

Appendix G PG/CC Quality Assurance Program Plan

NOTE: The Quality Assurance Program Plan (QAPP) was sent out in July 2004 to Bill Ray, QC Officer for the State Water Resources Control Board. His comments were incorporated and a final copy sent out for approval signatures in August 2004. As of the publication date for this ERP, final approval has not been received by Placer County for the QAPP. Therefore, the QAPP document provided is only tentatively approved.

FINAL

PG/CC WATER QUALITY MONITORING QUALITY ASSURANCE PROJECT PLAN

Version 1.1 - July 1, 2004

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TABLE OF CONTENTS

APPROVALS	1
TABLE OF CONTENTS.....	2
1. DISTRIBUTION LIST	5
2. PROJECT ORGANIZATION.....	5
3. PROBLEM DEFINITION/BACKGROUND	5
3.1. Problem Statement	5
3.1.1. Monitoring Mission and Goals	5
3.1.2. Program Goals	6
3.2. Intended Usage of Data	6
4. PROJECT/TASK DESCRIPTION	6
4.1. General Overview of Project	6
4.2. Objectives of Water Quality Monitoring.....	8
4.3. Project Timetable	8
5. PROJECT/TASK DESCRIPTION	8
5.1. Measurement Quality Objectives.....	8
5.2. Sensitivity	9
5.3. Precision	9
5.3.1. Chemical and Physical Parameters.....	9
5.3.2. Biological Parameters.....	10
5.4. Accuracy.....	10
5.4.1. Chemical and Physical Parameters.....	10
5.4.2. Biological Parameters.....	11

5.5.	Completeness.....	11
5.6.	Standardization of Instruments and Test Procedures (Chemical and Physical Parameters).....	12
5.7.	Comparability	12
5.8.	Representativeness.....	12
6.	TRAINING REQUIREMENTS	13
6.1.	Water Quality Monitoring/Training.....	13
6.2.	Macroinvertebrate Bioassessment (BMI) Training.....	13
6.3.	Quality Control (QC) Training and QC Sessions	13
7.	TEST RESULTS AND RELATED ANALYTICAL DOCUMENTATION	13
8.	SAMPLING PROCESS DESIGN	14
8.1.	Rationale for Selection of Sampling Sites.....	14
8.2.	Sample Design Logistics.....	14
9.	ANALYTICAL METHOD REQUIREMENTS	14
9.1.	Testing Procedures and Equipment.....	14
9.2.	Sampling and Preservation Techniques	16
10.	SAMPLE HANDLING AND CUSTODY PROCEDURES	18
10.1.	Sample Handling.....	18
10.2.	Custody Procedures.....	18
10.3.	Disposal.....	18
11.	ANALYTICAL METHODS REQUIREMENTS.....	18
12.	QUALITY CONTROL REQUIREMENTS	19
12.1.	Chemical and Physical Parameters.....	19
12.2.	Biological Parameters.....	19
13.	INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE ...	20

13.1.	Temperature.....	20
13.2.	Dissolved Oxygen.....	20
13.3.	pH and Conductivity	20
13.4.	Turbidity.....	21
14.	INSTRUMENT CALIBRATION (CHEMICAL AND PHYSICAL PARAMETERS)	21
15.	INSPECTION/ACCEPTANCE REQUIREMENTS	21
16.	DATA ACQUISITION REQUIREMENTS	22
16.1.	Professional Analytical Data.....	22
16.2.	Geographical Information/ Mapping.....	22
17.	DATA MANAGEMENT	22
18.	ASSESSMENT AND RESPONSE ACTIONS	22
19.	REPORTS	23
20.	DATA REVIEW, VALIDATION AND VERIFICATION	23
21.	VALIDATION AND VERIFICATION METHODS.....	23
22.	RECONCILIATION WITH DQOS.....	23
	APPENDIX 1. DATA QUALITY CONTROL FORMS.....	24
	APPENDIX 2. <i>FIELD DATA AND OBSERVATION SHEET</i>.....	28
	APPENDIX 3. PG/CC SAMPLING LOCATIONS.....	29
	APPENDIX 4. PROCESSING MACROINVERTEBRATE SAMPLES.....	31

1. Distribution List

All group leaders and technical advisors will receive copies of this Water Quality Monitoring Quality Assurance Project Plan (QAPP), and any approved revisions of this plan. Once approved, this QAPP will be available to any interested party by requesting a copy from Placer County Department of Planning.

2. Project Organization

This program is intended to help citizen-volunteers in monitoring and assessing natural streams, and habitat in the Pleasant Grove/Curry Creek Watershed (PG/CCW). Placer County, the Dry Creek Conservancy and Foothill Associates are the primary organizations identified to develop and establish the necessary processes and resources to equip local citizen-monitors. While the goals of this monitoring program are unique, the data quality objectives are consistent with other monitoring programs within the American River Basin and allow comparison of data collected by these different organizations.

Organizational Structure:

- Management (Monitoring Leaders and Trainers): David Baker, Christain Carleton, and Edmund Sullivan
- Data Managers: David Baker and Edmund Sullivan
- Quality Assurance (QA) Personnel: Wayne Fields, David Baker, Christain Carleton and Edmund Sullivan

Technical Advisory Committee:

Foothill Associates: Kate Kirsh and Chritian Carleton

Consulting Aquatic Biologists: Randy Bailey and Wayne Fields

Sierra College - Sean Booth, GIS Specialist

NOAA - John Baker

Dry Creek Conservancy - David Baker (Water Monitoring) and Shelly Hatleberg (Biologist)

Sutter County - Mary Keller

City of Roseville - Mark Morse

City of Rocklin - Kent Foster

3. Problem Definition/Background

3.1. Problem Statement

At present, there is insufficient information to adequately assess the health of the PG/CCW, which is the combination of biological integrity, physical integrity and dynamic equilibriums. In assessing the health of the watershed, its key physical, chemical, and biological features need to be monitored.

Placer County has assembled a monitoring team to address water quality concerns. If quality assurance (QA) is adequate, valuable information can be provided for improved watershed management and pollution prevention.

3.1.1. Monitoring Mission and Goals

The mission of citizen monitoring is to produce environmental information, which is needed to protect California's watershed and aquatic resources. Citizen monitoring will also inform and engage the community in effective watershed stewardship.

Placer County is dedicated to preserving and restoring land within the PG/CCW, providing compatible trails and recreation, raising awareness of the benefits of a healthy watershed, and encouraging citizen stewardship.

The mission of the Placer County's monitoring program is to gather pertinent and accurate data describing the physical, chemical and biological status of the watershed. The data will be compatible and usable by other public and private monitoring programs in the region and state, and will contribute toward establishing criteria for stream conditions in the Sierra Nevada foothill eco-region.

3.1.2. Program Goals

The goals of Placer County's monitoring activities are:

- Identifying valued resources and watershed characteristics for setting watershed management goals;
- Identifying land use and other watershed influences which affect the origin, transport, and fate of water pollutants;
- Documenting the status and trends of biological resources in and around PG/CCW and its tributaries;
- Monitoring for water quality within the PG/CCW;
- Establishing seasonal trends in water quality that would otherwise be un-monitored ;
- Measuring the effectiveness of restoration or management practices;
- Characterizing the effects of particular activities or structures on overall stream integrity;
- Evaluating the quality of water compared to specific water quality criteria; and
- Building community awareness of water quality issues, aquatic resources and pollution prevention.

3.2. Intended Usage of Data

Data will be compiled and maintained by Placer County Planning Department and the PG/CCW Group, which will be compatible with the regional GIS watershed database.

Future applications of the data will assist in protecting water resources by:

- Optimizing the water quality and quantity of groundwater resources and surface water bodies within the watershed through water conservation, natural erosion control, pollution control, and stream restoration;
- Preserving and maintaining the 100-year floodplain within the watershed in an open configuration, with a natural channel, and providing adequate area for the normal creek waters to meander through floodplain. The 100-year floodplain should be preserved as open space for uses that sustains native animals and their habitats;
- Identifying valued historical and natural resources for setting management objectives;
- Creating scenic trails, interpretive displays and recreation opportunities, which are compatible with the natural systems of the watershed;
- Developing enforceable construction standards for future development within the watershed that will ensure retention of the natural character of the floodplain;
- Developing physical, chemical and biological reference stream criteria;
- Designing and implementing scientifically credible studies to chronicle the relative health of the watershed; and
- Motivating citizens, business people and government officials to work together for responsible watershed stewardship.

