Surface Water Sampling
(Rivers and Streams)

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Preface

The Watershed Protection Branch (WPB) of the Georgia Environmental Protection Division (GAEPD) has created a series of standard operating procedures (SOP) establishing uniform methods for the field collection of data, document control, quality assurance, laboratory safety, as well as other activities. These guidance documents were developed to document, and ensure, the validity of measurements, analyses, repeatability, and the representativeness of samples collected. This is necessary in the event of a dispute with other parties regarding data collection techniques and the resulting quality of field information. Enforcement activities by the Branch require full documentation on particulars of data collection and the equipment used to collect it. All Branch associates who collect samples or field data must be familiar with the measures outlined in the appropriate SOP's.

Requirements pertaining to specifics of sample collection for certain parameters are specified in federal regulations under the authority of the Clean Water Act (CWA) and the National Pollutant Discharge Elimination System (NPDES) permitting program. The most widely applicable guidance at this level is *Title 40 of the Code of Federal Regulations (40 CFR)*. The procedures and techniques given in *40 CFR* are updated periodically by the United States Environmental Protection Agency and field workers are advised to consult the latest revision for proper procedures and new developments. In addition, the SOPs utilized by the Branch should be reviewed annually to certify their concurrence with federal statutes. Other references used in developing each SOP are cited at the conclusion of the individual documents.

The collection protocols in *40 CFR* are in many instances based on the concern for quality assurance. As such, each SOP will contain a section devoted to maintaining and improving the quality of data collected. 'Quality Assurance and Quality Control' sections contained within individual SOPs are not meant to replace the overall Quality Assurance Project Plan documents prepared for the Branch, but rather, are provided as supplemental data for each specific, standardized activity.

This document is dynamic and will be continually revised as new developments warrant. As the Branch assumes more responsibilities for studying and sampling in new investigational areas, it is anticipated that additional SOPs will be required.

A. Introduction

The Watershed Protection Branch (WPB) of the Georgia Environmental Protection Division (GAEPD) is responsible for managing the surface waters of the State of Georgia. The WPB works to ensure that Georgia's surface waters are of a quality and quantity sufficient for fulfilling multiple uses within the State by controlling nonpoint sources of pollution, managing storm water discharges, and regulating the amount of discharges to, and withdrawals from, surface waters. These tasks are accomplished through the issuance of National Pollutant Discharge Elimination System (NPDES) permits to local governments and industry for the discharge of treated wastewater and to local governments, industry, farmers and subdivisions for surface water withdrawals. However, none of these tasks would be possible without the vital data collected through water quality monitoring.

Water quality monitoring is integral to the WPB's successful management of the waters of the State. Monitoring and studies conducted by the WPB can be broadly categorized as either enforcement or non-enforcement related activities. The enforcement related monitoring includes water enforcement case investigations, NPDES compliance sampling inspections (CSIs), some diagnostic evaluations of municipal and industrial wastewater treatment plant discharges, and monitoring of sewage spills into surface waters. Monitoring conducted that does not have a specific enforcement objective includes trend monitoring, surveys to verify issued permit limits, waste load allocation and model calibration studies, and other intensive surveys for documenting water quality.

Monitoring is accomplished through surface water sampling events planned in accordance with the type, amount, and time frame of data required. Surface water sampling techniques and equipment have been designed not only to minimize possible contamination of the chemical and physical integrity of the sample, but also to provide a sample that is representative of the water body under investigation. If the guidance provided in this standard operating procedure (SOP) is followed, an unbiased, representative sample of the surface water should be obtained.

> *Because studies and data derived from non-enforcement type investigations could be used for enforcement purposes at a later time, both investigations follow the procedural guidelines presented in this document.

B. Purpose and Applicability

The purpose of this SOP is to establish uniform procedures for sampling the surface waters of the State of Georgia. The procedures outlined in this SOP are applicable to all Branch associates who collect, or assist in the collection of, surface water samples in support of water quality and compliance monitoring.

C. Summary of Method

Surface water samples are collected in accordance with the guidelines outlined in this SOP at intervals previously established in the Plan of Work (see SOP# EPD-WPMP-1). In-situ water quality parameters are measured using a multi-probe and the water stage is noted using either an established tape down point, or by reading a previously installed staff gage. Water samples are collected as the multi-probe stabilizes. The collected water samples may be instantaneous (grab) samples, discrete depth samples, or composite samples. If a composite sample is collected, a compositor is used to combine the individual samples into one homogeneous sample. Then, regardless of sample type, the sample is divided among one or more containers and preserved, if needed. Sample identification labels, detailing the sample location, collection date, collection time, and responsible Associate are adhered to the sample bottles. Laboratory Source Documents (Green Sheets) are completed, the samples are packed in ice, and then shipped to an appropriate, State certified laboratory.

D. Definitions

1. **Churn sample splitter** – A device used to composite individual samples into one homogenous sample from streamflows. Collected samples are poured into the splitter and mixed into one representative cross section sample of stream flow. The mixing action results from plunging a perforated disk up and down through the sample at a rate of approximately 9 inches per second.

2. **Clean Water Act (CWA)** – As amended in 1977, the Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave the U.S. EPA the authority to implement pollution control programs such as setting wastewater standards for industry. The Clean Water Act also contains requirements to set water quality standards for all contaminants in surface waters. The Act made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. It also funded the construction of sewage treatment plants under the construction grants program and recognized the need for planning to address the critical problems posed by nonpoint source pollution.

3. **Compliance Sampling Inspections (CSI)** – Studies which monitor permitted discharges for compliance with NPDES permits.

4. **Composite Sample** – A sample in which over a period of time, over multiple points across a water body, or over multiple depths, representative aliquots of a surface water are collected either manually or automatically and combined into one, homogenous sample.

5. **Discrete Depth Sample** – A discrete depth sample collects water from a specified depth in the water column using a specialized sampling device.

6. **Grab Sample** – A grab sample is an instantaneous sample from one point in the water body. This produces a sample that is representative of the surface water's quality at the moment the sample was taken.

7. **Intensive Survey** – An intensive survey is a study that incorporates many different fields of research to fully understand the complexity of a water system. In most cases, this includes tributary and lake sampling for water quality characteristics, biotic life, sediment quality, and flow status. These studies tend to be a minimum of a year in duration.

8. **Multi-probe (Data sonde) –** A water quality meter consisting of multiple probes for analyzing parameters of interest. For the purposes of GAEPD's monitoring, these probes will generally consist of ph, dissolved oxygen (DO), conductivity, and temperature.

