QUALITY ASSURANCE PROJECT PLAN

Volunteer Water Quality Monitoring

State of Oregon
Department of Environmental Quality

Laboratory & Environmental Assessment Division

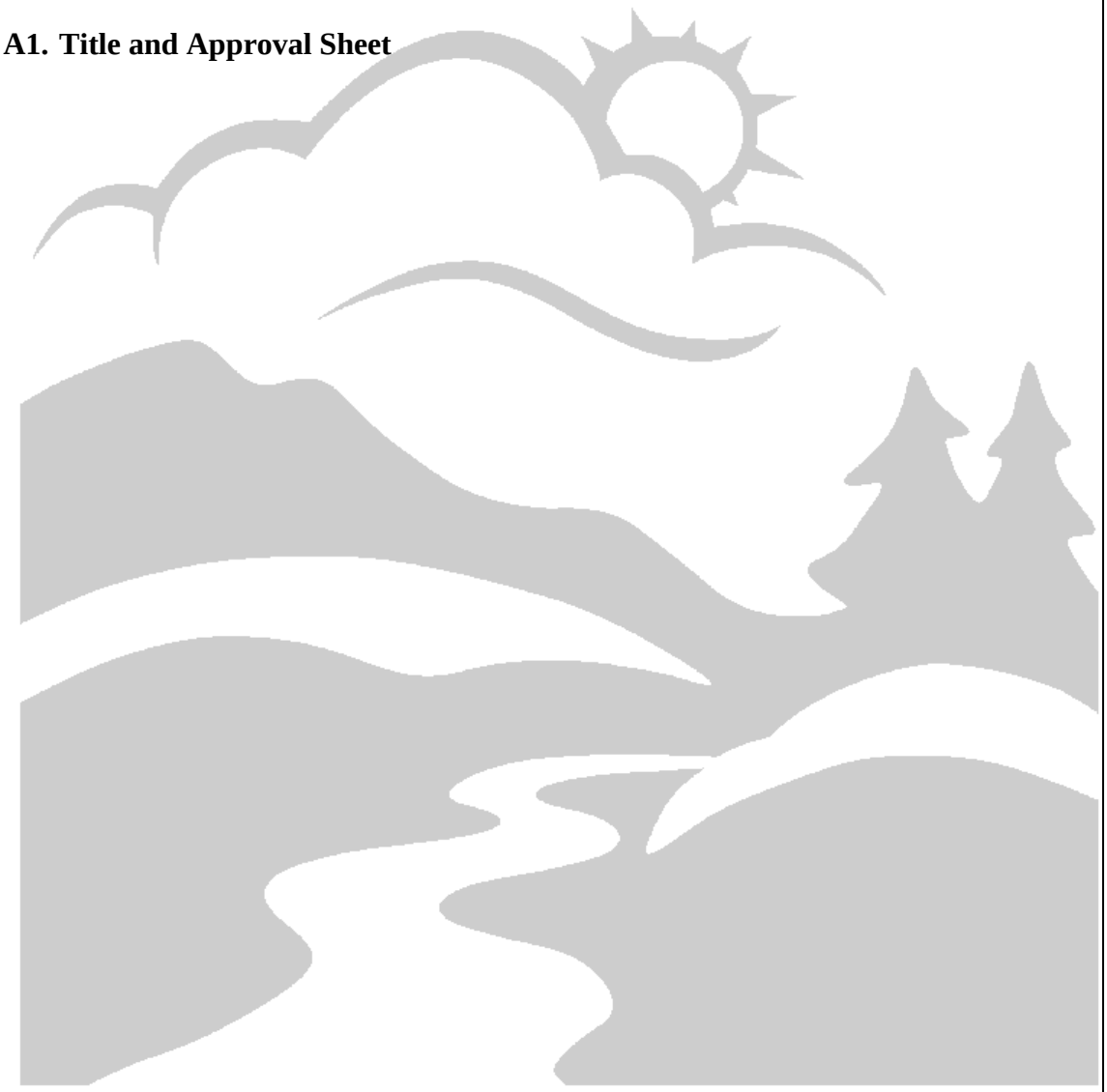
3150 NW 229th Avenue,
Suite 150

Hillsboro, OR 97124
503.693.5700
503.693.4999 FAX

www.deq.state.or.us

Group A: PROJECT MANAGEMENT

A1. Title and Approval Sheet



Steve Hanson, Volunteer Monitoring Specialist Date

Chris Redman, Quality Assurance Officer (QAO) Date

Dennis Ades, Water Quality Monitoring Section Manager Date

Signed copy on file with DEQ.

Last Update 10-Nov-2009
DEQ04-LAB-0047-QAPP
Version 2.0

Web pub#: 09-LAB-013

This page intentionally left blank

A2. Table of Contents

List of Tables

ACRONYMS

CBO- Community Based Organization (DEQ's volunteer monitoring program monitoring partners)

CCV- Continuing Calibration Verification (quality control test)

DEQ- The Oregon Department of Environmental Quality

DQL- Data Quality Level

DQM- Data Quality Matrix

EMAP- Environmental Monitoring and Assessment Program

ICV- Initial Calibration Verification (quality control test)

LASAR- Laboratory Analytical Storage And Retrieval (DEQ's public database for monitoring data)

LCS- Laboratory Control Sample (quality control test)

LEAD- Laboratory and Environmental Assessment Division (official name of the DEQ laboratory)

LIMS- Laboratory Information Management System (the DEQ laboratory's internal sample tracking, data entry and review application.

MS- Matrix Spike (quality control test)

OWEB- Oregon Watershed Enhancement Board

ORELAP- Oregon Environmental Laboratory Accreditation Program

QA- Quality Assurance

QAO- Quality Assurance Officer

QAPP- Quality Assurance Project Plan

QC-Quality Control

This page intentionally left blank

A3. Distribution List

This QAPP shall be posted on the DEQ's internal network at deq05/lab/qms/documents.asp and on the internet at http://www.deq.state.or.us/lab/wqm/volmonresources.htm . Participants in the DEQ's volunteer monitoring program will receive electronic notification of the document and subsequent revisions. The official signed document shall be filed at the DEQ laboratory. The Volunteer Monitoring program is expected to continue through multiple years, thus revisions should be anticipated. The Volunteer Monitoring Specialist may make revisions to this plan, which shall be approved by the signatories in section A1 above. The DEQ is not responsible for the control of reprinted copies from the web sites or photo copies of the original plan. It is the responsibility of the reader to ensure that they are using the most current QAPP. The QAO shall replace posted network files as the plan is revised.

A4. Project/Task Organization

Table A-1: ODEQ volunteer water quality monitoring project/task organization

Name	Project Title/Responsibility	Telephone Number
Steve Hanson	Volunteer Monitoring Specialist	503.693.5737
Field Operations Officer	ODEQ Laboratory WA staff schedule and collect samples to be split with CBO.	503.693.5700
Shannon Swantek	Sample coordinator	503.693.5784
Chris Redman	DEQ QA officer	503.693.5706
Community Based Organization Field Staff / Volunteers	Sampling and Analysis Project Plan preparation, project management, sample collection, data analysis, and data submittal	NA

DEQ personnel performing tasks under this QAPP will use the Q-Time number 41149 (Volunteer Monitoring) to track their time spent on the project.

A5. Purpose Statement/Problem Definition/Background

The DEQ's Volunteer Monitoring Program's (here after the program) goal is to involve Oregonians in identifying and solving the State's water quality problems. The program provides support including technical assistance in monitoring design, equipment use, data management and analysis. Community Based Organizations (hereafter CBO's) participating in the program are eligible to receive high quality monitoring equipment on loan. The purpose of the program is to improve the quality and quantity of data collected by groups around Oregon such that the data may be used locally by the CBO's and by the DEQ.

The goals of this of this plan are to (1) document CBO data quality, and (2) provide consistent basic quality assurance procedures for all partner CBO's. The purpose of monitoring projects conducted by specific CBO's must be identified in each group's Sampling and Analysis Plan (SAP).

CBO's able to follow this QAPP must prepare a (SAP which describes their monitoring project and defines any differences from this QAPP. Data generated by partner organizations using state funds to pay for analysis or equipment purchased by the state must be submitted to the DEQ for inclusion in the DEQ's Laboratory Analytical Storage and Retrieval database (LASAR). Data in LASAR is publicly

accessible over the internet and may be used by the DEQ for 303(d) list determination, total maximum daily load development, or other agency reporting purposes. In order for the DEQ or outside data users to apply CBO monitoring data appropriately it is essential that the quality of this data be defined. This plan includes quality assurance procedures followed by the CBOs and the processes used by CBOs and DEQ to quantify the quality of water quality data collected as part of DEQ's volunteer monitoring project.

A6. Project Task/Description

CBO's collect instantaneous grab samples for chemical, physical and biological stream parameters as well as continuous temperature monitoring. The CBO's approved SAP defines their monitoring question and how their sampling design will help answer that question. The SAP describes specific information regarding what data will be collected where, the kind of samples taken, the conditions to be sampled (storm events, summer baseflow, etc.), how samples will be analyzed, and a timetable for the monitoring. Unless otherwise specified in an approved SAP, CBO's will collect and analyze samples as described in this QAPP and referenced material. Quality control tests described in the OWEB Water Quality Monitoring Guidebook (http://oregon.gov/OWEB/docs/pubs/wq_mon_guide.pdf) must be followed and the results of these QC tests reported with the submitted data.

In addition to basic QC tests for specific parameters, the CBO and DEQ shall make a good faith effort to participate in side by side sampling events called split samples. Section B5 covers different types of split samples in more detail.

The critical project points related to quality assurance for DEQ are listed below as bullets.

Defining monitoring question- DEQ works with CBO's to identify an appropriate monitoring question.

Completing an approved SAP- DEQ provides technical assistance to CBO's in completing the SAP and reviews the plan before forwarding it to the DEQ QAO.

Training- DEQ provides training in methods.

Technical assistance- DEQ provides technical assistance to solve issue that are identified through QC sampling by the CBO

Split sampling- DEQ conducts side by side sampling with the CBO as a check for biases in data.

QC summaries- The DEQ prepares a summary of all available QC data relevant to submitted CBO data. The QC summary is appended to the final report.