4. Project/Task Description

4.1. General Overview of Project

Although baseline water quality monitoring will be conducted using a combination of professionals and volunteers, the key to the success of the watershed restoration activities, and ultimately to the development and implementation of the Pleasant Grove and Curry Creek Ecological Restoration Plan, will be the involvement and commitment of the landowners and concerned citizens. A water quality-monitoring handbook will be developed as a guide for public participation in the ongoing watershed-wide water quality monitoring. Until that handbook is developed the PG/CCW will use the State Water Resources Control Board (SWRCB) Clean Water Team Compendium of Water

Quality Monitoring Protocols. For Bioassessment, the PG/CCW will use the California Department of Fish and Game (CDFG) California Stream Bioassessment Procedure.

The water quality-monitoring program of physical and chemical parameters is an expansion from the PG/CCW existing biological monitoring program. This on-going program embodies a systematic method for visual and other sensory observations following the Stream/Shore Walk Visual Assessment Observation Sheet from the State Water Resources Control Board Clean Water Team Compendium of Water Quality Monitoring. Observations using this sheet will be made, at a minimum, on a quarterly basis. In addition, the stream habitat quality will be assessed, at least once per year, using the CDFG Physical Habitat Assessment Form. Observational data include epifaunal substrate/available cover, embeddedness, velocity/depth regimes, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, vegetative protection, and riparian vegetative zone width.

PG/CCW citizen-volunteers, with professional assistance as necessary, will monitor important biological, chemical and physical indicators of water quality in the PG/CCW. This QAPP delineates data quality objectives required for successfully carrying out this work. Table 4.1 identifies the monitoring design for the following water quality parameters, which will be measured in the field or sampled for later laboratory analysis. Samples will be collected by PG/CCW volunteers and staff, and sent to an agency, commercial, or academic laboratory for analysis (marked "P" in the table). The sampling plan contains references and instructions for the collection of samples for these substances. It has been determined that there will be no project-specific quality assurance and data quality objectives developed for the data generated. Samples may be sent to any laboratory capable of performing analysis. The project accepts the data generated that is within the analyzing laboratory's internal quality assurance program and the project will not comment on its quality relative to data from the same test generated by other laboratories.

Table 4.1 Type and Frequency of Monitoring in the PG/CCW Citizen-Monitoring Program

Parameter	Frequency*	Type**	Water Quality Standard Available
Velocity/Depth	Q	F	No
Temperature	Q	F	Yes
Dissolved Oxygen	Q	F	Yes
pH	Q	F	Yes
Conductivity	Q	F	Yes
TDS	Q	P	Yes
TSS	Q	P	Yes
Turbidity	Q	F	Yes
Ammonia-Nitrogen	Q	P	Yes
Nitrate-Nitrogen	Q	P	Yes
Ortho-Phosphate	Q	P	Yes
Biological Oxygen Demand (BOD)	Q	P	Yes
Oil & Grease	Q	P	Yes
Total Organic Compounds (TOC)	Q	P	Yes
Mercury	Q	P	Yes
Lead	Q	P	Yes
Zinc	Q	P	Yes
Copper	Q	P	Yes
Diazanon	Q	P	Yes
Chlorpyrifos	Q	P	Yes
PCBs	Q	P	Yes
Glyphosate	Q	P	Yes
Fecal Coliform Bacteria	Q	P	Yes
Odor and Visual Observations.	Q	F	No
Benthic Macroinvertebrates	A	F/P	No
Aquatic Toxicity	X	P	Yes
Trash	X	F	No

Parameter	Frequency*	Type**	Water Quality Standard Available
Dumping/Spills	X	F	No

*M: Monthly, Q: Quarterly; A: Annually; S: Seasonal, depending on flows; X: Irregular, as resources permit

**F: Field analysis; L: In-house laboratory analysis; P: Samples sent to analytical laboratory

4.2. Objectives of Water Quality Monitoring

The following objective have been identified for water quality monitoring within the PG/CCW:

- Initiate the understanding and documentation of the relationship between hydrologic function/water quality and watershed management/land use;
- Initiate and sustain a continuing process for collecting data for the purpose of assessing and modeling watershed condition over a long temporal scale;
- Initiate the education of residents about PG/CCW processes and to strengthen their connection to the ideal of a healthy watershed; and
- Make data available to decision makers and the public to foster improved watershed stewardship.

4.3. Project Timetable

Placer County will establish its citizen-monitor team through outreach and its presence in the community resulting from restoration, education, and planning projects. It will provide training to volunteers through technical advisors and professional workshops given in partnership with Dry Creek Conservancy (DCC). Placer County will use grant funds to pay for consultant and DCC help with data interpretation. Spring 2004 is the projected start date for PG/CCW Citizen Monitoring Program to initiate water quality data collection.

5. Project/Task Description

5.1. Measurement Quality Objectives

This section establishes water quality monitoring and data collection parameters. Data quality objectives were derived by reviewing the QA plans and performance of other citizen-monitoring organizations (e.g. Chesapeake Bay, Texas Watch, Coyote Creek Riparian Station, Southern California Citizen-Monitoring Steering Committee, Heal the Bay Malibu Stream Team), evaluating the specifications of the instruments and methods to be employed, and considering the utility of the data. Objectives for these data characteristics are summarized in Table 5.1. Parameters to be determined by analytical laboratories (i.e.: BOD, metals, pesticides, etc), follow EPA guidelines for water and wastewater determinations.

Table 5.1 Data Quality Objectives for Water Quality Parameters

Parameter	Method/Range	Units	Lower Detection Limit	Sensitivity	Precision	Accuracy Objective	Completeness
Temperature	Thermometer (-5 to 50)	°C	-5	0.5	± 0.5 °C	± 0.5 °C	80%
Dissolved Oxygen	Electronic Meter/Probe	mg/L	<0.1	0.1	± 10%	± 10%	80%
pH	pH Meter	--	2	0.1	± 0.2	± 0.2	80%
Conductivity	Conductivity Meter	uS/cm	10	10	± 10% or ± 10 uS; whichever is greater	± 10% or ± 10 uS; (whichever is greater	80%

Parameter	Method/ Range	Units	Lower Detection Limit	Sensitivity	Precision	Accuracy Objective	Completeness
Turbidity	Nephelometer	NTU	<0.1	0.1	± 10% or ± 1 NTU; whichever is greater	± 10% or ± 1 NTU; whichever is greater)	80%
	4-Beam Sensor	NTU	<0.1	0.1	± 10% or ± 1 NTU; whichever is greater	± 10% or ± 1 NTU; whichever is greater	80%
Depth	Vented Depth Cable	Feet	<0.01	0.01	± 10%	± 10%	80%
Ammonia-Nitrogen	Nessler Method	mg/L	<0.01	0.01	± 0.2 (<2.0) or ± 10% (>2.0)	± 0.2 (<2.0) or ± 10% (>2.0)	80%
Nitrate-Nitrogen	Cadmium Reduction	mg/L	<0.01	0.01	± 0.2 (<2.0) or ± 10% (>2.0)	± 0.2 (<2.0) or ± 10% (>2.0)	80%
Ortho-Phosphate	Ascorbic Acid	mg/L	<0.01	0.01	± 0.2 (<2.0) or ± 10% (>2.0)	± 0.2 (<2.0) or ± 10% (>2.0)	80%
Benthic Macro-invertebrates	Calif. Stream Bioassessment Protocol	N/A*	Family level	N/A*	≤5% difference	≤5% difference	80%
Bacteria (Total Coliforms & E. coli)	Colilert 18 hour	MPN/100mL	10	See IDEXX quantitary tables	Duplicates within 95% confidence limits	Positive standard within ½ of an order of magnitude	80%

*Not Applicable [NOTE: We don't need the bacteria parameter listed above since this is performed by a commercial laboratory using the Multiple Tube Fermentation; In the evolution if DCC's original QAPP bacteria testing was identified as something that volunteers could do in-house.]

5.2. Sensitivity

The method detection limit is the lowest possible concentration the particular instrument and/or analytical methodology can detect. This is important to record because the total absence of a pollutant cannot be determined. Rather, water quality analysis can only detect the presence and concentration above a certain value, know as the lover detection limit (LDL). Sensitivities for equipment and analytical techniques used in this plan are noted in Table 5.1.