9. **National Pollutant Discharge Elimination System (NPDES)** – As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal and other facilities must obtain permits if their discharges go directly to surface waters.

10. **Peristaltic Pump** – Commercially available pump that uses flexible pump tubes on a roller to systematically sample representative aliquots of water over a period of time. These tend to be used at stationary, monitoring stations to monitor complete hydrographs over a storm event, or in long term, intensive surveys when loading or trend data are desired.

11. **Special Response Investigation** – A special response investigation is a study conducted in response to a complaint or request submitted by a member of the general public, a water treatment facility operator, a member of a municipal government, a citizen's action group….etc.

12. **Surface water(s) of the State or surface water(s)** – Any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs producing in excess of 100,000 gallons per day, and all other bodies of surface water, natural or artificial, lying within or forming a part of the boundaries of the State which are not entirely confined and retained completely upon the property of a single individual, partnership, or corporation.

13. **Surface water trickle sampler** – A sampler designed for manual sampling of surface waters. The rate of filling is slow enough so that the apparatus can be lowered rapidly to the desired depth before much filling occurs and the body and cover are precisely machined for airtight, watertight closure.

E. Health and Safety Warnings

Collection and analysis of surface water samples can involve significant risks to personal health and safety. The sampler should treat all water samples as if they contain a chemical contaminant or biological agent that could cause illness and minimize exposure to both the sample and sampling medium. The sampler should wear appropriate personal protective equipment and appropriate clothing when conducting sampling events. Planning for any type of field sampling should include extensive health and safety considerations including required training (CPR, First Aid, Boating Safety), personal protective equipment, and degree of personal, physical condition in accordance with Federal, State, or organizational requirements.

F. Cautions

All Associates conducting sampling from bridges, or using transportation right-of-ways to access sampling sites, should wear high-visibility safety vests at all times.

Concentrated acids (nitric, sulfuric) are used to preserve metals and nutrient samples. Both preservatives are corrosive and toxic. Care must be taken when handling them.

When it is necessary to climb down bridge embankments to sample water, be extremely careful and avoid trip hazards, steep drop offs, slick terrain, and areas filled with rip-rap which could result in injury. It is advisable to wear closed toe, lug soled wading boots when dealing with these kinds of situations.

During extremely hot weather, be sure to pack plenty of fluids and drink often to ward off the risk of heat exhaustion and heat stroke.

During extremely cold weather sampling, be cautious to avoid ice on bridges and on trails leading to the water's edge.

During warm weather, pay attention to where you step to avoid contact with snakes, yellow jackets, poison ivy, and other venomous plants and animals.

*Field sampling should **NEVER** be conducted alone. Sampling teams should always consist of a minimum of two Associates.

G. Interferences

The purpose of representative sampling is to characterize the true picture of the surface water at the time of sampling. Contaminants introduced into the sample containers through careless handling, or by using "dirty" preservatives can bias the true picture. Common contaminants include, but are not limited to:

- Careless handling of sample container lids

- Stirring of bottom sediments in sampling area and subsequent introduction into sample
- Use of bottles which have been lying unprotected in work vehicle for extended periods of time
- Use of previously used sample containers without proper cleaning and rinsing
- Careless transfer of sample from one container to another
- Failure to pre-rinse sample compositor with sample water between sites
- Introduction of grit and dirt into sample from sampler rope lying on bridge between collections

H. Personnel Qualifications

All Branch associates who collect surface water samples or field data must be familiar with the procedures outlined in this document. In all aspects of water quality planning and field assessment activities, safety is to be addressed and treated as a critical element. The Georgia DNR *Safety Manual* is to be consulted and its policies, protocols, and procedures are to be incorporated and implemented in WPB field activities.

I. Procedural Steps

Sampling station characteristics often dictate the equipment and method of sampling to be used. The field team on site will be responsible for determining the most appropriate sampling methodology to employ. The following is a list of sampling techniques employed by the GAEPD in water quality monitoring. Each listed technique is followed by: a brief overview of possible situations that could be encountered in the field in which the technique should be employed; a list of required equipment; and, procedural steps for completing the sampling activity. This list of sampling techniques, and subsequent procedures, are intended to be dynamic and will be amended as needed when new sampling conditions are encountered.

1. **Preparations for Field Sampling-** Before leaving for the field, ensure that all necessary materials are present and accounted for in the vehicle. The following are required for all water quality sampling events, regardless of technique employed:

-Sample Bottles
-Trickle Sampler, churn splitter, stainless steel bucket (NOTE: If samples are to be collected using a stainless steel bucket, etch or mark lines on the churn splitter at 1/3 and 2/3 of its total capacity to ensure equal filling from each point sample.)
-Rope
-Carbouy filled with DI water
-Multiprobe sonde and sonde guard calibrated the morning of the planned sampling event, with spare batteries
-Engineer's measuring tape with weight (for tapedown)
-Safety Vests
-Disposable gloves
-Bottle Labels
-Log book

-Chain of Custody (COC) Forms
-Clear packing tape
-Enough coolers to properly store and cool samples
-Cooler liners and bags for COC forms
-GPS, gazeteer, and written directions for the sampling route
-DO titration kit and pH test strips

Before leaving the office, ensure that you have all bottles necessary for the day's sampling events. Always bring 1-2 more bottles than necessary. If the samples must be shipped, ensure the coolers are properly prepared and you have all materials necessary for shipping:

1. Make sure your district office address is clearly marked on the coolers so that the lab knows where to return it.
2. Place a heavy weight plastic liner inside the cooler before filling it with ice.
3. Fill the cooler ¾ full with ice, and pour off any water that has accumulated in the cooler prior to shipping
4. Make sure you have small Ziploc bags (for the chain of custody forms, clear packing tape, and overnight shipping labels with the correct destination address)

Ensure that all electronic water quality measuring devices (i.e multiprobe datasondes, turbidimeters, etc) are calibrated and functioning in accordance to the guidelines within the GAEPD calibration SOP (EPD-WPMP-7). In short:
-All multiprobe datasondes MUST be calibrated prior to departure. Any sonde utilized in the field must undergo a calibration check after sampling has been completed for the day.
-Datasondes regularly used in the field must undergo weekly maintenance as outlined in the calibration SOP. Maintenance should occur after all sampling events for the week have been completed.
-Turbidimeters must be checked for accuracy once per month and calibrated every quarter.
-Documentation demonstrating all calibration events must be held for at least two years in the event of data audits for potential water quality criterion violations.
-Calibration should occur within proximity of the sample sites such that a variance of no more than 15 mmhg absolute pressure exists between the initial calibration and sample locations. If the pressure at the sample sites differs by more than 15mmhg, consider recalibrating the DO meter using temperature-stable water.

