I. PROJECT MANAGEMENT

1. Title and Approval Page

Generic Quality Assurance Project Plan for
Lake Monitoring by RIDEM/OWR

State of Rhode Island, Department of Environmental Management
Office of Water Resources

May 2, 2011

Approval Signatures

Susan Kiernan, RIDEM/OWR Program Manager — Date: 8/4/11

Jane Sawyers, RIDEM/OWR Project Manager — Date: 8/4/11

Connie Carey, RIDEM/OWR Project QA Officer — Date: 8/4/11

Thomas Getz, RIDEM QA Project Manager — Date: 8/5/11

Katrina Kipp, USEPA Project Manager — Date: 8/2/11

Stephen DiMattei, USEPA QA Officer — Date: 08-02-11

Review Signatures

Brian Zalewsky — 8.13.11

Brian Zalewsky, RIDEM/OWR TMDL Program — Date

8/12/2011

Henry Leibovitz, Ph.D., Chief Registered Environmental Laboratory Scientist, State Health Laboratories — Date

Nicole Duffy — 8/12/11

Nicole Duffy, ~~Ph.D.~~, Environmental Sciences Quality Assurance Officer, State Health Laboratories — Date

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3. Distribution List

QAPP Recipient Name	Role	Organization	Telephone number and Email address
Steve DiMattei	EPA Quality Assurance Officer	USEPA New England Region 1 Laboratory	11 Technology Drive N. Chelmsford, MA 01863 Phone: 617-918-8369 FAX: 617-918-8397 Dimattei.Steve@epa.gov
Katrina Kipp	USEPA Project Manager	USEPA New England Region 1 Laboratory	11 Technology Drive N. Chelmsford, MA 01863 Phone: 617-918-8309 FAX: 617-918-8397 Kipp.Katrina@epa.gov
Susan Kiernan	RIDEM/OWR Program Manager	RIDEM/OWR	235 Promenade St. Providence, RI 02908 Phone: 401-222-4700 Ext. 7600 FAX: 401-222-3564 Susan.Kiernan@dem.ri.gov
Jane Sawyers	RIDEM/OWR Project Manager	RIDEM/OWR-NEIWPCC	235 Promenade St. Providence, RI 02908 Phone: 401-222-4700 Ext. 2032 FAX: 401-222-3564 Jane.Sawyers@dem.ri.gov
Connie Carey	RIDEM/OWR Project Quality Assurance Officer	RIDEM/OWR	235 Promenade St. Providence, RI 02908 Phone: 401-222-4700 Ext. 7239 FAX: 401-222-3564 Connie.Carey@dem.ri.gov
Thomas Getz, P.E.	RIDEM Quality Assurance Manager	RIDEM/Office of the Director	235 Promenade Street Providence, RI 02908 Phone: 401-222-4700 Ext 2417 Fax: (401) 222-6802 Thomas.Getz@dem.ri.gov
Henry Leibovitz, Ph.D.	Chief Registered Environmental Laboratory Scientist	RI State Health Laboratories	50 Orms Street Providence, RI 02904 Phone: 401-222-5578 FAX: 401-222-6985 Henry.Leibovitz@health.ri.gov
Nicole Duffy	Environmental Sciences Quality Assurance Officer	RI State Health	50 Orms Street Providence, RI 02904 Phone: 401-222-5554 FAX: 401-222-6985 Nicole.Duffy@health.ri.gov

4. Project/Task Organization

The Rhode Island Department of Environmental Management, Office of Water Resources (RIDEM/OWR) will conduct ambient monitoring of lakes as part of various OWR regulatory program needs. RIDEM/OWR will execute the fieldwork using permanent, contractual and/or seasonal personnel to collect field data and water samples and may contract with the Rhode Island Department of Health State Health Laboratories or other contractual laboratories to execute the laboratory analysis portion of projects. The organizational chart (Figure 1) describes the principal officials from RIDEM/OWR, State Health Laboratories and the US Environmental Protection Agency (USEPA) associated with the project and illustrates the pathways of communication that will be utilized during the project.

The U.S. Environmental Protection Agency (EPA) requires any data used to characterize environmental processes and conditions be collected and utilized under predetermined guidelines to ensure high data quality. An important component in this system is the Quality Assurance Project Plan (QAPP). There are two basic formats proposed by the EPA for QAPP development. A project-specific format is designed to address all aspects of a single project, and a generic format is intended to cover a general program where common activities will occur at multiple sites over an extended period of time (USEPA 2001). This document represents the generic format and general activities related to lake monitoring conducted by RIDEM/OWR. Site-specific information for data collection and analytical efforts will be included and updated through addenda to this QAPP. Addenda will also identify any changes or additions to the general organizational structure in Figure 1. It is anticipated that any number of addenda for lake sampling efforts undertaken by RIDEM/OWR may be developed in association with this QAPP.

The RIDEM/OWR Program Manager will oversee fiscal matters, contract agreements and general progress of the program. The RIDEM/OWR Project Manager will coordinate field data collection and laboratory analysis, and will serve as the primary point of contact for the project. The RIDEM/OWR Project Manager will be in charge of organizing sample and field data collection, will be the lead contact for all field sampling issues, and will maintain communication with field staff and external contractual providers through written and verbal means. Problems encountered in the field will be reported by field staff, in verbal or written communication, to the RIDEM/OWR Project Manager. The RIDEM/OWR Project Manager will actively participate during fieldwork to ensure that all procedures are implemented as outlined in this QAPP and will resolve any problems that may be encountered in the field. The RIDEM/OWR Project Manager will oversee work conducted by the State Health Laboratories and contractual agencies/laboratories. The RIDEM/OWR Project Manager will review field and laboratory data and provide regular written or verbal progress updates to the RIDEM/OWR Program Manager. Seasonal technicians, and, as resources and need allow, other personnel from RIDEM/OWR will also assist with collection of field data and water samples as members of the Field Data Collection Team. The RIDEM/OWR Project Quality Assurance (QA) Manager will ensure all involved personnel are properly trained in all appropriate protocol associated with field data collection. The

RIDEM/OWR Project QA Project Manager will verify the accuracy and correctness of procedures and protocol described in the QAPP and will confirm that data reporting requirements are met with respect to time of delivery and product quality. The Chemical Analysis Project Lead and the Environmental Sciences Quality Assurance Officer from State Health Laboratories and will ensure all involved State Health Laboratories personnel are properly trained in appropriate protocol associated with the laboratory analyses conducted by State Health Laboratories. Other contractual laboratories will be required to ensure that all personnel are properly trained for the contracted services.

This QAPP and any developed addendum will be routinely reviewed and updated accordingly. Jane Sawyers (RIDEM/OWR-NEIWPCC 401-222-3961 x2032), originator of this QAPP, will be responsible for maintaining the official, approved QAPP. QAPP addendum review and updates will be the responsibility of the Project Manager identified in the addendum. Identification of sampling locations, field and laboratory sampling and analytical protocol, and any project-specific team and personnel beyond the scope of this general QAPP, will also be identified in each addendum (USEPA-NE 2010).