Data quality review- DEQ reviews and assigns data quality levels to each reported result before loading the data into the DEQ database (target 6 weeks after data submission)

For CBO's an example timetable of important quality assurance elements is listed in Table A-2.

Table A-2: Project timeline for CBO's critical quality assurance elements

	PROJECT TIMELINE											
Project QA Processes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Develop monitoring objectives & study design												
Write QAPP												
Equipment & supplies procurement and training												

Project QA Processes	PROJECT TIMELINE											
	1	2	3	4	5	6	7	8	9	10	11	12
Collect field and lab data												
QC data assessment and response actions												
Compile and manage data												
Submit data to DEQ												
Assess and interpret data												
Convey results and findings												

A7. Measurement Quality Objectives

For water quality data to inform decision making it is critical that the quality of the results themselves be assessed in order to understand the sampling error and the error of the measurements themselves.

Sampling error will be determined by the natural variability of the environmental parameter, the distribution and type of samples in space and time, and the total number of samples.

Measurement error is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling, sample preparation, sample analysis, and data processing.

Specific QA Objectives for the volunteer monitoring water quality program are:

Collect a sufficient number of samples, sample duplicates, and field blanks to evaluate the sampling and measurement error.

Analyze a sufficient number of QC standards, blanks and duplicates during analysis to effectively evaluate results against numerical QA goals established for precision and accuracy.

Implement sampling techniques in such a manner that the analytical results are representative of the media and conditions being sampled.

CBO's are responsible for collecting the QC data needed for determining whether their data quality objectives are met. The DEQ reviews QC information before assigning data quality levels to the data in the LASAR database.

Precision and Accuracy: Table A-3 lists the precision and accuracy targets for standard water quality monitoring parameters collected as part of the DEQ program. The accuracy and precision limits listed in the table represent "A" level data as defined by the DEQ's field Data Quality Matrix (DQM) Version 4.0 unless noted otherwise. Any data collected which does not meet the accuracy and precision limits defined below will be downgraded to a lower data quality level (DQL) in accordance with the DQM and should only be considered in analysis after considering the cause of the data quality downgrade. For numeric targets for lower DQL's see the complete DQM at http://www.deq.state.or.us/lab/techrpts/docs/DEQ04-LAB-0003-QAG.pdf.

Table A-3: Accuracy and Precision Targets:

Matrix	Parameter	Precision	Accuracy	Measurement Range
Water	Temperature Cont. Temp.	± 0.5 °C ± 1.5 °C/30 min	± 0.5 °C ± 0.5 °C	-5 to 35 °C -5 to 35 °C
Water	pH	± 0.3 SU	± 0.2 SU	0 to 14 SU
Water	Conductivity	± 10% Relative percent difference	± 7% of Std. Value	≤ 1 to 4999 µS/cm
Water	Turbidity	± 5% Relative percent difference (± 1 NTU if NTU < 20 NTU)	± 5% of Std. Value	≤ 1 to 1000 NTU
Water	E. coli	± 0.6 log	NA	≤ 1 to >2419
Water	Dissolved Oxygen	± 0.3 mg/l	± 0.2 mg/l	≤ 0.1 to 20 mg/l
Water	Stream Discharge	± 10 % Relative percent difference	± 10 % of known	NA
Water	Laboratory Analytical Parameters	Defined by analytical laboratory; generally ± some Relative percent difference[1]	Defined by analytical laboratory; generally ± some % difference from laboratory control samples and no detection for blank samples.[1]	Defined by analytical laboratory; generally ≥ Limit of quantification[2]

1. Specific precision and accuracy objectives will vary with specific analytes and methods see Appendix A: DEQ Quality Control Limits.

2. Results reported below the limit of quantification but above the limit of detection for a method may be reported as estimates.

More information about specific quality control measurements used for accuracy and precision determination can be found in Table B-3. A report on the data quality of proposed physical channel measurements, pebble counts, , canopy, etc., is available on the EPA webpage at http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/phyhab.html.

Representativeness*:* Samples must be collected to most accurately represent the population defined in the SAP. Generally, in stream studies where ambient conditions are targeted, samples should be collected at or near the center of the stream channel where the water is well-mixed. If a study targets secondary portions of a waterbody—cold water refugia, mixing zones, near shore conditions, etc.—then these environments should be explicitly identified both in the SAP and in the station description. The sample

collection team shall record the date and time when the grab container is removed from the stream to the nearest 5 minutes. For macroinvertebrate sampling, physical habitat or channel measurements all sample and data collection should be done following the EMAP protocols (http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.pdf) or using an alternate method approved in the CBO's SAP.

Comparability*:* This monitoring program will ensure comparability with similar projects by following the standardized sampling protocols and procedures outlined in this plan. CBO's will follow procedures defined in OWEB's Water Quality Monitoring Guidebook or an approved SAP. Data quality determinations by DEQ will be determined following the Data Quality Classification for Volunteer Monitoring Grab Water Quality standard operating procedures (DEQ06-LAB-0027-SOP) and the Data Validation for the LASAR Database quality assurance guidance document (DEQ09-LAB-006-QAG).

Completeness*:* In determining the number of samples required a CBO should assume not all planned site visits will result in actual data collection. It is usually only practical to budget for a 10% over-sampling from the desired number of samples. For split sampling the target is to complete at least one split sample with all CBO's conducting water quality monitoring at least once a year. Sufficient valid data should be collected to fulfill any other contractual agreements.

If insufficient QC records are reported to the DEQ for assigning data quality levels, the data will be downgraded to "B- estimate", or "E- data of unknown quality" according to standard operating procedures and quality assurance guidance documents (DEQ06-LAB-0027-SOP & DEQ09-LAB-006-QAG, respectively).

Sensitivity*:* Sensitivity relates to the ability of an analytical method to quantify concentrations relevant to a study and the ability of the study design to successfully answer the monitoring question.

Analytical method sensitivity for a parameter can generally be determined by comparing the labs lowest reporting ability to existing data in the watershed or other similar watersheds. The DEQ database http://deq12.deq.state.or.us/lasar2/ can be used to estimate the general magnitude of expected results. If the analytical facility's methods are not sensitive enough, then many samples will be reported as below the reporting limit. If it will be a problem to have many non-detects, then it may be appropriate to look for a different indicator or method.

Study design sensitivity is the power of the expected results to answer a CBO's intended monitoring question. The variability of the population being sampled, the number of samples collected, the timing and distribution of site visits, and the required confidence in answering your question are all factors in determining if a study design is expected to successfully meet a CBO's goals. The characteristics of each population cannot be changed; but, by defining specific ecologically significant populations to characterize in their monitoring questions (for example average morning dissolved oxygen conditions during the spawning season rather than average conditions in general) the CBO may be able to reduce variability in their population and improve the subsequent sensitivity of their analysis.

A8. Training Requirements and Certification

A condition of the equipment loan agreement signed by CBO's when they receive DEQ purchased equipment is to follow procedures outlined in the OWEB Guidebook and to receive training from the DEQ. The CBO's project manager will coordinate the training of all volunteers before any monitoring activities are done, and schedule refresher training sessions as needed. All volunteers should be trained by DEQ staff or by CBO staff who have been trained and have experience in the specific water quality testing method. CBO staff should receive training on sample collection, processing, analysis and safety considerations. Newly trained volunteers should be supervised until the CBO project manager is assured the new individuals are confident in conducting the tests. Additional duplicates or split samples

conducted between CBO staff are a good ways to acquaint new monitoring personnel with procedures and document the quality of their technique.

A9. Documentation and Records:

In order to assure data quality over time CBO's should follow the document retention policy outlined in Table A-4 for all documents relevant to their study.

Table A-4: Document retention policy

Document or Record Name and Description	Storage Location	Storage Time
Quality Assurance Project Plan (QAPP)- DEQ04-LAB-0047-QAPP project description and assurance procedures.	DEQ Laboratory	5 years
CBO Sampling Analysis Plan- specific sampling information for each groups activities.	DEQ Laboratory & CBO office	5 years
OWEB Water Quality Monitoring Guidebook- Methods manual	DEQ Laboratory & CBO office	5 years
QC Summary Reports - Summarizing all QC data available for a specific organization during the dates relevant to the data submittal.	DEQ Laboratory: Final LIMS Report	5 years
Equipment Notebooks - records of quality control checks, calibrations and maintenance.	DEQ equipment boxes	5 years
Field Data Sheets and Chain of Custody Sheets - Field forms containing sampling meta data and raw field data. (Example see Appendix B)	CBO office	5 years
Chain of Custody Sheets: Sheets documenting what sample containers were collected where, at what time and by whom. When sent to an analytical laboratory should also document when the samples were received by the laboratory.	CBO office	5 years
ODEQ Original Record- Data submitted to DEQ by CBO for review, reformatting and upload into LIMS, usually a Microsoft Excel workbook.	DEQ Laboratory Vol_Data Drive	5 years
Final LIMS Report - Approved result values for each volunteer dataset submitted for upload to LASAR	DEQ Laboratory: Final LIMS Report	5 years

Group B: DATA GENERATION AND ACQUISITION

B1. Sampling Process Design

The most common study design for volunteer monitoring programs has been using targeted "integrator" sites with multiple samples collected at each location. In this scenario each site should be considered a population. Some organizations may have the opportunity to use a statistically rigorous random sampling approach where a defined geographic area (example: sub-watershed) or basin characteristic (example: land use) is the population and in which each sample is collected at a different randomly selected location.

In both design scenarios, multiple samples are used to characterize each population using measurements of central tendency (average, median), variability (min/max, percentiles), or extreme values (7 day moving maximum, number of water quality standard exceedances). The data can then be used to define the status of sites, identify locations warranting restoration or protection, compare to water quality criteria, or detect differences between populations for the purposes of determining trends or the effectiveness of projects.

Each CBO must include in their individual SAP the logic for selecting their intended sampling locations and sampling time and frequency. Their SAP should also define how they will access sites, identify the total number of sites, what parameters will be measured at each site, and when (time of year/day, environmental conditions, etc.). CBO's must submit a list of monitoring locations in their SAP. Parameters collected by CBOs may include any parameter described in the OWEB Guidebook, this QAPP or other parameters specified in the CBO's approved SAP. Any specific environmental conditions, ambient, summer base flow, runoff events, etc. needed to answer a CBO's specific monitoring question should be identified by the CBO in their SAP.