2. On-Site Preparation- Upon arrival at a site, park the vehicle within as close proximity as possible to your sampling point while minimizing risk to you and the vehicle. If you are parking on the side of the road, ensure that the shoulder is both wide enough to allow the vehicle to be completely off of the main road and allows for staff to enter and exit the vehicle without risk of walking into incoming traffic. Turn on the vehicle's emergency lights before departing for the sample location, and put on safety vests before exiting vehicle. Place an air thermometer near the sample location such that it is not on the ground or in direct sunlight. Associates must wear a new pair of disposable gloves at each site while conducting any of the methodologies described below.

3. Composite Sampling from Bridge – If a representative sample is required from a large, non-wadeable surface water, or access to the waterway itself is not possible due to hazardous conditions or private property concerns, bridge sampling is often the only way to proceed. A

trickle water sampler is lowered from the bridge at 3 points across the horizontal width of the surface water and homogenized.

Equipment and Supplies

Field Notebook, writing instruments
Water Quality Multiprobe (data sonde) and data logger
Sensor guard
Storage cup
Engineer's measuring tape and weight (for tapedown)
Sample containers – appropriate bottles for parameters of interest and laboratory conducting analyses
Trickle style water sampler
Churn sample splitter
Sample bottle labels, clear tape or tape strips for sealing labels
Coolers with ice
Stainless steel bucket
Rope
Safety vests
Disposable gloves
Carboy filled with DI water

Procedure

- Remember to conduct all sampling and measurements at the same points every visit, if possible.
- One associate will manage the multi-probe deployment, tape down/gauge measurements, turbidity measurements, and paperwork (including the log book, labels, and chain of custody form), while the other associate will collect the water samples. The suggested order of operations for the associate not collecting the samples is to: 1. deploy the sonde; 2. conduct the tapedown/gauge reading (if applicable); 3. return to the vehicle and fill out/apply bottle labels; and 4. return to the probe, log in-situ measurements and weather/stream conditions, retrieve the probe, and return to the vehicle.
- The water quality multi-probe is deployed at approximately 1 meter below the water's surface at mid-channel, with the circulator turned on (if applicable). If the water is less than 2 meters deep, deploy the probe at mid-depth. Note that the probe body must be fully submerged in order to collect an accurate reading. The probe may rest on the stream floor only if A) the water is too shallow to accommodate otherwise, or B) the current is too swift to allow the probe to remain at a depth of 1 meter. If the probe must rest on the bottom, attempt to orient it such that the sensors are facing upstream, and make a note of the probe location/depth in the log book. If, in the event that the water quality of a shallow stream bed is drastically different from the surface (i.e., slow moving shallow streams with a heavy detrital layer at the bottom, thus producing an anoxic environment near the stream floor), the probe may be deployed such that the sensors are suspended just beneath the water's surface and the body is not submerged. If the probe must be deployed in this manner, attempt to orient the unit within a shady area of the stream crossing, and ensure that the sensors are fully submerged. The probe is allowed to stabilize for 5-10 minutes (depending on conditions) before the reading is taken.
- If applicable to the site, a tapedown can be conducted using a weighted measuring tape from the preselected mark on the bridge to the water's surface. In some instances, a staff

gage will have been installed prior to the commencement of the water monitoring study. In these cases, all that is required is reading the gage at the point where the surface of the water makes contact. Please see the Stream Gauging SOP (EPD-WPMP-??) for the tapedown methodology.

- Before collecting a composite water quality sample, a subsurface grab will be collected to rinse the sampler and the compositor. This is a very important step in lessening the chance of cross contamination between sample sites. Remove the cap from the trickle sampler and place it in the churn splitter. Lower the sampler over the bridge just enough to collect a subsurface sample. Pour the sample water into the churn splitter. "Swish" the cap through the water and reattach to the trickle sampler. Replace the churn splitter cover and swirl for 5 seconds. Open the nozzle and allow sample water to flow through for 2-3 seconds, close the nozzle, and pour the rest of the water out.
- Three samples are collected across the water body; one at the horizontal midpoint of the stream, and one each at points halfway between the midpoint and the edge of downstream flow (fig. I-1). If the flowing portion of the wetted width is less than 1.5 meters wide, then three center-channel grabs may be collected. Avoid sampling in areas that are stagnant or contain backflow. Collect on the side of the bridge (up- or downstream) that was determined to be most feasible during the reconnaissance of the site. If an unforeseen event occurs that renders the usual sample side unsafe or infeasible (i.e. new beaver dam, shoulder closed for construction, etc.), then collect the samples from the opposite side of the bridge and note the change in location within the logbooks.
- Collect each sample by lowering the polypro water sampler to the bottom of the water body (as quickly as possible without damaging the unit) and then retrieving it at a constant rate sufficient to collect a representative sample from the entire water column and fill the sampler by the time it breaches the surface. In order to determine the retrieval rate, place the trickle sampler just below the water's surface and measure the length of time required for bubbles to stop emerging from the sampler. This is the amount of time required to fill the sampler. Lower and raise the sampler in such a way as to minimize rope contact with the side of the bridge (fig. I-2). This will help prevent foreign debris from entering the sample container.
- If the water is too swift or shallow to collect a depth-integrated sample, then a sub-surface grab may be collected with either a stainless steel bucket, or by removing the cap from the trickle sampler.
- Pour the retrieved sample into the compositor after each collection. Ensure that the top remains on the compositor at all times in order to prevent sample contamination from foreign debris.
- Once the samples have been collected, they are composited by churning action in the compositor, and dispensed into the various required sample containers. Maintain a constant rate of churning while filling each of the sample bottles. Do not allow the nozzle to contact the bottle while filling. Collect the turbidity sample prior to filling the other bottles, so that the temperature of the water within the cuvette has time to equilibrate with the air. If Ortho-phosphorus samples are collected, the analyte must be filtered in the field:

Ortho-Phosphorus Field Filtration

Materials:

-Latex or nitrile gloves

-1-4 filters (will vary depending on turbidity of sample)

-syringe

--Take one sterile syringe and pull out the plunger. Remove the paper backing from one of the filter packages, but leave the filter in the package.
--Screw the filter onto the syringe.
--Fill the syringe with sample water. Take care not to let the nozzle of the churn splitter touch the syringe.
--place the plunger into the syringe, and remove filter package from the syringe/filter assembly.
--place the filter over the open o-phos collection bottle and plunge the sample water through the syringe until it is empty or the filter is clogged. If the filter clogs, hold the syringe so that the filter points upward, remove the old filter, and attach a new one.
--filter two syringes worth of water, at least 100ml.
When finished, dispose of the used filters and separate the used syringes from the sterile.

