
    2. Calibration for dissolved oxygen measurements is accomplished using 100% air saturation as specified by the manufacturer.

1. 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 |

1. 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.

1. 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, 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.

1. 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, or Weston Solutions if the deviation(s) noted are considered detrimental to data quality.

1. 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 |

1. 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.

1. 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.

1. 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](mailto:info@aquabio.org)

Website: [www.aquabio.org](http://www.aquabio.org)

* Bioassessment

SWAMP SOP

Website: <http://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/sops.shtml>

Aquatic Bioassay & Consulting Laboratories

Phone: (805)-643-5621

Email: [info@aquabio.org](mailto:info@aquabio.org)

Website: [www.aquabio.org](http://www.aquabio.org)

Weston Solutions

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Email: [info@westonsolutions.com](mailto:info@westonsolutions.com)

Website: <http://www.westonsolutions.com>

* CRAM

California CRAM SOP

Website: <http://www.cramwetlands.org/documents/>

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* Water Collection

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* Fish Collection

California Department of Fish & Game

Phone: (805) 771-4162

Laboratory Analysis

* Chemistry

City of Los Angeles, EMD

Phone: (310) 343-0502

Email: [mahesh.pujari@lacity.org](file:///C:/Users/74349/Downloads/mahesh.pujari@lacity.org)

Website: <http://www.lacitysan.org/emd/index.htm>

* Bacteria

City of Los Angeles, EMD

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Email: [mahesh.pujari@lacity.org](file:///C:/Users/74349/Downloads/mahesh.pujari@lacity.org)

Website: <http://www.lacitysan.org/emd/index.htm>

* Benthic Macroinvertebrate

SAFIT Standard Taxonomic Effort

Website: <http://www.safit.org/ste.html>

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* Benthic Algae

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Appendix B

Data Quality Objectives for Each LARWMP Project Phase

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



Table 11. (Continued)



Table 11. (Continued)



Table 11. (Continued)



Table 11. (Continued)



Table 11. (Continued)



Table 11. (Continued)