5.3. Precision

5.3.1. Chemical and Physical Parameters

The precision objectives apply to duplicate and split samples taken as part of a Quality Control (QC) session or as part of periodic in-field QC checks. Precision describes how well repeated measurements agree. The evaluation of precision described here relates to repeated measurements taken by either different volunteers on the same sample (ie. at QC sessions) or the same volunteer analyzing replicate samples (ie. in the field). Sampling variability will not be covered in this section. The Data Quality Form: Precision, found in Appendix 1, will be used to record precision.

Instructions for Determining Precision (chemical analyses)

All volunteers will run tests on the same sample and record individual results from the tests. The mean value will then be determined as will the standard deviation. The standard deviation will then be compared to the precision

objective set in Table 5.1. If the standard deviation is greater for instance, corrective action will be taken to improve performance. Technical advisors will be consulted to determine the appropriate corrective action.

Table 5.2 Example: Data Quality Form: Precision

Parameter (Units)	Date	Mean (x)	Standard Deviation (S.D.)	S.D./x X 100	Precision Objective	Meet Objective? Yes or No	Corrective Action Planned	Date Corrective Action Taken
Temperature (°C)	5/21/01	22.0	0.53	2.4%	± 0.5	Yes	Precision calculated on corrected thermometers -see accuracy info	5/21/01
Dissolved Oxygen (mg/L)	5/21/01	8.4	1.0	11.9%	± 10%	No	Re-training needed. Probes not calibrated properly	6/15/01
pH	5/21/01	7.8	0.39	5.0%	± 0.2	Yes	None needed	
Conductivity (uS/cm)	5/21/01	735	59	8.0%	± 10%	Yes	None needed	
Turbidity (NTU)	5/21/01	5	2.4	NA	± 10%	Yes	None needed	

5.3.2. Biological Parameters

Precision for bacterial parameter, analyzed by citizen-monitors using commercial test kits, will be determined by having the same analyst complete the procedure for laboratory duplicates of the same sample. At a minimum this should be done once per day, or run duplicates on a minimum of 5 percent of the samples if there are over 20 samples run per day. The results of the duplicates should be within the confidence limits supplied by the manufacturer.

For benthic macroinvertebrate analysis, precision will be determined by having the technical advisor annually perform an evaluation on the citizen analysts as discussed in Section 12.2 of this QAPP.

5.4. Accuracy

5.4.1. Chemical and Physical Parameters

Accuracy describes how close a measurement is to its true value. Performing tests on standards at the Quality Control (QC) sessions, held twice a year, will check the accuracy of chemical measurements. Certified standards, of known concentrations, can be purchased from chemical or scientific supply companies. A professional partner, e.g. a local analytical laboratory, certified for water or wastewater analysis by EPA might also prepare reference standards. The concentration of the standards, known to the volunteer leader, will be unknown to the monitors until after measurements are determined. The concentration of the standards should ideally be within the mid-range of the equipment. The Data Quality Form: Accuracy, found in Appendix 1, will be used to record accuracy.

Table 5.3 Example of Quality Assurance Form: Data Accuracy

Parameter (Units)	Date	Sensitivity	Accuracy Objective	Estimated Bias	Meet Objective? Yes or No	Corrective Action Planned	Date Corrective Action Taken
Temperature (°C)	5/21/01	0.5	±0.5	-2% -0.5%*	Yes	One thermometer was way off; it was discarded. All other thermometers were given a correction factor to improve accuracy	5/21/01
Dissolved Oxygen (mg/L)	5/21/01	0.2	±10%	21.0	No	Replace reagent	6/15/01
pH	5/21/01	0.1	±0.2	-5%	Yes	None needed	
Conductivity (µS/cm)	5/21/01	100	±10%	+10%	Yes	None needed	
Turbidity (NTU)	5/21/01	5	± 5	+1.4	Yes	None needed	

*After correction factor given.

5.4.2. Biological Parameters

Accuracy for bacterial analysis will be determined by analyzing a positive control sample twice annually. A positive control is similar to a standard, except that a specific discrete value is not assigned to the bacterial concentrations in the sample. This is due to the fact that bacteria are alive and capable of mortality and reproduction. Instead of a specific value, an approximate target value of the bacterial concentration is assigned to the sample by the laboratory preparing the positive control sample.

For benthic macroinvertebrate analysis, accuracy will be determined by having 20 percent of the samples (annually) re-analyzed and validated to California Stream Bioassessment Protocol (CSBP) Level 3 (expert level) by a professional taxonomist. Alternatively, if for some reason these duplicates are not performed for at least 20 percent of the samples, then the difference will be made up with reconstituted samples.

5.5. Completeness

Completeness is the percent of planned data that must be collected in order to fulfill the statistical criteria of the project. Although useful in identifying potential watershed problems, volunteer data is not intended for regulatory enforcement applications. As a result, there are no statistical criteria that require a certain percentage of data. However, it is expected that 80 percent of all measurements could be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems.

Completeness will be determined by comparing the number of measurements planned to the number of measurements actually performed and 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. The Data Quality Form: Completeness, found in Appendix 1, will be used to record completeness.

Instructions for Determining Completeness

To determine the percent completed: Divide the number of valid samples collected and analyzed by the number of samples anticipated in the monitoring design. Multiply by 100 percent. In the example below, the volunteers met their objective of 80 percent completeness for temperature, but not dissolved oxygen. The volunteers reviewed their

sampling methods and realized that some volunteers were not fixing the dissolved oxygen samples correctly. When they corrected this activity their completeness improved.

Table 5.3 Example Quality Assurance Form: Completeness

Parameter	Collection Period	Number of Samples Anticipated	Number Valid Samples Collected and Analyzed	Percent Completed	Comments
Temperature	6/1/01 - 9/1/01	35	33	94.3	
Dissolved oxygen	6/1/01 - 9/1/01	35	27	77.1	Volunteers were not fixing samples correctly in field.
Temperature	9/1/01 - 11/1/01	35	32	91.4	
Dissolved oxygen	9/1/01 - 11/1/01	35	32	91.4	

5.6. Standardization of Instruments and Test Procedures (Chemical and Physical Parameters)

Temperature measurements will be standardized by comparing PG/CCW's Hydrolab Quanta and any other digital probe thermometers to a NIST-certified thermometer. All field meters (pH, conductivity, oxygen and turbidity) will be evaluated twice a year using NIST standards and/or by comparison of results of split samples with a State-certified laboratory.

Colorimeters and associated test kit reagents will likewise be evaluated twice a year using NIST or other certified standards and/or by comparison of results of split samples with a State-certified laboratory.

5.7. Comparability

Comparability is the degree to which data can be compared directly to similar studies. Citizen-monitoring groups will use the following methods to ensure that their data can be compared to others:

- EPA's Volunteer Monitoring Manuals for Streams, Lakes or Estuaries;
- California State Water Resources Control Board (SWRCB) Clean Water Team Compendium for Water Quality Monitoring and Assessment;
- CDFG's California Stream Bioassessment Protocol (CSBP) for Citizen-monitors;
- Heal the Bay's Malibu Creek Stream Team Pilot Project, Shattering the Myths of Volunteer Monitoring; and
- San Francisco Estuary Institute's Volunteer Monitoring Protocols.

Before modifying established methods, or developing alternative or additional methods, 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.

5.8. Representativeness

Representation describes how relevant the data are to the actual environmental condition. Problems can occur if:

- Samples are taken in a stream reach that does not describe the area of interest (e.g. a headwaters sample should not be taken downstream of a point source);
- Samples are taken in an unusual habitat type (e.g. a stagnant backwater instead of in the flowing portion of the creek); and

- Samples are not analyzed or processed appropriately, causing conditions in the sample to change (e.g. water chemistry samples improperly prepared and/or held in storage beyond established holding time limits)

Representativeness will be ensured by processing the samples in accordance with Section 8, 9 and 10, by following the established methods, and by obtaining approval of this document.

6. Training Requirements

6.1. *Water Quality Monitoring/Training*

All citizen-monitoring leaders must participate in a two day hands-on training class on water quality testing.

6.2. *Macroinvertebrate Bioassessment (BMI) Training*

For macroinvertebrate bioassessment citizen-monitoring leaders must also participate in a three-day training course provided by the CDFG, the Sustainable Lands Stewardship Institute, the American Fisheries Society or the SWRCB, or equivalent training. Trained citizen-monitoring leaders may then train other volunteers. Individual trainees will be evaluated by their performance of analytical and sampling techniques, by comparing their results to known values, and to results obtained by trainers and other trainees.