5. Background and Problem Definition

RIDEM/OWR is charged by the Federal Clean Water Act with comprehensively monitoring and assessing the water quality of the state's waters. The OWR also implements the state's Water Quality Standards and TMDL Programs. The purpose of these programs is to restore, preserve, and enhance the water quality of RI waters through development and implementation of water quality criteria and water quality restoration plans. Lake water quality monitoring provides an integral aspect to implementing these programs. An important part in this effort is the collection and use of high quality data reflective of the status of those resources.

RIDEM has mapped 20,917 lake acres in Rhode Island at a scale of 1:24,000. This includes 148 lakes or reservoirs of 20 acres or more in size and hundreds of smaller ponds. Lakes in RI can be characterized as small and shallow, and, excluding the kettleholes that dot the state, a number of lakes are actually reservoirs or impoundments of riverine systems. Most of the impoundments were formed with the development of man-made dams. Among the reservoirs, 42 are designated as public drinking water supply sources, representing 7,813 acres or 37% of the total lake acreage. There are no major WWTF discharges into lakes in RI.

The primary source of monitoring data concerning the condition of ponds and lakes is the University of Rhode Island Watershed Watch Program (URIWW). Initiated in 1987, the program is a professionally supervised volunteer monitoring program with an EPA-approved field and laboratory QAPP. The data generated through this program supports lake assessments, criteria development, and TMDLs by RIDEM. However, there are vital pieces of water quality information necessary to the mission of the RIDEM/OWR not collected by URIWW. Additionally, the lakes monitored by URIWW are chosen by the availability and interest of the volunteer monitors. The duties of the

RIDEM/OWR may necessitate conducting extended monitoring on lakes sampled by URIWW or special projects on lakes not routinely monitored by URIWW.

The general goal of lake monitoring is to attain data to accurately characterize the water quality of lakes in Rhode Island. This information can be used to make management, restoration, and implementation decisions by RIDEM/OWR and other State of Rhode Island governmental bodies. Collection of lake data by RIDEM/OWR can be used to refine or develop water quality criteria, report the water quality status of lakes in the Integrated Water Quality Monitoring and Assessment Report (Integrated Report) for the 305(b) and 303(d) requirements under the Clean Water Act (CWA), support permitting programs, assess progress to water quality restoration, and develop Total Maximum Daily Load (TMDL) plans. The general objective of lake monitoring by RIDEM/OWR is to obtain high quality data on lakes in Rhode Island to facilitate implementation of regulatory programs.

A data collection effort under this QAPP can include physical, chemical, and biological sampling and analysis. The sampling locations, parameters and Standard Operating Procedures (SOP) included in each lake monitoring project beyond those included in this QAPP will be specified in the addendum with site-specific project information. The decisions and outcomes rendered under each addendum will be project-specific in nature. The type of assessment undertaken in each project will be determined by the RIDEM/OWR goals and responsibilities, and any potential decisions and outcomes will be decided independently for each project.

6. Project Description

This QAPP is designed for the generic application to all lake monitoring activities conducted by the RIDEM/OWR. This section provides guidelines to develop project-specific addendum, which will include:

- Description of site-specific information
- Work to be performed including station locations, dates, sampling activities, and analytical procedures
- Map of station locations
- Products to be produced
- Schedule for work to be performed and products produced
- Project personnel
- Data records location and organization
- Identification of additional lines of communication
- Identification of additional field SOPs and contractual laboratory QAPP and SOPs
- Project-specific data quality, including:

- Number and frequency of QA reports
- Specific sources of variability for the project goals and how they will be reconciled (i.e. deep spot vs. near-shore sampling location, weather-related issues)
- Checklist of physical and electronic locations of downloaded information

The addendum can be in table or narrative format, depending on the goals and requirements of the project. Site-specific information should, at a minimum, include waterbody name, and WBID#, if one has been assigned in RIDEM's database, WQUAL. The addendum should include all parameters being measured for the water body and data quality objectives of the parameters not identified in Table 2. The expected number and type of samples to be taken from the water bodies (i.e. integrated, discrete, grab) should also be included. The Project Manager should be identified and affiliation of any team members, including project personnel contracted outside of RIDEM/OWR. The lines of communication of members should be identified when they are outside of those lines provided in Figure 1. New and updated versions of SOPs will be included in the addendum.

Resource and time constraints will be project-specific in nature. The funding, manpower, and equipment resources needed for the fieldwork will change depending on goals and budget of each project. There may be time constraints based on the goals of the project. The project and/or Program Manager will determine and communicate to field staff whether a certain season (i.e. spring, summer, fall), weather-related period (dry or heavy precipitation) or environmental phenomenon (i.e. phytoplankton blooms) must be captured by the fieldwork.

7. Data Quality Objectives and Measurement Performance Criteria

A. Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that clarify the intended use of the data, define which purposes the data may be used for, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. DQOs delineate the type of data needed to support decisions, identify the conditions under which the data should be collected, and state what requirements must be met in order to use the data for its intended purpose. If applicable, the DQOs should specify the tolerable limits of the probability of making a decision error because of uncertainty in the data.

For RIDEM/OWR lake monitoring projects, the intended purpose of the data collection and analysis is to characterize ambient water quality conditions and provide information to support criteria development, water quality assessments, TMDLs and other management decisions. This QAPP deals specifically with the data quality objectives during data collection and outlines the proper collection methods, procedures, and measurements to be utilized to reduce sources, magnitude, and frequency of errors during

data generation. By outlining and following these steps, uncertainties in the data will be reduced and data quality will be assured for proper use and interpretation of the data. To meet the data quality objectives, the following quality assurance measures will be employed to verify the use of proper, consistent field procedures, handling measures, and laboratory analyses.

- Standard Operating Procedures (SOPs) will be implemented during sampling and field data collection.
- EPA-approved, standardized methods will be adhered to for all chemical analysis procedures.
- Qualified, trained scientists will perform the sample collection and laboratory analyses.
- Chain of Custody forms will be completed when handling samples and transferring custody from field crew to the State Health Laboratories as well as the authorized state vendors for analytical laboratory services (Figure 2).
- One trip blank (sample bottles filled with DI water in the sampling center) for each day sampling will be transported by each field crew to ensure there is not contamination of sampling containers in the field during transport.
- Duplicate sample collections will be taken at 15-20% of sampling stations to ensure precise, reproducible results. Sampling stations for duplicate sample collections will be chosen randomly.

B. Data Quality Indicators

Data quality indicators (DQI) are the quantitative statistics and qualitative descriptors used to evaluate data quality and interpret the degree of acceptability of data to the user. The principal data quality indicators are: precision, accuracy, sensitivity, bias, representativeness, completeness, and comparability. To determine that the data meet the project's quality objectives, the data quality indicators are compared against predetermined standards deemed *measurement performance criteria* as discussed below for each DQI.

The projects associated with this QAPP can have any number of data collection parameters. The most common lake monitoring parameters are listed in Table 1 with the range of measurement values, accuracy, precision, and bias of each parameter. The project-specific addendum will identify any parameters not included in this table with the range of values, accuracy, precision, and, as appropriate, detection limits and quantitation limits of the parameter(s). Additionally, any method, SOP, or instrument specification that includes a different range, accuracy, and/or precision for the parameters listed below will be included in the project-specific addendum. All samples collected and/or submitted to a contractual partner will be subject to the contractor's data quality objectives and criteria. The Project Manager will communicate to contractual designees, including State Health Laboratories, the acceptable measurement performance criteria required for the data to meet project-specific data quality objectives. Contractual

laboratory QAPPs or SOPs should be referenced in each project specific QAPP addendum. All laboratory procedures for water samples will follow the guidelines for data quality objectives and criteria outlined in the laboratory's QAPP/SOP. The State Health Laboratories maintain SOPs for analyses they perform and an EPA-approved QAPP including data quality indicators for laboratory procedures.

