QUALITY ASSURANCE PROJECT PLAN
For the County of San Diego's
Inland Surface Water Monitoring Program

Prepared by
Joanna Wisniewska

County of San Diego
Watershed Protection Program
Department of Public Works

Revision 3 – February 2014

A. Project Management

1. Title and Approval Sheets

Quality Assurance Project Plan

For

The County of San Diego's Inland Surface Water Monitoring Program

February, 2014

County of San Diego
Watershed Protection Program
Department of Public Works

APPROVALS SIGNATURES

Title:	Name:	Signature:	Date*:
Project Manager	Nancy Stalnaker		
QA Officer	Joanna Wisniewska		
Laboratory QA Director	Jennifer Beyer		
Laboratory Director	Dan Verdon		

** This is a contractual document. The signature dates indicate the earliest date when the project can start.*

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3. Distribution List

Table 1: QAPP Distribution List

Title:	Name	Tel. No.:	No. of copies
Program Coordinator	Nancy Stalnaker	(858) 495-5645	1
Watershed Scientist	Joanna Wisniewska	(858) 694-2312	ORIGINAL
Watershed Specialist	Steven DiDonna	(858) 694-2332	1
Watershed Specialist	Ken Liddell	(858) 694-2335	1
Laboratory Director	Dan Verdon	(858) 560-7717	1
Laboratory QA Officer	Jennifer Beyer	(858) 560-7717	1

B. Project/Task Organization

4. Involved Parties and Roles

The Science and Monitoring Group is part of the Watershed Protection Program in the County of San Diego Department of Public Works. This group:

- Provides trained water quality staff for field observations, field measurements, and water sample collections for laboratory analysis
- Performs data quality assurance and quality control (QA/QC) practices.
- Provides a central location for data reporting and analysis.
- Integrates monitoring results into watershed water quality assessments.

4.1 Monitoring Group Supervisor and Project Manager (Nancy Stalnaker)

- Provides overall program coordination, including monitoring design, management, and implementation.

4.2 Field Staff

- Conduct field measurements and water quality sampling.
- Take, download and label photos of monitoring sites to designated folders.
- Transcribe field datasheet entries to the database.
- Calibrate and maintain field equipment.
- Follow sample collection procedures.
- Follow record keeping procedures.
- Follow monitoring project sampling plans.
- Deliver samples to the laboratory.

Additional Duties:

4.2.1 Steve DiDonna

- Furnish and maintain sampling equipment and supplies.
- Maintain database where monitoring data are stored
- Maintain sampling schedule
- Provide GIS support as necessary

4.2.2 Ken Liddell

- Maintain County contract with EnviroMatrix Analytical, Inc. (schedules sample deliveries, orders supplies, tracks invoices, etc.)
- Organize and maintain records, documents, and orders
- Review and enter data into the database

4.3 EnviroMatrix Analytical, Inc. (EnviroMatrix)

- Provide trained laboratory personnel to analyze water samples for physical, chemical, and bacteriological properties as designated by WPP.
- Provide review and verification of laboratory analytical data.

- Provide analytical results in hard copy and in electronic format to WPP.
- Manage and oversee subcontracts for any specialty not performed in-house.
- Act as technical resource to the Science and Monitoring Group and the Watershed Protection Program.

4.4 Quality Assurance Officer Role

The QA Officer, Joanna Wisniewska, works independently and is not involved in the collection of samples or the generations of project data. Her responsibilities are:

- Maintain/ update the Quality Assurance Project Plan (QAPP).
- Ensure compliance with the QAPP.
- Carry out validation and verification of field and laboratory data.
- Assign staff to perform routine quality assurance and quality control (QA/QC) of field equipment, field test kits and laboratory control samples.
- Conduct audits of field procedures.
- Conduct audits of equipment calibration and maintenance.
- Review 20% of field data sheets at random.
- Review the routine quality control documentation of laboratory procedures.
- Communicate pertinent QA/QC issues to EnviroMatrix and assure that any problems are resolved.
- Communicate pertinent QA/QC problems to the field staff and assure that any problems are resolved.
- Submit QA/AC reports to the Project Manager. Reports will include all requests for corrective action.

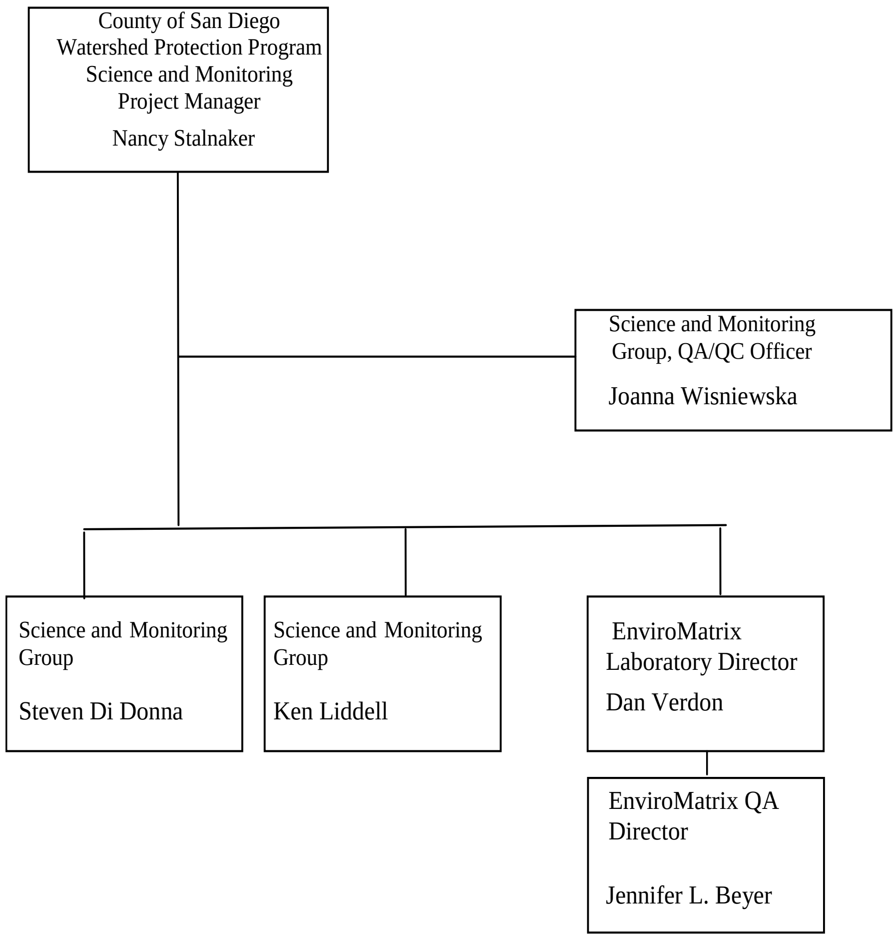
4.5 Persons Responsible for QAPP Update and Maintenance

The Quality Assurance Officer reviews and assesses all procedures during the life of the contract against QAPP requirements. Changes and updates to this QAPP may be made after a review of the evidence for change by the Science and Monitoring Group Project Manager and Quality Assurance Officer. Science and Monitoring Group's Quality Assurance Officer is responsible for making the changes, submitting drafts for review and preparing a final copy.

Table 2. Personnel Responsibilities.

Name	Organizational Affiliation	Title	Contact Information (Telephone Number, fax number, e-mail address)
Nancy Stalnaker	County of San Diego, Watershed Protection Program	Project Manager, Supervisor	858-495-5645 stalnaker.nancy@sdcounty.ca.gov
Steven DiDonna	County of San Diego, Watershed Protection Program	Field Staff	858-694-2332 619-204-6000 steven.didonna@sdcounty.ca.gov
Ken Liddell	County of San Diego, Watershed Protection Program	Field Staff	858-694-2335 619-884-8922 ken.liddell@sdcounty.ca.gov
Joanna Wisniewska	County of San Diego, Watershed Protection Program	QA Officer	858-694-2312 joanna.wisniewska@sdcounty.ca.gov
Dan Verdon	EnviroMatrix Analytical, Inc.	Laboratory Director	858-560-7717 dverdon@enviromatrixinc.com
Jennifer L. Beyer	EnviroMatrix Analytical, Inc.	QA Director	858-560-7717 jbeyer@enviromatrixinc.com

4.6 Organizational Chart and Responsibilities



5. Problem Definition/ Background

5.1 Problem Statement

According to the *Water Quality Control Policy For Developing California's Clean Water Act Section 303(d) List* (2004) "all listings of water segments shall be removed from the section 303(d) list if the listing was based on faulty data, and it is demonstrated that the listing would not have occurred in the absence of such faulty data."

Several water quality limited segments located within the County of San Diego's jurisdiction are on the 2008 CWA Section 303(d) list. The goal of the current monitoring program is to provide additional data that would either support or reject the placing of those segments on the list.

According to the policy (California SWRCB, 2004), for toxicants (including priority pollutants, metals, chlorine, and nutrients), the pollutant/ water segment combinations should be removed from the CWA section 303(d) list if the numeric water quality objectives (WQOs) (including maximum contaminant levels where applicable) or California/National Toxics Rule water quality criteria are not exceeded as follows:

- Using the binomial distribution, waters shall be removed from the section 303(d) list if the number of measured exceedances supports rejection of the null hypothesis as presented in Table 4.1.

- The binomial distribution cannot be used to support a delisting with sample sizes less than 28.

For conventional pollutants (that include dissolved oxygen, pH, and temperature), numeric water quality objectives are not exceeded as follows:

- Using the binomial distribution, waters shall be removed from the section 303(d) list if the number of measured exceedances supports rejection of the null hypothesis as presented in Table 4.2.

- The binomial distribution cannot be used to support a delisting with sample sizes less than 26.

TABLE 4.1: MAXIMUM NUMBER OF MEASURED EXCEEDANCES ALLOWED TO REMOVE A WATER SEGMENT FROM THE SECTION 303(D) LIST FOR TOXICANTS.

Null Hypothesis: Actual exceedance proportion $\geq$ 18 percent.
Alternate Hypothesis: Actual proportion < 3 percent of the samples
The minimum effect size is 15 percent.

Sample Size	Delist if the number of exceedances equal or is less than
28 – 36	2
37 – 47	3
48 – 59	4
60 – 71	5
72 – 82	6
83 – 94	7
95 – 106	8
107 – 117	9
118 – 129	10

For sample sizes greater than 129, the maximum number of measured exceedances allowed is established where α and $\beta \leq 0.10$ and where $|\alpha - \beta|$ is minimized.

α = Excel® Function BINOMDIST(k, n, 0.18, TRUE)
β = Excel® Function BINOMDIST(n-k-1, n, 1 – 0.03, TRUE)
where n = the number of samples,
k = maximum number of measured exceedances allowed,
0.03 = acceptable exceedance proportion, and
0.18 = unacceptable exceedance proportion.

TABLE 4.2: MAXIMUM NUMBER OF MEASURED EXCEEDANCES ALLOWED TO REMOVE A WATER SEGMENT FROM THE SECTION 303(D) LIST FOR CONVENTIONAL OR OTHER POLLUTANTS.