6.3. *Quality Control (QC) Training and QC Sessions*

In addition to completion of the above-described training courses, citizen-monitoring leaders must participate in semi-annual QC sessions. These sessions will be supervised by QC specialists and will provide an opportunity for citizen-monitors to check the accuracy and precision of their equipment and techniques. QC specialists are defined as water quality professionals from the EPA, the SWRCB, and the Central Valley Regional Water Quality Control Board (CVRWQCB). Additional qualified trainers may be recruited and designated by the above agencies from experienced citizen-monitoring organizations, universities and colleges, commercial analytical laboratories, and other federal, state, and local agencies.

The QC specialist or other trainers will examine testing kits for completeness of components, including: date, condition, and supply of reagents, and whether the equipment is in good repair. The trainers will check data quality by testing equipment against blind standards, and will also ensure that volunteer-monitors are reading instruments and recording results correctly. Sampling and safety techniques will also be evaluated. The trainers will discuss corrective action with the volunteers, and the date by which the action will be taken. The citizen-monitoring leader is responsible for reporting back that the corrective action has been taken. Certificates of completion will be provided once all corrective action has been completed.

Pertinent training, analytical proficiency and corrective action records will be maintained by PG/CCW on all citizen-monitoring leaders and it's other volunteers.

7. Test Results and Related Analytical Documentation

All field results will be recorded at the time of completion, using data sheets designed for this purpose (see Appendix 2). Data sheets will be reviewed for outliers (an extreme deviation from the mean) and omissions before leaving the sample site. The citizen-monitoring leader will sign data sheets after review. Data sheets will be stored in hard copy by Placer County. Field data sheets and supporting quality validation data will be archived for three years from the time they were collected. If data entry is performed at another location, duplicate data sheets will be used, with the originals remaining at Placer County Planning. Hard copies of all data as well as computer back-up disks will be maintained by Placer County with duplicates at a separate location. All voucher collections, completed

data QC forms and maintenance logs will also be kept by Placer County for five years from the time they are collected. Maintenance logs will be kept with dates of equipment inspection, battery replacement and calibrations, as well as the date's reagents and standards are replaced.

8. Sampling Process Design

8.1. Rationale for Selection of Sampling Sites

The Placer County project managers, in consultation with the TAC, have selected the sampling sites. Sampling sites are listed in Appendix 3. The following criteria were evaluated when choosing sampling locations:

- Does these site complement sites of other programs such as city or county mitigation programs or CVRWQCB Effluent Dominated Water bodies study?
- Is there an existing flow gauging station?
- Is there or has there historically been a major land use (agriculture, municipal, industrial, mining, recreational, etc.) or other potential water quality impairment that may affect water quality in the area?
- Is there previous water quality data that could be used?
- Is access safe?
- Is permission to cross private property granted?
- Can a sample be taken in main stream current or where homogeneous mixing of water occurs? (chemical parameters)
- Is the sample representative of the water body of interest?

If any reference sites are chosen upstream of a potential impact, then a site should also be chosen to reflect the impact of the particular discharge, tributary or land use far enough downstream such that the potential impact is completely integrated with the water, but upstream of any secondary discharge or disturbance.

8.2. Sample Design Logistics

Volunteers are instructed to work in teams of at least two people. If a scheduled team cannot conduct the sampling together, the team captain is instructed to contact the citizen-monitoring leader so that arrangements can be made for a substitute trained volunteer.

The leader will review sample sites before sending volunteers out to the site and ensure that someone on the team has a valid CDFG macroinvertebrate collection permit. The monitoring leader will also document permission for access and terms obtained from landowners. If access to the site is a problem, the citizen-monitoring leader will select a new site following the site selection criteria identified in Section 8.1.

Safety measures will be discussed with all volunteers. No in-stream sampling will be conducted if there are any creek flood warnings or advisories. It is the responsibility of the citizen-monitoring organization to ensure the safety of their volunteer monitors. Safety issues are included in the EPA Watershed Monitoring Manual and the SWRCB Clean Water Team Compendium.

9. Analytical Method Requirements

9.1. Testing Procedures and Equipment

Physical, chemical and biological parameters and their relevancy to the monitoring plan are presented in Table 9.1. All equipment that must be calibrated and documentation of calibration will occur before each sampling event.

Table 9.1 Stream Monitoring Parameters, and Environmental Relevancy

Parameters	Method	Equipment	Technical Relevancy
Water Depth	Direct Measurement	Wading rod	See below - flow
Stream Flow	USGS 2175	Global Flow Probe	The stream flow, or discharge, is the volume of water passing a single point in the stream over time. It is measured by determining the cross-sectional area and velocity of the flowing water. Flow affects the available oxygen in water that fish and other organisms depend on to live, and influences the stream's ability to dilute and degrade runoff pollutants.
Temperature	APHA 4500 H*	YSI 550 Probe and/or Hydrolab Quanta	Temperature directly influences the amount dissolved oxygen that is available to aquatic organisms. Water temperature that exceeds 18° C has a deleterious effect on several fish species in streams.
Dissolved Oxygen	APHA 4500 O G*	YSI 550 Probe and/or Hydrolab Quanta	DO is critical to the survival of various aquatic life in streams. The ability of water to hold oxygen is inversely proportional to temperature.
pH	APHA 4500 H*	YSI 63 Probe and/or Hydrolab Quanta	Naturally occurring fresh waters normally range between pH 6 and 8. The pH of water is affects the solubility of nutrients and how they are utilized by aquatic organisms.
Turbidity	APHA 2130 B* EPA 180.1**	Hach 2100P Turbidity Meter and/or Hydrolab Quanta	Insoluble solids or suspended particles such as clay and silt affect the clarity of the water. Turbidity, reported as Nephelometric Turbidity Units (NTU), is a measure of the light scattering properties of water. Fine particles may kill fish eggs and aquatic insects.
Total Dissolved Solids	EPA 160.1**	Membrane Filter	TDS is a measure of the amount of dissolved solids (less than 0.45um) that are in solution. This is an indicator of nonpoint source pollution problems associated with various land-use practices.
Conductivity	APHA 2510 B*	YSI 63 Probe and/or Hydrolab Quanta	Conductivity is the ability of the water to carry an electrical current, and indirectly measures the presence of inorganically dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium and calcium. It is expressed in microsiemens per centimeter (µS/cm) at 25° C.
Total Suspended Solids	EPA 160.2**	Membrane Filter or Analytical Laboratory	TSS represents sediments being carried in the flow.
Ammonia-Nitrogen	EPA 350.2**	Hach RD890 or Analytical Laboratory	Presence of ammonia-nitrogen can reduce DO levels in rivers and estuaries. Under eutrophic conditions, high pH (>8.0) will shift the equilibrium of favoring the formation of toxic un-ionized ammonia.
Nitrate-Nitrogen	EPA 300.0/ 353.2**	Hach RD890 or Analytical Laboratory	Nitrate-nitrogen is an essential nutrient for the growth of algae and cyanobacteria. Such growth is often stimulated to an undesirable extent in bodies of water that receive either treated or untreated effluents.

Parameters	Method	Equipment	Technical Relevancy
Ortho-Phosphate	EPA 300.0/ 365.1**	Hach RD890 or Analytical Laboratory	As with nitrogen, phosphorus is an essential nutrient for the growth of algae and cyanobacteria. Polyphosphates gradually hydrolyze in aqueous solution and revert to the form of ortho-phosphates.
COD	EPA 410.1/ 410.4**	Analytical Laboratory	COD allows measurement of the water's organic content in terms of the total quantity of oxygen required for oxidation to carbon dioxide. Along with the biological oxygen demand, COD is helpful in indicating toxic conditions and the presence of biologically resistant organic substances.
Oil & Grease	EPA 413.1**	Analytical Laboratory	Presence of oil & grease reflects contamination by petroleum substances and sometimes animal or plant source lipids.
Pesticides (Insecticides & Herbicides)	EPA 505/ 508/608/ 8080**	Analytical Laboratory	Pesticides may gain access to surface water through direct application or through percolation and runoff from treated areas. Pesticides maybe toxic to fish and other aquatic life.
Metals	Multiple Instrumental Procedures	Analytical Laboratory	Metals in waters may be in dissolved or particulate forms. Metal toxicity to aquatic life depends on the species and specific element involved.
Gasoline/ benzene, toluene, ethylbenzene & xylene (BTEX), and MTBE	EPA 8020/ 8015M & 8260B**	Analytical Laboratory	The presence of a major highway (I-80) and several adjacent filling stations may allow gasoline and its constituents to flow into the stream as runoff. These chemicals may be toxic to fish and other aquatic life.
Benthic Macro-invertebrates	California Stream Bioassessment Procedure***	D-Shaped Kick Net, Microscope, Misc. Items	Assesses the ability of an aquatic ecosystem to support a natural community of organisms. Integrates the effects of environmental stresses such as temperature, DO, sedimentation, scouring, nutrient enrichment and chemical and organic pollution.
Bacteria (Total Coliform & E. coli)	APHA 9221-A* Multiple-Tube Fermentation Procedure	Membrane Filter	Detection and enumeration of indicator organisms are intended to determine the degree of contamination.

*Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 20th Edition, 1998

** EPA Chemical Analysis of Water & Wast, 1984

***Measuring the Health of California Streams and Rivers, Harrington, Jim, CDFG, 1997

9.2. Sampling and Preservation Techniques

This program follows the EPA Watershed Monitoring Manual or the SWRCB Clean Water Team Compendium, which describes the appropriate sampling procedure for collecting samples for water chemistry. Samples will be taken with a Van Dorn, Niskin, or Kemmerer sampling device, a dissolved oxygen-sampling device, or by dipping a glass or plastic container into the midstream of a wadable creek. Precleaned sampling containers and those containing preservative chemicals, intended for pesticides, trace-level metals and other pollutants, should not be rinsed with sample water prior to taking the sample. Containers should be filled completely, but with care as to not cause an overflow.

Sampling devices will be rinsed at least three times with sample water prior to taking each sample. Whenever possible, the collector will sample from a bridge so that the creek is not disturbed from wading. All samples are taken in mid-stream, at least one inch below the surface. If it is necessary to wade into the water, the sample

collector stands downstream of the sample, taking a sample upstream. If the sediment is disturbed when wading, the collector will wait until the effect of disturbance is no longer present before taking the sample.

The following Table 9.2 describes the sampling equipment, sample holding container, sample preservation method and maximum holding time for each parameter. Since field probes will be used for DO, pH, conductivity and turbidity, samples would be taken only when they are to be sent to an analytical laboratory for check analysis purposes.

Table 9.2 Sampling Method Requirements

Parameter	Sampling Equipment	Preferred/Maximum Holding Times
<i>Conventional Parameters</i>		
Measure directly or in plastic/glass container	Within 15 Minutes	Measure directly or in plastic/glass container
Measure directly or in plastic/glass container/Glass D.O. bottle (Winkler Method)	Within 15 Minutes/24 hours for Winkler Method	Measure directly or in plastic/glass container/Glass D.O. bottle (Winkler Method)
Measure directly or in plastic/glass container	Within 15 Minutes	Measure directly or in plastic/glass container
Measure directly or in plastic/glass container	Within 15 Minutes/ At 4 ^o C in dark for up to 28 days for laboratory analysis	Measure directly or in plastic/glass container
Measure directly or in plastic/glass container	Within 15 Minutes/At 4 ^o C in dark for up to 28 days for laboratory analysis	Measure directly or in plastic/glass container
<i>Nutrients</i>		
Ammonia-Nitrogen	Van Dorn, LaMotte or plastic sampling bottle	At -20 ^o C in dark for up to 28 days for laboratory analysis
Nitrate-Nitrogen	Van Dorn, LaMotte or plastic sampling bottle	At 4 ^o C in dark for up to 48 hr
Ortho-Phosphate	Van Dorn, LaMotte or plastic sampling bottle	At 4 ^o C in dark for up to 48 hr
<i>Laboratory Analysis of Chemical Parameters</i>		
BOD	Acidified clean glass sampling bottle with Teflon liner	Refrigerate to 4 degrees C, Send to laboratory immediately
Metals	Acidified clean plastic sampling bottle	Fix with ultra pure (or comparable grade) nitric acid, Send to laboratory immediately
Oil and Grease	Solvent rinsed and dried glass sampling bottle, with Teflon liner	Refrigerate to 4 degrees C, Send to laboratory immediately
Pesticides and Other Organic Hydrocarbons	Solvent rinsed and dried glass sampling bottle with Teflon liner	Refrigerate to 4 degrees C, Send to laboratory immediately
<i>Biological Samples</i>		
Benthic Macro-invertebrates	Glass bottles	Fixed with ethanol within 15 minutes
Bacteria	Sterilized glass or plastic bottles with Na ₂ S ₂ O ₃	At 4 ^o C in dark for up to 6 hr

10. Sample Handling and Custody Procedures

10.1. Sample Handling

Identification information for each sample will be recorded on the provided field data sheets (see Appendix 2), when the sample is collected. Samples that are not processed immediately in the field will be labeled with the waterbody name, sample location, unique sample number, date and time of collection, sampler's name, and method used to preserve sample (if any).

10.2. Custody Procedures

Conventional water quality monitoring tests do not require specific procedures maintaining sample identity and integrity since they will, in most cases, be conducted immediately by the same person who does the sampling. In certain circumstances (such as driving rain or extreme cold), samples will be taken to a nearby residence for analysis. Samples for transport must be properly identified on individual containers to avoid later confusion, and those samples requiring chemical preservation should be fixed in the field. Normal custody procedures require that samples remain in the actual control of the individual collecting and performing the analysis. If samples can not be processed immediately, the use of both special seals and locked storage are acceptable practices for ensuring identity and integrity.

When samples are transferred from one volunteer to another member of the same organization for analysis, or from the citizen-monitoring group to an outside analytical laboratory, then chain-of-custody forms should be used. This form identifies the waterbody name, sample location, sample number, date and time of collection, sampler's name, and method used to preserve sample (if any). It also indicates the date and time of transfer, and the name and signature of the sampler and the sample recipient. In cases where the sample remains in the custody of the monitoring organization, then the field data sheet may double as a chain-of-custody form. For sample intended for analysis by an outside analytical laboratory, it is recommended that the chain-of-custody forms provided by that organization be used. Similarly, when an outside laboratory performs QC check, use their chain-of-custody procedures, labels and documentation procedures. For benthic macroinvertebrate samples, the CDFG Aquatic Bioassessment Laboratory chain-of-custody forms will be used.

10.3. Disposal

All analyzed samples (except for waste from the nitrate/cadmium (Cd) reduction test and the Nessler ammonia test) including used reagents, buffers and standards will be collected in a plastic bottle clearly identified and also marked "Waste." These materials, such as wastes from zinc reduction nitrate test and the salicylate ammonia test, will be disposed of according to appropriate state and local regulations. This will usually mean disposal into a drain connected to a municipal sewage treatment plant, but always check before disposing of any chemical materials.

Liquid waste from the cadmium reduction nitrate test will be kept separately in hazardous waste container, identified and marked as "Waste," and disposed of at a facility that is permitted to handle, transport, and dispose Cd waste. Liquid waste from the Nessler ammonia test, which contains mercury (Hg) will likewise be separately handled and disposed of at a facility that is permitted to handle, transport, and dispose Hg waste.

11. Analytical Methods Requirements

Water chemistry is monitored using protocols found in the EPA Watershed Monitoring Manual. The methods were chosen based on the following criteria:

- Capability of volunteers to use methods
- Provide data of known quality
- Ease of use
- Methods can be compared to professional methods in *Standard Methods*

If modifications of methods are needed, comparability will be determined, under the guidance of a qualified scientist or technician, by side-by-side comparisons with a US EPA or APHA Standard Method using blanks and duplicate samples spiked with known concentrations of the compound of interest. If the results meet the same precision and accuracy requirements as the approved method, the new method will be accepted.

12. Quality Control Requirements

12.1. Chemical and Physical Parameters

QC samples will be taken to ensure valid data are collected. Depending on the parameter, QC samples will consist of field blanks, replicate samples, or split samples. In addition, QC sessions (a.k.a. intercalibration exercises) will be held twice a year to verify the proper working order of equipment, refresh volunteers in monitoring techniques and determine whether the data quality objectives are being met.

