

Quality Assurance Project Plan

FOR

VOLUNTEER-BASED, WATER QUALITY MONITORING FOR THE WACCAMAW WATERSHED

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Date of Initiation:	6/15/2006

1. Title and Approval Page

Volunteer-Based, Water Quality Monitoring for the Waccamaw Watershed
(Project Name)

Coastal Carolina University
(Responsible Agency)

6/15/2006
(Date)

Project Manager Signature

Name/Date

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Name/Date

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Name/Date

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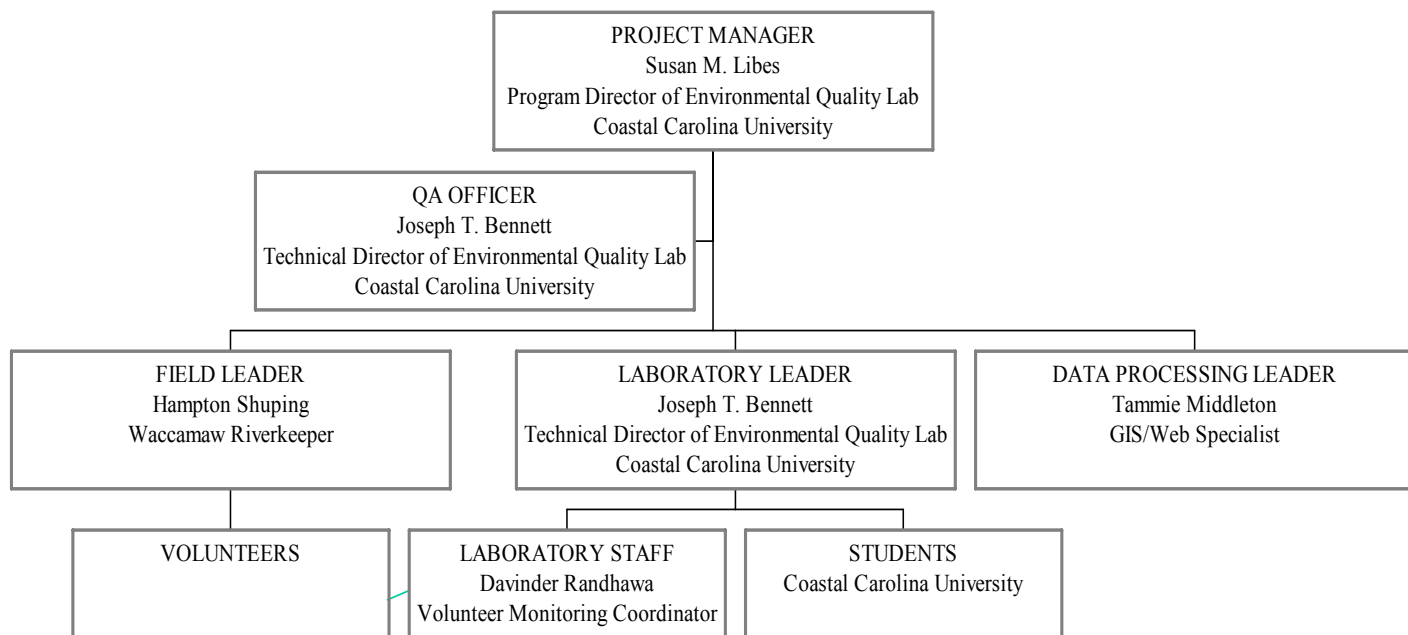
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Note: This manuscript contains description of the Quality Assurance Project Plan (QAPP) for the parameters to be recorded in the Phase I as well as the Phase II of the project. In other words, the QAPP is inclusive beyond Phase I in framework issues.

4. Project/Task Organization

The objective of this project is to initiate and stabilize a volunteer-based, water-quality monitoring program for the Waccamaw Watershed.

The organization and lines of responsibility for this project are as follows:



Responsibilities of the project's participants are as follows:

Project Manager

Project manager is the lead PI on the project and will oversee budget, personnel and reporting. The Project Manager is also the Program Director of the Environmental Quality Lab (EQL). The Program Director is a senior faculty member of Coastal Carolina University. The Program Director develops applied and basic research projects appropriate for utilizing and expanding the capabilities of the laboratory. The Program Director coordinates the involvement of students in the EQL to facilitate the laboratory goal of training students for careers in environmental chemistry and marine analytical technology. The Program Director meets frequently with the Laboratory Director to discuss and plan business EQL development activities.

Project QA Officer

The Project Quality Assurance Officer (QAO) is responsible for the direction of all laboratory quality assurance (QA) activities, and reports directly to the Project Manager. QAO responsibilities include development, documentation, and evaluation of quality assurance/quality control (QA/QC) procedures and policy. The QAO conducts internal audits, reviews data reports, compiles and evaluates method performance, trains staff in QA/QC requirements, tracks nonconformances and corrective actions, prepares quality documents and reports, reviews standard operating procedures (SOPs), and reports findings and quality issues to the Project Manager. A primary responsibility of the QAO is to ensure that all personnel have a clear understanding of the QA program, know their roles relative to one another, and appreciate the importance of their roles to the overall success of the project.

Field Leader

Field Leader for this project is also the Waccamaw Riverkeeper who is in contact with citizens interested in the river water quality. He is responsible for initial recruitment of the volunteers into the program. He will work with the project manager on sampling site selection and data presentation.

Volunteers

The main responsibility of a volunteer is to conduct water sampling. This entails following all the Quality Assurance and Quality Control guidelines including the standard operating procedures (SOP's) for the equipment to be used in the field. These guidelines have been developed after discussing with the Laboratory Leader.

Laboratory Leader

The Laboratory Leader oversees all functional aspects of the EQL. Duties include, but are not limited to, overseeing personnel training, equipment and systems maintenance, laboratory safety, working with customers to identify project-specific requirements, monitoring scheduling and status of work, approval of EQL standard operating procedures, implementing preventive and corrective actions, and cost control. The Laboratory Leader is ultimately responsible for the timely reporting of data and for ensuring that the data meet the project's specifications. Deputies to act in the Laboratory Director's absence include the Laboratory Quality Assurance Officer and the Laboratory Technician, relative to their particular work areas.

Laboratory Technician/ Volunteer Monitoring Coordinator

The Laboratory Technician reports directly to the Laboratory Director. For this project the technician will maintain the portable equipment and supplies used by the volunteers for

monitoring, will train the volunteers in the proper use of that equipment, and will serve as the primary liaison between the Field Leader and volunteers for questions concerning field sampling and measurements.

In the laboratory, the Laboratory Technician is responsible for generating technically valid analytical results to be reported on environmental samples and for documenting all data in support of those results. It is the responsibility of the technician to follow quality control procedures specified in laboratory standard operating procedures (SOPs), as well as the fulfillment of any project-specific quality control (QC) procedures that are designated for an analysis. Additionally, the technician must document any deviations from QC specifications that occur when conducting sample preparations, analyses, data entry, and data reductions and validation.

The Laboratory Technician also must perform, when applicable, instrument calibration, maintenance and troubleshooting. The Laboratory Technician may be required to write analytical SOPs at the direction of the QA Officer or Laboratory Director. The technician is responsible for critically observing and evaluating all procedures they perform, and for bringing any practices or occurrences that might affect the reliability of analytical data to the attention of the Laboratory Director or QAO. The technician is required to perform and document any necessary corrective action, enlisting the assistance of the Laboratory Leader or QAO when needed.