- Ensure that the labels attached to each sample bottle indicate the correct site location, time, date, and Associate that conducted the sampling. If the labels are not waterproof, they must be attached prior to filling the bottles and sealed with clear tape.. Place the samples in the cooler such that they are completely covered by ice.
- Rinse the sampling containers with DI water prior to departing to the next site.

Figure I-1. Three samples are collected across the water body; one at the horizontal midpoint of the stream, and one each at points halfway between the midpoint and the edge of downstream flow. Avoid sampling in areas that are stagnant or contain backflow.

Figure I-2. Take care to minimize rope contact with the side of the bridge when collecting samples.

4. Composite Sampling while Wading

Equipment and Supplies

Field Notebook, writing instruments
Water Quality Multiprobe (data sonde) and data logger
sensor guard
Storage cup
Engineer's measuring tape and weight (for tapedown)
Sample containers – appropriate bottles for parameters of interest and laboratory conducting analyses
Stainless steel bucket
Churn sample splitter
Sample bottle labels, clear tape or tape strips for sealing labels
Coolers with ice

Procedure

- One associate will manage the multi-probe deployment, tape down/gauge measurements, and paperwork (including the log book, labels, and chain of custody form), while the other associate will collect the water samples. The suggested order of operations for the associate not collecting the samples is to: 1. deploy the sonde; 2. conduct the tapedown/gauge reading; 3. return to the vehicle and fill out/apply bottle labels; and 4. return to the probe, log in-situ measurements and weather/stream conditions, retrieve the probe, and return to the vehicle.
- Proceed to the water's edge by the safest route possible.
- The water quality multi-probe is deployed on the stream floor at mid-channel UPSTREAM of the associate collecting samples, with the circulator turned on (if applicable). Attempt to orient it such that the sensors are facing upstream at an upward angle. Note that the probe body must be fully submerged in order to collect an accurate reading. The probe should be allowed to stabilize for 5-15 minutes (depending on conditions) before the reading is taken. Take care to disturb the stream substrate as little as possible while deploying the sonde.
- A tapedown is conducted using a weighted measuring tape from the preselected mark on the bridge, culvert, or other monument to the water's surface. In some instances, a staff gage will have been installed prior to the commencement of the water monitoring study. In these cases, all that is required is reading the gage at the point where the surface of the water makes contact. If the tapedown/gage reading cannot be performed without standing in the stream, wait until the samples are collected before conducting this task. Please see the Stream Guaging SOP (EPD-WPMP-??) for the tapedown methodology.
- The second associate will collect the water sample while the first Associate is deploying the multi-probe and conducting the tapedown. Rinse the bucket with stream water prior to collecting the first sample. Fill the bucket at most halfway with water, swirl for 3-4 seconds, and pour into the churn splitter. Replace the churn splitter cap and swirl for 5 seconds. Open the nozzle and allow sample water to flow through for 2-3 seconds, close the nozzle, and pour the rest of the water out downstream.
- Three samples are collected across the water body; one at the horizontal midpoint of the stream, and one each at points halfway between the midpoint and the edge of downstream flow (fig. I-1). If the flowing portion of the wetted width is less than 1.5 meters wide, then three center-channel grabs may be collected. Dip the stainless steel bucket beneath the surface of the water just upstream of your position and fill the churn splitter to 1/3 of its capacity. If the churn splitter is left at the bank, take care to walk downstream of your sample line while walking to and from the splitter (fig. I-3). Repeat this at the other two points. Note: Make sure that the first two points sampled are not located directly downstream of the sonde. This will allow time for any sediment introduced into the water from its placement to travel downstream beyond the sampling region.
- If the site is experiencing higher-than-normal flow and it is impossible to judge the depth of the water, DO NOT collect samples via wading. Deploy the sonde and collect the samples from the bank, and note the change in procedure in the logbook. If you are sampling an urban stream during a rain event, DO NOT collect samples via wading, as flash flooding can occur.
- Once the samples have been collected, they are composited by churning action in the compositor, and dispensed into the various required sample containers. Maintain a constant rate of churning while filling each of the sample bottles. Do not allow the nozzle to contact the bottle while filling.

- Ensure that the labels attached to each sample bottle indicate the correct site location, time, date, and Associate that conducted the sampling. If the labels are not waterproof, they must be sealed with clear tape.. Place the samples in the cooler such that they are completely covered by ice.
- Rinse the sampling containers with DI water prior to departing for next site.