The rationale for the DEQ's effort to assign data quality levels to all CBO data is to provide some general classification of data quality so the DEQ and external data users have a sense for the reliability of the data. The CBO data is organized into batches based on the sample collectors and analyst, when the samples were collected and analyzed, and what equipment was used. Quality control test results are then compared to control limits defined in the Data Quality Matrix (DQM- DEQ04-LAB-0003-QAG) and the Data Validation for the LASAR Database quality assurance guidance document (DEQ09-LAB-006-QAG) to assign a data quality classification of:

A = Data of known quality meeting quality control limits of this QAPP;

B = Data of known but lesser quality due to incomplete or poorly performing quality control results, method limitations or comments;

C = Data of known poor quality based on poor quality control test results or comments; or

E = Data of unknown quality.

The reasonableness of grab and continuous field result values are also considered. Results which appear questionable and do not have sufficient quality control data (duplicates, split data, accuracy checks or lab QC tests) or relevant comments to assure data quality, may be downgraded by the DEQ volunteer monitoring specialist during data review.

B2. Sampling Method Requirements

CBO's are required to identify the logistics for how sites will be visited for grab sampling surveys. During a sampling survey all the monitoring sites are visited either by (A) sending a small number of sampling teams to many sites; or (B) by having many teams each visit one or two sites each per sampling survey. Specific sampling protocols should be described by the CBO's in the SAP but will generally

follow protocols described in the OWEB Water Quality Monitoring Guidebook (http://www.oregon.gov/OWEB/docs/pubs/wq_mon_guide.pdf). If a CBO experiences any problems with sample collection techniques they should contact the DEQ volunteer monitoring specialist.

Water quality samples gathered by CBO's will be collected by wading or by using an approved sampling container such as a DEQ supplied stainless steel bucket.

Continuous monitoring will be conducted following the procedures in chapter 6 of the OWEB Guidebook. Recording intervals will be every 30 minutes or 1 hour as specified in the CBO's SAP.

Benthic macroinvertebrate samples will be collected following the protocols from the OWEB Guidebook except for the selection and number of riffle kicks used for collecting bugs. A total of eight, one foot kicks will be composited according to protocols documented in the ODEQ's Mode of Operations Manual http://www.deq.state.or.us/lab/qa/techdocs.htm.

Sediment and channel protocols will include a subset of the EMAP sediment and channel protocols http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.pdf. Each CBO should clarify in their SAP which parameters they will record to collect information on sediment composition (modified Wolman pebble count portion only) or to calculate the relative bed stability (slope, wet wood, thalweg, bankful height, bankful width). CBO's should contact the DEQ volunteer monitoring specialist for updates on methods.

Stream discharge measurements will be collected following protocols summarized in the ODEQ's Mode of Operations Manual based on USGS protocols described in the Water Resources Investigations Report 00-4036 (http://wwwrcamnl.wr.usgs.gov/sws/Wading.htm).

Table B-1: ODEQ Recommended sample container, holding times and preservation

Parameter	Container	Volume	Preservation	Holding Time
Benthic Macroivertebrates	wide mouth bottle	1 L	ethanol	not determined[1]
Temperature	in-stream/sampling container	NA	none	immediately
Dissolved Oxygen	BOD bottle, P	300 ml	I	0.5 h, 8h/8h[2]
Conductivity	in-stream, P	250 ml	A	28 days
pH	P	100 ml	A	Immediately (24 hr.)
Turbidity	P	50 ml	A	48 hours
Escherichia coli / Enterococcus	120 mL sterile bottle	100 mL	A	24 hours
Alkalinity	P	100 ml	A	14 days

[1] Samples stored with sufficient alcohol in concentration (> 70%) and quantity have an extended shelf life that should be verified with the CBO's taxonomist.

[2] Process sample immediately. Winkler allows stabilization & holding for 8 hours until titration.

Parameter	Container	Volume	Preservation	Holding Time
BOD_5	BOD bottle, P	300 ml	G	48 hours
$CBOD_5$	BOD bottle, P	300 ml	G	48 hours
$NBOD_5$	2X BOD bottle, P	600 ml	G	48 hours
Chloride	DP	100 ml	C	28 days
COD	R	50 ml	D	28 days
Ammonia Nitrogen	R	50 ml	D	28 days
Chlorophyll	Petri dish/Glass Fiber Filter	8 ml	H	28 days
Nitrite Nitrogen	DP, P	50 ml	A	48 hours
Nitrate + Nitrite Nitrogen	R	50 ml	D	28 days
Total Kjeldahl Nitrogen	R	50 ml	D	28 days
ortho-Phosphate	DP	100 ml	C	48 hours
Total Phosphate	R	100 ml	D	28 days
Sulfate	DP	100 ml	C	28 days
Total Organic Carbon	R	10 ml	D	28 days
Total Dissolved Solids	P	200 ml	A	7 days
Total Solids	P	100 ml	A	7 days
Total Suspended Solids	P	200 ml	A	7 days

Parameter	Container	Volume	Preservation	Holding Time
CONTAINER CODES P = Reused, Washed, 1000 ml polyethylene bottle. DP = Reused, Washed, 250 ml polyethylene bottle for filtered sample. R = Reused, Washed, 500 ml polyethylene bottle.		PRESERVATION CODES A = Refrigerate on ice at 4°C. B = No preservation required, but should be kept on ice at 4°C. C = Filter in Field (0.45 µ filter), and refrigerate at 4°C. D = Add 12 drops conc. H_2SO_4 to 500 ml bottle and refrigerate. [H_2SO_4 = Sulfuric Acid] G = No air-space in container; refrigerate at 4°C. H = Filter in field; store in acetone with Magnesium Carbonate; freeze with dry ice; avoid exposure to light!! I = Winkler reagents 1 through 3		

B3. Sample Handling and Custody Procedures

Surface water samples will generally be analyzed for temperature and conductivity in the waterbody or sampling container and DO, pH and turbidity will be analyzed streamside. Analyzing as many parameters at the site as possible eliminates the potential for sample degradation or loss and allows for immediate follow-up sampling if problems or questionable results are identified. However, conductivity, DO, pH and turbidity samples, when properly preserved, can all be measured at an office or laboratory at the end of the day as long as the holding time is honored.

Field results should be recorded immediately onto a field sheet, field notebook or field computer.

Escherichia coli bacteria samples will be transported on ice, in a cooler, and analyzed within the designated holding time (8 hours or 24 hours). Protocols for bacteria analysis from Chapter 15 of the OWEB Guidebook will be followed if analysis is done by CBO staff.

Water samples needing analysis at a laboratory should be stored in clearly labeled bottles with a chain of custody or field sheet documenting the origin of the water with date, time, sample collector and station. Sample bottles, holding times, preservation requirements and shipping methods should all be confirmed with the analytical laboratory and documented in the CBO's SAP. Any required filtration by the CBO should be identified in their SAP with the volume to filter and the size and type of filter required.

Macroinvertebrate samples will be preserved in the field with 95% alcohol and returned to the lab for identification and storage. Field preservative should be decanted off and replaced with fresh preservative within a week of collecting the sample. For samples with significant organic matter the process of replacing the alcohol should be repeated until the alcohol no longer turns a green or brown color after a week of contact with the sample. If the organic matter reduces the concentration of the alcohol to < 70% the bugs will decompose. The bottles should be marked according to the protocols described in Chapter 12 of the OWEB Water Quality Monitoring Guidebook. Macroinvertebrate sample jars will be labeled with a pencil on the outside with site name, date and time of collection, collectors, and sample jar number. The same information will be written on a piece of paper, in pencil and inserted into the jar. Transport of

the samples to the laboratory conducting the taxonomic work should be pre-arranged. Standard chain of custody procedures from the lab doing the macroinvertebrate taxonomy should be followed and documented in the SAP.

B4. Analytical Methods Requirements

Standard protocols from the OWEB Water Quality Monitoring Guidebook for stream temperature, pH, turbidity, conductivity, dissolved oxygen, E. coli and macroinvertebrates will be followed unless otherwise noted in the CBO's SAP.

Temperature and DO by meter are the only field parameter methods that must be determined immediately at the site either in the waterbody or in the sampling container. Turbidity, pH, conductivity and dissolved oxygen will be measured streamside or within their designated holding time when samples are preserved correctly.

Waste generated from field tests should be collected and can be disposed of in the sink with running water.

Escherichia coli will be processed after returning to the lab and macroinvertebrates will be identified at the end of the summer.

Waste generated from bacteria analysis must be sterilized before disposal.

Continuous monitoring equipment may also be used to collect field parameters, refer to DEQ's Volunteer Monitoring web page for resources used to validate and submit continuous data to DEQ.

Table B-2 lists the recommended type of equipment used for each parameter. If different equipment is used for a project the CBO must specify this in their SAP.

Table B-2: CBO Analytical methods and equipment

Parameter	Method	Units	Equipment
Field Temperature	Thermistor[1]	Celcius	NIST Traceable YSI Model 30 SCT meter or VWR digital thermometer
Continuous Temperature	Temperature Data Loggers	Celcius	Vemco, or Onset Temperature Data Loggers
Specific Conductance	Wheatstone Bridge[1]	µSiemens/ cm	YSI Model 30 SCT meter
pH	Electrometric[1]	S.U.	Meter with Orion Ross electrode or double junction glass electrode; or Oakton pHTestr 30 (B level data only)
Dissolved Oxygen	Modified Winkler[1]	mg/L	Burette or Hach digital titrator titration with standardized sodium thiosulfate
Turbidity	Nephlometric[1]	NTU	HACH 2100P
Benthic Macroinvertebrates	EMAP Protocols[1,2]	Various	500 µm Mesh D-Frame Kick Net,

Parameter	Method	Units	Equipment
Pebble Count	Modified Wolman[2]	Various	Tape Measure, Stadia Rod
Oregon Relative Bed Stability Module	EMAP Protocols[2,4]	None	Tape Measure, Stadia Rod, Clinometer
Stream Discharge	Velocity-Area[3]	Cubic feet/sec.	Top setting rod, Approved Current Meter, Tag Line

1 OWEB Water Quality Monitoring Guidebook http://oregon.gov/OWEB/docs/pubs/wq_mon_guide.pdf.

2 Western Pilot Study: Field Operations Manual for Wadeable Streams: http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.pdf

3 ODEQ Laboratory Mode of Operations Manual http://www.deq.state.or.us/lab/qa/techdocs.htm, and USGS WRI 00-4036 http://wwwrcamnl.wr.usgs.gov/sws/Wading.htm

4. Doug Drake, ODEQ Laboratory, personal communication.

When it is necessary for the CBO to subcontract analytical work, the DEQ recommends the CBO use ORELAP accredited laboratories, which should provide assurances that lab data will be of known quality. Analytical organization, methods, units and equipment must be provided in an approved SAP for each analytical parameter analyzed at a laboratory.