Students

The students working in the EQL report directly to the Laboratory Director. Students perform activities required to support laboratory operations, conduct sample analyses, and/or participate in independent study projects. This work, after completion of applicable training, may include sample preparation and analysis, maintenance activities on equipment (such as ovens, balances, and glassware), data archiving, research, and other duties, as needed. Each student is required to follow quality control procedures specified in laboratory standard operating procedures (SOPs), as well as the fulfillment of any special quality control (QC) procedures that are designated for an activity, and to document any deviations from QC specifications. He/she is also responsible for critically observing and evaluating all procedures they perform, and for bringing any practices or occurrences that might affect the reliability of analytical data to the attention of the Laboratory Leader or QAO.

Data Processing Leader

Data processing leader is responsible for collating and archiving the data deposited by the volunteer monitoring coordinator after QA/QC checks for the validity based on the Lab Control Samples readings recorded by the volunteers in the field. The Data processing leader also holds the responsibility of construction and maintenance of a database and a project website. The website will be up and running in the initial stages of the program for an efficient transfer of information (Project description, QA/QC guidelines, data reporting etc.) to the volunteer.

5. Problem Definition/Background:

A. Problem Statement

The Waccamaw Watershed is recognized as a unique and relatively pristine ecosystem threatened by an extraordinarily rapid pace of development. The major environmental impact of this growth is an increase in nonpoint source pollution carried by stormwater runoff. This watershed originates in the coastal plain of North Carolina and terminates in Winyah Bay, South Carolina. The proposed project seeks to moderate the impact of development on coastal ecosystem health and safety through an educational effort involving a watershed-wide water-quality monitoring program conducted by citizen volunteers.

B. Intended Usage of Data

The primary users of project-generated data will be the residents of Horry and Georgetown counties. The resulting water quality data will be posted on a web page hosted by CCU's Center for Marine and Wetland Studies and the Waccamaw Riverkeeper. This information will be presented in graphical format along with statistical analyses of temporal trends. Also provided will be a scorecard comparing the results to federal and state standards. These include swimming water criteria for bacteria and eutrophication criteria for nutrients, turbidity and dissolved oxygen.

Other data dissemination venues include presentations conducted by the Waccamaw Riverkeeper throughout the watershed. The results will also be given to SC DHEC as part of the Waccamaw Waterwatcher's annual report, to Mark Giffin, SC DHEC's Pee Dee watershed manager for inclusion in their next 305(b) reports. We also anticipate the city of Conway and Horry and Georgetown counties will be publishing the data to demonstrate compliance with their National Pollutant Discharge elimination System (NPDES) Phase II permits.

6. Project/Task Description

The Waccamaw riverkeeper has already formed volunteer squadrons in the upper, middle and lower South Carolina along the Waccamaw River. The volunteers will be invited to a training

session in the month of May 2006 at Coastal Carolina University (CCU).

Initially, monthly water sampling for temperature, pH, dissolved oxygen, and conductivity will be carried out all year round. As mentioned earlier, volunteers will be working in teams. Each team is responsible for sampling at the one or more designated sites. The sampling is scheduled for eight sites. The sampling meters and other piece of equipment like sampling bottles, ice cooler, beakers, distilled water, kim-wipes, extra batteries will be delivered to the volunteers a day before the scheduled sampling date. The volunteers who live near to the university might want to pick up the test kit from a designated room in the Center for Marine and Wetland Studies at CCU otherwise it will be delivered to them. Water samples, meters and field data will be collected from the volunteers towards the end of the sampling day. Calibrations for all the meters will be carried out in the lab, by the Volunteer Monitoring Coordinator, a day before sampling.

A Calibration Check will precede any field measurement. This will be performed by the volunteer using a Lab Control Sample (LCS) relevant to the parameter to be measured. Field data sheets will be collected on the day of sampling and scrutinized for any 'irrelevant' datum, followed by QC related calculations for the laboratory control samples (LCS) used by the volunteers. In the later stages of the project, the responsibility of calibrating the meters before use might be shifted onto some of the volunteers. Also, an increase in the frequency of sampling to twice a month is also anticipated soon after the whole project is up and running smoothly. This will depend fully on the performance and the comfort level of the volunteers.

Table 1: An example of a sampling cycle, assuming June 18 as the sampling day; from initial lab calibrations through final lab analysis.

Date	Time of the Day		
	8 am	1 pm	6 pm
June 17	Calibration of meters in the lab by VM Coordinator	Equipment Pick-up from EQL or delivery to the volunteers by VM Coordinator	
June 18 (Sampling day)	Sample Collection (temporary storage in an ice cooler) and Measurements by the Volunteers		
June 19	All samples and field data sheets relinquished to the Lab personnel		Lab analysis

Following each assessment, data will be entered into the computerized management system and analyzed.

An end year report will be produced and distributed in the month of January of each year. The project timetable is as follows:

Table 2: Annual Project Timetable

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Volunteer Recruitment and training/meeting					X				X		X	
Field Sampling						X	X	X	X	X	X	X
Lab Analysis						X	X	X	X	X	X	X
Data Evaluation/Processing and Reporting							X		X			X
Review of Sampling and Analysis (S&A) Plan									X			X
QAPP team meeting					X		X					X
Implementation of Revised S&A plan									X			X

7. Data Quality Objectives for Measurement Data

As previously stated the purpose of this project is to collect and analyze surface water samples in the Waccamaw watershed. This section establishes data quality objectives (DQOs) for measurement data to ensure collected and generated data satisfy the project’s and data users’ needs.

The quality of measurements made during the project is determined by the following DQOs, or characteristics: representativeness, accuracy, precision, measurement range, completeness, and comparability. Specific objectives for each characteristic are generally established to assist in the selection of appropriate sampling and analytical protocols and to identify applicable documentation, sample handling procedures, and measurement system procedures. These quality objectives are established based on site conditions, requirements of the project, and

knowledge of available measurement systems, and are addressed whenever appropriate for the data generated.

Representativeness

In our project the representativeness of the samples collected by the volunteers will largely depend on the on-site training of the volunteer. It will be made clear to the volunteers to:

- 1) Never sample stagnant water.
- 2) Preferably sample the outside curve of the river, as main current tends to hug this bank.

Accuracy

Accuracy describes the degree of agreement between an observed value and an accepted reference (true) value. DQOs for accuracy will be established through quality control limits for each parameter measured and for each analytical technique, per matrix where applicable (Table 2). Volunteers will be provided with the laboratory control samples (LCSs). These objectives will be assessed through the analysis of LCSs (reported as % Recovery) as specified by the analytical method. Nominal quality control limits for each parameter and analytical technique are specified in the analytical methods.

Precision

The data quality objective regarding precision will be assessed by making duplicate measurements in the field, for all the parameters of interest (Table 2). Volunteer (after demonstration of initial demonstration of capability in the lab training session) will report three readings for each parameter for a given sample on a scheduled sampling date. Wherever applicable and practical, laboratory replicates, and split laboratory samples, as specified by the analytical method, will be analyzed for each batch of samples.

Measurement Range

The measurement range for a parameter is determined primarily by the specific design of the measurement equipment and, if required, any processing of a sample (e.g., addition of reagent, dilution) before the final measurement. The lower boundary (i.e., reporting limit) of the range is determined by contaminant levels of the parameter of interest in reagents, lab ware, and equipment. The upper boundary of the range is established as the highest concentration level at which measurements of acceptable accuracy and precision can be made. Whenever an analysis method procedure is modified, the measurement range must be adjusted accordingly.