Field/Laboratory Blanks: For turbidity and specific chemical analysis (see Table 12.1) performed in the field, blanks (a.k.a. reagent blanks) will be taken once every 20 samples or quarterly, whichever comes first. To perform either field or laboratory blanks; distilled water is poured into a sample container and then analyzed immediately or later in the laboratory. Field blanks are recorded on the normal sampling datasheet.

Duplicate Field Samples: For chemical and physical analysis duplicate field samples will be taken once every 20 samples, or quarterly whichever comes first. Duplicate samples will be collected as soon as possible after the initial sample has been collected, and will be subjected to identical handling and analysis.

Split Samples: Twice a Year, split spiked samples (standards) will be analyzed as part of the QC (cross-calibration) Session. The split standard is one sample, containing a known concentration of an analyte, that is divided equally into two or more sample containers. Split standards will be analyzed by the volunteers, and sent to an analytical laboratory (except for dissolved oxygen, temperature, and pH), before the maximum sample handling time is exceeded. Volunteers will analyze the split standard normally and will perform at least three analyses on that same sample. From these results accuracy and precision will be determined. The analytical laboratory will analyze the sample using a method referenced in Table 9.1.

12.2. Biological Parameters

For benthic macroinvertebrate sampling, instead of duplicate sampling, each sampler will be evaluated annually by measuring the area sampled upstream of the net. The area should be two square feet, as verified by using a two square foot PVC frame or other appropriate method.

A minimum 20 percent of the benthic macroinvertebrate samples, performed by citizen-volunteers, will be subjected to validation by an outside professional taxonomist. Following analysis by the volunteers, the selected samples will be reconstituted and sent out for professional level 3 taxonomic analyses. Reconstituted means opening the vials containing the 100 identified specimens, pouring the specimens back into the original sample jar, and gently stirring the contents. In addition, once a year citizen macroinvertebrate analysts will participate in an intercalibration exercise in which their subsampling/sorting and taxonomic skills will be evaluated. A minimum of two teams of analysts will each inspect each other's processed grids immediately following completion of the subsampling procedure. There should be no more than 10 percent missed organisms. A technical advisor should then evaluate each of the citizen analysts by testing their identification to order and family level on at least 20 specimens, including at least one representative from each of the major orders and families as determined by the technical advisor for that watershed. Accuracy and precision can be determined by the results of these validation and evaluation measures.

Table 12.1. Quality Control Requirements

Parameter	Blank	Duplicate Sample	Split Sample to Laboratory	QC Session (Cross-calibration)
<i>Water quality</i>				
Temperature	None	5% per quarterly or whichever is greater	None	Twice a year
Dissolved Oxygen	None	5% per quarterly or whichever is greater	None	Twice a year
pH	None	5% per quarterly or whichever is greater	None	Twice a year
Conductivity	5%	5% per quarterly or whichever is greater	Twice a year	Twice a year
Turbidity	5%	5% per quarterly or whichever is greater	Twice a year	Twice a year
<i>Nutrients (colorimeters)</i>				
Ammonia-Nitrogen	Daily	5% per quarterly or whichever is greater	Twice a year	Twice a year
Nitrate-Nitrogen	Daily	5% per quarterly or whichever is greater	Twice a year	Twice a year
Ortho-Phosphate	Daily	5% per quarterly or whichever is greater	Twice a year	Twice a year
<i>Biological Parameters</i>				
Benthic Macroinvertebrates	None	None, instead conduct evaluation of sampling area annually	20% per year	Once a year
Bacteria (Fecal Coliform)	5%	5% per quarterly or whichever is greater	Twice a year	Twice a year

13. Instrument/Equipment Testing, Inspection and Maintenance

The designated PG/CCW monitoring group leader keeps a maintenance log. This log records reagent use, periodic servicing performed, and any problems identified with equipment. Monitors will be taught how to calibrate water monitoring equipment and all calibration information will be recorded on the datasheets.

13.1. Temperature

Before each use, liquid thermometers are checked for breaks in the column. If a break is observed, the alcohol thermometer will be placed in nearly boiling water so that the alcohol expands into the expansion chamber, and the alcohol forms a continuous column. Follow instruction manual for electronic thermometers. Verify accuracy by comparing with an NIST certified thermometer.

13.2. Dissolved Oxygen

Before each use, the DO probe is checked to see if it is clean and in good working order following the manufacturer's recommendations. Standards are replaced annually or sooner, depending on the manufacturer's recommendation. Discard decanted portions of DO standards after calibrations are completed, do not re-use. Standards are stored with caps firmly in place, in a dry area and away from extreme heat.

13.3. pH and Conductivity

Before each use, pH and conductivity meters are checked to see if they are clean and in good working order following the manufacturer's recommendations. Make sure pH and conductivity meters are calibrated before each sampling event. Bulk solutions of pH buffers and conductivity standards are replaced annually or sooner depending on the manufacturer's recommendation. Discard decanted portions of pH or conductivity standards after calibrations are completed, do not re-use. Standards are stored with caps firmly in place, in a dry area and away from extreme heat. When stored for extended periods, pH electrodes are to be kept in an appropriate solution, following the manufacturer's recommendation.

13.4. Turbidity

Turbidity meter (Nephelometer) should be checked for cleanliness and proper operation following the manufacturer's recommendations. Discard decanted portions of turbidity standards after calibrations are completed, do not re-use. Standards are stored with caps firmly in place, in a dry area and away from extreme heat.

14. Instrument Calibration (Chemical and Physical Parameters)

Instruments will be calibrated accordingly to the following schedule. Standards will be purchased from a chemical supply company or prepared by a laboratory certified by U.S. EPA for chemical analysis of water or wastewater. Calibration records will be kept at a location where they can be easily accessed before and after equipment use. This will likely be at Placer County Planning or kept by a designated PG/CCW volunteer leader.

Table 14.1 Instrument Calibration and Frequency (Conventional Water Quality Parameters)

Equipment Type	Calibration Frequency	Standard or Calibration Instrument Used
Temperature Probe	Every 6 months	NIST certified thermometer
Dissolved Oxygen Meter	Every sampling day	Commercial DO standards or water saturated air, as per manufacturer's instructions.
pH Meter	Every sampling day	pH 4.0, 7.0 and/or 10.0 certified buffers (or other values)
Conductivity Meter	Every sampling day	Commercial conductivity standard
Turbidity Meter (Nephelometer)	Every sampling day	For clear ambient conditions use 1.0 NTU standard, for turbid conditions use 10.0 NTU standard
Ammonia-Nitrogen (Hach RD 890 Colorimeter)	Every sampling day	Hach Calibration Standards
Nitrate-Nitrogen (Hach RD 890 Colorimeter)	Every sampling day	Hach Calibration Standards
Ortho-Phosphate (Hach RD 890 Colorimeter)	Every sampling day	Hach Calibration Standards

15. Inspection/Acceptance Requirements

Upon receipt, buffer solutions, standards, and reagents used in the field kits will be inspected by the citizen-monitoring leader for leaks or broken seals, and to compare the age of each reagent to the manufacturer's recommended shelf-life. Containers will be initialed and dated at inspection/acceptance and also when opened for the first time. All other sampling equipment will be inspected for broken or missing parts, and will be tested to ensure proper operation.

Before usage, thermometers are inspected for breaks (gaps) in the liquid column. Gaps can be eliminated by heating (see Section 13.1). If not, they will be returned to the manufacturer for repair or replacement.

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 chemical supply company. Reagent replacement dates are noted in the maintenance log.

16. Data Acquisition Requirements

16.1. Professional Analytical Data

State certified analytical laboratories and/or academic laboratories (with approval of State and/or Regional Board staff) will be used for QA checks and analysis of field samples. The Technical Advisory Committee (TAC) will review these laboratories' data.

16.2. Geographical Information/ Mapping

USGS maps will be used to verify watershed boundaries and stream courses. Additional information on distribution of natural resources will be obtained from Sierra College studies, Placer Legacy databases, and other agencies. Additional data may be acquired from the National Park Service, National Fish and Wildlife Service, and the CDFG's biodiversity database. Land use information will be obtained from local planning offices. Data should be provided with reference to geographical locations.

17. Data Management

Field data sheets are reviewed and signed in the field by the citizen-monitoring leader. The citizen-monitoring leader will discard (or flag – see section 23 below) any results where holding times have been exceeded, sample identification information is incorrect, samples were inappropriately handled, or calibration information is missing or inadequate. Such data will be marked as unacceptable by the monitoring leader and will not be entered into the electronic database.