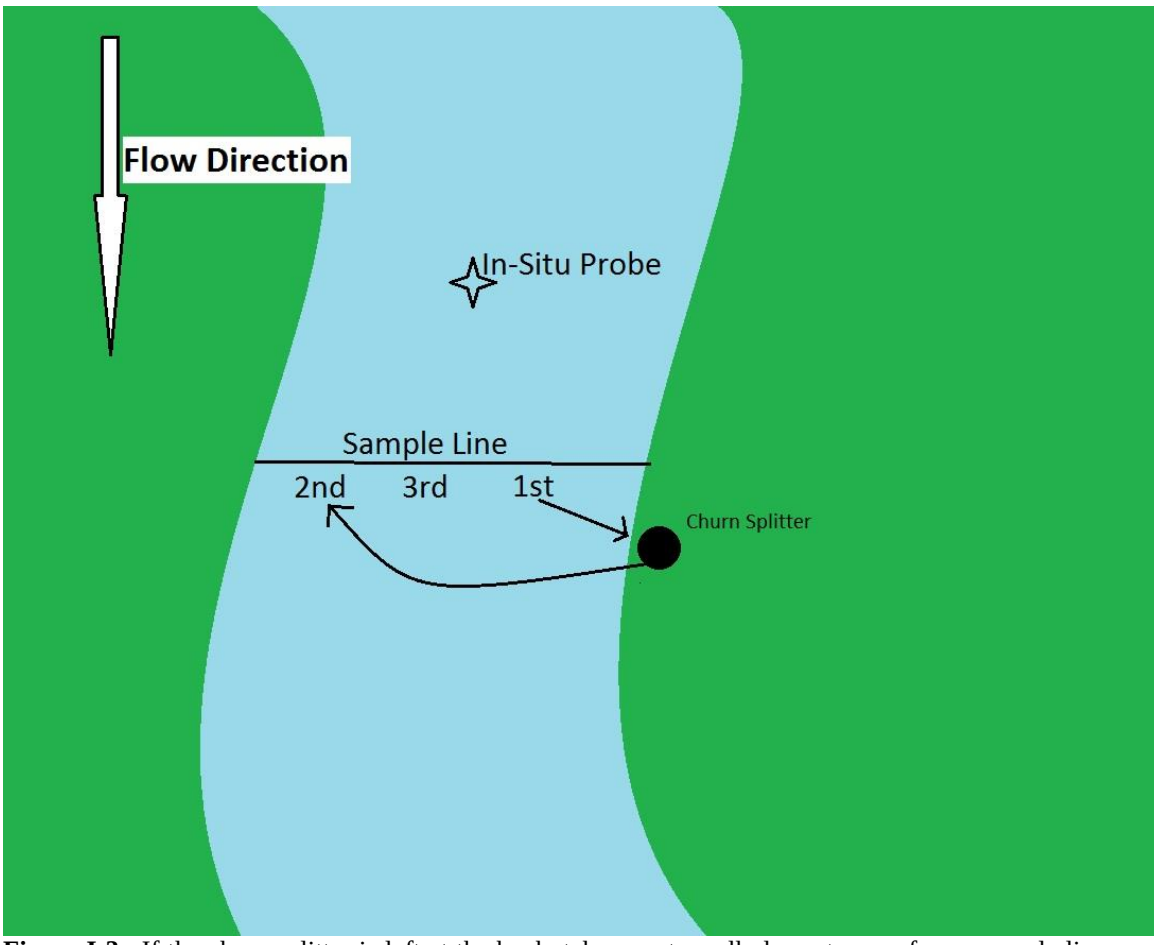

Figure I-3. If the churn splitter is left at the bank, take care to walk downstream of your sample line while walking to and from the splitter. Make sure that the first two points sampled are not located directly downstream of the sonde.

5. Composite Sampling of River from Boat – If a representative sample is required from a large, non-wadeable surface water, and bridge sampling is not an option, a composite sample collected from a boat will be necessary. A Polypro water sampler is lowered from the boat and samples are collected from multiple points across the horizontal width of the stream and homogenized.

Equipment and Supplies

Field Notebook, writing instruments
Water Quality Multiprobe (data sonde) and data logger
Sensor guard
Storage cup
Trickler style water sampler

Sample containers – appropriate bottles for parameters of interest and laboratory conducting analyses
Churn sample splitter
Sample bottle labels, clear tape or tape strips for sealing labels
Coolers with ice

Procedure

- Prior to departing in a boat, all Associates should don their high-visibility; U.S. Coast Guard approved personal flotation devices.
- Associates then proceed to the sampling location(s) by the safest route possible.
- The division of labor when sampling from a boat will depend on the type of boat used and the physical condition of the stream sampled. If only two associates are on the boat, one may have to devote their full attention to maintaining boat position while the other performs all other facets related to sampling. If an anchor is available, one associate can deploy the sonde and fill out the labels while the other collects the water samples.
- If applicable, depth can be determined using a boat-mounted depth finder, or in some instances, a staff gage will have been installed on a bridge pylon prior to the commencement of the water monitoring study. In these cases, all that is required is reading the gage at the point where the surface of the water makes contact.
- The water quality multi-probe is deployed into water so that probe is located at mid-channel approximately 1 meter below the water's surface with circulator turned on. The probe should be allowed to stabilize for 5-15 minutes (depending on conditions) before the reading is taken.
- Before collecting a composite water quality sample, a subsurface grab will be collected to rinse the sampler and the compositor. This is a very important step in lessening the chance of cross contamination between sample sites. Remove the cap from the trickle sampler and place it in the churn splitter. Lower the sampler over the bridge just enough to collect a subsurface sample. Pour the sample water into the churn splitter. "Swish" the cap through the water and reattach to the trickle sampler. Replace the churn splitter cap and swirl for 5 seconds. Open the nozzle and allow sample water to flow through for 2-3 seconds, close the nozzle, and pour the rest of the water out.
- Three samples are collected across the water body; one at the horizontal midpoint of the stream, and one each at points halfway between the midpoint and the edge of downstream flow. Avoid sampling in areas that are stagnant or contain backflow. Because the sonde readings are to be reflective of conditions at mid-channel, sample that point last. This way, the sonde can stabilize at mid-channel while the sample bottles are filled, labeled, and stored.
- Collect each sample by lowering the polypro water sampler to the bottom of the water body (as quickly as possible without damaging the unit) and then retrieving it at a constant rate sufficient to collect a representative sample from the entire water column and fill the sampler by the time it breaches the surface. In order to determine the retrieval rate, place the trickle sampler just below the water's surface and measure the length of time required for bubbles to stop emerging from the sampler. This is the amount of time required to fill the sampler.
- If the water is too swift to collect a depth-integrated sample, then a sub-surface grab may be collected with either a stainless steel bucket or by removing the cap from the trickle sampler.

- Pour the retrieved sample into the compositor after each collection. Ensure that the top remains on the compositor at all times in order to prevent sample contamination from foreign debris.
- Once the samples have been collected, they are composited by churning action in the compositor, and dispensed into the various required sample containers. . Maintain a constant rate of churning while filling each of the sample bottles. Do not allow the nozzle to contact the bottle while filling.
- Ensure that the labels attached to each sample bottle indicate the correct site location, time, date, and Associate that conducted the sampling. If the labels are not waterproof, they must be sealed with clear tape.. Place the samples in the cooler such that they are completely covered by ice.
- Rinse the sampling containers with DI water prior to departing for next site.

6. Grab Sampling while Wading – When an instantaneous sample is required, a grab sample is taken from the surface water's midstream point using the actual sample container. The following protocol applies to all constituents that are to be collected at a single point. If any grab samples are to be collected in conjunction with composite samples, collect the grab samples after the composite, but before the sonde is retrieved.