Null Hypothesis: Actual exceedance proportion ≥ 25 percent.
Alternate Hypothesis: Actual exceedance proportion < 10 percent.
The minimum effect size is 15 percent.

Sample Size	Delist if the number of exceedances equal or is less than
26 – 30	4
31 – 36	5
37 – 42	6
43 – 48	7
49 – 54	8
55 – 60	9
61 – 66	10
67 – 72	11
73 – 78	12
79 – 84	13
85 – 91	14
92 – 97	15
98 – 103	16
104 – 109	17
110 – 115	18
116 – 121	19

For sample sizes greater than 121, the maximum number of exceedances allowed is established at α and $\beta \leq 0.2$ and where $|\alpha - \beta|$ is minimized.

α = Excel® Function BINOMDIST(k, n, 0.25, TRUE)
β = Excel® Function BINOMDIST(n-k-1, n, 1 – 0.1, TRUE)
where n = the number of samples,
k = maximum number of measured exceedances allowed,
0.10 = acceptable exceedance proportion, and
0.25 = unacceptable exceedance proportion.

A 2011 review of existing data collected by the County as part of the Dry Weather Monitoring program and several special monitoring projects revealed 17 WQLS located in San Diego County that should be sampled for the purpose of potential removal from the 303(d) list based on preliminary sampling results or no available data (collected by the County). These include: one to be sampled for aluminum, one for ammonia as N, one for chloride, two for iron, five for manganese, one for pH, ten for selenium, three for sulfates, one for turbidity, and four for TDS. A list of the WQLS and the corresponding constituents of concern (COCs) together with designated sampling locations is provided in Table 3. The locations are also presented on a map in Figure 1.

Table 3. Water Quality Limited Segments and the Corresponding Monitoring Locations within the County of San Diego Jurisdiction.

Water Quality Limited Segments		Corresponding Sampling Locations			
Water Body Name	Constituents of Concern	Description	Designation	Latitude	Longitude
Escondido Creek	Manganese, Selenium, Phosphate, Sulfates, TDS, Total Nitrogen as N, DDT, Enterococcus, Fecal Coliform, Toxicity	Escondido Creek @ East County Club Drive	CAR02	33.09901	-117.13047
		Escondio Creek @ El Camino Del Norte	CAR03	33.04839	-117.22716
San Marcos Creek	Selenium	San Marcos Creek @ Discovery Street	CAR04	33.13046	-117.20045
Agua Hedionda Creek	Manganese, Selenium, Phosphorus, Sulfates, TDS, Total Nitrogen as N,Toxicity, Fecal Coliform, Enterococcus	Agua Hedionda Creek @ Oleander Ave.	CAR16	33.15629	-117.21513
Green Valley Creek	Chloride, Manganese, Sulfates, Pentachlorophenol (PCP)	Green Valley Creek @ Rancho Bernardo Road	SDG08	33.01962	-117.11974
San Dieguito River	TDS, Nitrogen, Phosphorus, Toxicity, Enterococcus, Fecal Coliform	San Dieguito River @ El Apajo (end)	SDG05	32.99948	-117.20550
Felicita Creek	Aluminum, TDS	Felicita Creek @ Quiet Hills Farm Road	SDG09	33.07326	-117.08373
Forester Creek	Selenium, pH, TDS, phosphorus, Fecal Coliform,	Forrester Creek @ Greenfield Drive	SDR07	32.80826	-116.91151
Los Coches Creek	Selenium	Los Coches Creek @ I-8 Business Route	SDR08	32.83599	-116.90040
San Diego River (Lower)	TDS, low DO, Nitrogen, Phosphorus, Fecal Coliform, Enterococcus, Toxicity	San Diego River @ Riverford Road	SDR10	32.85653	-116.94730
San Vicente Creek (San Diego County)	Ammonia as Nitrogen	San Vicente Creek @ Wildcat Canyon Road	SDR20	32.99628	-116.84387
Keys Creek	Selenium	Keys Creek @ Dunlin Road	SLR17	33.32384	-117.15723
Keys Creek	Selenium	Keys Creek @ Lilac Rd.	SLR29	33.28808	-117.08333
San Luis Rey River (west of I15)	Chloride, Phosphorus, Total Nitrogen as N, TDS, Toxicity, Fecal	San Luis Rey River at Bonsall Bridge	SLR16	33.26042	-117.23833

Water Quality Limited Segments		Corresponding Sampling Locations			
Water Body Name	Constituents of Concern	Description	Designation	Latitude	Longitude
	Coliform, Enterococcus				
Sandia Creek	Iron, Sulfates, TDS	Sandia Creek @ Sandia Creek Drive (at USGS station)	SMG07	33.42460	-117.24904
De Luz Creek	Iron, Manganese, Sulfates, nitrogen	De Luz Creek @ De Luz Road (Mile Marker 8 @ private driveway)	SMG08	33.42184	-117.32179
Sweetwater River, Lower (below Sweetwater Reservoir)	Selenium, TDS, Phosphorus, TDS, Total Nitrogen as N, Toxicity, Enterococcus, Fecal Coliform	Sweetwater River @ Plaza Bonita Road	SWT03	32.65069	-117.06374
Cottonwood Creek (Tijuana River watershed)	Selenium	Cottonwood Creek @ Old Highway 80 (Bridge Crossing)	TIJ01	32.78844	-116.49732
Cottonwood Creek (Tijuana River watershed)	Selenium	Cottonwood Creek @ Marron Valley Road	TIJ07	32.57288	-116.75798
Tijuana River	Eutrophic, Low DO, Pesticiees, Phosphorus, Sedimentation/ Siltation, Selenium, Solids, Surfactants (MBAS), Synthetic Organics, Total Nitrogen as N, Toxicity, Trace Elements, Trash, Indicator Bacteria	Tijuana River @ Hollister St.	TIJ05	32.55141	-117.08415
Cottonwood Creek (Tijuana River watershed)	Selenium	Cottonwood Creek @ Marron Valley Rd.	TIJ07	32.57288	-116.75798
Tecate Creek	Selenium	Tecate Creek @ Mexican Border Fence	TIJ09	32.57737	-116.61643

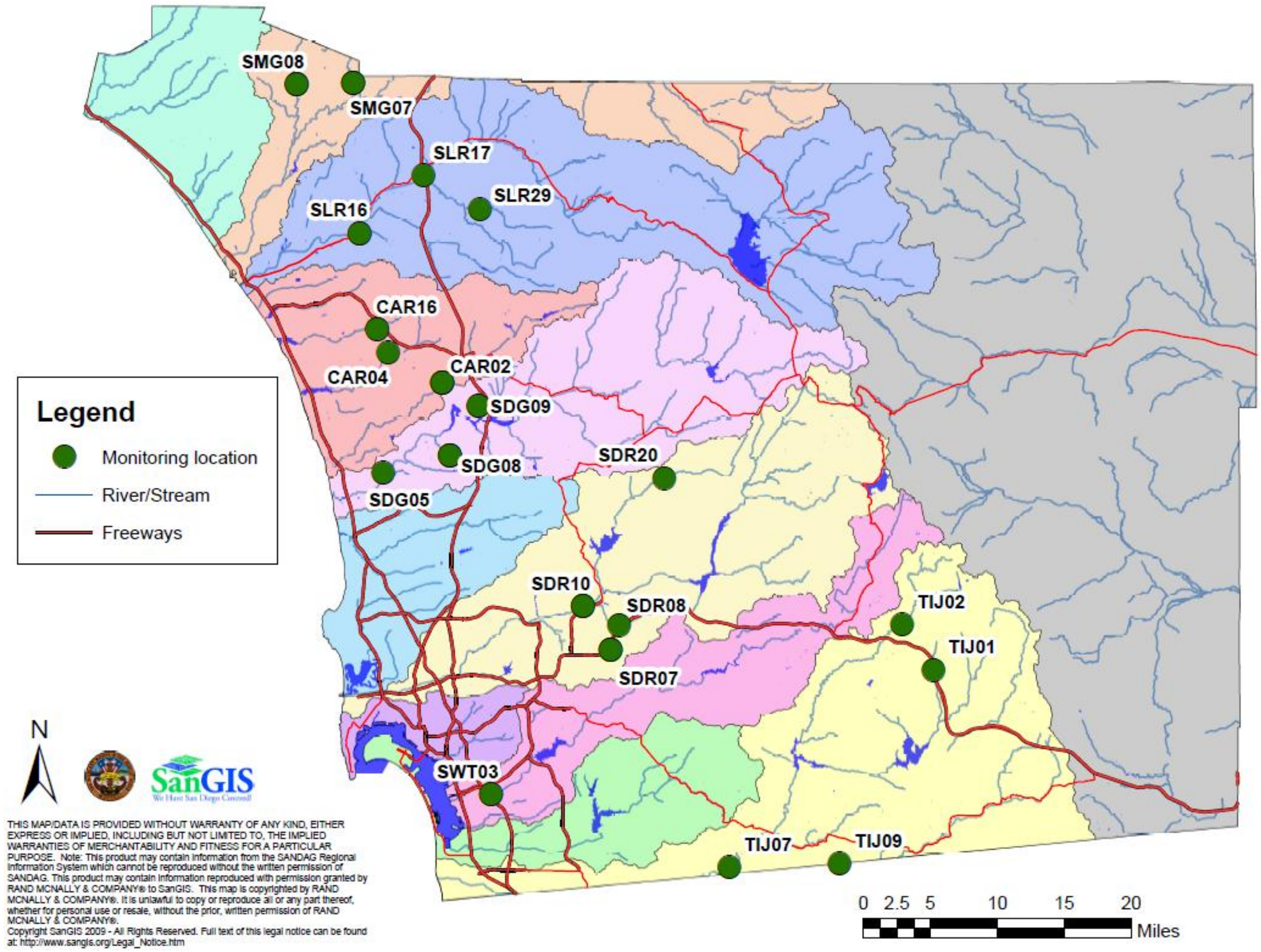


Figure 1. Monitoring Locations.

5.3 Decisions and Outcomes

All data collected through the County of San Diego's Inland Surface Water Monitoring Program are managed and maintained by the Science and Monitoring Group. The data are used by the Science and Monitoring Group to determine whether WQLS under investigation may potentially qualify for removal from the CWA Section 303(d). A decision process is employed to either continue or suspend sampling as illustrated in Figure 2. The collected data will also be made available to the regulatory and resource management agencies to supplement their existing data collection efforts. The information will be shared with the SDRWQCB and, upon request, with other state, federal and local agencies and organizations.