Independent laboratories will report their results to the citizen-monitoring leader. The leader will verify sample identification information, review the chain-of-custody forms, and verify if the data has been appropriately entered in the database. The technical advisors or designated quality auditor also reviews these data quarterly.

The data management coordinator will review the field sheets and enter the data deemed acceptable by the citizen-monitoring leader and the technical advisors. Upon entering the data the data management coordinator will sign and archive the field data sheets. Data will be entered into a spreadsheet (MS Excel) or a database (MS Access) in a way that will be compatible with EPA's STORET and the Regional Water Quality Control Board's (WQCB) database guidelines. Following initial data entry the data coordinator will review electronic data, compare to the original data sheets and correct entry errors. After performing data checks, and ensuring that data quality objectives have been met, data analysis will be performed.

After approval of the TAC, raw data will be provided to the State WRCB and Regional WQCB in electronic form at least once every two years so that it can be included in the 305(b) report. Appropriate QA information will be provided upon request.

18. Assessment and Response Actions

Review of field and data activities is the responsibility of the Placer County's designated citizen-monitoring leader, with the assistance of the TAC. The citizen-monitoring leader, or a technical advisor will accompany volunteers on one or more of their first 5 sampling trips. Optimally, volunteers in need of performance improvement will be retrained on-site. Volunteers are expected to attend at least one annual refresher courses offered by the citizen-monitoring group.

Within the first three months of the monitoring project, the State Water Board or Regional Board staff, or their designee, will evaluate field and laboratory performance and provide a report to Placer County. All field and laboratory activities, and records may be reviewed by state and EPA QA officers as requested.

19. Reports

Technical advisors will review draft reports to ensure the accuracy of data analysis and data interpretation. Placer County will report data to its constituents or other data users after QA has been reviewed and approved by their technical advisors. Every effort will be made to submit data and/or a report to the State and/or Regional Board staff in a fashion timely for their data uses, (e.g. 305(b) report or special watershed reports).

20. Data Review, Validation and Verification

Data sheets or data files are reviewed quarterly by the technical advisory committee (TAC) to determine if the data meet the QAPP objectives. The TAC will identify outliers, spurious results or omissions to the citizen-monitoring leader. They will also evaluate compliance with the data quality objectives. They will suggest corrective action that will be implemented by the citizen-monitoring leader. Problems with data quality and corrective action will be reported in final reports. Data will not be released until approved by the TAC.

21. Validation and Verification Methods

As part of standard field protocols, any sample readings out of the expected range will be reported to the designated Placer County monitoring leader. A second sample will be taken as soon as possible to verify the condition. If the data is invalid, then the data will be noted (flagged) on the data sheet. Placer County will take further actions to trace the sources of error, and to correct identified problems. If the error is a result of improper monitoring procedures, then PG/CCW may re-train monitors until performance is acceptable.

22. Reconciliation with DQOs

The TAC, working with Placer County's designated monitoring leaders, will review data quarterly to determine if the data quality objectives (DQOs) have been met. A quorum, consisting of a simple majority of the TAC, will be required for committee decisions. If a quorum is not met at the meeting, work will still proceed. The work product (e.g., review and comments on data or reports) will then be sent out to the whole TAC for approval with a 30-day review period.

If data do not meet the project's specifications, the following actions will be taken. First, the technical advisors working with Placer County's designated monitoring leader(s) will review the errors and determine if the problem is equipment failure, calibration/maintenance techniques, monitoring/sampling techniques or data entry problems. They will suggest corrective action. If the problem cannot be corrected by training, revision of techniques, or replacement of supplies/equipment, then the technical advisors and the TAC will review the DQOs and determine if the DQOs are feasible. If the specific DQOs are not achievable, they will determine whether the specific DQO can be relaxed, or if the parameter should be eliminated from the monitoring program. Any revisions to DQOs will be appended to this QAPP with the revision date and the reason for modification. The appended QAPP will be sent to the agency representatives that approved and signed the original plan. When the appended QAPP is approved, the citizen-monitoring leader will work with the data coordinator to ensure that all data meeting the new DQOs are entered into the database. Archived data can also be entered.

APPENDIX 1. Data Quality Control Forms

Data Quality Form: Accuracy

Quality Control Session

PG/CCW	Type of Session (Field or Laboratory)
Your Name	QA Leader
Date	

Parameter/ units	Sensitivity	Accuracy Objective	Standard Conc.	Analytical Result	Estimated Bias	Meet Objective? Yes or No	Corrective Action Planned	Date Corrective Action Taken
Temperature °C								
Dissolved Oxygen (mg/L)								
pH Standard Units								
Conductivity (uS/cm)								

Comments:

APPENDIX 2. *Field Data and Observation Sheet*

Field data sheet reviewed by: _____

Data entered by: _____

Data entry checked by: _____

APPENDIX 3. PG/CC Sampling Locations

Site ID	Description	Justification	Physical/ Chemical Parameters	Biological Parameters
PG1	Pleasant Grove Creek between Foothills Blvd. and Industrial Ave.	This site is located just west of the Rocklin City limits which will help to identify developmental/urban water quality influences from Rocklin on the Pleasant Grove drainage system. The creek can be easily access from Industrial Avenue.	Velocity/Depth, Temperature, pH Specific Conductance, corrected to 25°C, Total Dissolved Solids, Turbidity, Turbidity, Total Suspended Solids, Seattelable Solids (1 hr) , Oil & Grease, Alkalinity, Dissolved Oxygen, Total Coliform and E. coli, Nitrate Nitrogen, Nitrite Nitrogen, Ammonia Nitrogen, Orthophosphate, Total Organic Carbon, Biological Oxygen Demand, CAM 17 Metals, Total Mercury, Organophosphorous Pesticides, Organochlorine Pesticides, Herbicides, Glyphosate	Benthic Macro-Invertebrate Speciation
PG2	Pleasant Grove Creek immediately downstream of the Crocker Ranch Road bridge	Location within upper watershed used as an alternate to PG3 for BMI monitoring.	Not Sampled	Benthic Macro-Invertebrate Speciation
PG3	Pleasant Grove Creek immediately upstream of the Fiddymment Road bridge on the north bank.	The site captures the main branch of Pleasant Grove Creek as it transitions from an urban to rural surroundings.	Same as PG1	Not Sampled
PG4	Pleasant Grove Creek immediately downstream of the Brewer Road bridge	On the downstream side of the Brewer Road bridge, provides a site located in the middle of the watershed. May be exchanged for a site in Reason Farms when access is obtainable through the City of Roseville.	Same as PG1 except no Metals, Pesticides or Herbicides	Benthic Macro-Invertebrate Speciation (If access is obtained)
PG5	Pleasant Grove Canal at Howsley Road	Located at the bottom of the watershed before entering the Cross Canal, this site will monitor the cumulative impacts of the entire watershed on the Sacramento River.	Same as PG1	Not Sampled

Site ID	Description	Justification	Physical/ Chemical Parameters	Biological Parameters
SPG 1	South Branch Pleasant Grove Creek at Veterans Memorial Park	Located behind the Veterans Memorial Park in Roseville, this site provides easy public access and a downstream location to monitor developmental/urban influences on the South Branch Pleasant Grove Creek drainage system.	Same as PG1 except no Metals, Pesticides or Herbicides	Benthic Macro-Invertebrate Speciation
C1	Curry Creek immediately upstream of the Pleasant Grove Road bridge in Sutter County	Located in lower Curry Creek, this site is indented to monitor the water quality of a drainage system that is primarily dominated by agricultural lands. The creek can be easily accessed from Pleasant Grove Road.	Same as PG1 except no Metals, Pesticides or Herbicides	Benthic Macro-Invertebrate Speciation
K1	Kaseberg Creek downstream of the Pleasant Grove Blvd. bridge in the Sun City development	Located on Kaseberg Creek as it enters the Sun City development, this site provides easy and safe access with permission from the HOA, and drains south-west Roseville.	Same as PG1 except no Metals, Pesticides or Herbicides	Benthic Macro-Invertebrate Speciation