Precision

Precision is a measure of agreement among repeated measurements of the same property under identical, or substantially similar conditions, expressed generally in terms of the standard deviation (USEPA 2002). At 15-20% of monitoring locations, a set of duplicate water samples will be collected. For field measurements, at least 15-20% of monitoring locations will include the repeated measurement of each parameter by the same analyst using the same equipment and technique. For field measurements, refer to the respective SOP for procedure of repeated measurements and acceptable limits. Precision of duplicate sample analyses run in a contracted laboratory will be assessed with a relative percent difference (RPD), and an RPD greater than 20% will require the water sample to be reanalyzed. If the data from the duplicate samples are not within the acceptable RPD range, the data will not be used from these samples.

Accuracy

Accuracy is the overall agreement of a measurement to a known value and includes error from both bias (systematic error) and precision (random error) (USEPA 2002). The accuracy of electronic field equipment will be checked according to manufacturer's specification to known values or standards. Refer to Table 1 for acceptable accuracy of the commonly measured lake parameters. SOP Standard Operating Procedure WR-W-14 for the Measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity using a Handheld YSI Model 85 Instrument documents the schedule for evaluation of accuracy for each parameter measured by the YSI-85 (Appendix H). The accuracy of all other field equipment will be assured by comparison with known standards in the field (i.e. Secchi depth determined by a tape measure instead of markings on the rope). For water collections, one (1) trip blank (sample bottles filled with DI water in the lab) for each sample collection day will be transported by the field crew for laboratory analyses to ensure there is no contamination of sampling containers during transport.

The accuracy of each laboratory method is established by the laboratory calibration and use of its pre-determined method detection limit (MDL) and quantitation level (QL). The QL is the minimum concentration of a substance that can be reliably identified, measured, and reported with confidence it is accurate. The MDL is the lowest concentration of a substance that can reliably be measured and reported with some degree of confidence that the substance is present in the sample.

Bias

Bias is the persistent influence of a measurement process that causes error in one direction (USEPA 2002). All field analysts will be trained to use the field equipment with the same SOPs to reduce operator bias. The use of trip blanks and duplicate samples

will be used to assess sampling, transportation, and laboratory bias due to contamination. The acceptability of all constituent concentrations will be evaluated using reagent and procedural blanks. The results of the trip and procedural blanks will be reported with the data results.

Sensitivity
The method and instrument detection limit is addressed by the range of measurements capable by the equipment listed in Table 1.

Completeness
Completeness is the measure of valid data obtained from sampling. At a minimum, the project should require that 90% of the data received to be collected, analyzed, and judged valid for completeness to be achieved. If the project team or requirements of the project determine that a percentage greater than 90% should be achieved for completeness, this will be indicated in the project-specific addendum. If completeness is not met, statistical procedures, including power analysis, and best professional judgment will be used to determine whether use of the remaining data will produce correct data interpretations and conclusions.

Data Comparability
A number of lakes have been routinely monitoring by the URIWW. The data collected by RIDEM can be compared against the range of historical data collected by URIWW. If the lake sampled has not been sampled and analyzed by URIWW, then the data collected can be compared to values typical of a similar lake (i.e. deep, highly turbid, colored, etc.)

Representativeness
The representativeness of the individual sampling effort will be addressed by the project-specific goals. Each project will need to address if specific conditions are being sought or excluded from the data collection. A minimum of 90% of samples should meet the specific conditions required for the project to be considered representative of the water quality conditions the project is designed to examine.

8. Special Training/Certification

Field data collection will be overseen by a qualified limnologist, aquatic biologist, environmental engineer, or similarly qualified individual as Project Manager. The Project Manager will be trained in lake collection techniques, analysis, and interpretation. All field personnel will be familiar with project fieldwork and SOPs necessary for project execution. The Project Manager will train RIDEM field personnel performing any lake sampling fieldwork in the data collection methods stated in SOPs associated with the sampling activities listed in the site-specific project addendum. Field analysts will have a training record form filled out and retained by the Project Manager to document that the field analyst has read and understands each SOP (Figure 3). The QA Project Manager will keep a list of all field personnel appropriately trained to perform the fieldwork. Field personnel should have previous academic study or work experience in an environmental

science field. Field personnel should also be familiar with basic water and boating safety and first aid guidelines.

Special training and certification for parameters measured by a contractual designee will be the responsibility of the contracted party. A qualification record will be available from the contractual designee to track the training and performance of those personnel.

9. Documentation and Records

The retention of all field collection records will follow the policy of the State of Rhode Island General Records Retention Schedule GRS5 (Appendix A). The Project Manager will be responsible for determining the extent and scope of data records required for each project and ensuring that field staff are provided with the most recent version of this generic QAPP, SOP(s) used, and other documents necessary for field collection efforts. At a minimum, the Project Manager will retain any original field notes, instrument data sheets, copies of chains of custody, and laboratory results for samples submitted to an external contractor. The explicit location and organization of these hardcopy files will be identified in the project-specific addendum. All electronic data will be permanently retained and backed up in a separate storage device (i.e. CD/DVD, flash drive). Electronic data may also be stored in OWR's water quality database, WQUAL. Digital photograph records will follow the storage requirements and organization of RIDEM/OWR SOP-WR-W-26 Digital Photograph Collection and Storage SOP (Appendix B).

II. DATA GENERATION AND AQUISITION

1. Sampling Process Design

This QAPP is designed for all lake monitoring projects undertaken by RIDEM/OWR. At this time, the RIDEM/OWR does not conduct routine water quality monitoring of lakes. The focus of RIDEM/OWR lake sampling efforts is to gain directed sampling information (USEPA 2002). The projects undertaken through this QAPP are designed to obtain high quality data on hand-picked sites for the purpose of water quality criteria development, water quality assessments, and TMDL development. The number and location of sites deemed representative for the project-specific purpose and the time schedule for implementing the sampling program will be identified in the project-specific addendum.

If any site becomes inaccessible during the project (i.e. drawn down, unsafe launching site), the Project Manager will be responsible for deciding to proceed without the site or postponing the sampling effort on the site until conditions are acceptable for safe and accurate data collection. On private property, the Project Manager will communicate and receive permission from the landowner for access prior to project initiation. If a

landowner denies access to the field analyst, the field analyst should contact the Project Manager to determine further action.

The treatment of samples during collection and transport will be determined by the holding time and necessary conditions (i.e. ice, acid preservation) of the parameter(s) chosen for the project. The time water samples will be sent to the laboratory will depend on the parameters chosen for the project and holding times dictated for analysis. Most lake sampling efforts take place outside of winter conditions, and the Project Manager will be responsible for deciding any seasonal factor to either avoid or capture through the sampling effort (i.e. phytoplankton growing season, spawning, high or low precipitation). No sampling will take place during dangerous weather conditions (i.e. lightning, high wind advisories). Other sources of variability specific to the project will be addressed in the project-specific addendum.