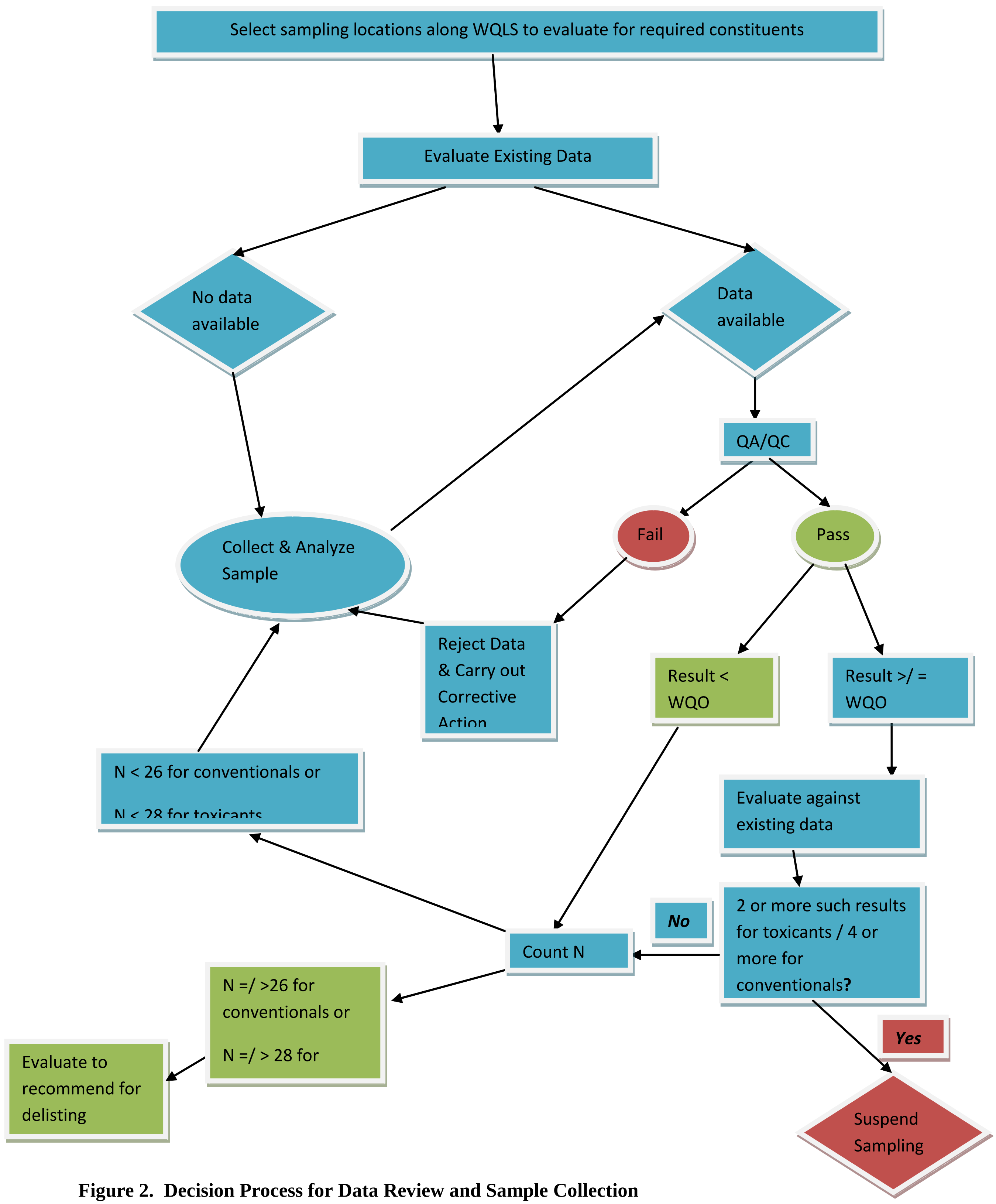


Figure 2. Decision Process for Data Review and Sample Collection

5.4 Inland Surface Water Quality or Regulatory Criteria

The water quality objectives employed in the screening are summarized in Table 4.

Table 4. Available Water Quality Objectives (WQO).

Analyte	Units	Water Quality Objective	Source
Nutrients and Conventionals			
Turbidity	NTU	5[k]	Basin Plan
		20[l]	
pH	pH Units	6.5 < pH < 8.5	Basin Plan
Ammonia-Nitrogen	mg/L	< 0.025	Basin Plan
Chloride	mg/L	250[d]	Basin Plan
		50[e]	
Sulfate	mg/L	500[h]	Basin Plan
		300[i]	
		250[m]	
		65[j]	
Total Dissolved Solids	mg/L	500[d]	Basin Plan
		300[e]	
Metals			
Aluminum	µg/L	100[a,c]	Basin Plan
		20[b,c]	
		9.0[f, g]	
Iron, Total	mg/L	0.3	Basin Plan
Manganese, Total	mg/L	0.05	Basin Plan
Selenium, Total	µg/L	Acute N/A	USEPA Recommended Aquatic Life Water Quality Criteria
		5.0[f]	
		(g)	

N/A = Water quality objective is not available at this time.
(a) Primary standard for waters designated for use as domestic or municipal supply (MUN). From Basin Plan Table 3-4: "Maximum Contaminant Level for Inorganic Chemicals specified in Table 64431-A of section 64431 of Title 22 of the California Code of Regulations as amended June 12, 2003."
(b) Secondary standard for waters designated for use as domestic or municipal supply (MUN). From Basin Plan Table 3-6: "Secondary Maximum Contaminant Levels for Consumer Acceptance Limits specified in Table 64449-A of section 64449 of Title 22 of the California Code of Regulations as amended January 7, 1999."
(c) Criteria are drinking water standards.
(d) WQO specified for Inland Surface Waters in the San Luis Rey Hydrologic Unit and Sweetwater Hydrologic Unit.
(e) WQO specified for Inland Surface Waters in the San Diego Hydrologic Unit.
(f) Criteria Continuous Concentration (CCC).
(g) The CMC = 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 ug/l and 12.82 ug/l, respectively. However, based on findings from a February 2009 SETAC Pellston Workshop on Ecological Assessment of Selenium in the Aquatic Environment, diet is the primary pathway of selenium exposure to aquatic life, and traditional methods for predicting toxicity on the basis of exposure to dissolved concentrations are not appropriate for selenium. (h) Criterion applies to Otay Valley, Lower Sweetwater HU, and Lower San Diego HU
(i) Criterion applies to Ysidora HA, Murrieta HA, Cave Rocks HA, Aguanga HA,and Oakgrove HA
(j) Criterion applies to San Vicente HA, El Capitan HA, and Boulder Creek HA
(k) For inland surface waters with municipal (MUN) beneficial use (Basin Plan)
(l) For inland surface waters with beneficial uses other than municipal (MUN) (Basin Plan)
(m) Criterion applies to Carlsbad hydrologic Unit including Loma Alta HA, Buena Vista Creek HA, Agua Hedionda HA, Encinas HA, San Marcos HA, and Escondido Creek HA

5. Project/Task Description

6.1 *Work Statements and Products*

The goal of this monitoring program is to collect and analyze water quality samples from various WQLS throughout the County of San Diego's jurisdictional area in order to assess whether their inclusion on the CWA Section 303(d) list is justified. Sampling from different location is to occur at random throughout the year.

6.2 *Constituents to Be Monitored and Measurement Techniques*

At each sampling location, the monitoring process includes photographic documentation of sample locations, selected field observations, water flow estimates and, as needed, water sample collection for analytical analysis and/or physicochemical measurements.

Qualitative field observations may be made during site visits. These observations are intended to provide a general assessment of the site and they include variables such as odor, water clarity, the presence or absence of floatable matter, visible deposits / stains, vegetative density and biological status. All qualitative field observations are recorded on standard Field Data Sheets (Appendix 1).

To provide additional information and documentation of site conditions, each site is photographed at least once a year or if/when significant changes occur at the site. In addition to providing important descriptive information, photographs serve as an official record of site visits; a visual record of the condition of physical structures such as pipes and biological aspects of the surrounding environment. The photographs are also used to assist staff in locating sites on subsequent visits. All photographs are in digital format and are stored in a common directory and fully backed up on a daily basis. All photographs should be properly labeled with site names and the dates on which they were taken.

Flow measurements are conducted at each site where water is flowing. Estimated flow rates are used in pollutant mass loading calculations. Flow is measured using the Global Flow Probe, Model FP101-FP201 (See Appendix 5 for the probe's SOP). If water flow is too slow or the water is too shallow to measure the velocity using the probe the velocity may be estimated by timing the travel of a piece of floating debris (e.g., a leaf). The "apparent" velocity is calculated by dividing the travel distance (feet) by the recorded travel time (second) (See Appendix 5 a more detailed description of different flow measurements methods).

Each sampling location has a designated list of target analytes and/or physiochemical properties that is based on the associated CWA Section 303(d) listing. The physicochemical properties are measured according to the list using the Horiba U-10 6-parameter probe (see Appendix 5 for the probe's SOP and calibration procedures). The parameters measured with the probe include: pH and turbidity. If water is deep enough, the probe is placed horizontally on the creek bed, facing upstream. If the water is shallow, a syringe is used to collect water in a beaker to measure the properties. All data are recorded on the Field Data Sheets. Analytical samples are then collected to test for the listed analytes. Methods used to measure all above-mentioned parameters are summarized in Table 5.

Table 5. Constituents to be Monitored and Corresponding Analytical Methods

Constituent	Analytical Method	Notes
pH	Measured in the Field	Horiba Multiparameter Water Quality Instrument
Turbidity		
Total Dissolved Solids (TDS)	SM 2540C	
Ammonia as Nitrogen	SM 4500 NH3 D	
Total & Dissolved Aluminum	EPA 200.8; EPA 200.7	
Total Iron	EPA 200.8; EPA 200.7	
Total & Dissolved Manganese	EPA 200.8; EPA 200.7	
Total & Dissolved Selenium	EPA 200.8; EPA 200.7	
Total Hardness	SM 2340B	
Chloride	SM 4500 Cl C	
Sulfate	SM 4500 SO4 E; EPA300	

6.3 Project Schedule

Table 6 details the project schedule for the Inland Surface Water Monitoring Program, including start and end dates of major tasks, required deliverables and their corresponding due dates.

Table 6. Project Schedule and Deliverables

Activity	Date		Deliverable	Deliverable Due Date
	Anticipated Date of Initiation	Anticipated Date of Completion		
Identify or modify sampling locations	02/01/11	03/01/11	List of Monitoring Sites	03/03/11
Prepare/ Modify the Surface Water Monitoring Sampling Plan	03/01/11	03/21/11	Sampling Plan Ready to Implement	3/21/11
Prepare/ Update QAPP	03/01/11	03/21/11	Updated QAPP	3/21/11
Conduct Inland Surface Water Monitoring	3/21/11	Ongoing	Monitoring Data Ready for Evaluation Against CWA Section303(d) Listings	As Needed

6.4 Geographical Setting

The Science and Monitoring Group is responsible for monitoring WQLS in the unincorporated areas of the County of San Diego (Figure 3). The unincorporated areas of the County cross over eight watershed management areas; these are Santa Margarita River, San Luis Rey River, Carlsbad Management Area, San Dieguito River, San Diego River, Sweetwater River, Otay Watershed, and Tijuana Watershed.

6.5 Constraints

The Inland Surface Water Monitoring is conducted throughout the year. Proper safety precautions need to be observed by the staff and therefore sampling cannot be conducted during times of excessive flows or other conditions that may compromise the safety of the personnel.