B5. Quality Control Requirements

CBO Field Data: Quality control procedures should follow the recommended list below in the bullets and Table B-3 unless otherwise defined in a CBO's approved SAP.

Precision of grab samples shall be evaluated by measuring the difference in duplicate samples--samples collected within 15 feet and 15 minutes of each other. Each sampling team collects duplicates for all water quality measurements at a minimum of 10% of the total number of monitoring sites (1 duplicate for every 10 sites) during each sampling survey.

For sampling teams collecting only 1-2 samples per sampling survey, all parameters must be duplicated on their first sampling expedition. After the first duplicate, then duplicates should be collected at a rate of one every ten samples or at least once every 6 months, whichever generates more duplicates. When duplicates are applied in this way, sampling team members must be tracked and reported with the water quality data to DEQ using a consistent notation.

Duplicates are required even for parameters measured in the waterbody, like temperature or conductivity. When parameters are measured in the waterbody, measurement procedures should be repeated to record two readings to serve as a duplicate.

Accuracy checks for pH, conductivity and turbidity will be conducted at the beginning and end of each sampling day unless otherwise noted in the CBO's approved SAP. If accuracy checks at the start of the day show inaccuracy, then the equipment should be calibrated and retested for accuracy. If an accuracy check at the end of the day shows a meter is not reading within the limits for accuracy from the DQM for "A" level data, then data from that day should be downgraded accordingly and the meter should be calibrated before being used again.

IDEXX Colilert reagents will be tested with IDEXX Quanti-Cult culture to test the media at the start and end of the monitoring year. Incubator temperatures will be checked at the beginning and end of each

incubation and recorded in a log book kept with the incubator along with date, time and who completed the check the equipment.

Continuous data precision is measured by collecting a grab sample at the monitoring site and comparing results of the grab and continuous monitoring device result at the time the grab sample was collected. A minimum of one audit at the time of deployment and on one at the time of retrieval of continuous equipment are required to assess data quality.

Accuracy of continuous data requires pre and post deployment accuracy checks. For continuous temperature data loggers the procedures described in chapter 6 of the OWEB Guidebook for warm and cold water baths monitored with a NIST traceable thermometer will be followed. For multi-parameter datasondes the accuracy check requirements should be outlined in the CBO's approved SAP.

A field duplicate and inner-lab duplicate will be collected for 10% of the total macroinvertebrate stations (see OWEB Guidebook chapeter 12). In addition, 10% of the macroinvertebrate samples will be cross-checked by another taxonomist.

Table B-3: Required quality control measurements for common water quality tests conducted by CBOs

PARAMETER	ACCURACY When How Data Quality Levels	PRECISION When How Data Quality Levels
Continuous Temperature	(1) Before and after each field season (2) Warm and cold water baths as described in OWEB guidebook (3) A level is difference from master thermometer of ≤ 0.5 C°	(1) At deployment and retrieval as an absolute minimum. (2) Field audits with NIST traceable digital thermometer (3) A level is difference from field audit of ≤ 1.5 C° when recording at half hour intervals
Grab Temperature	(1) Annually (2) 5 temperature water baths (3) Acceptable level is difference from master thermometer of ≤ 0.5 C°	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Duplicate samples, in stream measurements are done sequentially (3) A level difference between duplicates of ≤ 0.5 C°
Specific Conductivity	(1) Bracketing your sample results, preferably at the start and end of each day (2) Tests against secondary standard in the ranges of 1400 and/or 140 µS/cm (3) A level is difference from standard of ≤ 7% of standard value	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Duplicate samples, in stream measurements are done sequentially (3) A level is relative percent difference[1] ≤ 10%

PARAMETER	ACCURACY When How Data Quality Levels	PRECISION When How Data Quality Levels
pH	(1) Bracketing each day's samples at a minimum. (2) Tests against 7 and 10 buffers, recalibrate if off by 0.1 from buffer (3) A level is difference from buffer of ≤ 0.2 S.U.	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Duplicate samples (3) A level is difference between duplicates of ≤ 0.3 S.U.
Dissolved Oxygen by Winkler Methods	(1) Not required (2) Side by side testing with DEQ, or "blind" samples sent to test titrations (3) A level is difference from DEQ of ≤ 0.3 mg/L or for blind titration ≤ 0.2 mg/L	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Duplicate samples (3) A level difference between duplicates of ≤ 0.3 mg/L
Dissolved Oxygen by Electrometric Methods	(1) Start and end of each monitoring day with Winkler or saturated air. Saturated air checks require additional confirmation of accuracy with Winkler for each survey[2] (2) Comparisons against Winkler and saturated air. (3) A level is difference from Winkler of ≤ 0.3 mg/L for both results bracketing data	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Duplicate samples (3) A level difference between duplicates of ≤ 0.3 mg/L
Turbidity	(1) Before and after each sampling day (2) Tests against secondary standards. Secondary standards are certified and relabeled every 3 months after calibration of meter with primary standards in the lab (3) A level is difference from standard of ≤ 5% of standard	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Duplicate samples (3) A level is relative percent difference between duplicates is ≤ 5%
E. coli[3]	(1) Upon receipt of reagents at DEQ (done by DEQ staff). [3] (2) Estimates can be done by doing side by side samples with DEQ (3) A level is difference of the logs of the side by side samples ≤ 0.6 log units	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Duplicate samples (3) A level is a difference between the logs of the values ≤ 0.6.

PARAMETER	ACCURACY When How Data Quality Levels	PRECISION When How Data Quality Levels
Laboratory Analytical Parameters	(1) Each analytical batch processed (2) Method blanks, laboratory control samples, calibration verifications, and matrix spikes. (3) See Appendix A: DEQ Quality Control Limits	(1) Every day or at 10% of sampling sites, whichever is greater[1] (2) Field duplicate and lab duplicate samples (3) See Appendix A: DEQ Quality Control Limits.

1. Under monitoring programs where samplers only collect 1 -2 stations per sampling event, each sampler should have duplicate for all parameters on their first sampling (for each season if only seasonal sampling is done); and duplicates for all parameters for ≥ 10% of the samples they collect or once every 6 months(whichever is greater).

2. Confirmation of the quality of saturated air accuracy checks should established initially during each survey, where a survey is the sampling frequency defined in the QAPP—often monthly, quarterly or during a storm event.

3. Quality control checks on dilution and blank water should be run using spikes comparable to Quanti-Cult® to test for promotion or inhibition of *E. coli* growth. If sampling conditions require use of a secondary sampling container frequent blanks should be conducted at targeted locations most likely to be contaminated to assess possible serial contamination. These tests are completed by the sampling/analytical organization.

Laboratory Analytical Data: When it is necessary for the CBO to subcontract analytical work, the DEQ recommends the CBO use ORELAP accredited laboratories, which should provide assurances that lab data will be of known quality. Analysis done by laboratories for CBO's must provide sufficient information about the analysis for the results to be assessed for data quality. Individual SAP's should identify what QC data will be reported by the analytical laboratory to the CBO and DEQ. Minimum information required includes:

Analytical method reference (like Standard Methods, or specific manufacturer's methods)

Analytical instrumentation

Reporting units (including, where appropriate, whether concentrations are molecular, like mg/L as NO3, or atomic, like mg/L as N)

Target reporting limit as defined by the laboratory following established procedures in the CFR, or based on the lowest concentration of their calibration standards.

Expected accuracy as measured against laboratory control samples (LCS)

Expected precision as measured by field or lab duplicates

QC results including method blanks and LCS results for all the analytical batches used to process the CBO's samples.

DEQ's quality control limits for a number of common analytes is presented in Appendix A: DEQ Quality Control Limits. Each CBO project may establish their own targets based on how their data will be used.

Split Sampling Data: Side by side sampling with independent analysis (split sampling) is an excellent way of assessing data quality issues. CBO's are encouraged to conduct one split sampling event with DEQ staff each year. Two types of split sampling opportunities exist with DEQ: routine ambient monitoring with split sampling or specific split sampling trips.

Routine ambient monitoring splits will be conducted by ODEQ Laboratory staff during normal sampling of the ambient network (http://www.deq.state.or.us/lab/wqm/ambientmonitoring.htm). CBO staff will meet DEQ staff at a predetermined time at an ambient monitoring station and collect samples simultaneously with DEQ staff. Both the DEQ and CBO's will follow their normal sampling and analysis protocols as defined in their respective SAP. The number of stations where split samples are taken will vary on the availability of the CBO. Result values from the DEQ and CBO will be compared to determine the accuracy of the CBO's results relative to the DEQ. Ambient split samples may be used to compare any of the DEQ's ambient monitoring parameters also analyzed by the CBO.

Timetable: Routine ambient monitoring splits may be conducted during any sampling run throughout the year. Most sites are sampled once every two months. A summary QC report will be submitted in a memo to the DEQ QA Officer for specific organizations when the group's grab water quality data is submitted for upload into LASAR. This memo will become part of the data's final report.

DEQ staff will conduct sampling trips specifically for doing split samples with a CBO. On these trips the DEQ staff will accompany CBO staff on their routine sampling trips, collecting simultaneous samples at stations defined by the CBO. A minimum of 3 split samples will be collected per split sample, but if time and resources allow 5 to 10 split samples is preferred. Result values from the DEQ and CBO will be compared to determine the accuracy of the CBO's results relative to the DEQ. Generally these split samples will compare routine field parameter results and *Escherichia coli* concentrations but may include comparison of other parameters to be defined in specific SAPs.