Completeness

Ideally, volunteers are expected to sample at all the eight sites on every scheduled date. Each group assigned to a site, will have two to four members, to ensure complete sampling at each site even if one of them is not available. If needed, sampling schedule will be adjusted, due to any potential reason (weather, local recreational activity, holiday, training a new volunteer etc.) that might hinder sampling. This adjustment depending upon the situation could be for whole of the watershed or for a few sites and will be done after discussing with the volunteers. In general, it is expected that samples will be collected from 90% of the sites.

Comparability

Standard sampling and analytical methods will be used. Units of reporting for the meters are standard and are commonly used elsewhere. Data comparison with the data being collected from other fresh water sites in the Horry County by the Environmental Quality Lab will be done to satisfy the data quality objective. Additionally, the EQL holds or is pursuing the applicable certifications in the SC DHEC Environmental Laboratory Certification Program for pH, Dissolved oxygen, temperature and turbidity.

The project's DQOs were determined by considering the intended uses of the data, the expected concentration ranges of the parameters to be monitored, and the capabilities of the measurement techniques. The field and laboratory monitoring parameters are listed in Table 1. The lists of parameters are not static and will be evaluated and revised periodically. Parameters listed as "Phase I" in Table 1 will be the initial monitoring parameters. After about six months the appropriateness of the initially selected monitoring parameters will be evaluated. The overall effectiveness (i.e., completeness of data collected) and practicality of the measurements will be evaluated. If believed warranted and practical, monitoring parameters will be revised; in particular, the additional parameters listed as "Phase II" candidate parameters will be considered.

Table 1. Field and laboratory monitoring parameters.

Project Phase	Field Monitoring		Laboratory Monitoring	
	Parameters	Comments	Parameters	Comments
Phase I – Initial Monitoring Parameters	Conductivity		Conductivity	Backup if field measurement unsuccessful
	Dissolved Oxygen			
	pH			
	Temperature		pH	Backup if field measurement unsuccessful
	Nitrate		Turbidity	
	Nitrite			
	Ammonium			
Phase II – Candidate Monitoring Parameters	Bacteria – Enterococci		Anions	Chloride, Fluoride, Nitrate, Nitrite, Phosphate, Sulfate
	Bacteria – Fecal Coliform			
	Bacteria – E. coli		Cations	Ammonium, Calcium, Magnesium, Potassium, Sodium
	Optical Brightner		Chlorophyll	
	Total nitrogen		Oil and Grease	
	Total Phosphorous			

Initially established DQOs for the field monitoring parameters are provided in Tables 2.

Table 2. DQOs for analyses of Phase I parameters.

Parameter	Units	Accuracy ^a (LCS %R)	Precision ^a (%RSD or RPD)	MDL	RL	MR
Conductivity	µS/cm	±5%	<20%	0.1	<5 µS/cm	0-199,900
Dissolved Oxygen	mg/L	±10%	<20%	0.1	< 1mg/l	0-20
	% Saturation	±10%	<20%	0.1	<5%	0-200
pH	pH units	±0.1 pH units	<20%	0.01	<2	0-14
Temperature	°C	±1°C	<10%	0.1	<10°C	0-50
Turbidity	NTU	10%	<20%	1	<1.0	1-400
Nitrate test strips	mg/l			0.5		0-
Ammonium test strips	mg/l			0.25		0-
LCS = laboratory control sample		% R = percent recovery				
MDL = method detection limit		RL = reporting limit				
MR = measurement range		RPD = relative percent difference				
NA = not applicable		% RSD = percent relative standard deviation				
^a Criteria apply to concentrations ≥ RL?						

Initially established DQOs for the laboratory monitoring parameters are provided in Tables 3.

Table 3. DQOs for analyses of Phase II parameters.

Parameter	Units	Accuracy ^a (LCS %R)	Precision ^a (%RSD or RPD)	MDL	RL	MR
Enterococci by IDEXX Enterolert <150 CFU/100 mL	CFU/100 mL	NA	≤200	<10	<10	0-2400
Enterococci by IDEXX Enterolert ≥150 CFU/100 mL	CFU/100 mL	NA	≤100	NA	NA	0-2400
E. Coli by Colielert or M-Colibblue						
Total Nitrogen	mg/L	±30%	<25%			
Total Phosphorus	mg/L	±30%	<25%			
Chlorophyll	µg/l	10%	<25%	0.2	<0.2	0-200
Optical Brighteners						
LCS = laboratory control sample MDL = method detection limit RPD = relative percent difference MR = measurement range NA = not applicable			% R = percent recovery RL = reporting limit % RSD = percent relative standard deviation			
^a Criteria apply to concentrations ≥ RL.						

8. Training Requirements and Certification

The generation of reliable data by the project requires that all operations be conducted by knowledgeable and trained personnel. The project requires the accomplishment of a prescribed sequence of training objectives by all participants before that individual is designated qualified and permitted to independently conduct any assignment or analyses. The indoctrination and qualification process includes as a minimum:

- Reading and understanding applicable project or laboratory SOP,

- Reading and understanding applicable reference documents,
- Hands-on training under the supervision of an experienced and qualified individual, and
- For analytical methods used for measurements, a successful initial demonstration of analytical capability (i.e., IDC) by performing four replicate measurements which satisfy precision and accuracy criteria for the method (IDC Form 113, Appendix A).

Training records are maintained by the Project QA Officer, and training files are kept for all laboratory staff and volunteers participating in the project. A summary of training accomplishments is recorded on a Personnel Qualification Record, Form 110 (Appendix A).

It is mandatory that each volunteer goes through a three step training procedure. First step of the training is orientation sessions (held in different parts of the watershed) where volunteers are provided with the answers to some basic questions about the project. This is done to equip the volunteers with an understanding of the context of the project, importance of volunteer monitoring and to give them an idea of the background activities like funding sources, QAPP certification, and data usage. This session is thought to be important in the respect that after understanding almost every aspect of the project volunteers might come up with some ideas that might be helpful in improving project coordination and efficiency.

The initial orientation sessions organized by the coordinator will include a presentation on the background and importance of Volunteer Monitoring:

- Watershed description
- Sampling sites
- Success stories about water Quality monitoring in the US
- Introduction to QA and QC concepts
- Emphasis on the importance of their effort and that it should produce the data of highest quality.
- Description of the test kit and the associated equipment.

Second step will be the indoor training session. It will be held in the laboratory at Coastal Carolina University. They will be trained to do dip in temperature, pH, DO, and conductivity measurements. The initial training does not involve calibration of the instruments by the volunteers. They will be handed the meters after all the calibration procedures for the meters have been completed in the lab. They will be provided with a Lab control sample (LCS) for the field parameters to be measured. LCS will be used for a calibration check before actual measurement. Volunteer monitoring coordinator is responsible for calibrating the meters each time within 24 hrs before sampling and handing the equipment to the volunteers. In this training session each volunteer should make three replicate measurements from the laboratory control samples (LCSs). And document the data on the field data sheets.

The data collected on the first day of training from both the LCS and the sample measurements will be evaluated and checked against the data quality objectives.

The third step of training will be in the field. On this day, the volunteer monitoring coordinator visits each sampling site along with the volunteers. The entire site related sampling issues will be discussed with the volunteers. In particular, it will be made sure that the volunteer chooses a specific place for sampling, which he feels comfortable sampling from and which does not compromise the DQO of representativeness. All future samples will be collected from the selected place of sampling. The volunteer follows the standard sampling procedure under the supervision. If any volunteer has fallen short on an objective as shown by the first day evaluation (indoor training session), he will be observed carefully and possible suggestions will be given. As described in the SOP's, a typical sampling for a parameter of interest will include the measurement of a LCS as well. Thus, on the second day, each volunteer takes three sample readings from his site plus the LCS sample reading.