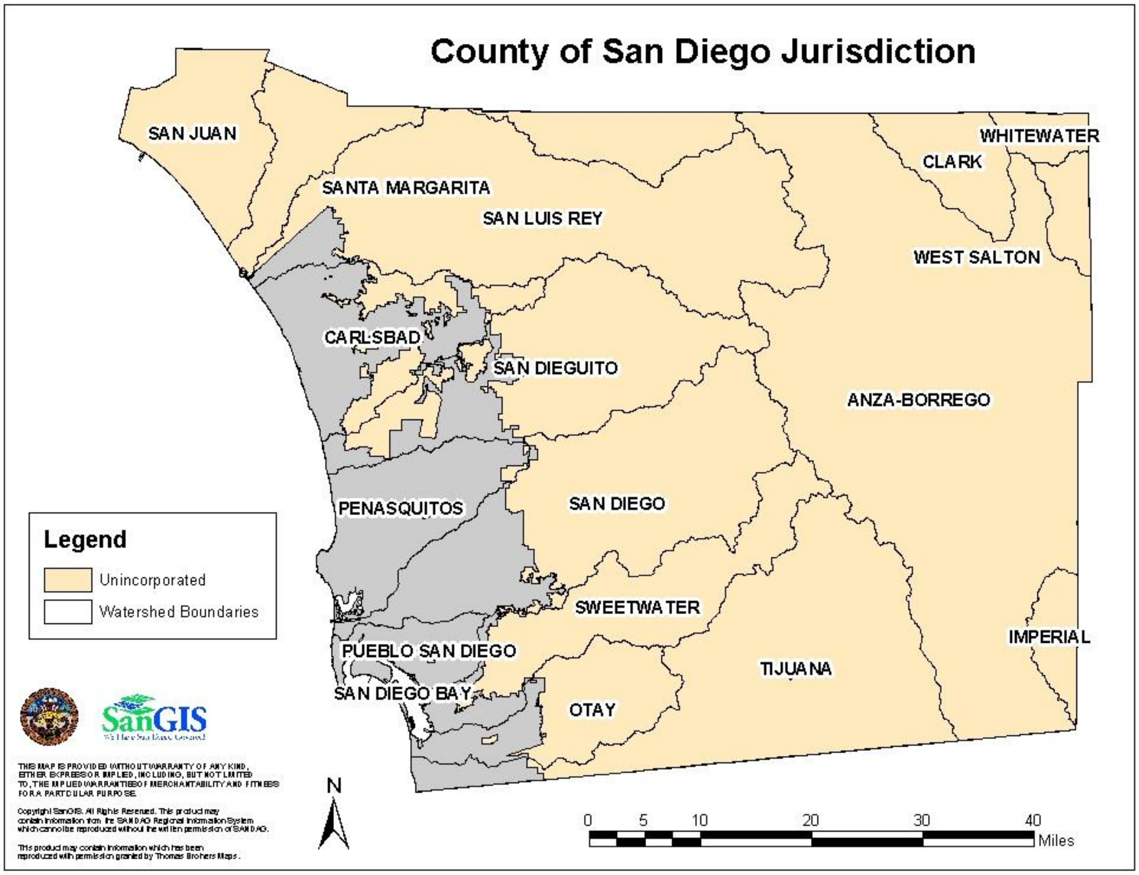


Figure 3. Unincorporated areas of San Diego County subject to the Inland Surface Water Monitoring Program.

6. Quality Objectives and Criteria for Measurement of Data

6.1. *Data Quality Definitions*

7.1.1. Precision

Precision is the degree of mutual agreement among replicate analyses of a sample or standard. The precision is determined with replicate analysis of the same sample or a sample of known analyte concentration (standard sample). It is calculated as the relative standard deviation (% RSD):

$$\%RSD = \frac{s}{\overline{X}} \times 100$$

Where s is the standard deviation and $\overline{X}$ is the mean of repeated samples.

Where duplicate samples are used to estimate precision, the Relative Percent Difference (RPD) between the two samples is calculated using the following formula:

$$\text{RPD} = \frac{|x1 - x2|}{((x1 + x2)/2)} \times 100$$ where $x1$ and $x2$ are sample duplicates

7.1.2. Accuracy and Recovery

Accuracy is the degree of agreement between an observed value and a "true" value or an accepted reference (e.g., standard). The accuracy is evaluated by analyzing samples of known concentration (standard sample) or by adding a known concentration of the analyte of interest to field-collected samples (spiked sample). When a standard is used, the accuracy is calculated by comparing the known value to the measured value. When a spiked sample is used, the accuracy is obtained by comparing the added (known) amount against the measured amount. The accuracy is usually expressed as percent recovery (% R).

$$\%R = \frac{\text{Measured value}}{\text{Known value}} \times 100$$

The measured value may be the mean of several replicate analyses of a spiked sample/standard.

7.1.3. Method Detection Limit and Reporting Limit

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs must be established as defined in 40 CFR Part 136, Appendix B. Reporting limit (RL) or practical quantitation limit (PQL) is the lowest level achievable among laboratories within specified limits during routine laboratory operations. The RL (PQL) is about five times the MDL and represents a practical and routinely achievable detection level with a relatively good certainty that any reported value is reliable. Values less than the MDL are reported as not detected (ND) or <[value of MDL]. Values greater than the MDL and less than the QAPP listed RL are qualified with the "J" character as estimates. Values greater than the RL are reported without qualification unless required because of other QC related issues.

7.1.4. Completeness

Completeness is the percentage of actual measurements that are judged to be valid, over the planned overall measurements. An invalid measurement would be one that does not meet the sampling method requirements and the data quality objectives. Accidental or inadvertent loss of samples during transport or lab activities leads to the loss of original samples, resulting in irreparable loss of data. Percent completeness (%C) for measurement parameters is defined as follows:

$$\%C = V/T \times 100$$

where V is the number of measurements judged valid and *T* is the planned number of measurements. US EPA recommends that monitoring programs should try to achieve a level of completeness in which no less than 95 percent of samples are judged to be valid. This QAPP requires 90% completeness.

7.2. Data Quality Objectives for Field Measurements

Water pH, conductivity, turbidity, dissolved oxygen, and temperature are measured *in situ* using the Horiba U-10 6-parameter probe. The data quality objectives for these parameters are summarized in table 7 and the MDLs are listed in Table 9.

The precision (expressed as % RSD) is determined as follows: After calibration using two standard solutions, the probe is used to measure a third standard solution to obtain multiple readings. The accuracy for each parameter (expressed as % R) is calculated by measuring the standard against its respective known value. The “true” value of temperature for the standard can be obtained by using a calibrated standard thermometer.

Table 7. Data Quality Objectives for Field Measurements

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limits	Completeness
Field Testing	pH	± 0.2 units	± 0.2 units	NA	NA	90%
Field Testing	Turbidity	± 30%	No SWAMP requirement; will use ± 30%	NA	NA	No SWAMP requirement; will use 90%

7.3. Data Quality Objectives for Laboratory Analysis

Laboratory analyses include the determination of chemical properties of water samples. Data quality objectives for all analytes are provided by the contract laboratory and presented in Table 8.

Table 8. Data Quality Objectives for Chemical Properties of Water

Group	Parameter	Accuracy	Precision	Recovery	Target Reporting Limits	Completeness
Chemical Laboratory Analysis	Hardness	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by supplier. If not available, within 80% to 120% of true value	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	10.0 mg/L	90%
Chemical Laboratory Analysis	Ammonia-N	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by supplier. If not available, within 80% to 120% of true value	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	0.01mg/L	90%
Chemical Laboratory Analysis	**Dissolved Metals** Aluminum (Al) Manganese (Mn) Selenium (Se)	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by supplier. If not available, within 80% to 120% of true value	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Matrix spike 75% - 125% or control limits at ± 3 standard deviations based on actual lab data.	0.1 mg/L 0.025 mg/L 0.025 mg/L	No SWAMP requirement; will use 90%
Chemical Laboratory Analysis	**Total Metals** Aluminum (Al) Manganese (Mn) Selenium (Se) Iron (Fe)	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by supplier. If not available, within 80% to 120% of true value	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Matrix spike 75% - 125% or control limits at ± 3 standard deviations based on actual lab data.	0.1 mg/L 0.025 mg/L 0.025 mg/L 0.15 mg/L	90%
Chemical Laboratory Analysis	Chloride	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by supplier. If not available, within 80% to 120% of true value	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	50 mg/L	90%
Chemical Laboratory Analysis	Sulfate	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by supplier. If not available, within 80% to 120% of true value	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	5 mg/L	90%
Chemical Laboratory Analysis	Total Dissolved Solids	Standard Reference Materials (SRM, CRM, PT) within 95% CI stated by supplier. If not available, within 80% to 120% of true value	Laboratory duplicate, Blind Field duplicate, or MS/MSD 25% RPD Laboratory duplicate minimum.	Matrix spike 80% - 120% or control limits at ± 3 standard deviations based on actual lab data.	20 mg/L	90%

8 Special Training Requirements/Safety

8.1 Specialized Training and Certifications

8.1.1 Photo Documentation

There is no specialized training for photo documentation. At least one photograph per year should be collected at each site. If a site is new, one photograph looking upstream and one looking downstream should be taken. Photographs have to be properly dated, saved and stored.

8.1.2 Water Quality Monitoring

Although there are no special training needs required for these monitoring programs, all field personnel are trained/refresher trained in proper field sampling and sample handling techniques prior to each sampling season by the Quality Assurance Officer. All field personnel are trained and have experience in the collection, handling/storage, and chain of custody procedures as they relate to sample collection. Health and safety training is conducted each month at Watershed Protection Program staff meetings with an annual update of the Illness, Injury Prevention Plan (IIPP) for the Science and Monitoring group.

8.1.3 Analytical Laboratory

EnviroMatrix Analytical, Inc. is certified by the Environmental Laboratory Accreditation Program (ELAP) for the analyses of inorganics, toxic chemical elements, and organics in wastewater (Certificate 1237).

8.2 Training and Certification Documentation

All personnel are responsible for complying with all quality assurance/quality control requirements pertaining to their organizational/technical function. Each technical staff member possesses a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures, and record management.

8.2.1 Field Sampling

All field personnel refresher training is documented and records kept in the County of San Diego Department of Public Works, Human Resources Office and on file at Project Manager’s office.

8.2.2 Analytical Laboratory

EnviroMatrix Analytical, Inc. maintains records of their training. Those records can be obtained if needed from EnviroMatrix through the Quality Assurance Director.

8.3 Training Personnel

The Quality Assurance Officer provides training for field personnel in proper field sampling techniques prior to work initiation to ensure consistent and appropriate sampling, sample handling/storage, and chain of custody procedures.

9 Documentation and Records

Science and Monitoring Group documents and tracks all aspects of the sample collection process which include generating field datasheets at each site and chain of custody forms for all analytical samples collected. Chain of custody (COC) forms accompany water samples to the laboratory for analysis. EnviroMatrix Analytical, Inc. documents and tracks all aspects of sample receipt and storage, analyses and reporting. Copies of the COC forms are included in the final report.

The Science and Monitoring Group maintain the databases for all data collected. The databases and all related electronic files and reports are backed-up daily through the County of San Diego network service provider.