2. Sampling Methods

Sampling methods for all projects undertaken through this QAPP will use established SOPs. Any SOP not included as an appendix to this QAPP will be included in the project specific addendum. Any new SOPs will be formulated and submitted for approval by the Project Manager under the SOP RIDEM QD-QM-1 Procedures for Developing and Approving Standard Operating Procedures (Appendix C). The data collection will be performed by RIDEM/OWR permanent, seasonal, and contractual staff.

Lake sampling efforts can include the collection of physical, chemical, and biological data. The type, duration, and number of efforts will be identified in the project-specific addendum. Typically, a sampling visit to a lake will include collection of water with a water sampling device (i.e. Van Dorn, integrated sampler) or bottle-direct method, water clarity measurement with a Secchi disk or similar equipment, and a water column profile collected with a single or multi-probe electronic sonde for a single, instantaneous measurement from a canoe or other small watercraft. The decision between a grab, composite and discrete water collection will be the responsibility of the Project Manager based on the goals of the project. Any deployment of long-term data equipment in the lake will be addressed in a SOP.

To minimize contamination or carry-over between sites, sample collection equipment will be rinsed, prior to water collection, three times with resident lake water. To minimize disturbance of biological and chemical conditions, rinse water will be obtained and disposed on the side of the boat opposite water column profile measurements. When collecting lake samples, final water sample collection will take place on the boat side not used for rinse water collection. In order to minimize the spread of aquatic invasive species, all monitoring equipment, including hip boots and waders, will be rinsed with tap water twice on-shore following collection and prior to departure. Water craft and trailers will also be visually inspected for chemical and/or biological contamination, which will be removed by hand or rinsed off with lake water when best professional judgment indicates that the material is not a human health risk. If the material appears to be a

human health risk, the field staff will contact the Project Manager to decide the best course of action for removal and disposal.

The amount of water collected for each parameter will be determined by the analytical requirements of the contractual laboratory. Most water samples will be in clean, clear plastic containers, which are typically sent to RIDEM/OWR by the contractual laboratory including HEALTH. Any analyte requiring a different container (i.e. amber, glass) will be identified in the SOP associated with the sample collection. Limitations for sample analysis are identified in Table 2 measurement ranges or an SOP associated with parameters not included in Table 2. The limitations of sample analysis performed in contractual laboratories will be identified in the laboratory's SOP and QAPP for analysis. Samples that must be homogenized, composited, split, or filtered prior to submission to the contractual laboratory will be specified in the SOP WR-W-34 Standard Operating Procedure Collection for Bottle-Direct Water Samples – Lakes, Ponds, and Reservoirs (Appendix G).

Data collection limitations will be monitoring equipment, vehicle, watercraft, weather, or site-specific in nature. Potential equipment failure will be addressed through the stated data quality objectives in this QAPP and manufacturer-specific, routine maintenance. Vehicle failure will be addressed by a pre-trip visual check of the general appearance of the vehicle and adherence to routine maintenance schedules for state vehicles. Watercraft will also be visually inspected prior to collection trip departure. Any issues with vehicles or watercraft will be communicated, verbally or written, with other field staff in RIDEM/OWR and resolved promptly. Any monitoring equipment, vehicle, or watercraft not working properly will not be taken in the field and field collection will be postponed until a suitable replacement or repair can be made. Weather limitations will be identified by website, radio, television, or best professional judgment of field staff or Project Manager, preferably prior to departure for field collection. Should weather conditions deteriorate en-route or on-site, the collection effort will be postponed until conditions improve. Limitations of the sampling site will be addressed by collection of historical information, verbal or written, and available maps. The Project Manager may also decide to perform, or designate field staff to perform, reconnaissance of on-site conditions prior to field collection effort.

3. Sample Handling and Custody

All water collection bottles will be labeled using a Sharpie® or other permanent marker with at least: sampling-site name, collector, project affiliation (RIDEM/OWR), date, and time. A contractual laboratory may require further documentation on the bottles, such as a HEALTH Client name. Water collection bottles will be kept out of direct sunlight prior to and after collection to keep the contents from becoming too hot in summer weather. Temperature of the water sample can affect the results of conventional parameters tested in lakes. The temperature required upon receipt for specific chemical parameters will be determined by the contracted laboratory. Biological parameters (i.e. phytoplankton identification) do not typically require a minimum temperature for transport or receipt,

but the sample should not exceed room temperature for extended periods of time to prevent deterioration. Biological parameters are typically preserved on-site. Samples requiring phytoplankton or chlorophyll analysis should be kept in low light to prevent degradation.

Parameters requiring preservation methods (i.e. acid, ethanol, Lugol's) will have the correct amount or concentration of preservative added to the collected sample according to the SOP. Parameters not requiring direct preservation will be kept on ice during transport to the appropriate contractual laboratory or RIDEM/OWR sampling center. Holding times will be dictated by the analyte of interest and indicated in the SOP. All water samples will be accompanied by a chain of custody form, which will be signed by the collector upon delivery to the contractual laboratory or RIDEM/OWR sampling center.

Samples brought to the State Health Laboratories for analysis will be delivered to the receiving area by 3:00PM Monday through Thursday and by 12:00PM on Fridays. Projects including analysis of unfiltered five-day biological oxygen demand (BOD_5) will not be able to submit samples for BOD_5 on Tuesdays or Wednesdays. Sampling delivery will follow established State Health Laboratories protocol. A signed chain of custody will accompany all samples delivered to State Health Laboratories. Samples will be assigned a unique alphanumerical identified code from the State Health Laboratories LIMS. A sticker with the LIMS code will be applied to the bottle(s) from each sampling site and chain of custody. RIDEM/OWR and State Health Laboratories personnel will sign the chain of custody to verify delivery and receipt of the samples. State Health Laboratories retains the original copies of the chains of custodies and makes copies for RIDEM/OWR.

Maintaining field notebooks, datasheets, and chains of custody will be the responsibility of the field analyst throughout the sample collection effort. At the conclusion of the project, the Project Manager will retain project field notebooks, datasheets, and copies or originals of chains of custody in the physical location listed in the project-specific addendum.

4. Analytical Methods

The analytical methods used for each data collection effort will depend upon the nature and goals of the project. The field parameters typically measured in a lake monitoring program are listed in Table 1 with the data quality objectives and appropriate SOPs. Any parameters and associated SOPs beyond Table 1 will be listed in the project-specific addendum. The SOP(s) will identify the methods and equipment to be used. Specific method performance criteria and the individual(s) responsible for corrective action and documentation will be addressed in the SOP. Any parameter analyzed in a laboratory will follow the protocols and methods listed in the laboratory QAPP and SOP for sample disposal, laboratory turn-around-time, and method validation information. State Health

Laboratories laboratory follows standard EPA-approved methods and maintains SOPs and an EPA-approved QAPP.

5. Quality Control

Quality control for field collection will adhere to the data quality objectives listed earlier in this document. Field blanks, splits, and duplicate measurements will be used to assess the amount of error introduced into the sampling effort. Field measurements will follow guidance in the measurement performance criteria and SOPs (Table 1). Quality control analysis for field measurements will follow procedures and formulas for calculating applicable QC statistics in field sampling SOPs and comparison with historical information and ecological knowledge of the water body. Laboratory quality control will follow established laboratory SOP and QAPP guidance on the analytes' requirements for standards, blanks, splits, and spikes. Formulas for calculating applicable laboratory QC statistics will be addressed in the laboratory SOP and QAPP guidance.