9. Documentation and Records

Data and associated records from field activities, laboratory activities, and support activities are provided in Table 6.

Table 6. Data and records generated by different activities.

Activity	Data Generator	Data Type	Data Format	Forms ^a	Reference ^b
Sample collection	Sampler/Volunteer	Field information	Written Chain-of-Custody	EQL COC, Form 218	SOP 302
Sample receipt	Laboratory Technician	Receipt custody and temperature	Written Chain-of-Custody	EQL COC, Form 218	QAM 4.2
			Receipt Log Spreadsheet	Receipt Log, Form 220	QAM 4.3
Internal custody	Laboratory Technician	Time and location of storage	Written Chain-of-Custody	Form 217 and 217C	QAM 4.4
Analysis	Laboratory Technician	Conductivity, Turbidity and pH measurements	Written log sheets		
Data review, verification and validation	Laboratory Technician	Analysis results	Run Log Spreadsheet	Run Log	QAM 7.1
Report	Laboratory Director	Analysis results	Electronic template / database		
^a All forms are provided in Appendix A					
^b Referenced SOPs are provided in Appendix D and QAM = EQL QA Manual					

Storage of Records

All laboratory paper records are stored in file cabinets within the secure laboratory facility for a period of one to three years. After that period the records are placed in labeled boxes and transferred to a locked room in a nearby separate university building. Electronic data are stored in the laboratory's desktop computers and on a restricted access (i.e., access

restricted to Laboratory Director and Laboratory Technician) intrauniversity network. Backup copies of electronic media are prepared at least annually and stored in a secure area off-site.

Retention of Records

Records are stored for a nominal period of at least ten years. Records are stored for longer periods if requested or required by the customer or regulatory authority.

Requests for Records

Access to recent (i.e., within the previous year) laboratory records is restricted to laboratory personnel. Access to archived laboratory records is restricted to the Laboratory Director and Laboratory Technician. All requests for laboratory records should be directed to one of those individuals. Original documents shall not be taken from the file storage area without permission from one of the listed individuals, and copying and distribution of such documents must also have their authorization.

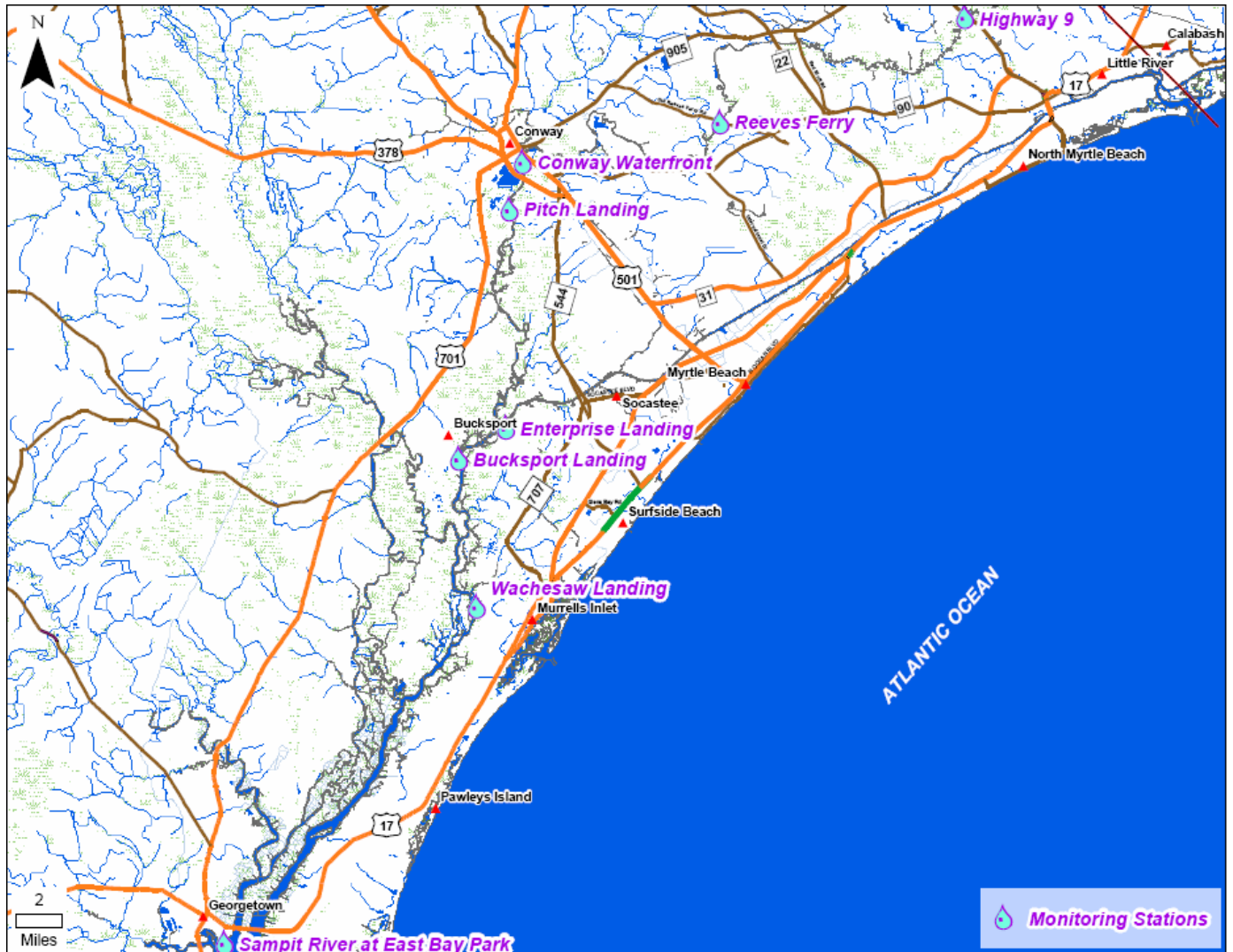
10. Sampling Process Design

A. Rationale for Selection of Sampling Sites

Waccamaw watershed monitoring will be done at nine sites in South Carolina. SC DHEC are currently sampling ten sites, in the watershed, mostly in the main stem of the river. We are hypothesizing that stormwater runoff is a significant source of pollution, so we will collect samples along the main stem of the Waccamaw River (n = 9). Some of the main stem sites will overlap with SC DHEC for quality control. Thus the proposed work will expand upon routine monitoring, thereby filling in large data gaps caused by insufficient funding at the state level. We plan to incorporate macroinvertebrates sampling, using Index of Biotic Integrity (IBI), into the project at a later stage.

B. Sampling Design Logistics

Sites location and description is as follows:



Above figure shows some of the topographical features of the Waccamaw River. The Waccamaw river is one of the four major rivers that comprise the Pee Dee Basin or Winyah Bay Watershed. The Waccamaw River originates in North Carolina in a series of swamps that surround Lake Waccamaw. The Lake itself contributes only a small volume to the overall discharge of the river because a small dam controls its outflow. The river is about 140 miles in length, starting from the lake Waccamaw to the Atlantic Ocean. The small elevation gradient (0.45 feet per mile) causes it to have a relatively low flow and a very wide floodplain covered by hardwood swamps. This also makes the total number of stream miles very large as the river meanders through the swamps and links up with numerous tributary creeks (Libes, 2003).