All records generated by this project are stored at the Science and Monitoring Group's office. EnviroMatrix Analytical, Inc. records pertinent to this project are maintained at EnviroMatrix main office. Copies of all records held by EnviroMatrix are provided to the Science and Monitoring Group both electronically, in specified format, and by hard copy and stored in the project file.

Copies of this QAPP are distributed to all parties involved. Updates to this QAPP are distributed in like manner, and all previous versions are discarded from the project file.

<u>Record maintenance responsibilities are assigned as follows:</u>

Ken Liddell - maintains all sample collection, sample transport, chain of custody, and field datasheet forms; maintains all records associated with the receipt and analysis of samples processed by EnviroMatrix Analytical, Inc. and all records submitted by EnviroMatrix.

Steven DiDonna - maintains backup copies of the databases

Dan Verdon (Laboratory Director for EnviroMatrix Analytical, Inc.) - maintains EnviroMatrix records

Joanna Wisniewska (QA Officer for the Science and Monitoring Group) – maintain records of QA/QC audits and reports.

Nancy Stalnaker (Science and Monitoring Group Project Manager/Supervisor) - oversee the actions of these persons and arbitrate any issues relative to records retention and any decisions to discard records.

Table 9. Document and record retention, archiving and disposition information.

	Document/ Record Type	Retention	Archival	Disposition
Sample Collection Records	*Chain of Custody Forms*	5 years	5 years	5 years
Field Records	*Site photographs*	5 years	5 years	5 years
	Field data sheets	5 years	5 years	5 years
Analytical Records	*Hardcopy laboratory data*	5 years	5 years	5 years
Data Records	*Databases*	5 years	10 years	10 years
	Laboratory Data – electronic version	5 years	10 years	10 years
Assessment Records	*Calibration Datasheets*	5 years	5 years	5 years
	QA/QC audits	5 years	5 years	5 years
Data Analysis	*Analysis of data results*	5 years	10 years	10 years

	Document/ Record Type	Retention	Archival	Disposition
& Reports	*Annual reports*	5 years	10 years	10 years

B. Data Generation and Acquisition

10. Sampling Process Design

The main objective of the Inland Surface Water Monitoring Program is to provide additional data that would either support or reject the placing water quality limited segments (WQLS) in question on the CWA Section 303(d) List of Impaired Water Bodies. The 2011 review of existing data collected by the County as part of the Dry Weather Monitoring program and several special monitoring projects revealed 17 WQLS located in San Diego County that should be sampled for the purpose of potential removal from the 303(d) list based on preliminary sampling results or no available data (collected by the County). These include: one to be sampled for aluminum, one for ammonia as N, one for chloride, two for iron, five for manganese, one for pH, ten for selenium, three for sulfates, one for turbidity, and four for TDS. A list of the WQLS and the corresponding constituents of concern (COCs) together with designated sampling locations is provided in Table 3. The locations are also presented on a map in Figure 1.

The sampling site locations in each WQLS are identified by GPS coordinates and Thomas Brothers® map coordinates. Each site is visited approximately every two weeks, depending on staff availability, regardless of the weather provided proper safety conditions. Each sampling location is photographed at least once per year in an effort to identify any physical and/or biological alterations to the site. Field measurements, using the Horiba U-10 6 Parameter probe, are conducted at locations with flowing or ponded water that are located along WQLS listed for either pH or turbidity on the CWA Section 303(d) list. Water samples are collected at the visited locations to be analyzed in the laboratory for specific constituents selected based on each WQLS 303(d) listed impairments. If a site becomes inaccessible, a reasonable attempt is made to locate a replacement site along the same WQLS.

11. Sampling Methods Requirements

Constituents and measurements performed at each sampling location are specific to that WQLS as they are based on the 303(d) listed impairments identified fort that WQLS.

At each site, flow is estimated and, based on the corresponding WQLS 303(d) listed impairments, in-situ measurements of pH and/or turbidity are made and/or grab samples are collected and analyzed in the laboratory for the listed constituents. All Standard Operating Procedures (SOPs) including the proper use, maintenance and calibration of sampling equipment, sampling protocols and safety procedures are described in the "Inland Surface Water Monitoring Program's Monitoring Plan" (Appendix 5).

Water samples for laboratory analysis are collected from an outfall or stream/creek at its horizontal and vertical center or at a location that is most representative of its water quality. All samples are collected using the appropriate sample containers (supplied by EnviroMatrix Analytical, Inc.) with appropriate preservatives and not to exceed specified holding times (Table 10). Samples are stored at ≤4°C in an ice cooler.

When collecting water samples from creeks/streams with wide flow, boots or waders are worn to enter the water just downstream of the designated sampling point. Gloves are also worn during analytical sampling. Samples are collected by pointing the bottle opening upstream lowering it to mid-depth position and allowing the bottle to fill while care is taken to avoid collecting floating debris. In shallow water (less than 6 in deep), bottles are filled from the surface of the stream. A clean syringe may also be used to collect water in very low flow or in ponded water.

Field data sheets (Appendix 1) are completed for each site visit. The empirical observations of the site and water quality characteristics include: meteorological conditions at the time of sampling; odor, water clarity, presence of floatable matter, visible deposits/ stains and biological status. Each site is also photographed annually to identify any alterations in vegetative coverage or physical status.

Table 10. Water Quality Analytical Parameters for Water Quality Monitoring Projects

Analytical Parameter	Analytical Method	Container type	Sample Volume (mL)	Preservative	Maximum Holding Time
pH	N/A	Analyzed in Field	N/A	N/A	N/A
Turbidity	N/A	Analyzed in Field	N/A	N/A	N/A
Ammonia-N	EPA 350.2	Plastic	500	Acidify to pH<2 with H2SO4	28 days
Total Aluminum	EPA 200.8	Plastic	500	Acidify to pH <2 with HNO3	6 months
Dissolved Aluminum	EPA 200.8	Plastic	500	None, 4' C	6 months
Total Manganese	EPA 200.8	Plastic	500	Acidify to pH <2 with HNO3	6 months
Dissolved Manganese	EPA 200.8	Plastic	500	None, 4' C	6 months
Total Iron (Fe)	EPA 200.8	Plastic	500	Acidify to pH <2 with HNO3	6 months
Total Selenium (Se)	EPA 200.8	Plastic	500	Acidify to pH <2 with HNO3	6 months
Dissolved Selenium (Se)	EPA 200.8	Plastic	500	None, 4' C	6 months

Analytical Parameter	Analytical Method	Container type	Sample Volume (mL)	Preservative	Maximum Holding Time
Chloride	SM 4500 Cl C	Plastic	500	None, 4' C	28 days
Sulfate	SM 4500 SO4 E; EPA300	Plastic	500	None, 4' C	28 days
Total Hardness	EPA 130.2 / EPA 200.7, SM 2340 B	Plastic	500	None, 4' C	6 months
Total Dissolved Solids (TDS)	SM 2540C	Plastic	500	None, 4' C	7 days

12. Sampling Handling and Custody

12.1 Photo Documentation

No special handling or custody procedures are needed. The digital camera is returned to the office and the digital photographs are downloaded, labeled with specific dates and locations and placed in their appropriate folders. All photographic data are backed up daily.

12.2 Water Quality Samples

The grab samples collected during monitoring events are labeled with site location, date, sample time, analysis to be performed, sample preservation (if any) and field sampler's name. Each site visit is assigned a unique sample event ID number and recorded in a logbook. The time, date, site, and event type is also recorded in the logbook next to the sample event ID number. Sample bottles are stored and transported at ≤4°C in an ice cooler until processed. Samples are delivered to EnviroMatrix Analytical, Inc. within specific holding times (Table 10).

Field data sheets (Appendix 1) and Chain of Custody records (Appendix 7) are employed to document sample identity, handling and possession. The COCs are used to document sample transfer from field collection staff to laboratory staff. One COC record may accompany a group of samples. Persons who have custody of the samples sign the form and ensure that the samples are not left unattended unless properly secured. Documentation of sampling, handling and custody includes the following:

- Sampler identifier
- Sample collection date and time
- Sample Event ID number
- Any special notations on sample characteristics
- Signature of person(s) collecting the sample
- Date and time the sample was received by the EnviroMatrix Analytical, Inc. staff
- Constituents to be tested, preservatives, and temperature requirements

The COCs must be kept dry and legible. Upon receipt of the samples, EnviroMatrix Analytical, Inc. staff must note the date and time of receipt, sign the COC and give a copy to the field staff while keeping the original form. At the laboratory, laboratory staff verifies sample and document condition and ensures that sample transport/storage temperature, labels on bottles are in agreement with the description on the COC form. Any discrepancies are noted and discussed with the sample delivery personnel or by contacting the Program QA Officer. The COC records are included in final reports prepared by the analytical laboratory.

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13. Analytical Methods Requirements

Table 11 details the analytical methods for parameters measured in the field for water quality monitoring. Methods to be used for laboratory analysis of chemical parameters are summarized in Table 12. EnviroMatrix Analytical, Inc. shall follow all analytical procedures described in the methods. The laboratory shall notify WPP of any modification of the methods and procedures.

Table 11. Field Measurement Methods

Analyte	Project Action Limit	Analytical Methods		Achievable Laboratory Limits	
		Analytical Method	Modified for Method (Y/N)	Method Detection Limits	Method Reporting Units
pH	< 6.5 or > 8.5	EPA 150.1	N	0.1	pH units
Turbidity	20	EPA 180.1	N	0.006	NTU

Table 12. Laboratory Analytical Methods

Analyte	Project Action Limit	Project Quantitation Limit	Analytical Methods		Achievable Laboratory Limits	
			Analytical Method	Modified for Method (Y/N)	Method Detection Limits[2]	Laboratory Reporting Limits
Total & Diss. Aluminum	0.2 mg/L	0.25 mg/L	EPA 200.7/ EPA200.8	N	0.05 mg/L	0.1 mg/L
Ammonia-N	0.025 mg/L	0.025 mg/L	SM4500 NH3 B,C	N	0.005 mg/L	0.01 mg/L
Chloride	250 mg/L	2.5 mg/L	SM 4500 Cl C	N	0.5 mg/L	1.0 mg/L
Total Hardness		100 (mg CaCO3/mL)	EPA 200.7, SM 2340 B	N	10 (mg CaCO3/mL)	10 (mg CaCO3/mL)
Total Iron (Fe)	0.3 mg/L	0.25 mg/L	EPA 200.7/ EPA200.8	N	0.05 mg/L	0.15 mg/L
Total & Diss. Manganese	0.05 mg/L	0.025 mg/L	EPA 200.7/ EPA200.8	N	0.005 mg/L	0.025 mg/L
Total & Diss. Selenium	0.05 mg/L	0.0025 mg/L	EPA 200.7/ EPA200.8	N	0.0005 mg/L	0.001 mg/L
Sulfate as SO_4	65 mg/L	5 mg/L	SM 4500 SO4 E/ EPA300	N	1 mg/L	5 mg/L
Total Dissolved Solids (TDS)	300 mg/L	5 mg/L	SM 2540 C	N	1 mg/L	20 mg/L

[1] Water Quality objective for total and dissolved metal fractions are based on Total Hardness (as CaCO3) and are calculated as described by Title 40 of the Code of Federal Regulations (Part 131) (USEPA 2000).
[2] Method detection limits are subject to change.