APPENDIX 4. Processing Macroinvertebrate Samples

Standard Laboratory Operating Procedures for Laboratory Processing

<p>Sample log-in</p>	<p>Enter the required sample information into the Laboratory Log. The last three entries may occur later, as the sample is processed further.</p> <ul style="list-style-type: none"> • <u>Laboratory Number</u> - Select the next consecutive number that follows the last log entry • <u>Stream</u> - Identify the stream from which the sample was collected • <u>Location</u> - Record the location by name, landmark or other distinguishing feature, consistent with the field data sheet • <u>Sample Date</u> - Record the date the sample was collected from the field • <u>Collector Name</u> - Note the name of the sample collector(s) • <u>Picker Name</u> - When sub sample picking is completed, enter the date and last name(s) of the sample picker(s) • <u>Keyer Name</u> - Enter the last name of keyer(s), showing who did which order or family. • <u>Notes</u> - Record the sample's current status and your initials, to help the next person continue it's processing. Note things like: "replaced field alcohol "; "picked"; "sorted to order"; "partially keyed to family"; "keying completed"; "needs stats run"; etc.
<p>Storing data sheets</p>	<p>By the time field collection and laboratory processing are completed for a stream sample, you will have entered data in the following forms. Please store them in the Data Binder in the section designated for that stream.</p> <ol style="list-style-type: none"> 1. The laboratory log entry 2. Field Reconnaissance and Notes 3. The California Bioassessment Worksheet <ul style="list-style-type: none"> Side 1- Field Data <ul style="list-style-type: none"> Habitat Assessment Summary Biometrics Results Side 2 -Sample Subsampling and Taxonomy 4. The Initial Picking Data Sheet (to sub sample 100 organisms)

Continued on next page

Sample picking		The steps to pick representative 100 organisms from the sample are listed in the table below.	
	Step	Procedure	Description of Procedure
	1	Spread the sample in tray	<p>Create a new label for the main sample that includes the newly assigned laboratory number (from the sample log). Use this laboratory number on all subsequent sub samples from this sample. Labeling instructions appear under the “Labeling” section of this document.</p> <p>Pour entire sample into sieve. Save the alcohol. Transfer entire sample from sieve into tray with marked grids. Add enough 70 percent ethanol or water to keep sample moist but not swimming.</p> <p>Remove large organic material by hand, after inspecting for clinging organisms. Distribute material evenly, breaking apart clumps of vegetation.</p>
	2	Sub sample the sample	<p>Select five or more numbered grids, using random number table. Write the grid numbers in order on the Initial Picking Data Sheet.</p> <p>With a razor blade, remove the first grid and transfer it to a petri dish. Use alcohol or water to cover the sample.</p> <p>Prepare a temporary sub sample label for the petri dish. (See section on labeling.)</p>
	3	Pick out the organisms	<p>Pick all of the organisms out of the first sub sample, using clicker or tick marks to keep count. Record the number of organisms you found in the sub sample on the Initial Picking Data Sheet (IPS).</p> <p>Have someone check this and all subsequent petri dishes for any overlooked organisms. Record checker’s count on IPS and note reason for any disparity.</p> <p>Set first picked dish aside and prepare the next sub sample by putting material from the next grid into another petri dish. Label this dish and pick it clean or until you have picked 100 organisms, whichever comes first.</p>

Sample picking		The steps to pick representative 100 organisms from the sample are listed in the table below.	
	Step	Procedure	Description of Procedure
<i>Continued</i>	4	Counting the remnant	<p>When picking your last sub-sample, a subset of the organisms will go into your 100-organism sample. The rest of the organisms (left in the petri dish after you reached 100) will be picked out, counted and placed in a separate vial (the remnant).</p> <p>When picking organisms to complete the 100 sample, it is important to avoid preferential picking, e.g., selecting the big organisms, the stained organisms, the ones that “catch your eye” first, etc. To ensure randomness at this stage of the picking, you must methodically pick all organisms from one section of the petri dish before moving to the next.</p> <p>Suggestion: A silicon grid drawn on the inside of the petri dish bottom will help you pick with less bias. Record the number of organisms in the remnant sample on the line provided at the bottom of the Initial Picking Sheet.</p>
	5	Put away the main sample	After removing all of the organisms from the petri dishes, return any material left in the petri dishes (sand, vegetation, etc.) to the main sample.
	6	Bottle the 100 organism sample	<p>Combine the 100 organisms picked from the sub samples and put them together into a vial. Label per instructions.</p> <p>Label the remnant in the same way but add the word “Remnant” to the label.</p> <p>Fill in the following information on Side 2 of the bioassessment worksheet:</p> <ul style="list-style-type: none"> • Person performing subsampling and signature • Number of organisms in each grid picked • Person checking subsampling and signature <p>Note in the logbook that you have completed the picking.</p>

Sample picking		The steps to pick representative 100 organisms from the sample are listed in the table below.	
	Step	Procedure	Description of Procedure
<i>Continued</i>	7	Put away data sheets	Put the bioassessment worksheet and the Initial Picking Sheet in the Data Binder, under the section designated for that tributary. Each tributary section is organized from front to back by laboratory number, with the highest laboratory number in front, going toward lowest at the back.

Sorting to family	This table will walk you through the steps of sorting and identifying a 100-organism sample and entering your data into the worksheet.	
	Step	Procedure
	1	Select a 100-organism sample that has not been identified to family.
	2	Pour it into a petri dish add enough water or 70 percent alcohol to submerge the organisms completely.
	3	<p>Using a dissecting scope and Order/Suborder keys from your training notebook, separate the sample into orders or suborders and then to family. Non insects can be grouped under “Other” to await further breakdown.</p> <p>Count the number of organisms in each family or “other” and place each group into a separate vial.</p>
	4	Make a label for each vial per labeling instructions.
	5	Have the taxonomy verified. If the sample meets QC standards continue. If not, taxonomy should be repeated with assistance from others.
	6	Record the number of organisms in each family on Side 2 of the bioassessment worksheet.
	7	Record names of people who performed taxonomic ID.
	8	Record name of person verifying taxonomy for this sample. Include signature and address.
	9	Record in laboratory logbook that sample ID is complete or indicates what part of the processing has been completed.
	10	Group all of the family vials together and the remnant by putting them into a dry jar (a plastic “specimen bottle”). In addition to the labels in the individual family vials, make a label for the dry jar that faces toward the outside of the jar. See labeling instructions.

Statistics	Using the numbers from the bioassessment worksheet, enter the information into the various bio-metrics. <i>(More on this in future edition of this SOP.)</i>
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Labeling	
Field sample label	<p>Replace or modify the original sample label with a new label, adding the laboratory number you have just assigned.</p> <div data-bbox="634 409 1307 569" style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p>Stream _____ Sample date _____ Location _____ Laboratory number _____</p> </div>
Temporary subsample label	<p>The temporary subsample label is a temporary label used to keep track of one or more subsamples (selected at random from the main sample), while they are being picked. From these subsamples comes the 100-organism sample for keying.</p> <p>The results of the initial picking should be recorded on the “Initial Picking Laboratory Data Sheet”.</p> <p>Once the organisms have been completely picked out of the subsamples, the material remaining in the petri dishes can be returned to the main sample and the subsample labels can be thrown away.</p> <div data-bbox="634 1108 1307 1268" style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p>Laboratory number _____ Subsample number(s) _____</p> </div>
Labels for 100 Count Sample and Remnant	<p>The 100 Count Label should be filled out and stored in the container with the 100 organisms picked from the subsample(s).</p> <div data-bbox="634 1480 1307 1724" style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p>Laboratory number _____ Stream _____ Number of organisms in sample _____ Number of organisms in remnant _____ Picker’s name _____</p> </div>
<i>Continued</i>	<p>Make a similar label for the remnant vial, adding the word “REMNANT”:</p>

	<div data-bbox="631 231 1304 451" style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"><p style="text-align: center;"><u>REMNANT</u></p><p>Laboratory number _____</p><p>Stream _____</p><p>Number of organisms in remnant _____</p><p>Picker's name _____</p></div>
<p>Order or family label</p>	<p>After the sample has been sorted by order or family, you should prepare a new label for each of the vials containing a grouping of organisms. This label may be changed as the sample is further subdivided to family.</p> <div data-bbox="634 747 1295 957" style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"><p>Laboratory number _____</p><p>Order _____</p><p>Family _____</p><p>ID by: _____</p></div> <p>The individual vials should be grouped in a larger “dry jar” to keep them together. The final sample label should include the following information. Make the label face the outside of the jar for easy reading.</p> <div data-bbox="634 1241 1295 1417" style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"><p>Laboratory number _____</p><p>Stream _____</p><p>Sample Date _____</p></div>