All the selected sites are along the main stem of the river. All sites are open for public access and therefore, no permission is required to conduct sampling on any of the selected sites.

11. Sampling Method Requirements

Specific procedures for sample container preparation and sample collection are provided in EQL SOP 301 (Sample Container Preparation) and EQL SOP 302 (Sample Collection) (Appendix D). A summary of sample collection, handling, and preservation requirements is provided in Table 10.

Table 10. Sample collection, handling, and preservation requirements.

Parameter Measured	Sampling Equipment	Sample Container	Minimum Sample Size*	Preservation Method/ Transportation/ Storage
Conductivity (Field)	Hach CO150 or Sension5 Conductivity meter	1000 ml wide-mouth plastic bottle	500 mL	NA
Conductivity (Lab)	Hach CO150 or Sension5 Conductivity meter	1000 ml wide-mouth plastic bottle	100 mL	Store in refrigerator at 1-4 °C, analyze within 28 days
pH (Field)	Hach EC 10 or Sension156 pH meter	1000 ml wide-mouth plastic bottle	NA	NA
pH (Lab)	Hach EC 10 or Sension156 pH meter	1000 ml wide-mouth plastic bottle	NA	Analyze ASAP (preferably within 2hrs of receipt)
Temperature (Field)	Hach meter	1000 ml wide-mouth plastic bottle	NA	NA
Dissolved Oxygen (Field)	Hach Sension6 or Sension156 DO meter	1000 ml wide-mouth plastic bottle	300 mL	NA
Turbidity (Lab)	Orbeco-Hellige digital Turbidimeter	1000 ml wide-mouth plastic bottle	NA	Store in dark, refrigerate; Analyze within 48 hrs.

* Minimum sample size is based on the recommendations by Franson et al (1989).

Sampler collectors will normally be the monitoring volunteers but may also be the Laboratory Director, Laboratory Technician, or CCU students trained in sampling. In general, samples collected are surface water grab samples (i.e., sample collected at a specific time and place) and collected manually. Samples are collected using glass or plastic sample bottles. Bottles will be rinsed three times with the sample water prior to sample collection. Sample will be collected

carefully as to not contaminate by touching the inside of either the bottle or its lid. The bottle is filled with sample upto the brim, and then the lid is replaced. The bottle is then placed in a cooler with ice for transport to the laboratory.

Samples collected by EQL personnel are placed in appropriate containers, having the required preservatives or additives, and labeled with site-specific information to uniquely identify each container at the time of collection. Conditions at sampling sites, sample IDs, number of samples, dates/times of collection, equipment calibrations, etc., are recorded on site in field data sheets or on EQL chain of custody forms as appropriate. Until their delivery to the laboratory, samples are stored in coolers with ice at 1-4 °C. Sample receipt will be logged onto the Chain of Custody form.

12. Sample Handling and Custody Requirements

For all sample collection, handling, receipt, treatment and storage, the associated record keeping procedures are integral parts of the project's QA program. The chain-of-custody policies are designed to ensure that each sample is accounted for at all times. The primary objectives of sample control procedures are as follows:

- Each sample received for analysis is uniquely identified,
- The correct samples are analyzed and are traceable to the applicable data records,
- Important and necessary sample characteristics are preserved,
- Samples are protected from loss, damage, or tampering,
- Any alteration of samples during collection or shipping (e.g., filtration, preservation, breakage) is documented,
- Records of sample custody (i.e., chain of custody) and integrity are established which will satisfy legal scrutiny, and
- A record of ultimate sample disposition (i.e., disposal or release from laboratory) is established.

A. Labeling sample

Sample bottle label must be unique for a sample collected from a particular site and written with indelible ink on the sample bottle label. The label should have three items; Site ID, Date of sampling (MMDDYY) and the sample collector's initials. The volunteers will be asked to use the same initials as they used for the sign-up during recruitment. A "VM" number (explained later) is written on the sample bottle after sample receipt.

For EQL samplers at the time of lab receipt, a chain of custody (COC) Form 218 (Appendix A) must be filled out. The following information must be recorded:

- Date of sample collection
- Time of sample collection
- Location of sample

- Environmental conditions (e.g., wind, sun/cloud cover, rain, runoff.)
- If the sample bottle was labeled correctly or not
- Name of sampler
- Lab personnel to whom the sample was relinquished.
- Number and types (i.e. pH, DO, conductivity, test strips) of data sheets collected from each volunteer sampling team.

B. Sample Custody

The sample collector is considered to have custody of the sample until relinquishing the sample. The sample is properly in the custody of the sampler as long as the sample is in possession of the sampler, within sight of the sampler, or locked in a secure place. When the sampler relinquishes custody he/she should sign, date, and write the time the sample was relinquished on the COC form. Sample receipt in the laboratory is indicated by Laboratory Director or Laboratory Technician accepting the sample and documenting it on the COC form. The person receiving the sample should then sign, date, and write the time the sample was received on the same line. The sample can be relinquished to other qualified individuals in the same manner. If the same individual transports the sample to the lab and processes that sample in the laboratory, then that person will record both accepting and relinquishing the sample on the COC form.

For samples not collected by EQL staff but remanded to EQL custody must be documented on a chain of custody (COC) form.

C. Sample Receiving

Samples must be delivered to the laboratory in coolers packed in ice less than 48 hours (for turbidity analysis in the lab; a phase I parameter) after sample collection. The sample holding time will be changed to 6 hrs when bacteria analysis is started in the phase II. At the beginning of sampling, a sample bottle containing water should be placed in the cooler with ice, and then upon delivery of the cooler to the laboratory, the water in this bottle is measured to verify sample receipt temperature.

Prior to accepting custody and signing for the samples, the laboratory representative verifies that all samples submitted are listed on the COC and that the COC documentation is complete. Received samples and corresponding documentation are carefully reviewed for compliance with regard to condition of containers, sample preservation and temperature (i.e., reading temperature of water blank in the cooler), holding times (collection date/time), and accurate identification on the COC.

Once the COC has been verified against the delivered samples, sample information is entered into the laboratory receipt log. The receipt log (Form 220) for samples is kept as a Microsoft Excel spreadsheet. The file is password protected.

D. Sample Identification and Storage

Samples received by the laboratory are identified by unique laboratory identification numbers. The first two characters (“VM”) identify it as an EQL sample. The next two characters identify the year in which the sample was received (i.e., 06 represents the year 2006). The final four characters are numbers assigned sequentially to identify the sample relative to the order that the sample was received. The sample number VM06-0023 therefore is the 23rd Waccamaw river water sample received in the year 2006 by the EQL for analysis.

The sample’s EQL laboratory number is transcribed to each container associated with that sample using an indelible marker. Numbered samples are stored in secured areas according to aliquot preservation requirements.

At the end of the day or as soon as practical, the section of the receipt log covering all samples received on that day is printed and placed in a logbook in chronological order. The printed sheet(s) must be reviewed by the QA officer for correctness and then initialed at the bottom of the sheet where it states:

“Printed (date of printing) by _____” and “Approved (date of printing) by _____”

These hard copy pages of the receipt log are numbered sequentially. In the event an error is later found in the receipt log, the change must be made in the spreadsheet and then corrected on the appropriate hard copy page. The hard copy corrections must be made by drawing a single line through the error, writing the correct data above or to the side, and initialing and dating the entry.