14. Quality Control Requirements

Quality control (QC) checks for both the field and laboratory are used to ensure that valid data are collected. Quality Control checks provide data that are used to compute statistical indicators of data quality. Corrective actions will be taken when QC check data exceed control limits that have been established for each analyte of interest. Quality Control checks include the use of blanks, duplicates, matrix spikes, and laboratory control standards (LCS). The frequency of QC checks is presented in Table 13.

Table 13. Quality Control Checks

Category	Blank	Duplicate	Matrix spike	LCS
Field	3 per season	10%	N/A	N/A
Laboratory	1 per batch of 20 samples or less	1 per batch or 10%	1 per batch of 20 samples or less	1 per batch of 20 samples or less

Field blanks are collected at a rate of one per 20 samples for laboratory analysis and field testing. Field blanks are used to monitor contamination originating from the collection, transport or storage of environmental samples. A field blank is prepared by pouring analyte-free water (i.e. deionized water) into the sample collection device and sub-sampling for analytes to verify that field cleansing procedures are adequate and that sampling, handling and transportation do not introduce any analytes of interest. The results from field blanks are reported in the annual report as part of the Data Quality Control and Quality Assurance discussion; however, they are not used to correct (blank adjust) data. Field blanks are analyzed in the laboratory for Ammonia-N, Aluminum, Manganese, Iron (Fe), Selenium (Se), Chloride, Sulfate, Total Hardness, and Total Dissolved Solids (TDS).

At least one field duplicate is submitted per 10 samples collected for field and laboratory analyses. Field duplicates are two samples collected at the same time and location using two sampling bottles, and processed and analyzed in an identical manner. Field duplicates are analyzed in the laboratory for Ammonia-N, Aluminum, Manganese, Iron (Fe), Selenium (Se), Chloride, Sulfate, Total Hardness, and Total Dissolved Solids (TDS).

All contract laboratory analysis is performed under the guidelines of the quality assurance and quality control programs established by EnviroMatrix Analytical, Inc. For each batch of 20 or fewer samples, this includes a laboratory duplicate, a laboratory control sample (LCS), a laboratory control sample duplicate (LCS Dup), a matrix spike, and a matrix spike duplicate. Reference samples are also prepared and/or surrogates analyzed for some analytes. Laboratory duplicates are prepared by taking two aliquots of a sample from the same container. The relative percent difference between the two results defines precision of the method evaluated. A matrix spike is a sample prepared by adding a known mass of a target analyte to a specified amount of sample matrix for which an independent estimate of the target analyte concentration is available. Matrix spikes are used to evaluate any bias to the analysis from the sample matrix. A LCS is prepared from a certified standard that is spiked into purified water and analyzed in the same way as the environmental samples. The LCS is used to demonstrate method proficiency irrespective of matrix.

15. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All field testing equipment is cleaned and inspected upon return from each sample day/event. The Horiba U-10 6-parameter probe is auto-calibrated prior to field use and upon return and the results recorded in the calibration data sheet (Appendix 4). The Horiba probes are replaced at the first sign of deviation from standard solution concentrations and any deviations/replacements are noted in the instrument logbook.

EnviroMatrix Analytical, Inc. maintains its equipment in accordance with its standard operating procedures (SOPs) which include those specified by the manufacturer and those specified by the method. “EnviroMatrix Analytical, Inc. Quality Assurance Program Manual” (Chapter 10) details their equipment and systems testing, inspection, maintenance and calibration specifications and schedule.

Table 14. Testing, inspection, maintenance of sampling equipment and analytical instruments.

Equipment / Instrument	Maintenance Activity, Testing Activity or Inspection Activity	Responsible Person	Frequency	SOP Reference
Horiba U-10 6-parameter probe	Clean, inspect, check with pH7 and pH10 solutions before and after field visit, replace probes as necessary	Field staff	Upon each field visit and replace probes as necessary	Appendix 4, Appendix 5
Global Flow Probe	Clean, inspect, check/replace batteries	Field staff	Upon each field visit	Appendix 2, Appendix 5
Field Camera	Clean, inspect, recharge/replace batteries	Field staff	Upon each field visit	

16. Instrument/Equipment Calibration and Frequency

All equipment and instruments used by the Science and Monitoring Group are operated and calibrated according to the manufacturer’s recommendations as well as by criteria defined in individual SOPs (Appendix 5). Operation and calibration are performed by field personnel trained in these procedures. Documentation of all routine and special calibration information is recorded in appropriate logbooks. If a critical measurement is found to be out-of-compliance during analysis, the results of that analysis are reported, corrective action is taken and documented, and the analysis repeated if possible.

The Horiba U-10 6-parameter probe is calibrated prior to use each day using the AutoCal procedure (Appendix 5) and tested with pH 7 and pH10 solutions. Upon return from the field, the probe is checked again with the pH 7 and pH 10 solutions and the results recorded. All calibration data are recorded on calibration data sheets (Appendix 4) and filed in the instrument’s logbook. If measured results do not meet the DQOs, the multi-meter is recalibrated using the two-point calibration procedure (Appendix 4). Quarterly, a full calibration of the probe is conducted and documented in the instrument logbook. The flow meter is calibrated using other flow measurement methods.

“EnviroMatrix Analytical, Inc. Quality Assurance Program Manual” (Chapter 10: Calibration Procedures) details their equipment calibration procedures and schedule.

Table 15. Testing, inspection, maintenance of sampling equipment and analytical instruments.

Equipment / Instrument	SOP reference	Calibration Description and Criteria	Frequency of Calibration	Responsible Person
Horiba U-10 6-parameter probe	Appendix 4	Auto-calibrate and check with pH7 and pH10 solutions and conduct full instrument calibration	Auto-calibrate upon each visit; check with pH7 and pH10 solutions before and after each field visit; full calibration 4X/year	Field staff
Global Flow Probe	Appendix 2	Check meter against other flow measurements methods	N/A	Field staff

17. Inspection/Acceptance Requirements for Supplies and Consumables

The County of San Diego only purchases supplies and consumables for approved vendors that meet the County Purchasing and Contracting Department's strict guidelines. Critical supplies for this project include calibration standard solutions, buffer solutions, reagents, and sample collection bottles supplied by EnviroMatrix Analytical, Inc.

Upon receipt, buffer solutions, standards, and reagents are inspected for leaks or broken seals. Reagents are replaced before they exceed manufacturer's recommended shelf life. These shelf lives are typically one to two years. However, specific replacement dates can be determined by providing the reagent lot number to the manufacturer. Reagent replacement dates are noted in the reagent log sheet. Steve DiDonna is responsible for keeping the reagent log sheet. He also ensures that buffer solutions, standards, and reagents are inspected for leaks or broken seals and replaced when necessary, and also that consumables are replaced before they exceed manufacturer's recommended shelf life. All supplies and consumables are stored in accordance with manufacture's specifications in a secure location.

All sampling equipment is inspected for broken or missing parts and tested to ensure proper operation on a regular basis.

Table 16. Inspection/acceptance testing requirements for consumables and supplies.

Project-Related Supplies / Consumables	Inspection / Testing Specifications	Acceptance Criteria	Frequency	Responsible Individual
Calibration standard solutions	Check seals and containers for breaks, check expiration dates; ensure proper storage	Containers properly stored; seals and containers intact; used containers properly closed; solutions not expired	Upon receipt and each use	Steve DiDonna & other field personnel who use the supply/consumable
Buffer solutions	Check seals and containers for breaks, check expiration dates; ensure proper storage	Containers properly stored; seals and containers intact; used containers properly closed; solutions not expired	Upon receipt and each use	Steve DiDonna & other field personnel who use the supply/consumable
Reagents	Check seals and containers for breaks, check expiration dates; ensure proper storage	Containers properly stored; seals and containers intact; used containers properly closed; reagents not expired	Upon receipt and each use	Steve DiDonna & other field personnel who use the supply/consumable
Sample collection bottles	Check seals and containers for breaks; ensure proper storage	Bottles and seals intact; bottles properly stored and transported	Upon receipt and each use	Steve DiDonna & other field personnel who use the supply/consumable

18. Non-direct Measurements

Non-direct measurements are used to support the selection of sampling sites and to assist in the development of monitoring plans for Watershed Water Quality Monitoring. These measurements include data collected during previous years as part of Dry Weather Monitoring and special project monitoring as well as the Regional Water Quality Control Board Surface Water Ambient Monitoring Program (RWQCB SWAMP) data, and data obtained from other agencies. In addition, photo documentation, topographical maps, land use maps, and hydrological maps generated from San Diego Association of Governments and County of San Diego GIS databases, are used.

All non-direct measurement data are reviewed against data quality objectives stated in section 7 and only those data that pass the review are used in this project.

19. Data Management

Field data sheets are checked and initialed in the field by field staff. Following initial data entry into the appropriate database, the QA Officer reviews electronic data. The QA Officer reviews 20% or the datasheets for completeness, accuracy and for data entry and transcription errors. After performing checks, and ensuring that data quality objectives have been met, analysis can be performed.

Data are maintained as described in section 9. All original field data sheets, statistical worksheets, and reports produced are accumulated into project specific files that are maintained at the Science and Monitoring Group's office. Data files, databases and final report text and tables are maintained on the County of San Diego network in project specific folders and are backed up daily for storage offsite.

EnviroMatrix Laboratory, Inc. records pertinent to this project are maintained at EnviroMatrix's main office. Copies of all records held by EnviroMatrix are provided to the Science and Monitoring Group both electronically, in specified format, and by hard copy and stored in the project file. EnviroMatrix Laboratory, Inc. also reports laboratory analytical results to the QA Officer who verifies sample identification information, reviews the chain-of-custody forms, and identifies the data appropriately in the report. The QA Officer is responsible for identifying any results where holding times have been exceeded, sample identification information is incorrect, samples were inappropriately handled, or calibration information or quality control data are missing or inadequate. Such data are marked as unacceptable and will not be entered into the database.

C. Assessment/Oversight

20. Assessments and Response Actions

The use of approved equipment and methods when obtaining water samples and conducting field measurements and/or laboratory analyses, must undergo periodic verification that proper sampling and measurement methods are, in fact, being employed as planned. The internal and/or external verification is required to ensure that:

- All elements of the QAPP are correctly implemented as prescribed.
- The quality of data generated by implementation of the QAPP is adequate.
- Corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

Although external assessments including a 3rd party audit may be employed when needed, internal assessments provide sufficient information about the degree to which QAPP is implemented. All assessments and reviews are conduced by the Science and Monitoring Group's QA Officer, Joanna Wisniewska. She conducts quarterly reviews of field activities and reports the results to the Project Manager, Nancy Stalnaker. The reviews include, but are not limited to: the examination of equipment, record keeping, locating a sample site, sampling procedures, Horiba 10-U 6-parameter probe calibration, sample handling and transportation, and field documentation.