Timetable: Monitoring by CBO's is ongoing for the foreseeable future. Specific timetable for each CBO's monitoring will be required in their SAP. Split sampling field trips may be conducted at any time during the year. A unique DEQ SAP will be submitted prior to each split sampling trip. Within 6 weeks of completing the split sample the DEQ volunteer monitoring specialist will submit a report of the results to the CBO. The results of these split sampling field trips will also be included in the QC report memo submitted to the QA Officer when the group's data is submitted for upload into LASAR.

Split samples will also be used as a measure of bias for CBO results. Each CBO should specify in their SAP whether ambient split samples or split sampling field trips will be required to obtain split samples. During split samples, duplicate samples will be collected at a minimum of 10% of the total number of monitoring sites, or at least once per split sampling event.

B6. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All reagents and supplies should be checked at the start and end of each sampling survey for expiration dates, damage, contamination or degradation. Problems with any supplies or equipment should be communicated to the DEQ as soon as possible to allow sufficient time for corrective action before the next sampling survey. CBO's must follow the maintenance and inspection recommendations below for all equipment lent them as part of the volunteer monitoring program's equipment loan program.

Table B-4: Equipment testing, inspection and maintenance requirements for standard equipment provided to CBO's.

Equipment Type	Inspection Frequency	Type of Inspection
NIST Thermometer	Each monitoring day and annual accuracy check	Cables and batteries
pH Meter	Each monitoring day	Accuracy checks at start and end of each monitoring day, pH probe connections, and reference solution and storage solution fluid levels.
Conductivity Meter	Each monitoring day and annual temperature accuracy check	Accuracy, cables and batteries
Dissolved Oxygen Kit	Each monitoring day	Glassware & titrator, quantity and expiration of powder pillows and thiosulfate cartridges
Turbidity Meter	Each monitoring day	Accuracy, batteries and look for scratches or smudges on vials. Clean and lightly oil sample and standards vials.
IDEXX QuantiTray Sealer	Yearly or as needed (if there is an overflow)	Take apart and clean
Incubator	Prior to and at end of sample incubation	Check thermometer reading
D-Frame Kick Net and Sieve Bucket	Prior to and end of each site	Inspect net for rips or clinging organisms.
Marsh McBirney Flowmate Current Meter	- Prior to each measurement - Start of monitoring season and every 3 months	- Check for film upon or damage to probe - Zero check as per manual.
Standard Price AA or Pygmy Current Meter	- Prior to and after each use - End of each monitoring day	- Spin test (45 second and 120 second minimum for Pygmy and Price AA, respectively & no abrupt stop). Insert brass pin (Pygmy) or fasten raising nut (Price AA) when finished with each measurement. - Clean with tap water and if necessary apply small amount of supplied oil.
Stadia Rod	Prior to and end of each site	Check base for breaks resulting in loss of rod height.
Clinometer	- Prior to and after each day of use - Every month	- Check for damage and free movement of interior dial. - Back-check measurements to check for bias.

B7. Instrument Calibration and Frequency

Of the standard volunteer monitoring program equipment lent out to groups, only the pH meter is likely to need frequent calibration by CBO's based on accuracy check results. The turbidimeter will need to be calibrated regularly every 3 months with Hach StablCal standards, or equivalent, and new values assigned to the gel filled daily accuracy check vials. If other equipment is in need of calibration, then the equipment will need to be returned to DEQ.

Table B-5: Equipment calibration requirements for standard DEQ volunteer monitoring program equipment.

Equipment	Calibration Frequency	Standard	Responsible Party
NIST Traceable Thermometer	When > 0.5°C difference from NIST Certified Thermometer	NIST Certified Thermometer at 5, 10, 15, 20 and 25°C	DEQ
Orion Model 210A pH Meter	Daily or when > 0.1 S.U. from buffer value	Standard buffers 7 and 10	Field personnel
YSI Model 30 Conductivity Meter	When > 7% difference from standard	YSI Primary Standard	DEQ
HACH 2100P Turbidity Meter	Every 3 months	HACH StablCal (<0.1, 20, 100 and 800 NTU)	CBO Project QA Officer
Marsh McBirney Flowmate Current Meter	Calibrated if will not zero	Sent to Factory	DEQ

B8. Inspection/Acceptance Requirements

Each CBO should specify where they will keep their equipment organized. Equipment and supplies should not be stored in an area where it would be exposed to extreme humidity, heat or cold. When supplies are consumed it must be reported to the CBO project manager immediately so the supplies can be restocked. Expirations dates of all supplies should be clearly labeled. Damaged or contaminated equipment or supplies should also be reported immediately to the CBO project QA officer who will determine if it can still be used.

Table B-6: Supply inspection and acceptance requirements for CBO's of standard DEQ volunteer program equipment

Supply	Location	Inspection	Responsible Party
pH filling, storage and pHisa solutions	pH Meter	Quantity and contamination	Field personnel
pH buffer 7 and 10	CBO	Quantity, expiration and contamination	Field personnel
pH beaker, stir bar and stir plate	CBO	Presence and batteries	Field personnel
Turbidity secondary standards, vials, oil, and cleaning cloth	Turbidty meter box	Presence, quantity and contamination	Field personnel

Supply	Location	Inspection	Responsible Party
Winkler DO reagents 1-3, sodium thiosulfate titrant cartridges and starch	CBO	Quantity, expiration and contamination	Field personnel
Conductivity secondary standard	CBO	Quantity, expiration and contamination	Field personnel
Field sheets, clip board and pen	CBO	Presence	Field personnel
Sample collection bottles	CBO	Quantity and contamination	Field personnel
Cooler and Ice	CBO	Quantity	Field personnel
Permanent marker	CBO	Presence and condition	Field personnel
Safety cone and Orange safety vest	CBO	Presence and condition	Field personnel
IDEXX 120 mL Sterile sample bottles	CBO	Quantity and condition of sterile cap seal	Field personnel
Quanti-Tray 2000	CBO	Quantity and contamination	Lab personnel
Colilert	CBO	Quantity, expiration and contamination	Lab personnel

A list of additional equipment needed for macroinvertebrate sampling includes the following:

- Long sleeve rubber gloves
- Sample labels
- 1 ltr. Wide-mouth plastic sample jars
- Bug brush
- 500 micron D frame kicknet
- Sample Viewing Bucket w/mesh bottom
- Pencil
- Ethanol sample preservative

B9. Data Acquisition Requirements

Streamflow and weather data may be retrieved by CBO's online or by contacting directly the USGS, OWRD, and Oregon Climate Center for analysis and presentation purposes. Unless noted otherwise in the retrieved data, the quality of these results will be assumed to be of sufficient quality to use when analyzing CBO data. The limitations of all data collected will be referenced in any reports or presentations. Streamflow or weather data acquired from third parties will not be uploaded into LASAR.

For DEQ, data acquisition is the primary, measurable benefit from the volunteer monitoring program. Data management and submission procedures defined in section B10 outline how data is acquired by the DEQ from CBO's.

B10. Data Management

A CBO's internal data management procedures must be documented in the SAP for each project. All water quality data, including quality control results, generated by the CBO using equipment or supplies purchased by the state must be submitted to the DEQ for inclusion in the LASAR database. Data must be submitted to the DEQ in electronic format described and approved in the CBO's SAP.

Monitoring Stations*:* All data in the DEQ's database must be associated with a physical location defined by a latitude and longitude. CBO's should check their site locations against DEQ's existing LASAR water monitoring stations. The DEQ's online mapping application (http://deq12.deq.state.or.us/lasar2/startmap.aspx?dt=0) allows CBO's to check their sites on a map showing existing stations. When DEQ LASAR stations already exist for a CBO's site, the existing LASAR number should be reported with the data. If a significant hydrologic feature, like a confluence or discharge exists between the existing site and CBO monitored site, then two separate LASAR stations should be created regardless of whether the sites are very close (within ¼ mile for rivers).

If a new station must be created then latitude and longitude must be reported to DEQ. Latitude and longitude can be determined with the LASARWeb mapping application's "Set Location" tool. Aerial photographs (color ortho photos 2005) or USGS maps (under show advanced map features) can be used to help correctly set the monitoring location. If LASARWeb is not used to determine coordinates, then the method's datum must be reported with the coordinates. A map image of where new stations are should also be sent to the volunteer monitoring specialist for all monitoring locations needing a new station. The LASARWeb map image of a monitoring location can be e-mailed by selecting the "E-mail map" option after the location of the site has been set.

Submitting Data*:* An example formats for submitting grab and continuous water quality data can be found on the DEQ's web page at http://www.deq.state.or.us/lab/wqm/volunteermonitoringresources.htm. The required data elements for grab water quality data submissions can be found at http://www.deq.state.or.us/lab/wqm/docs/Vol_WQ_Grab_Data_SubmittalFormat_2.1_Descriptions.pdf. If a CBO is submitting data for a parameter not currently on the upload template's "Raw Data" worksheet, then the CBO must specify what fields will be submitted for the new parameter. Generally these fields will include analytical organization, method, units, result value, data quality level, and comments. It may also be necessary to include laboratory batch numbers to link result values to appropriate QC results. The CBO should verify data submittal fields with their analytical laboratory and the DEQ volunteer monitoring specialist and include the fields in their approved SAP.

For continuous data the preferred method for submitting data is the continuous audit format 2 Excel workbook available on the volunteer monitoring resources web page. This workbook contains separate worksheets for master site and logger information, pre and post accuracy check information, and field audit results. The continuously logged field data results are reported as separate worksheets for each logger. These logged field data worksheets should contain all data results from the time of deployment to time of retrieval. Including data points before deployment and after retrieval with a DQL of "D" can be helpful in assessing the quality of deployment and retrieval audits. If CBO's can submit the raw, individual, unclipped text files created after downloading data loggers when the continuous data file is submitted, these files can help the volunteer monitoring coordinator process the data.

Table B-7 includes the major data management procedures for entering CBO generated data into the DEQ LASAR database. Information for submitting benthic macroinvertebrate data, sediment data and channel data is not included in the table below and the formatting of this data should be discussed with the DEQ Volunteer Monitoring Specialist before it is submitted.