E. Sample Distribution and Handling

Retrieval of samples from their designated storage areas must be documented using EQL form 217, which is an internal COC record. Personnel removing samples from the storage areas are required to record the sample numbers removed, date, time, and their initials on the form. Staff must also document on form 217 the date and time samples are returned to storage. Where necessary, several coolers and a refrigerator in the laboratory are used for temporary storage of samples requiring refrigeration and awaiting preparation or analysis.

While identifying samples with parameters with critically short hold times (i.e., less than 48 hours) notification is provided verbally or in writing to the laboratory analytical staff on the day of receipt of such samples. Once notified, it is the responsibility of the analyst to perform the requested analysis within the appropriate hold time.

F. Sample Disposal

In general, samples are disposed of 30 days after results have been reported. All sample

container labels are removed or obliterated prior to disposal. Samples are drained into conventional drain to the municipal sewage treatment system. The date of sample disposal is recorded on the EQL's internal COC form (Form 217).

13. Analytical Method Requirements

Analytical method SOPs are the key guidance documents for analysis activities in the laboratory. The analytical method SOPs use the following general format:

- SOP Title Number, Revision Number, Date and Page Number header
- Review and Approval Signature Block
- Scope/Application
- References
- Definitions
- Safety
- Method (Apparatus/Materials, Reagents, Procedures, Quality Control, Corrective Action)
- Calculations

The analysis methods used for field and lab analyses are listed in Table 11.

Table 11. Analytical methods for field analysis

Parameter	Analysis Description	Reference Method	Standard Operating Procedure
Conductivity	By electrical conductivity using Hach CO150 or sension6 Portable Conductivity Meter	SM 2510 B.	
Dissolved Oxygen	By membrane electrode method using Hach sension6 or sension156 Portable Dissolved Oxygen Meter	SM 4500-O G.	
pH	By electrometric method using Hach EC10 or sension156 Portable pH Meter	SM 4500-H+ B. EPA 150.1	
Temperature	By thermometer or thermistor using Hach CO150 or sension6 Portable Conductivity Meter	SM 2550 B. EPA 170.1	
Turbidity	By nephelometry using Orbeco-Hillage turbidity meter	SM 2130 B.	

14. Quality Control Requirements

Quality control procedures for measurements for this project are summarized in tables 14- . Table 13 lists by parameter the individual QC summary tables (Tables 14 -).

Table 13. Listing of quality control summary tables by parameter.

Parameter	Table Identification
Conductivity	Table 14
pH	Table 15
Dissolved Oxygen	Table 16
Temperature	Table 17
Turbidity	Table 18

Table 14. QC requirements for field analysis for conductivity by Hach conductivity meter.

QC Sample or Activity	Minimum Frequency	Acceptance Criteria	Corrective Action
Capability demonstration	Attend training sessions in the initial phase of the project and re-training as required by the project needs.	LCS recovery and duplicate precision attained	Repeat until acceptable
Laboratory control sample	Daily prior to sample analysis using provided LCS	90-110% R for <200 $\mu\text{S}/\text{cm}$ 95-105% R for ≥ 200 $\mu\text{S}/\text{cm}$	Investigate, identify and correct any problem. If no obvious problem, recalibrate and reanalyze entire batch with back-up sample.
Field duplicate (i.e., separate sample collected at same site as initial sample)	Once every four months for each sampling site. Three replicate measurements will be done on each sample every sampling time.	Not Applicable; Used to determine natural variability within the site plus variability introduced by sampling	If high variability-increase sampling frequency or investigate site.
Sample duplicate	Once every four months for each sampling site	$\text{RPD} \leq 20$	If system (meter) precision is in control, qualify results. If system precision is out of control then reanalyze entire batch.
LCS = laboratory control sample %R = percent recovery RPD = relative percent difference			

Table 15 . QC requirements for analysis for Hach pH meter

QC Sample or Activity	Minimum Frequency	Acceptance Criteria	Corrective Action
Capability demonstration	Attend training sessions in the initial phase of the project and re-training as required by the project needs.	LCS recovery and duplicate precision attained	Repeat until acceptable
Laboratory control sample	Daily prior to sample analysis using provided LCS	±0.1 pH units	Investigate, identify and correct any problem. If no obvious problem, recalibrate and reanalyze entire batch with back-up sample.
Sample duplicate	Once every four months for each sampling site	RPD ≤ 20	If system (meter) precision is in control, qualify results. If system precision is out of control then reanalyze entire batch.
Field duplicate (i.e., separate sample collected at same site as initial sample)	Once every four months for each sampling site. Three replicate measurements will be done on each sample every sampling time.	Not Applicable; Used to determine natural variability within the site plus variability introduced by sampling	If high variability-increase sampling frequency or investigate site.
LCS = laboratory control sample %R = percent recovery RPD = relative percent difference			

Table 16 . QC requirements for analysis for Hach Dissolved Oxygen meter

QC Sample or Activity	Minimum Frequency	Acceptance Criteria	Corrective Action
Capability demonstration	Attend training sessions in the initial phase of the project and re-training as required by the project needs.	LCS recovery and duplicate precision attained	Repeat until acceptable
Laboratory control sample	Daily prior to sample analysis using provided LCS	90-110%	Investigate, identify and correct any problem. If no obvious problem, recalibrate and reanalyze entire batch with back-up sample.
Sample duplicate or matrix spike duplicate	One (1) every four months for each sampling site	$RPD \leq 20$	If system (meter) precision is in control, qualify results. If system precision is out of control then reanalyze entire batch.
Field duplicate (i.e., separate sample collected at same site as initial sample)	One (1) every four months for each sampling site. Three replicate measurements will be done on each sample every sampling time.	Not Applicable; Used to determine natural variability within the site plus variability introduced by sampling	If high variability-increase sampling frequency or investigate site.
LCS = laboratory control sample %R = percent recovery RPD = relative percent difference			

Table 17. QC requirements for analysis for Oebec-Hillger turbidity meter

QC Sample or Activity	Minimum Frequency	Acceptance Criteria	Corrective Action
Capability demonstration	Attend training sessions in the initial phase of the project and re-training as required by the project needs.	Criteria for LCS recovery and duplicate precision	Repeat until acceptable
Laboratory control sample	Daily prior to sample analysis using provided LCS	95-105%	Investigate and identify and correct any problem. If no obvious problem, recalibrate and reanalyze entire batch.
Sample duplicate or matrix spike duplicate	One (1) per four months	$RPD \leq 20$	Investigate problem. If system precision is in control, qualify results. If system precision is out of control, reanalyze entire batch.
Field duplicate (i.e., separate sample collected at same site as initial sample)	One (1) per four months	Not Applicable; Used to determine variability within the site plus variability introduced by sampling	NA
LCS = laboratory control sample %R = percent recovery RPD = relative percent difference			

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

Manufacturer recommended preventative maintenance schedules must be performed internally for all equipment. All the meters will be calibrated within 24 hrs prior to use.

Maintenance logs must be used to document any procedures performed either internally, or by vendor service technicians. Documentation in the logs is the responsibility of the analyst or technician operating the instrument or equipment and will use existing EQL logs.

A summary of preventive maintenance activities for equipment utilized for this project is provided in Table 8.

Table XX. Instrument and equipment preventive maintenance.