For EnviroMatrix Analytical, Inc., the technical systems audits are thorough, systematic onsite qualitative assessments. The audits include, but are not limited to the examination of facilities, equipment, personnel, training, procedures (SOPs), and record keeping for conformance to the QAPP. The Science and Monitoring Group QA Officer routinely audits EnviroMatrix Analytical, Inc. yearly. During the laboratory systems audit, it should be clear what equipment is used, what personnel are involved, and what procedures are followed for data quality verification.

Assessments are accomplished by conducting performance evaluation and technical systems audits of field sampling, field measurement, and laboratory analysis. "Blind" samples are used for performance evaluation. "Blind" samples are those whose identity is unknown to those operating the measurement system. These can be standards or duplicate samples. Use of these materials allows for assessment of data quality objectives such as precision and accuracy.

The QA Officer has the power to halt all sampling and analytical work conducted by both the Science and Monitoring Group and EnviroMatrix Analytical, Inc. if the deviation(s) noted are considered detrimental to data quality.

20.1 Field Corrective Actions

The initial Responsibility for monitoring the quality of field measurements lies with the field personnel. The QA Officer is responsible for verifying that all QA/QC procedures are followed. This requires that the Officer assess the correctness of the field methods and the field staff's ability to meet

QA/QC objectives. Consequently, the QA Officer has to make a value judgment regarding the impact a given problem may have upon data quality.

If a field situation occurs that jeopardizes the integrity of the project, misses a QA/QC objective, or significantly impacts data quality, the field staff must immediately notify the QA Officer or the Project Manager. Corrective action measures are then decided upon and implemented. The QA Officer documents the situation, the field objective affected, the corrective action taken, and the results of the action. Copies of the documentation are filed in the project binder.

20.2 Laboratory Corrective Action

If any discrepancy is discovered during an audit, the Science and Monitoring Group QA Officer will discuss the observed discrepancy with the person(s) responsible for the activity (see organization chart, Figure 1). Issues discussed should include enquiries such as: 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.

Any practices or procedures that do not conform to the written QAPP must be addressed in a timely manner. Any inadequacy(ies) must be documented and communicated in writing to the laboratory Project Manager. The laboratory Project Manager is then responsible for making corrections needed and for reporting these actions in writing to the Science and Monitoring Group QA Officer. Copies of the documentation are filed in the project binder. Follow-up inspections may be used to confirm that deficiencies have been addressed and corrected.

If an internal laboratory process is out-of-control, corrective action(s) shall be taken and documented (see Appendix 7, EnviroMatrix Analytical, Inc. Corrective Action Form), with regard to:

- Indication/description of the out-of-control situation
- Cause that was discovered
- Action taken to resolve problem
- Was the corrective action acceptable?

If the out-of-control process or out of calibration conditions affected project data results, notification from the laboratory Project Manager must sent to the Science and Monitoring Group QA Officer and filed in the project binder.

21. Reports to Management

Table 17 outlines the schedule of reports due to the Project Manager.

Table 17. Management Reports

Type of Report	Frequency	Projected Delivery Dates(s)	Person(s) Responsible for Report Preparation	Report Recipients
Inland Surface Water Monitoring Program's Monitoring Plan	As Needed	March 21, 2011	Joanna Wisniewska	Nancy Stalnaker, Project Manager
Quality Assurance Project Plan	As Needed	March 21, 2011	Joanna Wisniewska	Nancy Stalnaker, Project Manager

Inland Surface Water Monitoring Annual Report	Annually	December 30, 2009	Joanna Wisniewska	Nancy Stalnaker, Project Manager
Data Quality Control and Quality Assurance Report	Annually	December 30, 2009	Joanna Wisniewska	Nancy Stalnaker, Project Manager

D. Data Validation and Usability

22. Data Review, Verification and Validation

Data validation is the process whereby data are filtered and accepted or rejected, based on a set of criteria. The data validation process consists of data generation, reduction, and review and it is an on-going process involving field and laboratory staff, Laboratory Managers, and QA/QC personnel. The Science and Monitoring Group QA Officer is responsible for the data review, verification, and validation.

22.1 Data Verification

Data Verification is confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. It is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method and procedural, or contractual, requirements. The process of data verification effectively ensures the accuracy of data using validated methods and protocols and is often based on comparison with reference standards.

Questions that may be asked in data verification are:

- Have the data been collected according to a specified method?
- Have the collected data been faithfully recorded and transmitted?

22.2 Data Validation

Data Validation is confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Data validation is an analyte-and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set.

Data meeting verification and validation criteria are accepted for inclusion in the database. Data that do not meet these requirements are excluded.

23. Verification and Validation Methods

23.1 Database Generation

All data collected in the field are recorded on-site using filed data sheets (Appendix 1). All data sheets are completed in waterproof ink, reviewed for accuracy and completeness and initialed by the field staff present.

The field staff member who generates the data is primarily responsible for its accuracy and completeness and must review the data to ensure that:

- Sample description information is correct and complete
- Analysis information is correct and complete
- Results are correct and complete
- Documentation is complete

Upon return from the field or as soon as possible thereafter, the data are entered into the database. Once data entry is completed, the person entering the data dates and initials the top of the pertinent datasheet. The datasheets are then placed in the appropriate project binder labeled with the data type and project name. Note: a long-term project being carried out by the Laboratory Coordinator aims to cross-check 100% of the field data sheets with the data entered into the DWM database. After each sheet is checked, it is marked “QA/QC” and dated and initialed in red ink in the lower right corner.

23.2 Error Checking and Verification

On a weekly basis, 20% of the data entries are screened by the QA Officer or designee. If any errors are found they are corrected and noted on original datasheet(s). If no errors are found, the datasheets are marked with a “√” and initialed.

Laboratory data validation is performed by the Laboratory QA Director. If an outlier or other issues arise, the QA Director will contact the Laboratory Director and attempt to resolve any discrepancies. Data validation is accomplished through routine audits of the data collection procedures and by monitoring of QA/QC sample results.

Data validation includes dated and signed entries by the technicians on the bench sheets and notebooks used for all samples; the use of sample tracking and numbering systems to track the progress of samples through the laboratory; and the use of quality control criteria to reject or accept specific data.

The minimum requirements for each analytical run area are:

- Matrix spike and duplicate analyses per concentration level and per matrix for every sample batch analyzed (where appropriate).
- Reference materials analyses compared with "true" values and acceptable ranges. Values outside the acceptable ranges indicate that the sample values are invalid. Following correction of the problem, the reference material should be reanalyzed.

24. Reconciliation with User Requirements

The QA Officer reviews data after each survey to determine if data quality objectives (DQOs) are met. If data do not meet the project’s specifications, the QA Officer will determine if the problem is due to calibration/maintenance, sampling techniques, or other factors and suggest corrective action. It is expected that encountered problems can be corrected by retraining, revision of techniques, or replacement of supplies/equipment. If not, then the DQOs will be reviewed for feasibility. If specific DQOs are not achievable, the QA Officer will recommend appropriate modifications. Any revisions require approval by the Project Manager, Nancy Stalnaker.

All data collected by the Science and Monitoring Group and other organizations will be analyzed using basic statistics and used by the County for water quality assessment within CWA Section 303(d)

List WQLS. The data will be utilized to provide evidence for either removing a WQLS from the 303(d) list or to confirm its placement on the list. The data may further be used to characterize and analyze water quality conditions, for example, to compare water quality between different watersheds and different sites, and/or analyze water quality trends over time. The data collected from these projects will allow for identification of waterbodies where pollution controls may be needed or for determining the effectiveness of controls already in place. These objectives are accomplished by comparing measurement results to the established water quality objectives.

25. References

California State Water Resources Control Board Regional Water Quality Control Board. 2004. *Water Quality Control Policy For Developing California's Clean Water Act Section 303(d) List.* http://www.swrcb.ca.gov/water_issues/programs/tmdl/docs/ffed_303d_listingpolicy093004.pdf

US EPA Surface Water Standards and Guidance Current Aquatic Life Criteria Table. 2014. http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm#altable

US EPA, 1998. EPA Guidance for Quality Assurance Project Plans. EPA/600/R-98/018.

APHA, AWWA, and WEF, 1998. Standard Methods for Examination of Water and Wastewater. 20th edition.

Puckett, M. 2002. Quality Assurance Management Plan for the State of California's Surface Water Ambient Monitoring Program (SWAMP). December 2002.

Appendix 1. Field Data Sheet

COUNTY OF SAN DIEGO
WATERSHED PROTECTION PROGRAM

DEPARTMENT OF PUBLIC WORKS
5201 RUFFIN ROAD, SUITE P
SAN DIEGO, CA 92123

Inland Surface Water Monitoring Datasheet

New Site? ☐ Yes ☐ No

GENERAL SITE DESCRIPTION

Site ID		Site Type		Sample Event ID		Sample Event Type	Field Screening
Location					Watershed	Hydrologic Unit	
Date		Time		Latitude		Hydrologic Area	
Field Staff		Thomas Guide		Longitude		Hydrologic Subarea	

QC Sample	☐ None	☐ Original	☐ Duplicate	☐ Blank	☐ Split	☐ Lab Standard		
Land Use (Primary) (Check one only)	☐ Residential	☐ Rural Resid.	☐ Commercial	☐ Industrial	☐ Agriculture	☐ Parks	☐ Open	
Land Use (Secondary) (Optional, >10%)	☐ Residential	☐ Rural Resid.	☐ Commercial	☐ Industrial	☐ Agr.	☐ Parks	☐ Open	☐ None
Conveyance (Check one only)	☐ Concrete Channel	☐ Natural Creek	☐ Earthen Channel	☐ Manhole	☐ Catch Basin	☐ Outlet	☐ Curb/Gutter	

WATER FLOW ☐ Flowing ☐ Ponded ☐ Dry **REFERRED FOR** ____________

GENERAL CONDITION

Weather ☐ Sunny ☐ Partly Cloudy ☐ Overcast ☐ Fog **Last Rain** ☐ > 72 hours ☐ < 72 hours
☐ ≤ 0.1 inches ☐ > 0.1 inches

OBSERVATIONS N/A

Odor	☐ None	☐ Musty	☐ Rotten Eggs	☐ Chemical		☐ Sewage	☐ Other
Color	☐ None	☐ Yellow	☐ Brown (Silty)	☐ White (Milky)		☐ Gray	☐ Other
Clarity	☐ Clear	☐ Slightly Cloudy	☐ Opaque				☐ Other
Floatables	☐ None	☐ Trash	☐ Bubbles/Foam	☐ Sheen	☐ Algae	☐ Fecal Matter	☐ Other
Deposit	☐ None	☐ Coarse Particulate	☐ Fine Particulate	☐ Stain		☐ Oily Deposit	☐ Other
Vegetation	☐ None	☐ Limited	☐ Normal	☐ Excessive			☐ Other
Biology	☐ None	☐ Insects ☐ Algae	☐ Snails	☐ Fish	☐ Birds	☐ Cray Fish	☐ Other

FLOW MEASUREMENT N/A

Flowing Creek Average

Width	ft
Depth	ft
Velocity	ft/sec (enter 0 if water is ponded)
Length of Ponded Area	ft