If quality control analysis indicates that a large amount of error is being introduced into the project, the Project Manager will identify whether retraining of RIDEM field collectors or equipment maintenance is necessary. The Project Manager will also follow-up, in verbal or written communication, with any contractual designee if the quality control analysis indicates that the contractual personnel or laboratory quality control is introducing a large proportion of error into the project.

6. Instrument/Equipment Testing, Inspection, and Maintenance

RIDEM/OWR equipment and supplies are located in the sampling center of The Foundry, located at 235 Promenade Street, Providence, RI. All routine field instrumentation and equipment testing, inspection, and maintenance will adhere to the requirements listed in the data quality objectives and measurement performance criteria. Instruments and equipment will be regularly tested, inspected, and maintained according to manufacturer specifications. The instruments that will require regular maintenance throughout the field season are the YSI instruments. Refer to SOP OP-WR-W-14 Standard Operating Procedure for the Measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity using a Handheld YSI Model 85 Instrument for the schedule of regular maintenance (Appendix H). Maintenance and testing of the YSI instruments will be performed by the Project Manager, but the Project Manager may delegate the responsibility for calibration of the instrument to the field analyst during the field season. Other equipment, such as canoes, Secchi disks, anchors, etc., will only need an annual maintenance check conducted by the Project Manager or delegated field analyst to ensure parts are present and working properly following the field season. The field analyst will verify that the equipment is in proper working condition prior to each sampling event.

When best professional judgment indicates equipment or instruments are not functioning properly, the field analyst will perform any manufacturer guidance on troubleshooting to assess the potential problem. If the field analyst finds that the instrument or equipment is not readily repairable, then they will arrange for further testing, inspection, and/or maintenance with the manufacturer or other authorized inspection and repair entity. All laboratory equipment will be tested, inspected, and maintained according the laboratory's SOP and QAPP guidelines.

7. Instrument/Equipment Calibration and Frequency

Most field equipment will not need calibration, but any single or multi-probe meter will need to be calibrated prior to use in the field. RIDEM/OWR typically operates a YSI Model 85 for field measurement collection. The procedure for calibration of this instrument will follow the RIDEM/OWR Standard Operating Guidelines for the Standard Operating Procedure for the Measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity using a Handheld YSI Model 85 Instrument (Appendix H). This SOP documents how to perform the calibration, including required documentation, test criteria, and standards. The SOP also indicates how deficiencies will be resolved and documented. Any future acquisition of field measurement instruments will follow the manufacturer's guideline for calibration and frequency in an SOP. All laboratory equipment will be calibrated according the laboratory's SOP and QAPP guidelines.

8. Inspection/Acceptance of Supplies and Consumables

Any supplies and consumables received by RIDEM/OWR will be checked against the shipping and order information to ensure an accurate and complete order was received. All equipment, instruments, and supplies will be visually checked for obvious defects or damage. Any shipments with leaking contents or damage will not be accepted by the RIDEM/OWR Project Manager or designated field staff. The Project Manager or designated field staff will notify the appropriate RIDEM staff member responsible for supply ordering and/or purchase requests or the company to determine suitable order replacement or reshipping. Prior to and at the conclusion of the field season, the Project Manager or designated field staff will assess the supply inventory and arrange for restocking as necessary. Any supply source will be arranged through purchasing staff. Field equipment will also be evaluated during the inventory for any necessary repairs or part replacements to be arranged in the off-season.

All inspection and acceptance of supplies and consumables necessary for laboratory analysis of water samples is the responsibility of the contractual laboratory. State Health Laboratories maintains certificates of analysis for reagents and standards, which are reviewed by the Environmental Sciences Quality Assurance Officer or qualified designee. The Chemical Hygiene Plan is maintained by State Health Laboratories and is available on the premises.

All sample bottles with preservative received from State Health Laboratories or other contractual laboratory will be checked by members of the Field Data Collection Team to verify if the bottle cap is securely fastened to prevent leaking of the preservative prior to sample collection. To ensure retainment of the appropriate amount of preservative, sample bottles that have lost preservative will not be used. Acceptable sample bottles will be stored in the OWR Sampling Center until required for fieldwork. Field supplies stored in the OWR Sampling Center will be inventoried before the start of each sampling day, and problems will be reported to the Project Manager. At the end of each field day, supplies and gear will be rinsed or washed as needed, allowed to dry, and stored in the OWR Sampling Center.

9. Non-direct Measurements

Any data obtained from existing data sources, such as literature, maps, or historical databases, will generally be used to shape field collection project priorities, requirements, and goals. Most historical water quality data for Rhode Island lakes and tributaries are available in the RIDEM Microsoft Access database, WQUAL. Methods for use of historical data for other projects will depend on project goals.

Non-direct data may also be used to evaluate calibration standards for field equipment (i.e. calibration with a higher upper standard for a site with historically high values). Any data and maps obtained from geographic information sources can be used to assist with site reconnaissance and project priorities and goals. Data calculated from direct field measurements (i.e. calculation of total dissolved solids (TDS) from specific conductivity) will be addressed in a SOP with specific formula for calculation and source of formula. Final project reports or conclusions may include or reference data from existing data sources and will depend on the expected project outcomes and data requirements. The project goals or final reports will address the specific uses and considerations of data quality for existing data.

10. Data Management

The Project Manager will review all analytical data from field and laboratory data analysis. The data will be reviewed for completeness and accuracy. If errors or unusual data points are identified by a review of the data quality objectives, as described in the Data Review, Verification, and Validation Section, or best professional judgment of the Project Manager, the Project Manager will follow-up with the field and/or laboratory staff to determine whether any sampling, analysis, or data-entry problems were encountered. Unusual data that is determined to be accurate of sampling and analysis conditions will be noted in the hard-copy or electronic data. Data resulting from sampling and/or analysis error will be reviewed and rectified by the Project Manager in consultation with the project team.

All hard-copy data generated from lake monitoring will be organized according to the specifications set out in the project-specific addendum. The physical location of hard-copies will also be specified in the project addendum. Electronic lake monitoring data will be organized according to the project-specific addendum. Information downloaded from an electronic sampling device will be verified as stored on a computer or other electronic storage device before deletion from the instrument. As stated earlier, a second back-up copy will be made on a different storage media, and the retention of all records follows the State of Rhode Island Records Retention Schedule (Appendix A). Electronic water quality data from lake monitoring data may also be stored in OWR's water quality database, WQUAL. The data management process will result in three copies of the electronic data. A checklist indicating the physical and electronic locations will be included in the project-specific addendum.

III. DATA VALIDATON AND USABILITY

1. Data Review, Verification, and Validation

The data review, verification, and validation methods for data used in water quality assessments are addressed in the CALM (2009, as updated). Other projects undertaken through this QAPP will follow the schedule and breadth of data review, verification, and validation necessary specified for each project. Final data review will follow the basic procedures as outlined in RIDEM's Quality Management Plan (QMP; RIDEM 2010). At a minimum, final review of data consists of:

- Checking consistency and range of parameters,
- Checking the completeness and appropriateness of the sampling and testing,
- Checking that the correct methods were used,
- Checking for transcription errors,
- Checking that the work was done in accordance with the plan, or if changes were necessary, that changes were adequately documented.