Table B-7: DEQ Volunteer monitoring program data management procedures

Input	Action	Responsible Party	Output
Instantaneous Grab Water Quality Data			
Raw Field Data and Quality Control Results	Internal data management at the CBO including review for reasonableness, completeness, data quality and existing DEQ LASAR stations[i], entry into electronic data storage, and formatting of data, including duplicate data, and assigned data quality level into an approved electronic format.	CBO staff or volunteers identified in an SAP	Completed electronic data submittal file for DEQ.
Submitted Raw Field Data (DEQ's "original record")	Review for formatting and completeness; create new LASAR stations for new locations, assign appropriate DEQ parameter codes, sampling organization codes, and analytical organization codes.	ODEQ Volunteer Monitoring Specialist	Completed Request For Analysis (RFA) (LIMS field sheet) Needed codes for electronic upload to LIMS
Submitted Raw Field Data	Quality assurance review and reformatting data. Review and analyze all reported quality control information including splits, accuracy reports, duplicates and other results. Review/assign data quality levels to each reported result. Reformat submitted data to LIMS electronic upload comma separated values format and assign all associated LIMS codes. Email electronic upload file and RFA to ODEQ Sample Coordinator.	ODEQ Volunteer Monitoring Specialist	QA memo LIMS electronic upload comma separated file
LIMS Electronic Upload File and RFA	Create LIMS Sampling event number and upload into LIMS	ODEQ Sample Coordinator	DAR
DAR	Review for successful upload and approve DAR.	ODEQ Volunteer Monitoring Specialist, ODEQ Managers	Approved DAR
Approved DARs	Print and sign Final Report.	ODEQ Sample Coordinator	Official Printed Final Report signed.
Release Data	Transfer electronic data to LASAR	ODEQ Technical Services staff	Data accessible on the DEQ webpage
Data in LASAR	Check on sampling event loading into LASAR, review 10% of sampling events for correct data transfer.	ODEQ Volunteer Monitoring Specialist	Verified LASAR data

Input	Action	Responsible Party	Output
Continuous Temperature Data			
Raw Field Data and Quality Control Results	Internal data management at the CBO including review for reasonableness, completeness, data quality, and existing DEQ LASAR stations[1]. Electronic entry, formatting and comparison of audit temperatures and data logger values for field audits and pre and post deployment accuracy checks; assign data quality levels; convert raw bin files into comma separated ASCII files in the "Date (MM/DD/YYYY), Time (00:00:00); result value" format and name files by logger number or site ID to match up with quality control information.	CBO staff or volunteers identified in an SAP	Completed electronic data file(s) for submittal to DEQ.
Submitted Electronic Data Files (DEQ's "original record")	Review for formatting and completeness; match quality control information, site information and data logger files; create new LASAR stations for new locations, assign appropriate DEQ sampling organization codes.	ODEQ Volunteer Monitoring Specialist	Needed codes for electronic upload into Continuous LIMS Application
Submitted Electronic Data Files	Compare all field audit information to logger values and enter into Continuous LIMS Application; assign data quality levels to all raw field data results and trim data sets down to deployment and retrieval dates and copy data into format for upload into LIMS; create field sheet and obtain LIMS sampling event number using Continuous LIMS Application; upload data into LIMS using Continuous LIMS Application, review uploaded data in LIMS, print a sampling event field sheet and QC report for the Sample Coordinator, and approve sampling event.	ODEQ Volunteer Monitoring Specialist	- Sampling Event Field Sheet - Initialed QC Report - Approved data set in LIMS
Reviewed LIMS Data set	Managerial approval and release of sampling event and upload to LASAR	ODEQ Sample Coordinator	Official Final Report signed.
Release Data	Transfer electronic data to LASAR	ODEQ Technical Services staff	Data accessible on the DEQ webpage
Verify data in LASAR	Verify the sampling event was transferred and check 10% of sites to assure the sampling events are loading properly.	ODEQ Volunteer Monitoring Specialist	Verified data in LASAR

[i] The online mapping application allows CBOs to check their sites on a map against existing stations http://deq12.deq.state.or.us/lasar2/default.aspx

Group C: ASSESSMENT AND OVERSIGHT

C1. Assessment and Response Actions

The quality assurance procedures defined above are essential to document the quality of the data collected; however, improving the quality of the data can only be achieved by continually assessing quality control test results and taking appropriate response actions when problems arise. Field or lab personnel should report to the CBO project manager whenever quality control results do not meet the "A" level data quality objective and quality control results should be reviewed by the project manager after each survey is completed to assign overall data quality levels to the data being collected.

Accuracy*:* CBO's will determine accuracy for pH, turbidity, and conductivity grab data by measuring standards before and after each sampling. Deviation from the expected value for the standard will be compared to accuracy ranges defined in the DQM (DEQ04-LAB-0003-QAG) to assign an accuracy classification for samples collected on that day for each parameter. Field personnel should assign accuracy DQL's based on the equipment they have used. For continuous data, pre and post accuracy checks will be used to determine the accuracy of data. The CBO's QA officer will determine accuracy for the continuous data.

Precision: Duplicate sample results will be used by CBO's to determine the precision of grab water quality measurements by each sampling team. Field and lab personnel will compare differences between duplicate values against precision requirements outlined in the DQM (DEQ04-LAB-0003-QAG) to assign data precision classifications. Having a space for assigning precision data quality levels on field sheets reminds field personnel to consider data quality at the time of analysis. Comparison between macroinvertebrate field and lab duplicates will be used to assess sampling and sub-sampling variability, respectively. Re-identification of macroinvertebrates by a second taxonomist will assess variability between taxonomists. Results should be compiled by the CBO's QA officer and reported with the data.

Laboratory Analytical Data*:* Samples analyzed by laboratories should report results to the CBO with a minimum of a method blank and LCS results for each batch of data analyzed. Method blanks should be less than the method reporting limit, and LCS results should be within the control limits identified in the CBO's approved SAP. Analytical reports submitted to the CBO should be reviewed immediately by the project manager or QA officer to make sure that the laboratory is meeting the project's data quality objectives. Data not within the control limits should be downgraded to "B" level data.

Split Sample Data*:* For field and lab results will be compared between samplers and and follow-up actions taken immediately if values for a group do not compare within "B" level precision limits defined in the DQM (DEQ04-LAB-0003-QAG). If comparisons do not meet the expectations of the DEQ Volunteer Monitoring Specialist or the CBO staff, then additional training, equipment maintenance or other corrective action will be taken.

The CBO's project manager will be responsible for reviewing the entire monitoring project on a regular basis and initiating corrective actions with field and lab personnel when the data quality objective of "A" level data is not being met. Appropriate steps for resolving problems with data that occur during assessment are: re-sampling; checking for unusual sampling or analytical conditions documented in the comments; inspecting and testing equipment used to generate questionable results; and reviewing

procedures to identify potential procedural errors or biases. The CBO project manager should contact the DEQ volunteer monitoring specialist if problems persist after reviewing sampling and analysis procedures with field and lab staff. The cause of data quality problems should be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be retrained.

C2. Reports to Management

Each CBO's project SAP should identify how the results of quality control tests and other project assessments will be reported including to whom the information will be reported and when. Reporting should include the following:

CBO field staff conducting accuracy and precision tests each day of sampling and should report the results on the field sheet unless noted otherwise in their approved SAP.

Performance assessment results conducted by the CBO QA officer will always be communicated immediately to field staff and the project manager.

The DEQ volunteer monitoring specialist will complete summaries of QC data and provide the information to the CBO project manager and the DEQ QA officer. For split sampling field trips, a short report on the results will be submitted to the CBO within 4 weeks of the data becoming available. For each data submittal to DEQ, all relevant QC data will be summarized in QA report to be submitted to the DEQ Sample Coordinator at the time a CBO's data is submitted for upload into LIMS and LASAR. This QA report is scanned and becomes part of the LIMS final report.

Group D: DATA VALIDATION AND USABILITY

D1. Data Review, Validation, and Verification

All data generated by the CBO will be reviewed by the CBO's project officer, QA officer or technical committee to determine if it meets the group's objectives stated in their SAP. The CBO's SAP should clarify who will be reviewing the data. At the discretion of the CBO, state agency staff may be asked to review and comment on the data. A CBO's decisions to accept, qualify, or reject data will be made by the CBO's project manager or QA officer.

The DEQ Volunteer Monitoring Specialist and the DEQ QA officer will determine if the data collected meets the objectives of this QAPP. All data will be reviewed in LIMS by project lead field staff. Decisions to accept, qualify, or reject data will be made by the volunteer monitoring specialist and DEQ QA officer. Additional information regarding the assessment of CBO generated data is described in section B10.

D2. Validation and Verification Methods

Validation and verification procedures for CBO's and DEQ personnel should include the following basic steps:

Completeness: Each step of the data generation and management should be assessed for completeness as soon as possible. Both missing parameter results and sample information, like time, collector, equipment, etc., should be reviewed. Missing information may warrant qualifying data (i.e. "B" data).

Reasonableness: Data generated should be reviewed for reasonableness to help catch any significant errors in result values and sample information. Data which appears unreasonable should be investigated and qualified when appropriate. At a minimum a comment should be added to explain unusual values.

QC Data Review: All available QC data should be analyzed to estimate the accuracy and precision of generated results. All result values will be classified with a data quality level based on the Oregon DEQ's Data Quality Matrix Version 4.0 or later for field data (http://www.deq.state.or.us/lab/techrpts/docs/DEQ04-LAB-0003-QAG.pdf) or the Data Validation for the LASAR Database quality assurance guidance document DEQ09-LAB-0006-QAG for laboratory analytical data.

Data Transfer Errors: At least 10% of data should be verified against original records whenever data is transferred either electronically or manually from one system to another. This includes transcribing field sheet data to databases at the CBO, or when DEQ reformats submitted data for upload into LIMS and then LASAR.

The DEQ Volunteer Monitoring Specialist will verify that these validation procedures are completed.

D3. Reconciliation with Data Quality Objectives

CBO's are ultimately responsible for determining how they use data that does not meet their data quality objectives. The DEQ strives to use only the highest quality of data and generally only use "A" level, and sometimes "B" level data. Data that is designated as "E" level may be used to assist planning additional monitoring or other uses that do not make a determination about a site's water quality. If the data generated by a CBO is discovered to not sufficiently address a CBO's monitoring objectives, then the SAP should be revised or appended to describe any changes to the monitoring program to help the group better achieve their objectives.