Instrument	Frequency	Preventive Maintenance
Conductivity meter	Each use	Rinse probe and check battery
Dissolved Oxygen meter	Each use	Rinse probe and check battery; Check membrane and change if needed.
Controlled temperature equipment (refrigerator)	Daily	Check temperature and adjust if needed
	Annual	Check temperature distribution, check electrical cord, clean instrument
pH meter	Each use	Rinse probe, refill electrode storage solution
	As needed and annual	Clean probe, replace probe electrolyte, check electrical cord
Thermometers	Annual	One-point or two-point calibration
Water deionizing system	Each use	Check water resistance
	Semi-annual	Sterilize, change final filter
	Annual	Check connections and electrical cord, change exchange cartridges if needed
Analytical Balance	Each use	Check level and adjust if needed, clean after use
	Monthly	Clean, level, calibration verification
	Annual	Annual maintenance service, check electrical cord

16. Instrument Calibration and Frequency

Equipment requiring calibration must be calibrated according to manufacturer's instructions or the analytical method. General guidelines for analytical instrument calibrations are covered in the corresponding analytical SOPs.

The following minimum information must be recorded in a calibration log or on the field data sheet: equipment identification (Model number and serial number), calibration date, analyst initials, standard(s) used, equipment reading(s) per standard, calibration verification standard(s) results.

It is the responsibility of the analyst performing the calibration to record this information in the calibration log.

17. Inspection and Acceptance Requirements for Supplies

To maintain efficient, safe, and high quality operations in a laboratory, it is essential that standardized and clearly understood procedures are used for ordering and the receipt of materials and services. Consequently, the EQL requires its staff to follow the CCU's specific procurement procedures. These procedures include standard practices for source verification, ordering, receiving, inspection and testing, recordkeeping, and, if necessary, return of faulty equipment to the vendor for repair.

18. Data Management

Field data sheets will be inspected by the VM coordinator and signed to document review by the end of the sampling day. Within three days, he is expected to get back to any sampler who had committed an error or missed some important information and draw the volunteer's attention to the issue to avoid it in the future. If a field data value is missing for a sample, the sample collected from the volunteer will be used as a lab backup for analyzing the sample for that analytical parameter. The samples, which were not properly preserved or had passed their recommended holding time, will be discarded (ref. Section 12 F.). All the data reviews will be checked by the QA officer. The data sheets will be stored in the EQL in designated logs. And data will be entered into the receipt log.

A. Data Generator Review and Verification

Data generators (i.e., the analyst or personnel conducting analyses) are responsible for conducting real-time review and verification of 100% of the data resulting from their activities. This review must be documented by the data generator's signature and review date on the field data sheet and on a data review checklist (ref. Appendix). Data generators are accountable for ensuring that all data they generate are complete, accurate, and compliant with applicable requirements (QAM, SOP, method). VM coordinator is responsible for performing all data reduction required prior to independent technical review and reporting, and for notifying the Laboratory Director and/or QAO of any problems encountered during analysis and data review that may potentially impact data quality.

B. Peer Review

All the laboratory data must be peer reviewed (i.e., independent technical review and validation). The independent technical reviewer(s) must be a qualified individual other than the data generator (e.g., Laboratory Director). He/she must meet the minimum training and qualifications requirements for analysts (ref. Section 8). Individuals not qualified to perform

biogeochemical data interpretation cannot perform independent technical review. The independent reviewer(s) must ensure that:

- Data generation and reduction were conducted in a technically correct manner in accordance with the methods used.
- Data are reported in the proper units and with the correct number of significant figures.
- Calculations were performed with a valid calculation program (Microsoft Excel) and are correct. Calculations are checked by a spot check of verified calculation programs or 100% check of all hand calculations.
- All variances from an accepted method and the rationale for the variations were documented and approved.
- Data were reviewed for transcription errors.
- QC measurement results are within established program specification limits, or if not, the data are appropriately qualified.
- Analytical sample holding times were met, or exceptions are documented.

This independent technical review is required before any data are approved for release and submitted to the data reporting process. The independent technical review process is documented with a signed and dated data review checklist.

19. Assessment and Response Actions

A. Assessments:

Assessments are tools used to examine laboratory systems as they normally operate and to determine if quality assurance needs (Data quality objectives, chain of custody etc.) of the project are being met by current policies. Review of the Waccamaw river volunteer monitoring is the responsibility of the volunteer monitoring coordinator in conjunction with the QAO and the Project Manager. Each sampling team will be accompanied and their performance will be evaluated twice a year. If errors were identified consistently, more retraining will be scheduled. Volunteers who need more improvement in their sampling and measurement skills will be retrained. Additionally, a yearly re-training session will be held. The laboratory is evaluated through surveillance (e.g., an analyst's initial demonstration of capability (IDC) exercise, data generator review), and peer review.

i) Demonstration of Capability

An analyst's training on a given method must involve an initial demonstration of capability (IDC) performed without the supervision of a qualified analyst. To do this the analyst must prepare three aliquots of a known level of the analyte of interest, analyze them according to the appropriate method, and demonstrate the ability to recover the analyte within established acceptance criteria. Acceptance criteria for IDCs, depend on analytical

technique and are listed on the EQL's IDC form, Form 113. Calculation of IDC results is performed by either the analyst or the QAO. Results are filed in the employee/volunteer technical training file.

ii) Data Generator Review and Verification

See Section 18 A.

iii) Peer Review

See Section 18 B.

iv) Internal Audits

Internal audits are conducted by the EQL Quality Assurance Officer (QAO). An audit may be performed by another designated staff member who is knowledgeable of the process.

Activities of an internal audit include, but are not limited to the following:

- Review of the SOP against the referenced method(s)
- Review of the procedure with a staff member who routinely performs the process
- Review of data files for complete and proper documentation, calculations, and quality control frequency (examination may include all testing records showing standardization, spikes, duplicates, and QC samples from one or more analytical runs)
- Review of logbooks for accuracy and completeness
- Review of the process for compliance with laboratory QA policies including error corrections, corrective action, reagent labeling policies, etc.

EQL internal audits occur at minimum of one laboratory area per quarter. Areas are defined by method or technique for analytical audits and by section for operational activities audits. Auditing in this manner allows for a comprehensive, on-going review of several areas throughout the year. The scheduling of the quarterly audits is at the discretion of the QAO and Laboratory Director.

v) External Audits

External audits are initiated primarily by states, agencies, or affiliations through whom EQL holds some form of certification or contract. Audits of this nature cover the entire scope of the accreditation and project tasks, including sample handling, preparation, analysis, and reporting for all parameters. The level of detail of an external audit is at the discretion of the auditor as related to the lab's responsibilities and activities described in the project QAPP.

B. Response Actions/Corrective Actions:

Corrective actions like repairs to equipment, revision of an SOP to eliminate a repetitive problem, or obtaining an approved variance to a procedure will be done in response to any of the following:

i) Nonconformances

Nonconformances are items or conditions of a process, which do not meet, established SOP, method, or project requirements. As described in EQL SOP 201, "Nonconformance Identification and Corrective Action", all nonconformances, and the corrective actions taken, must be documented in a Non-Conformance/Corrective Action Report (NCR). Completion of a NCR should include not only a description of the problem and corrective actions but also copies of any documentation to support the same. NCRs must be routed through the QAO and Laboratory Director for approvals and closure. All NCRs are logged, and originals are retained in QAO files.

ii) Variances

A variance is a type of corrective action involving an approved change to a process or procedure. A variance describes a deviation from a method, which affects the operation of the method, but not the method's ability to achieve the performance standards or quality assurance objectives required. Variances must be requested in writing and receive approvals from the Laboratory Director and QAO.

iii) Emergency Alternatives Policy

Under extreme or unavoidable circumstances (such as equipment failure, or irreconcilable matrix difficulties) samples may not be able to be analyzed by methods specified by the client or program. Alternative procedures may be acceptable. Laboratory staff identifying the problem must notify the Laboratory Director. This communication must take place prior to reporting the results of the test by the alternate method and must be documented.