As stated earlier, the Project Manager will routinely review all field data throughout the project and address any data quality concerns that are identified by the violation of the data quality objectives and best professional judgment. Data from field sheets will be reviewed for meeting the data quality objectives (Section I, #7; Table 1) and ecological knowledge as it is entered into the project's specific data storage format. Data manually entered or downloaded from a field instrument will be reviewed for meeting the data quality objectives (Section I, #7; Table 1) and ecological knowledge before deletion from the instrument as well. The Project Manager will follow-up on any data issues, with verbal or written communication, to the field staff or equipment manufacturer. The Project Manager or other RIDEM/OWR personnel may solicit internal or external review of data and methods for each project to assess whether the data meets the objectives and goals of the project.

All data from a contractual entity will adhere to the contractor's internal data review, verification, and validation processes before being submitted to RIDEM/OWR. State Health Laboratories maintains a laboratory QAPP that outlines the data review, verification, and validation procedures for laboratory samples. These laboratory results will be reviewed internally in accordance with State Health Laboratories procedures to verify that values and data quality indicators meet criteria and are within the acceptable ranges for each parameter. RIDEM/OWR will supplement the contractor's data process with review of the data by the Project Manager prior to use in any project. Best professional judgment and ecological knowledge of conditions appropriate for Rhode Island lakes and tributaries will also be used to identify potentially erroneous data. The Project Manager will contact, with verbal or written communication, the contractor to address data issues and resolve whether the data is suitable for use in the project.

Any data consolidation, transformation, or standardization procedure specific to a project will be identified in each project (i.e. use of only lakes greater than 2m, log transformation for normality assumptions). The Project Manager and personnel will decided whether to address the data review, verification, and validation procedures regarding consolidation, transformation, or standardization in the project-specific addendum, data analysis plan, or reports generated for the project.

2. Verification and Validation Methods

As stated earlier, verification of field data will use methods to evaluate for completeness, correctness, and conformance of data to method standard or SOP associated with each field parameter. While the verification process will evaluate the specific dataset in regards to data quality, data validation will evaluate the use of the dataset for the end use of the project. The validation of the data will pertain specifically to the goals and needs of each project. Should a project's goals or funding requirements necessitate a more rigorous review, verification, and validation method, then the RIDEM QMP (2010) procedure for a data usability assessment using relevant state and federal guidance will be implemented. A contractual entities' approved QAPP for data collection, laboratory analysis, or statistical analysis will contain the methods for verification and validation of data for the contracted project. RIDEM/OWR will communicate, through verbal or written mean, with contractual entities about the methods for data verification and validation.

The Project Manager will be responsible for reviewing the field and laboratory reports and data packages, as well as data entries and transmittals, for completeness and adherence to QA requirements. Along with the procedures set forth in the RIDEM SOP BEP-WR-1 Summary Guidance for Reviewing Environmental Monitoring Data (Appendix I), which contains a checklist for review of environmental data and reports, data quality will be assessed by comparing data with the data quality indicators discussed earlier. Decisions to qualify, accept or reject data will be discussed by the RIDEM/OWR Program and Project Managers and the QA Project Manager. The RIDEM/OWR Program Manager will make the final determination to reject data and remove any

unusable data. Assumptions of the project design and limitations in the data set will be documented for future communication to data users and water quality managers.

3. Reconciliation with User Requirements

Since this QAPP is designed to be a general guidance document, the methods for reconciliation of data with user requirements will be guided by the project goals. In coordination with the RIDEM/OWR QA Project Manager, the RIDEM/OWR Project Manager and Program Manager will determine if data collected meet the measurement performance criteria for the project and verify that all the SOPs have been followed. Data that meets the DQO for the project will be accepted or qualified, but data that does not comply with DQO and cannot be reconciled will be rejected. Since the projects undertaken with this QAPP will be targeted sampling of specific water bodies, the methods employed will generally be simple descriptions without extrapolation to other water bodies. If the project team determines that the criteria for the project have not been met, the team will determine if additional data need to be collected or specify limitations on data use for the project and data users.

IV. ASSESSMENT AND OVERSIGHT

1. Assessments and Response Action

Field data collection efforts, field notes, laboratory data and maps generated as part of the projects will be reviewed throughout the sampling period by the RIDEM/OWR Project Manager to ensure that data collected is useable for the purposes of the study. The RIDEM/OWR Project Manager will provide oversight for each field data collection effort to ensure that protocols described in the QAPP are being followed. This duty includes: ensuring that field equipment are properly calibrated, data are recorded in a consistent manner, sampling methodology are being conducted in accordance with respective SOPs, samples are properly stored and transferred to custody of State Health Laboratories or other contractual laboratory, and documentation records are properly stored. Any specific schedule of data review will be project-specific in nature.

If inconsistencies are detected, the RIDEM/OWR Project Manager will request, by written or verbal means, the field or laboratory work to stop and discuss field instrument calibration and data collection with field personnel and chemical analysis with the appropriate laboratory designee, usually the Chemical Analysis Lead. The RIDEM/OWR Project Manager will discuss both field and laboratory inconsistencies with RIDEM/OWR QA Project Manager. The Project Manager will also review documentation that field staff are trained in the correct procedures and SOP version prior to the beginning of data collection. Any field staff not trained will be contacted through verbal or written means and provided with the necessary instruction, materials and documentation. The QA Project Manager will update training documentation list to

reflect proper training in project-associated methods. The implementation of a routinely-scheduled field assessment will be determined by the Project Manager.

Prior to field collection, the Project Manager or designated field analyst will annually document whether equipment and instruments are functioning properly according to the accuracy data quality objectives stated earlier. As stated earlier, the Project Manager or designated field staff will inventory supplies and equipment at the end of the field season and order supplies as needed for the next field season.

2. Reports to Management

The number of QA reports and the frequency of submittal to management will be determined by individual project goals and requirements of the funding source(s), which will be documented in the project description. As needed, the Project Manager will meet and communicate with responsible management, usually at least the RIDEM Program Manager and QA Project Manager, to compose a schedule and identify the outcomes to be reported in management reports. The RIDEM/OWR Project Manager will coordinate electronic or verbal communications on the project progress and updates to the Program Manager and QA Project Manager. The contents of reports will also be identified by the project goals and funding source requirements, but the report could include updates on data collection, training of field staff, summary of actions-to-date, interim assessments of attainment of goals or final summary of the project and conclusions, and/or significant QA problems and recommended solutions. The person responsible for generating the report to management will be dictated by the project goals and funding source requirements, but the process will usually involve the identified Project Manager. Outside of the agreed upon report schedule, the Project Manager will communicate, as needed, verbal or written updates to other RIDEM/OWR personnel and management.

REFERENCES

RIDEM. 2009. *2010 Consolidated Assessment and Listing Methodology for Section 305(b) and 303(d) Integrated Water Quality Monitoring and Assessment Reporting*. Office of Water Resources, R.I. Department of Environmental Management. http://www.dem.ri.gov/programs/benviron/water/quality/pdf/finlcalm.pdf

RIDEM. 2010. *Quality Assurance Project Plan for Rhode Island Ambient River Monitoring Program*. Office of Water Resources, R.I. Department of Environmental Management.