Appendix A: DEQ Quality Control Limits

The list of quality control limits for common analytes analyzed by the DEQ laboratory follows below. Relevant acronym definitions include the following:

CCV- Continuing Calibration Verification: Test to measure the stability of the calibration. This QC measure is conducted routinely during the analysis of the samples.

ICV- Initial calibration verification: Test to measure the accuracy of the calibration. This QC measure is conducted immediately after calibration (before samples are run). The ICV should come from a source different from the calibration standard(s).

LCS- Laboratory Control Sample: A test of a known QC sample that is carried through all sample processing steps.

MS- Matrix Spike: A test of sample that has had added to it a known quantity of analyte.

Table D-1: ODEQ Data Quality Indicators

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Field Measurements								
Dissolved Oxygen	mg/L	4500-O C	1	≤ ± 0.3	N/A	N/A	≤ ± 0.3[vi]	≤ ± 0.2[vii]
Flow	cfm	MOMs[viii]	1	N/A	N/A	N/A	N/A	N/A
Percent DO Saturation	%		N/A		N/A	N/A	N/A	N/A
Sample Depth	Ft		1		N/A	N/A	N/A	N/A
Temperature	°C	EPA 170.1	1	± 1.5	N/A	N/A	N/A	≤ ± 0.5[ix]
pH	S.U.	EPA 150.1	Sensitivity to 0.1	± 0.3	N/A	± 0.2[x]	N/A	≤ ± 0.2
Alkalinity	mg/L	Titration	1	± 2	–	N/A	N/A	≤ ± 1
Specific Conductivity (@ 25°C)	µmhos/cm	EPA 120.1	1	± 10%	N/A	N/A	±7%	±7%
Turbidity	NTU	SM 2130 B	1	± 5%	N/A	N/A	±5%	±5%
Redox	Mv	Electrometric probe	1	± 20	N/A	N/A	± 10	

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Microbiological Examination								
Escherichia Coli (E.Coli)	CFU / 100mL	SM 9223B	1	0.6 (log)	N/A	Positive Confirmation	N/A	N/A
Enterococcus	CFU / 100mL		10	0.6 (log)	N/A	Positive Confirmation	N/A	N/A
Bacteria - Total Coliform only	CFU / 100mL	TBD	1	0.6 (log)	N/A	Positive Confirmation	N/A	N/A
Physical & Aggregate Properties								
Solids Ash Free Dry Weight	mg/L	TBD	10		N/A			
Total Dissolved Solids	mg/L	2540 C	10	± 20%	N/A	± 20%	N/A	N/A
Total Solids	mg/L	2540 B	10	± 20%	N/A	± 20%	N/A	N/A
Total Suspended Solids	mg/L	2540 D	1	± 20%	N/A	± 20%	N/A	N/A
Alkalinity	mg/L	2320 B	1	± 10%	N/A	± 20%	± 0.3 pH	± 0.1 pH
Bicarbonate Alkalinity	mg/L	2320 B	1		N/A			
Conductivity	µmhos/cm	120.1/2510 B	1	± 5%	N/A	N/A	± 5%	± 5%
Salinity	ppth	2520 B	1		N/A			
Settleable Solids	mL/L	2540 F	0.01		N/A			
Turbidity	NTU	180.1/2130 B	1	± 20%	N/A	± 10%	± 10%	± 10%
pH	SU	150.1/4500-pH B	0.1	± 0.2 pH	N/A	± 0.1 pH	± 0.3 pH	± 0.1 pH
Color	CU	2120 B	1		N/A			
Density	g/ml	NA	0.1		N/A			

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Metals								
Mercury, Total	µg/L	245.1/7470A	LOQ	± 10%	± 20%	± 15%	± 10%	± 10%
Antimony by Graphite Furnace, Dissolved	µg/L	TBD	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Lead by Graphite Furnace, Total Recoverable	µg/L	TBD	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Thallium by Graphite Furnace, Dissolved	µg/L	TBD	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Calcium Hardness	mg/L	TBD	LOQ	± 20%	NA	± 15%	± 10%	± 10%
Hardness by ICP-AES	mg/L	TBD	LOQ	± 20%	NA	± 20%	± 10%	± 10%
Metals by ICP, Total								
Aluminum	mg/L	TBD	LOQ	± 20%	± 30%	± 15%	± 10%	
Chromium	mg/Kg wet	TBD	LOQ	± 20%	± 30%	± 15%	± 10%	± 10%
Total Sulfur	mg/L	TBD	LOQ				± 10%	± 10%
Metals by ICP, Total Recoverable								
Aluminum	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Antimony	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Arsenic	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Chromium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Copper	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Iron	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Lead	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Nickel	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Silicon	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Strontium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Thallium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Tin	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Titanium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Vanadium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals by ICP, Dissolved								
Antimony	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Arsenic	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Copper	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Lead	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Silica	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Strontium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Thallium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Titanium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Vanadium	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Drinking Water Metals by ICP AES	mg/L	200.7	LOQ	± 20%	± 30%	± 15%	± 10%	± 5%
Metal Cations by ICP, Dissolved	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Indicator Metals #2, Dissolved	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals ICP Scan, Dissolved	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metal Cations by ICP, Total	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals by ICP Scan, Total	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Indicator Metals #2, Total Recoverable	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metal Cations by ICP, Total Recoverable	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals ICP Scan, Total Recoverable	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals by ICPMS[xi]	µg/L	200.8 / 6020	LOQ	± 20%	± 30%	± 15%	± 10%	± 10%
Metals in Pesticide Samples by ICP-MS	µg/L	200.8 / 6020	LOQ	± 20%	± 30%	± 15%	± 10%	± 10%
Metals in Pesticides by ICP AES	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals in Industrial Effluent by ICP AES	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals in Reagent Water by ICP	mg/L	200.7 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 5% / ± 10%
Metals, Total Recoverable in Landfill Samples	mg/L	6010B / 6020	LOQ	± 20%	± 30%	± 15%	± 10%	± 10%

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
TCLP Percent Solids-Metals	%	1311	LOQ					
Mercury,TCLP	mg/L	1311 / 7470 A	LOQ	± 10%	± 20%	± 15%	± 10%	± 10%
TCLP - Toxic Pollutant Metals by ICP #1	mg/L	1311 / 6010B	LOQ	± 20%	± 30%	± 15%	± 10%	± 10%
Inorganic Non-Metals			LOQ					
Ammonia	mg/L	4500NH3 B,H	LOQ	± 20%	± 20%	± 20%	± 10%	± 10%
Chloride by Colorimetry	mg/L	325.2/4500Cl E	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Nitrate by Colorimetry	mg/L	353.2/4500N O_3F	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Nitrate/Nitrite	mg/L	353.2/4500N O_3F	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Nitrite	mg/L	353.2/4500N O_3F	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Total Kjeldahl Nitrogen	mg/L	351.2/4500N_{org}D	LOQ	± 20%	± 20%	± 20%	± 10%	± 10%
Total Nitrogen	mg/L	MOM grab	LOQ					
Bromate	µg/L	300.1	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Bromide by Ion Chromatography	mg/L	300.0	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Chlorate	µg/L	300.1	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Chloride by Ion Chromatography	mg/L	300.0	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Chlorite	µg/L	300.1	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Fluoride by Ion Chromatography	mg/L	300.0	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Nitrate by IC	mg/L	300.0	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Sulfate by IC	mg/L	300.0	LOQ	± 10%	± 20%	± 10%	± 10%	± 10%
Biochemical Oxygen Demand,5 Day Diluted	mg/L	5210 B	LOQ	± 10%	N/A	± 15%	N/A	N/A
Biochemical Oxygen Demand,5 Day Un-Diluted Stream	mg/L	TBD	LOQ					
Biochemical Oxygen Demand, Carbonaceous 5 Day Diluted	mg/L	TBD	LOQ					
pH for NonMetals workgroup (QC checks)	S.U.	TBD	LOQ		N/A			
Chlorine, Free	mg/L		LOQ		N/A			
Chlorine, Total Residual	mg/L	4500CL E,I	LOQ	± 10%	NA	± 10%	NA	± 10%
Orthophosphate	mg/L	4500P E	LOQ	± 10%	± 10%	± 5%	± 5%	± 5%
Total Phosphorus	mg/L	4500P B,E	LOQ	± 10%	± 10%	± 5%	± 5%	± 5%
Organic GC and HPLC								
Drinking Water - Chlorinated Pesticides by GC/ECD Method 508	µg/L	508 / 8081B	LOQ	≤ 30%	± 35% / CC[xii]	± 30%	± 20%	± 20%

Parameter	Units[ii]	Method	Target[iii]	Precision [iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Chlorinated Pesticides by GC/ECD	µg/L	508 / 8081B	LOQ	≤ 30%	± 35% / CC[xii]	± 30%	/± 20%	± 20%
PCBs as Arochlors	µg/L	508/ 508A / 8082A	LOQ	≤ 30% / 20% / 30%	35% / 30% / CC[xii]	± 30% / ± 20%	/± 20%	± 20%
EDB/DBCP/TCP by GC/ECD	µg/L	504.1	LOQ	≤ 30%	± 35%	± 30%	/± 20%	± 20%
Nitrogen/Phosphorous Pesticides by GC/NPD	µg/L	8141B	LOQ	≤ 30%	CC[xii]	± 30%	/± 20%	± 20%
Volatile Organic Compounds by GC/MS	µg/L	524.2 / 8260C	LOQ	≤ 30%	± 30%	± 30%	± 30%	± 30%
Drinking Water Semi-volatile Organic Compounds by GC/MS	µg/L	525.2	LOQ	≤ 30%	± 30%	± 30%	± 30%	± 30%
Semi-volatile Organic Compounds by GC/MS	µg/L	8270D	LOQ	≤ 30%	CC[xii]	± 30%	± 20%	± 20%
Polynuclear Aromatic Hydrocarbons by GC/MS SIM	µg/L	8270D	LOQ	≤ 30%	CC[xii]	± 30%	± 20%	± 20%
Phenoxy Herbicides by GC/MS	µg/L	8270D	LOQ	≤ 30%	CC[xii]	± 30%	± 20%	± 20%
Phenoxy Herbicides by GC/ECD	µg/L	SM6640B	LOQ	≤ 30%	CC[xii]	± 30%	± 20%	± 20%
Solvent Extractable nonvolatile compounds by HPLC/TS/MS	µg/L	8321B	LOQ	≤ 30%	CC[xii]	± 30%	± 20%	± 20%