Equipment and Supplies

Field Notebook, writing instruments
Water Quality Multiprobe (data sonde) and data logger
Sensor guard
Storage cup
Tapedown tape (meters)
Sample containers – appropriate bottles for parameters of interest and laboratory conducting analyses
Sample bottle labels, clear tape or tape strips for sealing labels
Coolers with ice

Procedure

- Associates should proceed to water's edge by the safest route possible.
- One associate will manage the multi-probe deployment, tape down/gauge measurements, and paperwork (including the log book, labels, and chain of custody form), while the other associate will collect the water samples. The suggested order of operations for the associate not collecting the samples is to: 1. deploy the sonde; 2. conduct the tapedown/gauge reading (provided this can be done while standing out of the stream; if not, do this last); 3. return to the vehicle and fill out/apply bottle labels; and 4. return to the probe, log in-situ measurements and weather/stream conditions, retrieve the probe, and return to the vehicle.
- The water quality multi-probe is deployed on the stream floor at mid-channel UPSTREAM of the associate collecting samples, with the circulator turned on (if applicable). Attempt to orient it such that the sensors are facing upstream at an upward angle. Note that the probe body must be fully submerged in order to collect an accurate reading. The probe should be allowed to stabilize for 5-15 minutes (depending on conditions) before the reading is taken. Take care to disturb the stream substrate as little as possible while deploying the sonde.

- A tapedown is conducted using a weighted measuring tape from the preselected mark on the bridge, culvert, or other monument to the water's surface. In some instances, a staff gage will have been installed prior to the commencement of the water monitoring study. In these cases, all that is required is reading the gage at the point where the surface of the water makes contact. If the tapedown/gage reading can not be performed without standing in the stream, wait until the samples are collected before conducting this task. Please see the Stream Gauging SOP (EPD-WPMP-6) for the tapedown methodology.
- The second associate will collect the water sample while the first Associate is deploying the multi-probe and conducting the tapedown. The specific methodology differs based on the sample to be collected:
- **Fecal Coliform, E. Coli, and Pesticides:** To collect the sample, the Associate first dons nitrile, or latex, gloves and moves to midchannel of the stream. While facing upstream, the submerge the bottle with the cap on. The sample should be taken at mid-depth if possible, or at least well below the surface to eliminate the chance of collecting surface film while avoiding disturbance of the stream bed. Position the bottle so the opening is facing upstream and remove the lid under water, allowing it to fill to the shoulder. Then, once the bottle is filled, replace the lid and remove the bottle from the water.
- **Clean Metals:** Sampling metals requires use of the clean hands technique, illustrated below:

  (This procedure was adapted from EPA method #1669 (EPA July 1996 & EPAune 1999).

  - Samplers decide who will be the "clean hands" and who will be the "dirty hands".
  - "Dirty hands" person opens the outer bag of the metals sampling kit.
  - "Dirty hands" reaches in and retrieves one pair of gloves from the outer bag. "
  - "Dirty hands" puts on first pair of gloves.
  - "Dirty Hands" retrieves second pair of gloves from outer bag. "Dirty hands" should only touch cuff portion of clean hands gloves.
  - "Dirty hands" rolls top of bag and holds under arm
  - "Dirty hands" puts second pair of gloves on clean hands. Contact with outside surface of clean hands gloves should be limited to the clean sample bottle.
  - "Dirty hands" then unrolls bottle bag.
  - "Clean Hands" unseals the inner bottle bag and retrieves metals bottle from inner bag with minimal contact with bags.
  - "Clean hands" moves to mid channel of stream and facing upstream submerges metals bottle with cap on. Sample should be taken well below the surface to eliminate chance of collecting surface film.
  - "Clean hands" removes top from bottle allowing it to fill then recaps bottle before bringing it back to surface.
  - "Dirty hands" unrolls bottle bags and "clean hands" places filled sample bottle in inner bag and seals it.
  - "Dirty hands" compresses bags to expel air and closes outer bag.
  - Sample label is prepared prior to sampling and taken to sample location. Sample label is placed in the outer bag. Sample is put on ice.

  Notes:

  1. Sample contact with air must be kept to a minimum. It is important that bags be sealed or rolled immediately after opening to keep air out. In

addition, the sample bottle should not be opened at any time except when submerged in the stream.

2. Clean Hands (wearing gloves) should not touch any surface other than the outside of the sample bottle or the inner bag.
3. A clean metals field blank should be collected on each sampling date.

- Because the sonde is typically deployed at the mid-stream point, make sure the associate collecting the grab sample allows for any sediment introduced by the sonde placement to flow downstream prior to sampling.
- Ensure that the labels attached to each sample bottle indicate the correct site location, time, date, and associate that conducted the sampling. If the labels are not waterproof, they must be sealed with clear tape. Place the samples in the cooler such that they are completely covered by ice.

7. Grab Sampling from Bridge- If a single-point sample is required from a large, non-wadeable surface water, or if the waterway itself is rendered inaccessible due to hazardous conditions or private property concerns, bridge sampling is often the only way to proceed. If any grab samples are to be collected in conjunction with composite samples, collect the grab samples after collecting the composite sample. If only grab samples are to be collected, in-situ readings and tape down/gage measurements must still be obtained; follow the sonde deployment and division of labor directions listed in the composite bridge sampling protocol above.

Fecal and Pesticides:- Fecal samples are collected by lowering the sample container housed by a weighted bottle holder into the water body at mid-channel. The bottle holder for fecal samples may be made from any easily-washable material, but it must be able to firmly grip the sample container and pull it under water. Any bottle holder used for pesticides must be made entirely out of metal; or, it must be coated with Teflon. DO NOT use a bottle holder with plastic components.
-Put on latex or nitrile gloves and walk towards the center channel of the stream.
-attach the bottle to the holder, and check that the bottle can not slip out. Remove the lid.
-Lower the bottle to the water, ensuring the rope is held away from the bridge to prevent debris from falling into the open container (fig I-2). Submerge the container to just below the water's surface and allow it to fill completely.
-Upon retrieval of the bottle (again, ensuring that the rope does not contact the side of the bridge), pour enough water out so that the container is filled to the shoulder.
-Replace the cap, tape the label directly to the bottle, and immediately place in the cooler, completely covered in ice.

Metals:- Metals sampling utilizes a variation of the clean hands technique illustrated above. DO NOT use a bottle holder with any metal components.