USEPA. 2001. *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5*. Office of Environmental Information, U.S. Environmental Protection Agency. EPA/240/B-01/003.

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FIGURES

Figure 1: Organizational Chart for RIDEM Lake Monitoring Projects

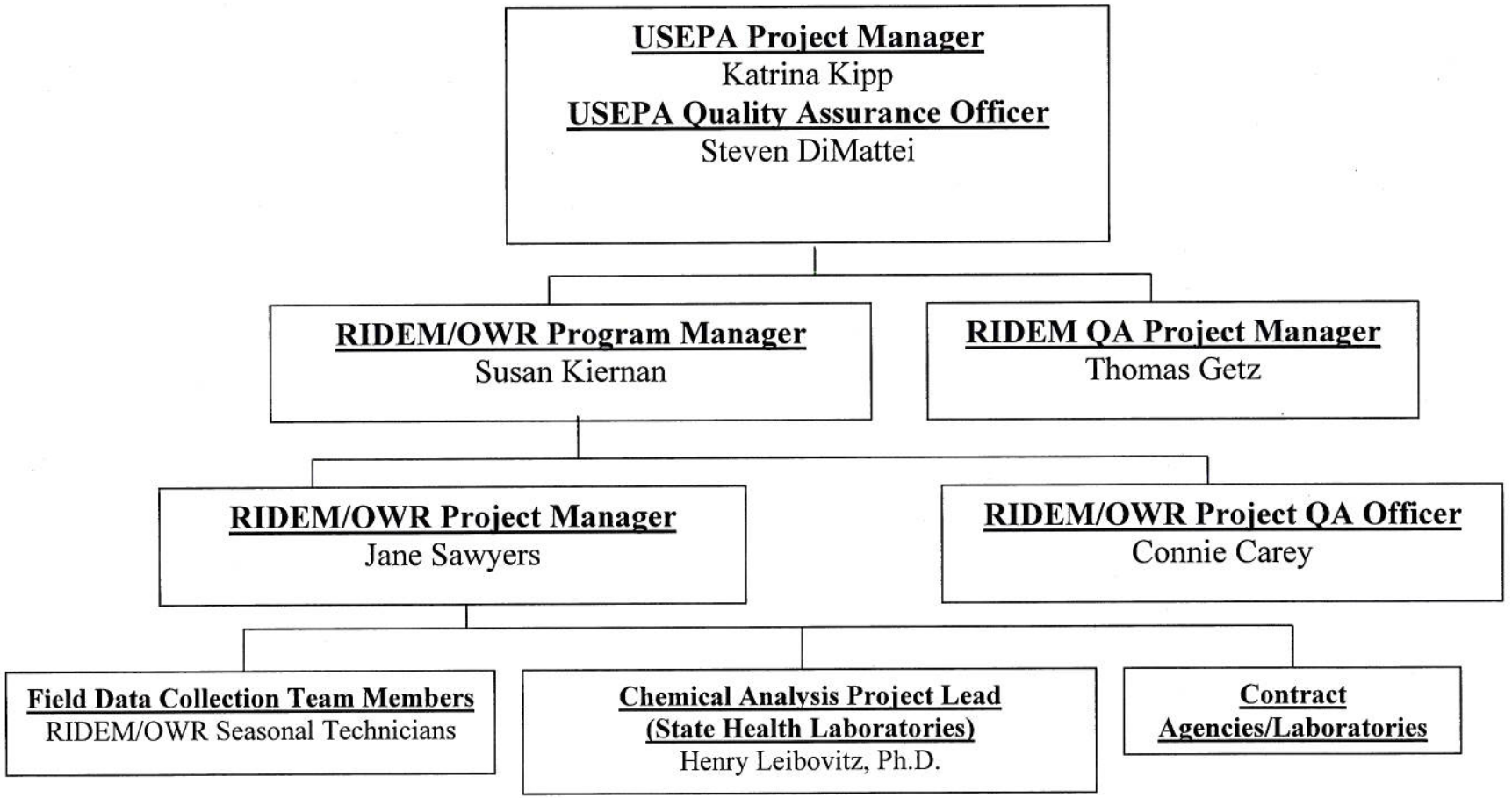

Figure 2: Sample Submission Form/Chain of Custody for HEALTH

☐ ICED FOR TRANSPORT

Sample Submission Form/Chain of Custody
Rhode Island Department of Health Laboratories
50 Orms Street, Providence, RI 02904

Sample Submission Number

Legal Sample | |

Client: DEM - WRE Ambient River Monitoring

A. Client ID#: WRE-AMBIENT MONITORING Run #:
B. Client Name: **DEM-OWR**

Mail Report To: RIDEM – OWR Room 200
Street: 235 Promenade Street
City: Providence, RI
Report To (Agency/Person): Mark Nimiroski

Collected By: _____ Collected Date: _____ Time: _____ Matrix: Water X Other

Source# **C.** Facility ID#: **D.** **E.** Sample Point ID#:

Collection Point (tap/well): _____

Collection Point Address: _____
Name **Street** **City**

Class: _____ Origin#: _____ pH: _____ (adj.pH): _____ CL Residual: _____

Inorganics Lab	DUP
Non-metals Tests	
_X_ WL1 Turbidity	___
___ WL4 Color_____	___
_X_ WL7 Total Suspended Solids	
___ WL10 BOD	
_X_ WL12 Total Phosphorous	___
_X_ WL13 pH	___
_X_ WL17 ortho-phosphate	
_X_ WL ammonia - N	
_X_ WL Total Kjeldahl - N	___
_X_ WL Total Nitrogen	
___ WL11 Cyanide (335.4)	___
_X_ WL16 Nitrate (353.2)	___
___ WL18 Alkalinity (2320B)	
_X_ WL20 Chloride (300.0)	___
__ WL21 Fluoride (300.0)	___
_X_ WL22 Hardness (2340B)	
___ WL56 Nitrite (353.2)	___
___ WL_____	___
Metals DEM Ambient River Monitor	
_X_ WL62 (200.8) Diss. Cd, Cu, Pb	___
	___
_X_ WL62Fe (200.8) Total Fe	
	___
__WL67 Full Set (200.8)	
___ WL69 Magnesium	
___ WL70 Potassium	
_X_ WL71 Sodium	
___ WL72 Calcium	
__ WL73 Sodium Composite(200.8)	

Metals	DUP
___ WL36 Mercury (245.1)	___
___ WL65 Lead & Copper(200.8)	___
Metals for New Systems	
___WL66 Full Set (200.8)	
___ WL75 Antimony	___
___ WL76 Arsenic	___
___ WL77 Barium	
___ WL78 Beryllium	___
___ WL79 Cadmium	___
___ WL81 Chromium	
___ WL64 Copper	___
___ WL82 Iron	___
___ WL63 Lead	
___ WL83 Manganese	___
__ WL84 Nickel	___
___ WL85 Selenium	
___ WL86 Silver	___
___ WL87 Thallium	___
_X_ WL88 Zinc	
Metals Routine Set	
___WL68 Full Set (200.8)	___
__ WL78 Beryllium	___
___ WL81 Chromium	
___ WL84 Nickel	
___ WL76 Arsenic	___
___ WL85 Selenium	
___ WL79 Cadmium	___
__ WL75 Antimony	___
___ WL77 Barium	___
___ WL87 Thallium	___