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
Pharmaceutical and Personal Care Products by LC/MS/MS	µg/L	1694	LOQ	≤ 30%[2xiii]	Varies by composition	Varies by composition	± 30%	± 30%
Steroids and Hormones by HRGC/HRMS	µg/L	1698	LOQ	≤ 30%[xiii]	Varies by composition	Varies by composition	± 30%	± 30%
NW Total Petroleum Hydrocarbons - Diesel Range	mg/L	NWTPH-D	LOQ	≤ 30%	± 50%	± 30%	± 20%	± 20%
NW Total Petroleum Hydrocarbons - Gasoline Range	mg/L	NWTPH-G	LOQ	≤ 30%	± 50%	± 30%	± 20%	± 20%
NW Total Petroleum Hydrocarbons Identification	Mg/L	NWTPH	LOQ	NA	NA	NA	± 20%	± 20%
Algal Toxins by LC/MS-MS Anantoxin and Microcystin	µg/L	MOM grab	LOQ					
Microcystin by ELISA	µg/L	MOM grab	LOQ					
TCLP - Phenoxy Herbicides by GC/MS	mg/L	1311/8270D	LOQ	≤ 30%	CC[xii]	± 30%	± 20%	± 20%
TCLP - Semivolatile Organic Compounds by GC/MS	mg/L	1311/8270D	LOQ	≤ 30%	CC[xii]	± 30%	± 20%	± 20%
TCLP - Volatile Organic Compounds by GC/MS	mg/L	1311/8260C	LOQ	≤ 30%	± 30%	± 30%	± 30%	± 30%

Parameter	Units[ii]	Method	Target[iii]	Precision[iv]	Accuracy[v]			
					MS	LCS	CCV	ICV
TCLP - Chlorinated Pesticides by GC/ECD	mg/L	1311/8081B	LOQ	≤ 30%	CC[xii]	± 30%	/± 20%	± 20%
Organic: Aggregate Constituents & Properties								
Oil & Grease	mg/L	1664	LOQ	± 10%		± 10%		
Chemical Oxygen Demand	mg/L	5220D	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Dissolved Organic Carbon	mg/L	415.1/5310B	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Total Organic Carbon	mg/L	415.1/5310B	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Flash Point	°F	1020B / ASTM D3278	LOQ		N/A			
Chlorophyll	µg/L	SM10200 H	LOQ		N/A	N/A	± 10%	± 10%
Chlorophyll by Area	mg/m²	Calculation	LOQ		N/A	N/A	N/A	N/A
Total Cyanide	mg/L	9014/4500CN E	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Total Cyanide (SDWA)	mg/L	4500CN E	LOQ	± 20%	± 10%	± 10%	± 10%	± 10%
Cyanide Weak Acid Dissociable	mg/L	4500CN C,G	LOQ	± 20%	± 25%	± 15%	± 10%	± 10%
Fluorescein by Spectrometry	mg/L	TBD	LOQ					
Lignin and Tannin	mg/L	TBD	LOQ					
NCASI Color	CU	TBD	LOQ		N/A			
Phenolics	mg/L	TBD	LOQ					

[ii] The units of the QC (Target, Precision, and Accuracy) limits are listed in this column. If the QC limit is reported with a "%" sign it is unit-less.

[iii] The target level is the anticipated reporting level for this project. A target level of "LOQ" means the laboratory will use its current LOQ. If the requested target level is less than the laboratories LOQ, the laboratory will estimate the result down to the laboratory's LOD. The laboratory will not report values less than its LOD.

[iv] The precision control limit is to be used to evaluate both field duplicate and laboratory duplicate samples. Use the laboratory's current duplicate control limits, unless specified otherwise.

[v] Actual laboratory control limits may vary, since laboratories are expected to revise control limits over time. Some QC measures are not applicable (NA) to the test method. Use the laboratory's current accuracy control limits, unless specified otherwise.

[vi] If the Dissolved Oxygen (DO) probe method is used, verify the accuracy **daily** with end of day saturated air checks, and during each with the Winkler titration method by measuring the DO of sample water by both methods. If the Winkler method is used, there is no recommendation for a CCV.

[vii] If the Dissolved Oxygen (DO) probe method is used, verify the accuracy of the probe by comparing the Winkler titration method and DO probe measurements of reagent water. If the Winkler method is used, verify the accuracy of each batch of thiosulfate titrant with potassium bi-iodate.

[viii] Stream flow measurements will be conducted according to the ODEQ methodology derived from USGS stream flow protocols.

[ix] Thermometer Accuracy checked with NIST standards.

[x] Low ionic control sample.

[xi] The Limit of Quantification (LOQ) is dependent on preparation technique TCLP, Dissolved, Total, and Total Recoverable.

[xii] Limits are based on laboratory historical data obtained from Control Charts

[xiii] Control limit for most compounds, some are > 30%.

Appendix B: Example Field Data Sheet

Survey Name: Weather:

Survey Team: Samples Received by Lab Date/Time: Name:

Survey Date: Start time: End time: Field Data Reviewed ☐ Yes by: Entered into Database ☐ Yes by:

ITEM	SITE ID	SITE DESCRIPTION	QC TYPE[3]			TIME HH:MM	Temp °C	SpCond µS/cm	Turb NTU	pH S.U.	DO mg/L	DO%sat %	*E.coli* MPN/dL		Note #
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															

NOTES:

SURVEY QUALITY CONTROL TEST RESULTS

Precision control limits based on differences between duplicates		Abs	RPD[5]	RPD	Abs.	Abs.		Log Diff		
	A	≤ ±0.5	≤ ±7%	≤ ±5%	≤ ±0.3	≤ ±0.3		≤ ±0.6		
	B	≤ ±2	≤ ±10%	≤± 30%	≤ ±0.5	≤ ±1		≤ ±0.8		
	C	> ±2	> ±10%	> ±30%	> ±2	> ±2		> ±0.8		
SURVEY PRECISION										
SURVEY ACCURACY See page 2 for accuracy data		na						na		

Survey Comments

[3] **S**= sample; **P**= sample duplicate primary; **D**= sample duplicate; **SB**= sample blank; **SPT**= split sample
[4] Abs.Diff= Absolute difference between two results
[5] RPD= Relative Percent Difference = absolute difference between two results ÷ average of the two results

Sampling Survey Accuracy QC Check Information

Survey Name:_____ Survey Date:_____ Survey Team:_____

Turbidity Meter #:	**Pre Check Acc Date/Time:**				**Pre** Data Quality Level	**Post Check Acc Date/Time:**				**Post** Data Quality Level	Data Quality Criteria in % Diff	**Accuracy Data Quality Level**
Analyst Initials:	Std Value	Read	Abs. Diff	% Diff		Std Value	Read	Abs. Diff	% Diff			
Comments:											A ≤ ±5%,	
											B ≤ ±30%	
											C > ±30%	

Conductivity Meter #:	**Pre Check Acc Date/Time:**					**Pre** Data Quality Level	**Post Check Acc Date/Time:**					**Post** Data Quality Level	Data Quality Criteria in % Diff	**Accuracy Data Quality Level**
Analyst Initials:	Std Value	Temp °C	Read	Abs. Diff	% Diff		Std Value	Temp °C	Read	Abs. Diff	% Diff			
Comments:													A ≤ ± 7%	
													B ≤ ±15%	
													C > ±15%	

pH Meter #:	**Pre Check Acc Date/Time:**					**Pre** Data Quality Level	**Post Check Acc Date/Time:**					**Post** Data Quality Level	Data Quality Criteria in % Diff	**Accuracy Data Quality Level**
Analyst Initials:	Std	Temp °C	Theor Value	Read	Abs Diff		Std	Temp °C	Theor Value	Read	Abs Diff			
Comments:													A ≤ ± 7%	
													B ≤ ±15%	
													C > ±15%	

Appendix C: Revision History

Table D-2: Revision History

Version	Date	Summary	
1.1	11/14/2005	Added Table 11: QAPP Revision History List of Tables and List of Figures Captions to Tables and Figures Text to B10 to include CBO's map images of sampling sites	Steve Hanson & Chris Redman

Version	Date	Summary	
2.0	9/21/2009	QA information specific to split samples conducted by the DEQ with volunteer organizations was removed. More specific information follows A1- Title changed from "Water Quality Volunteer Monitoring" to "Volunteer Water Quality Monitoring"; Signature updated from Greg Pettit to Dennis Ades- current section manager. A2- Acronyms list added A3- Internal network link to find QAPP updated A4- Names and telephone numbers of project participants updated A5- Goal of plan expanded to include consistent QA procedures A6- Split information removed; list and timetable critical project QA procedures added A7-Measurement quality objectives discussion expanded to include sampling and measurement errors; accuracy and precision targets expanded in Table A7.1 and Appendix A; updated versions of the data quality matrix, the SOP for assigning DQL's to volunteer data, and the QAG on DQL's were added. A8- Specified that CBO project manager is responsible for volunteers getting trained. A9- Reduced list of documents to those relevant to the volunteer partners. B1- Split sampling design info removed; added descriptions of basic volunteer program designs and description of data grading process B2- Sample holding times updated in table B2. B3- Clarification on field and laboratory sample handling B4- Table B4.1 updated and added what is needed in the volunteer groups SAP when outside labs are used B5- Rewritten and added to more explicitly list required QC data for field, laboratory and split data. Table B5.1 added with summary of accuracy and precision data requirements. B6- updated B7- updated B8- updated; macro invertebrate supply list items for bug sorting and counting removed B9- removed irrelevant information B10- expanded description of data management requirements and updated Table B10.1; removed split sample information C1- Updated references for accuracy and precision determination and added guidance for analyzing laboratory analytical data. Removed annual split sample report which has not and will not be done C2- Included QC reports attached to each LIMS final report. D1- Updated D2- Changed emphasis from QC review to overall data review. D3- Identified DEQ's general data use policies for different DQLs. Appendixes: Changed figures to appendixes: Added quality control limits table for analytical parameters; updated field data sheet; Deleted Figure 2; Blue Form, Figure 3: RBS physical habitat field sheet	Steve Hanson

Version	Date	Summary	

Last page of document intentionally left blank