20. Reports

After completion of analyses, analysts enter results for both samples and QC measurements into the laboratory's computer-based report templates (i.e., spreadsheets or SQL database). After peer review of the data is completed and the results are acceptable, the Laboratory Director reviews the preliminary report and works with necessary laboratory personnel to make any needed corrections. The results will be uploaded on the project web page. Annually, the results will be compiled and distributed to the Volunteer Monitoring Project funding agencies for inclusion in

their Phase II reports to SC DHEC.

For electronic data deliverables (EDDs) in Microsoft Excel or similar formats, files are maintained on the laboratory's desk top computers and the university's intranet, with access restricted to the Laboratory Director and Laboratory Technician. Backup copies of the electronic files are prepared at least annually and stored in a secure area off-site.

QA Progress Reports:

A monthly QA progress report will be submitted to the Laboratory Leader and Project Manager by the VM coordinator. As a minimum, the report will provide the following:

- A summary of precision, accuracy and completeness for all samples analyzed
- Identification of any problems that could affect the quality of the data collected, the project schedule, or the completion of the project
- A summary of any corrective actions implemented and their results
- Explanation of any changes in the project's experimental design, objectives, or staffing
- Explanation of possible need for additional equipment to achieve project objectives
- Explanation of possible need for additional staff to achieve project objectives
- A summary of overall data quality evaluation and usability

21. Data Review, Validation, and Verification Requirements

All processes at EQL (sample receiving and handling, sample analysis, data reduction, data reporting, data review, etc.) are subject to examination to evaluate adherence to project specifications. The Volunteer Monitoring Coordinator, Quality Assurance officer and the Project Manager will review QA progress reports to determine if the QAPP objectives are being met. This examination consists of several layers of technical and QA review. These reviews ensure that all data released by EQL were scrutinized by qualified independent reviewers and are scientifically sound, appropriate to the method, completely documented, and legally defensible.

All data shall receive analyst review and independent analyst (i.e., qualified peer) review. The Laboratory Director and QAO also review the data to varying degrees at different points in the review process. These review processes are appropriately documented before data are released from the laboratory. All of these steps are described in detail in section 21 A and 21 B.

A. Data Review, Verification, and Validation

Data review ensures that field data are properly collected, reduced, and reported. *Data verification* confirms by examination of the measurement process and provision of

evidence, that specified requirements have been met. For example, QC measurements must indicate that deviations between measured values and known values are smaller than the maximum allowable error. At EQL, a data review checklist (DRC) for each analytical process outlines the performance criteria for the process. The worksheet or checklist is completed and signed for each analysis batch by both the analyst and a qualified peer to document the process as described earlier in the *Data Generator Review* (ref. section 18 A) and *Verification and Peer Review* (ref. 18 B) subsections of this section of the QAPP.

The EQL review process must examine as a minimum the following data recording requirements for analyses:

- All original data must be recorded, signed, and dated in black waterproof ink.
- All data must be recorded clearly and accurately in laboratory records, bench sheets, or logbooks, and include applicable sample identification numbers.
- All changes and additions to original data must be made with a single-line drawn through the error with the correction entered above or next to the line-out. White-out, correction tape, or similar correction techniques must not be used for changing laboratory data. The change must be initialed and dated by the individual making the change (an explanation of the change or addition must be included if the change or addition deals with rejecting data).
- All data used from logbooks and laboratory records must be transferred and reduced completely and accurately.
- All laboratory records shall be maintained in permanent files.
- Data shall be organized into standard formats.
- All electronic data shall be stored appropriately to ensure that sample and QC data are protected and readily retrievable. Corrections made to hardcopy data must also be made in electronic data files whenever possible.

The final step in the data validation and usability determination in the EQL analysis and reporting process is the project management review conducted by the Laboratory Director.

B. Project Management Review

One hundred percent of the data reports must receive a relational technical review by the Laboratory Director. This review must ensure that:

- Data are technically reasonable based on the technique used.
- Reported analytical data documentation or data package meets the project's data quality objectives (DQOs) and includes, data forms, QC measurement results, narrative comments, COC forms, NCR's , Data review check lists (DRC) and sample tags, as appropriate to the report level requested.
- Quality control (QC) criteria (e.g., holding times, spike criteria, etc.) were met, or exceptions documented.
- Relationships between related parameters are scientifically reasonable.

The project management relational review occurs after all data entry is complete and analytical peer review has taken place. This project management review is documented by the Laboratory Director's signature and date on the final reports.

22. Validation and Verification Methods

If field data sheets or the lab sample analysis record that the QC checks were out of the acceptance range, then the lab sample will be analyzed by the Volunteer Monitoring Coordinator. The cause of the discrepancy will be identified and solved. If the problem persists and is encountered by more than 20% of the volunteer groups then changes in the instructions for the volunteers (SOP's), acceptance limits etc. will be made. These issues will probably be identified and resolved in the initial stages of the project.

Once the data is entered into the spreadsheet, it is printed, and proof read by the Volunteer monitoring coordinator against the field data sheets and double checked by Lab Director. Errors in the data entry will be corrected. Problems with data quality will be discussed in the QAPP team meetings.

23. Reconciliation with Data Quality Objectives

Reconciliation of data with DQOs to determine data usability is performed primarily by the Laboratory Director working in direct communication with the analysts. Data that do not satisfy project DQOs may necessitate reanalysis of involved samples or other corrective actions to satisfy the DQOs. If DQOs cannot be satisfied (e.g., no sample available for reanalysis) and data must be reported, an explanation appropriately qualifying the data must accompany the report of analysis.

E. REFERENCES

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Appendix A

i) EQL Standard operating Procedures

S no.		SOP no.
1	Sample container Preparation	301
2	Field Sampling	302
3	pH measurement using Hach Sension156 meter	611
4	pH measurement using Hach EC10 meter	610
5	Conductivity measurement using Hach Sension5 meter	613
6	Conductivity measurement using Hach CO150 meter	612
7	Dissolved Oxygen measurement using Hach Sension 156 meter	615
8	Dissolved Oxygen measurement using Hach Sension6 meter	614

i) Volunteers Field Standard operating Procedures

S no.		SOP no.
1	Sampling day steps to be followed	NA
2	pH measurement using Hach Sension156 meter	711
3	pH measurement using Hach EC10 meter	710
4	Conductivity measurement using Hach Sension5 meter	713
5	Conductivity measurement using Hach CO150 meter	712
6	Dissolved Oxygen measurement using Hach Sension 156 meter	715
7	Dissolved Oxygen measurement using Hach Sension6 meter	714
8	Test strips	716

Appendix B

i) EQL Quality Assurance Forms

S no.		Form no.
1	Initial Demonstration of Capability Form (IDC)	113d
2	Receipt Log	220d
3	Internal chain of custody form	217
4	Qualification record form	110
5	Volunteer chain of custody form	218d
6	pH calibration log	114a
7	Conductivity calibration log	114b
8	Dissolved oxygen calibration log	114c
9	Data review check list	NA

ii) Field Data Forms

S no.		Form no.
1	PH field data form	NA
2	Conductivity field data form	NA
3	Dissolved Oxygen field data form	NA
4	Test strips data form	NA