- Samplers decide who will be the "clean hands" and who will be the "dirty hands".
- "Dirty hands" person opens the outer bag of the metals sampling kit.
- "Dirty hands" reaches in and retrieves one pair of gloves from the outer bag. "
- "Dirty hands" puts on first pair of gloves.
- "Dirty Hands" (with gloves on) retrieves second pair of gloves from outer bag. "Dirty hands" should only touch cuff portion of clean hands gloves.
- "Dirty hands" rolls top of bag and holds under arm

- "Dirty hands" puts second pair of gloves on clean hands. Contact with outside surface of clean hands gloves should be limited to the clean sample bottle.
- "Dirty hands" then unrolls bottle bag.
- "Clean Hands" unseals the inner bottle bag and retrieves metals bottle from inner bag with minimal contact with bags.
- "Clean Hands" inserts bottle into holder while "Dirty Hands" stabilizes and secures bottle to holder WITHOUT touching the bottle. "Clean Hands" removes cap and holds it within gloved hand to help prevent contamination from airborne metals.
- "Dirty hands" lowers the sample to the water, taking care not to let the rope touch the sides of the bridge (fig I-2). Sample should be taken well below the surface to eliminate chance of collecting surface film.
- "Dirty hands" retrieves and stabilizes holder, taking care not to touch the bottle in the process. "Clean hands" removes bottle from holder, and replaces cap.
- "Dirty hands" unrolls bottle bags and "clean hands" places filled sample bottle in inner bag and seals it.
- "Dirty hands" compresses bags to expel air and closes outer bag.
- The sample label is prepared prior to sampling and taken to sample location. The sample label is placed in the outer bag. Place the sample in a cooler and cover with ice.
    1. Sample contact with air must be kept to a minimum. It is important that bags be sealed or rolled immediately after opening to keep air out. In addition, the sample bottle should not be opened at any time except when submerged in the stream.
    2. Clean Hands (wearing gloves) should not touch any surface other than the outside of the sample bottle or the inner bag.
    3. A clean metals field blank should be collected at each sampling location
    4. Sample contact with air must be kept to a minimum. It is important that bags be sealed or rolled immediately after opening to keep air out. In addition, the sample bottle should not be opened at any time except when submerged in the stream.
    5. Clean Hands (wearing gloves) should not touch any surface other than the outside of the sample bottle or the inner bag.

8. Grab Sampling from Boat

Equipment and Supplies

Field Notebook, writing instruments
Water Quality Multiprobe (data sonde) and data logger
Sensor guard
Storage cup
Sample containers – appropriate bottles for parameters of interest and laboratory conducting analyses
Sample bottle labels, clear tape or tape strips for sealing labels
Coolers with ice

Procedure

- Prior to departing in a boat, all Associates should don their high-visibility; U.S. Coast Guard approved personal flotation devices.

- Associates then proceed to the sampling location(s) by the safest route possible.
- Upon arrival, navigate to the center of the channel and deploy the water quality multi-probe so that probe is approximately 1 meter below the water's surface with circulator turned on. Allow the probe to stabilize for 5-15 minutes (depending on conditions) before the reading is taken.
- Depth is determined using a boat-mounted depth finder, or in some instances, a staff gage will have been installed on a bridge pylon prior to the commencement of the water monitoring study. In these cases, all that is required is reading the gage at the point where the surface of the water makes contact.
- The second associate will collect the water sample while the first Associate is deploying the multi-probe and reading the depth finder, or staff gage. An instantaneous grab sample should be taken from the surface water's mid-channel point.
- To collect the sample, the Associate first dons nitrile, or latex, gloves and moves to midchannel of the stream. While facing upstream in the bow section of the boat (away from the engine) submerge the sample bottle on either the left or right side of the boat up to the Associate's elbow with the cap on?. The sample should be taken well below the surface to eliminate chance of collecting surface film. Position the bottle so the opening is facing upstream and remove the lid under water, allowing it to fill. once the bottle is filled to the shoulder, replace the lid. Once the bottle lid has been replaced, the bottle is removed from the water.
- Alternatively, a stainless steel scoop may also be used to reach away from the side of the boat into the water. The sample is still collected with the scoop's opening facing upstream and the subsequent sample is then transferred to the sample bottle.
- Once the sample has been collected, the Associate attaches a label with the time, date, and Associate making the collection marked on the label. The label is sealed with clear tape, and the sample is placed in the cooler of ice for shipment.

9. Discrete Depth Sampling from Boat (one depth) **–** When only one depth has been specified for sampling, and samples must be collected from a boat, either a discrete depth sampler (i.e. van dorn) or a trickle water sampler may be employed. A polypro water sampler, or discrete depth sampler is lowered from the boat to the desired depth and a sample is collected. This technique can also be employed at multiple points across the horizontal width of the surface water at the same depth to collect a composite, discrete depth sample.

Equipment and Supplies

Field Notebook, writing instruments
Water Quality Multiprobe (data sonde) and data logger
Weighted sensor guard
Cable
Storage cup
Sample containers – appropriate bottles for parameters of interest and laboratory conducting analyses
Sipper style water sampler
Kemmerer or Van Dorn style sampler
Churn sample splitter
Sample bottle labels, clear tape or tape strips for sealing labels
Coolers with ice

Procedure

- Prior to departing in a boat, all Associates should don their high-visibility; U.S. Coast Guard approved personal flotation devices.
- Associates then proceed to the sampling location(s) by the safest route possible.
- Upon arrival, the water quality multi-probe is deployed into water so that probe is approximately 1 meter below the water's surface with circulator turned on. Allow the probe to stabilize for 5-15 minutes (depending on conditions) before the reading is taken..
- Depth is determined using a boat-mounted depth finder, or in some instances, a staff gage will have been installed on a bridge pylon prior to the commencement of the water monitoring study. In these cases, all that is required is reading the gage at the point where the surface of the water makes contact.
- The second Associate will collect the water sample while the first Associate is deploying the multi-probe and reading the depth finder, or staff gage.
- The sample is to be collected by lowering the polypro water sampler, or Kemmerer or Van Dorn style sampler, to the desired depth in the water body.
- If a Polypro water sampler is used, allow 20 seconds for it to fill before retrieving. If a Kemmerer or Van Dorn style sampler is used, first release the messenger to trip the sampler's doors closed, and then retrieve to the surface.
- The first sample will be used to rinse the sampler and the compositor. This is a very important step in lessening the chance of cross contamination between sample sites.
- After the rinse sample has been completed, three samples are collected across the horizontal width of the stream at the same specified depth, in the same, previously described manner.
- Once the samples have been collected, they are composited by churning action in the compositor, and dispensed into the various required sample containers. Then, labels are attached to each sample bottle with the time, date, and Associate making the collection marked on the label. The labels are sealed with clear tape, and the samples are placed in the cooler of ice for shipment.

10. QC Sampling- EPD collects replicate samples at 10% of all sample events (this is subject to change based on the project plan and/or lab constraints). The exception to this rule is metal sample blanks, which are collected once per sampling date. For each day of sampling that requires a QC, the site to receive the QC should be determined prior to going out in the field. Replicates must be obtained by repeating the entire sampling procedure after the initial sample event is processed; that is, the sampler and churn splitter (if used) must be rinsed, and the samples are collected in the same manner and location as the initial sample. The one exception to this rule is the clean metals QC, whose procedure is as follows:

-Sampling from bridge (composite):

-The clean metals QC requires two bottles; one with the metals bottle blank (which is pre-filled with DI water by the EPD Laboratory and marked as "blank"), and an empty metals bottle.