Evidence of Overland Flow? ☐ Yes ☐ No ☐ Irrigation Runoff
☐ Other ____________

Outlet Diameter ____________ Liters/Second ____________

Leaf Float Distance________ft Time_________sec

FIELD MEASUREMENT N/A

Horiba Meter: ☐ In Stream ☐ In Bucket ☐ Agitated (DO)

Sample Filtered for Test Kits? ☐ Yes ☐ No
Analytical Lab Sample Collected? ☐ Yes ☐ No

Parameter	Reading	Parameter	Reading
pH (Unit)		DO (mg/L)	
Cond. (mS/cm)		Temp (°C)	
Turb. (NTU)		Salinity (%)	

Appendix 2. Flow Probe User Instruction

1. The FP101 probe handle is a two-piece rod expandable from 3' to 6'. To expand the rod for correct placement in flow, loosen the locking nut on the handle, pull out the top piece, and retighten the nut.
2. Make sure the Flow Probe's propeller turns freely by blowing strongly on the prop.
3. Point the propeller directly into the flow you wish to measure. Face the arrow inside the prop housing downstream.
4. Scroll with the right button until the "V" for velocity appears on the left hand of the screen. The top number in "V" mode is the instantaneous velocity to the nearest 0.1 ft/sec. Push the left button to toggle the bottom number between maximum ("mx") and average ("av") velocities to the nearest 0.01 ft/sec.
5. With the propeller placed at your measuring point, push both the right and left buttons simultaneously and release to clear the computer and reset the average and maximum velocities.
6. For small streams, the probe can be moved slowly and smoothly throughout the flow during average velocity measurement. Move the probe smoothly and evenly back and forth from top to bottom of the flow so that the probe stays at each point in the flow for approximately the same amount of time. Keep moving the probe for 20-40 seconds to obtain an accurate average value that accounts for surging. (Move the probe as if you were spray painting and attempting to get an even coat of paint over the entire surface.).

   The Flow Probe uses true velocity averaging. When the average and maximum velocities are zeroed by pushing both buttons, a running average is started. As long as the probe remains in the flow, the averaging continues. One reading is taken per second, and a continuous average is displayed. For example, after 10 seconds, 10 readings are totaled and then divided by 10 and this average is displayed. Once the average reading becomes steady, the true average velocity of the stream is obtained. When you pull the probe from the water, this average value is frozen on the display until it is reset.

7. Measure/calculate the cross-sectional area of your flow stream in square feet.
8. The average velocity (calculated with the Flow Probe in feet/second) times the cross-sectional area (square feet) equals flow in cubic feet per second (cfs), or Q = V x A.
9. If the propeller gets fouled while measuring flow, clean it until the prop turns freely and start over.

Computer Set-up

The computer's set-up sequence is entered automatically when the batteries are changed. You can also enter the set-up sequence at any time by holding both buttons simultaneously for 8 seconds. During the set-up sequence, all of the display segments are displayed first, and then "mi" appears for English units and "km" appears for metric units. The left button toggles between English and Metric units.

If you wish to measure in English units (standard), or in "feet per second", toggle to "mi". Push the right button to enter "CAL" mode. This is your Flow Probe calibration function. Set the calibration at 33.31. When you change your batteries, you must reset this number. Pushing the left button increases the number when the arrow points up and decreases the number when the arrow points down.

If you wish to measure in Metric units, or in "meters per second", toggle to "km". Push the right button to enter "CAL" mode. This is your Flow Probe calibration function. Set the calibration at 1603. When you change your batteries, you must reset this number. Pushing the left button increases the number when the arrow points up and decreases the number when the arrow points down. NOTE: Unless Metric units are specified when ordering, then measuring in metric units (meters per second) the numbers on the display read 10 times higher than actual measurements (2.23 meters per second reads 22.3).

To continue the set-up sequence after you have set your English or Metric calibration:

1. Push the Right button - be sure "CAD" is not displayed.
2. Push the Right button - SLEEP will appear. If you are not using your Flow Probe for 1-2 month, leave it in this SLEEP mode, to reduce battery drain.
3. Push the Right button - push the Left button to toggle between 24 hr and 12 hr clock.
4. Push the Right button - push the Left button to set HOUR (time of day).
5. Push the Right button - push Left to set the MINUTE (time of day).
6. Push the Right button - you are now out of Set Up and back in Velocity ("V").

Appendix 3. Chain of Custody Form

EnviroMatrix Analytical, Inc.

4340 Viewridge Ave., Ste. A - San Diego, CA 92123 - Phone (858) 560-7717 - Fax (858) 560-7763

CHAIN-OF-CUSTODY RECORD

EMA LOG #:

Client: County of San Diego
Attn: Kenneth Liddell
Samplers(s):
Address: 5201 Ruffin Road, Suite P
San Diego, CA 92123
Phone: (858) 694-2335 Fax: (858) 495-5263
Email: Kenneth.Liddell@sdcounty.ca.gov
Billing Address: same as above

Project ID: Dry Weather Monitoring
Project #: Contract #:

Requested Analysis

ID #	Client Sample ID	Sample Event ID	Sample Date	Sample Time	Sample Matrix	Container # / Type	Oil & Grease	Coliform, □ Total (MTF) □ Fecal (MTF)	Enterococcus, by MTF	Diazinon, Chlorpyrifos and Malathion	MBAS																	
1																												
2																												
3																												
4																												
5																												
6																												
7																												
8																												
9																												
10																												

Matrix Codes: A = Air, DW = Drinking Water, GW = Groundwater, SW = Storm Water
WW = Wastewater, S = Soil, SED = Sediment, SD = Solid, T = Tissue, O = Oil, L = Liquid
Shipped By: □ Courier □ UPS □ FedEx □ USPS □ Client Drop Off □ Other
[1]**Turn-Around-Time:** □ Same Day □ 24 hr □ 48 hr □ 3 day □ 4 day □ 5 day □ STD (7 day)
[1]**Reporting Requirements:** □ Fax □ PDF □ Excel □ Geotracker/EDF □ Hard Copy □ EDT
[1]**Sample Disposal:** □ By Laboratory □ [2]Return to Client: P/U or Delivery □ Archive

Sample Integrity

Correct Containers: Yes No N/A		Containers Properly Preseved: Yes No N/A
Custody Seals Intact: Yes No N/A		Temp @ Receipt:___________________
COC/Labels Agree: Yes No N/A		Sampled By: Client EMA Autosampler

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Signature		Signature
Print		Print
Company:		Company:
Signature		Signature
Print		Print
Company:		Company:
Signature		Signature
Print		Print
Company:		Company:

Project/Sample Comments:

Three (3) extra dilutions for total and fecal coliform. Range: 20 to 1.6 million MPN/100 ml.

Two (2) extra dilutions for Enterococcus. Range: 10 to 160,000 MPN/100 ml.

[1]Additional costs may apply, consult a project manager for details.

[2]EMA reserves the right to return any samples that do not match our waste profile.

NOTE: By relinquishing samples to EMA, Inc., client agrees to pay for the services requested on this COC form and any additional analyses performed on this project. Payment for services is due within 30 days from date of invoice. Samples will be disposed of 7 days after report has been finalized unless otherwise noted. All work is subject to EMA's terms and conditions.

Appendix 4. Horiba U-10 Meter Calibration Procedures

(Revised February 2005)

1. Set **S.SET** to ***A*** (Auto-salinity)
2. Calibrate the meter using the *AutoCal* solution
3. Verify the meter using second calibration solutions (Table 1).
4. If the relative percent difference (RPD) is <±5% for all parameters (Table 2), calibration is complete.
5. Record all the readings in the logsheet.

6. If RPD is >±5% for a parameter, recalibrate the parameter using the solutions and values provided in Table 1.
7. After recalibration, verify the meter using the same solutions.
8. If RPD is <±5% for recalibrated parameters, calibration is complete.
9. Record all the reading in the logsheet.

Table 1. Calibration solutions and values

Parameter	***AutoCal***	**2nd Solutions**	**Note**
pH	4.00	7.00	At room temperature (~22^{o}C)
Conductivity	4.49 mS/cm	5.87 mS/cm	25 ^{o}C
Turbidity	0 NTU	100 NTU	
DO	8.52 mg/L	0.0 (Zero oxygen)	Set to *A* (Auto-salinity)

Table 2. Standard values and ranges with ±5% error

Parameter	**Value**	**-5%**	**+5%**
pH	4.00	3.80	4.20
	7.00*	6.80	7.20
Conductivity	4.49	4.27	4.71
	5.87	5.58	6.16
Turbidity	100	95	105
DO	8.52	8.09	8.95

*N/A

Table 3. pH values at different temperatures

Temperature	**pH 4**	**pH 7**
20	4.00	7.00
22	4.00	7.00
25	4.01	7.00

Horiba U-10 Calibration Logsheet

CALIBRATED BY______________ DATE______________ TIME:______________

Calibration		pH	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (^{o}C)	Salinity (%)
1st AutoCal	Std. Value	4.00	4.49	0.0	8.52	@ 22	
	Reading						
2nd Solutions	Std. Value	7.00	5.87	100			
	Reading						
DO*	0.0 mg/L	N/A	N/A	N/A		N/A	N/A

*Zero DO calibration only.

CALIBRATED BY______________ DATE______________ TIME:______________

Calibration		pH	Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp. (^{o}C)	Salinity (%)
1st AutoCal	Std. Value	4.00	4.49	0.0	8.52	@ 22	
	Reading						
2nd Solutions	Std. Value	7.00	5.87	100			
	Reading						
DO*	0.0 mg/L	N/A	N/A	N/A		N/A	N/A

*Zero DO calibration only.

Parameter	Value	-5%	+5%
pH	4.00	3.80	4.20
	7.00*	6.80	7.20
Conductivity	4.49	4.27	4.71
	5.87	5.58	6.16
Turbidity	100	95	105
DO	8.52	8.09	8.95

*N/A.

Appendix 5. Inland Surface Water Monitoring Plan

Appendix 6. “EnviroMatrix Analytical, Inc. Quality Assurance Program Manual”

Appendix 7. EnviroMatrix Analytical, Inc. Corrective Action Form

EnviroMatrix Analytical, Inc.

CORRECTIVE ACTION FORM

ISSUED TO: RESPONSE REQUIRED BY:

CORRECTIVE ACTION REQUESTED BY:
DATE:

____(ISSUER) WILL PROVIDE A BRIEF DESCRIPTION OF HOW PROCEDURE WAS DETERMINED TO BE OUT-OF-CONTROL:

OUT-OF-CONTROL PROCEDURE(s):

LIST SAMPLE I.D.(s) AFFECTED:

DESCRIBE IMMEDIATE ACTION TAKEN TO REMEDY SITUATION:

DESCRIBE FINAL PLANNED ACTION WHICH WILL CORRECT PROBLEM, EXPECTED DATE OF FINAL PLANNED ACTION, AND HOW YOU INTEND TO PREVENT RECURRENCE OF THE PROBLEM:

SIGNATURE:__________________________________ DATE:______________

REVIEWED BY:______________________________ DATE:____________