-Use the Clean Hands technique described in section 6, making sure that "dirty hands" holds both the blank and sample bottle bags. Remove the QC metals bottle from the inner bag and pour the water into the empty metals container. Place the now-filled metals bottle into the inner bag from whence it originated, and seal.

-Sampling from bridge (single point):
-Use the Clean Hands technique described in section 6 to install the QC metals bottle into the weighted bottle holder.
-Remove the cap and allow "Dirty Hands" to lower the bottle holder until it is just above the water's surface. DO NOT allow the holder to interact with the water.
-Pull the holder back up, replace the cap, place the bottle into the inner bag from whence it originated, and seal.
-**Sampling while wading**:

-Use the Clean Hands technique described in section 6 to retrieve the metals blank.
-Remove the cap of the metals blank and expose the opening to the air for 5 seconds.
-Replace the cap, and place the metals blank back in the inner bag and seal.

11. Post-Sampling Activities -Once all samples for the day have been collected, three primary tasks must be finished before the end of the field day: the cooler must be prepared for shipping or overnight storage; the sonde must be post-calibrated; and the equipment must be cleaned.
Shipping/Storage preparations:
If the samples are to be hand delivered, but will have to be stored overnight before delivery, observe the following steps:
-bring the cooler(s) into a climate controlled facility for storage. Do not leave them in a vehicle overnight.
-drain excess water from the cooler
-add more ice until the cooler is full and all samples are completely covered.

If the samples are to be shipped, observe the following steps:
-drain excess water from the cooler and add ice until the samples are completely covered. This is especially important during warm weather months.
-twist the bag opening several times and wrap tape around the twisted portion.
-place the completed chain of custody forms in a ziploc bag and seal. Fold the seal and tape the bag to the inside lid of the cooler.
- use clear tape to seal the cooler. Vertically wrap the cooler in at least two locations.
- place the overnight shipping label on top of the cooler.

***Sample Handling**
After collection, all sample handling should be minimized. Investigators should use extreme care to ensure that samples are not contaminated. If samples are placed in an ice chest, investigators should ensure that melted ice cannot cause the sample containers to become submerged, as this may result in sample cross-contamination. Plastic bags, such as Zip-Lock® bags or similar plastic bags should be used when small sample containers (e.g., VOC vials) are placed in ice chests to prevent cross-contamination. Trace metals sampling is to be conducted according to the WPB document, *Interim Protocol: Clean Laboratory and Sampling Techniques for Determination of Trace Metals*, and U.S. EPA trace metal sampling protocols.

Data Sonde Post-Check –The multiprobe used for in-situ measurements must be post-checked at the end of each field day. If the sonde is to be used the following day, it may be calibrated the next morning, which would serve as both a post-check for the current day's sampling and pre-calibration for the next day. If the sonde will not be used the next day, then it must be post-checked that evening. Information regarding Sonde calibration and care is located in GAEPD SOP EPD-WPMP-7.

Equipment Cleaning- Upon returning from the field, all trickle samplers, churn splitters, Van Dorns, steel buckets, mixing carboys, and single-point sampling equipment must be cleaned. Using a soft brush and phosphate-free detergent (i.e. Liquinox or Citrinox), scrub both the inside and outside of each sampler, and thoroughly rinse with DI water. If ortho-phosphorus samples were collected, the syringes will need to be sterilized using the following method:
-Make sure the plungers are separated from the syringes and fully immerse both in a water bath containing 10% HCl. Allow the syringes to soak overnight.
-While wearing gloves, remove and rinse the syringes and plungers using DI water, and allow to air dry before placing in a Ziploc bag for storage.

Data entry (if applicable)- If the data collected in the field is to be entered into a database, do so as soon as possible after each sampling day, so as to minimize the loss of information in the event that the log book is lost or destroyed.

J. Data and Records Management

Data and records will be managed according to the policies outlined in the GAEPD SOP# EPD-WPMP-1. Any deviation from the policies outlined in the SOP should have prior approval from first the Unit manager, and then the Program manager, and be documented accordingly.

K. Troubleshooting and Error Management

◆Log book and COC data recording- if an error is made while recording information within either the log book or COC form, draw a single line through the erroneous entry, write the correct information next to it, and initial the correction. Do not attempt to erase or "scratch out" the erroneous information.

◆Potentially erroneous sonde values- If, during a site visit, the sonde is reporting water quality values that deviate substantially from typical values given at a particular site, relocate the sonde to a different section of the sample site and check to see if the values at the new position agree with the original readings. If both readings agree with one another, use the field verification kit to confirm or refute the sonde's reported values, and note the results in the log book.

◆Damage to the sonde- If any damage occurs to the sonde that impairs its ability to function (i.e., the case or one of the sensors is physically cracked, the membrane on the clark cell is removed or destroyed, the pH bulb is broken), do not continue to use it in the field.

◆Loss of equipment- In the event that a piece of equipment falls into the water from a bridge, only retrieve it if you can locate it and it is easily retrievable via wading. DO NOT attempt to swim or dive after lost equipment. Report any instance of lost or broken equipment to your supervisor immediately upon returning from the field so that replacements may be obtained as quickly as possible.

L. References

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), 1992, *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, Washington, D.C.

APHA-AWWA-WEF, 1995, *Standard Methods for the Examination of Water and Wastewater*, 19th Edition, Washington, D.C.

APHA-AWWA-WEF, 1998, *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, Washington, D.C.

Georgia Department of Natural Resources, May 1990, *Safety Manual*, Atlanta, GA.

United States Environmental Protection Agency (USEPA), 1983, *Methods for Chemical Analyses of Water and Wastes*, Second Edition, Cincinnati, OH.

United States Environmental Protection Agency, Region IV, May 1996, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Athens, Georgia.

United States Environmental Protection Agency, 1994, *NPDES Compliance Inspection Manual*, Washington, D.C.

United States Environmental Protection Agency (USEPA), Office of Environmental Information, April 2007, *Guidance for Preparing Standard Operating Procedures (SOPs)*, EPA/600/B-07-001, Washington, D.C.

United States Environmental Protection Agency (USEPA), Office of Water, March 1991, *Technical Support Document for Water Quality-based Toxics Control*, Second Edition, EPA/505/2-90-001, Washington, D.C.