Organics Lab	DUP
___ PE4–CARB (531.1)	___
___ PE12–Pest/PCB (608)	___
___ PE14–EBD/DBCP (504)	___
___ PE18–Pest/PCB (508)	
___ PE21–HERB/ (515.3)	
___ PE22–Pest/PCB+ (508)	___
___ PE_____	
___ TO2–THM (524.2)	___
___ TO3–PWVOC (524.2)	___
___ TO4–PET HCS & TO3	
___ TO11–UFVOC (624/603)	___
___ TO12–WQVOC (524.2)	___
___ TO14–USR Fee B/N Ext	
___ TO17–PET HC & TO12	___
__ TO19–Total EXTR (625)	___
___ TO25–WQ SEMI (525.2)	
___ TO27–AGR SVOC (525.2)	___
___ TO32_Chlorophyll a (446)	___
__ TO_____	

FB	Sanitary Microbiology
___	___ SM2 – MF Total Coliform
___	___ SM3 – SPC
___	___ SM34 – Colilert
	___ SM36 – Pres./Abs.
	___ SM1 – MPN
___	# of Tubes ____ Dil._____
	Thru___ Fecal Coliform____
	_X_ SM37 Enterolert
___	___ SM38 A1 Fecal Coliform
___	

Must Be Completed For Legal Sample	Container		Preservative Added		
Test Code	Number	Type	By Lab	By Collector	Special Instructions

Chain of Custody

Relinquished By	Date	Time	Received By	Date	Time	Comments

Figure 3. Sample Training Form for Monitoring Section Field Personnel

TRAINING DOCUMENTATION FORM (Front)

Signatures below indicate _____ has received a copy of the *Generic Quality Assurance Project Plan for Lake Monitoring by RIDEM/OWR* from the RIDEM/OWR Project Manager. _____ has read and understands the document, and has been given the opportunity to ask any questions pertaining to policies and procedures described herein. The undersigned has received appropriate training in these QAPP procedures and has also read the associated Standard Operating Procedures. This original training documentation form will be kept on file with the Project Manager and personnel may be provided with a copy if requested. Subsequent field assessments will be recorded below to document that the Project Manager periodically evaluates said personnel in the field to insure conformance with this QAPP.

_____	_____	_____
Printed Name	Signature	Date
_____	_____	_____
Project Manager	Signature	Date

Personnel Field Assessment for Lake Data Collection

To ensure field operations are in compliance with the project data quality objectives indicated in this QAPP, the Project Manager will train and periodically conduct a Personnel Field Assessment to evaluate personnel conformance with the QAPP and associated SOPs.

Results of the Field Assessments will be documented below to indicate conformance or non-conformance (or if not evaluated, indicate N/A). Should the undersigned fail to comply with procedures outlined herein the RIDEM/OWR Project Manager will consult with the RIDEM/OWR Quality Assurance Manager and take corrective action to retrain personnel in proper procedures.

FOR TRAINING PURPOSES

Name of Trained Field Personnel: Project Manager Initials:

Training Date:	Task Evaluated	Performance Assessment Result: -Conforms to QAPP -Non-conformance -Not evaluated (N/A)	Corrective Actions Taken or other comments
	Calibration Procedures and Documentation		
	Field Data Recording		
	Sampling Methodology		
	Sample handling, storage and labeling		
	Chain of Custody Procedures and Documentation		

TABLES

Table 1: Quality Objectives for Commonly Measured Lake Parameters

Parameter	Measurement Range	Accuracy	Precision	SOP
Temperature	-5 – 65°C	+/-0.1°C	+/-1.0°C	SOP-WR-W-14
Dissolved Oxygen – % Saturation	0 – 200 %*	+/-2%*	N/A	SOP-WR-W-14
Dissolved Oxygen – Concentration	0 – 20 mg/L	+/-0.3mg/L	+/-5%	SOP-WR-W-14
Secchi	0.1 – 25.0m	N/A	+/-5%	SOP-WR-W-7
pH	1.0 – 14.0	+/-0.1	+/-5%	SOP-WR-W-14
Conductivity**	0 – 499.9 µS/cm 0 – 4999.9 µS/cm	+/-0.5%FS*** +/-0.5%FS***	+/-5%	SOP-WR-W-14
Macrophyte Abundance	0 – 100%	N/A	+/-10%	SOP-WR-W-29

*Air Saturation
**Derived parameter – Specific conductivity
***FS – Full scale

Table 2: Project Quality Control Checks for Field Measurements

QC Check	Type	Information Provided
Blanks	Field Blank	Transport, storage, and field handling bias
Spikes	N/A	N/A
Calibration check samples	Routine maintenance-equipment specific	Calibration drift
Replicates, splits	Field splits	Shipping + interlaboratory precision
	Analysis replicates	Instrument precision

APPENDIX A
State of Rhode Island
General Records Retention Schedule GRS5:
Daily Operations Records

GRS5 Daily Operations Records

GRS5.1 General Correspondence and Memoranda

Routine written communications created or received in the normal course of agency business. May include, but is not limited to, referral letters, requests for information pertaining to the agency, requests for publications that the agency provides to the public, requests for the services provided by the agency, requests for records under the Access to Public Records Act (RIGL § 38-2), any other correspondence that does not affect agency policy or procedures, and routine internal memos (unless specific to agency policy or procedures). Records may be arranged chronologically, by subject, or in some other order that is meaningful to the agency. This series does not include correspondence that involves personnel decisions, allegations of misconduct, the agency's facilities, complaints, or the agency's budget.

Retention: Retain one (1) year.

Note: When a written communication initiates a substantive transaction that requires creating a separate file, it becomes part of another appropriate series, rather than the General Correspondence series.

See also: Executive Records - Correspondence and Memoranda - GRS1.1.

GRS5.2 Phone Logs

Includes all records of incoming and outgoing calls to and from agency personnel.

Retention: Retain one (1) year.

GRS5.3 Mail Logs

Includes all records of incoming and outgoing mail to and from agency personnel.

Retention: Retain one (1) year.

GRS5.4 Surveys/Questionnaires

Surveys/questionnaires conducted by an agency or municipality in response to issues identified as significant to operations or policy, or to gather information. Includes forms distributed by the agency or municipality that were filled out and returned and the data compilations from the survey/questionnaire.

a) Completed survey/questionnaire forms

Retention: Retain one (1) year.

b) Compiled data

Includes compilations of data that were created from surveys/questionnaires conducted or distributed by the agency or municipality.

Retention: Retain until report is compiled and issued. Before disposal of Compiled Data, consult State Archives to review for historical value.

GRS5.4 Surveys/Questionnaires (continued)

c) Reports and recommendations
Reports, summaries, and recommendations issued, instituted, or arising from surveys/questionnaires.
Retention: Permanent.

d) Surveys unrelated to agency mission or programs
May include compiled data and reports.
Retention: Retain until of no further administrative value.

See also: Executive Records - Special Plans, Publications, Studies and Report - GRS1.6.

GRS5.5 Contact Lists and Directories
Includes mailing lists, directories, and rosters compiled by the agency for contact purposes.

Retention: Retain until superseded or of no further administrative value.

GRS5.6 Scrapbooks/Photo Albums/Clippings
Includes records of activities and events, official in nature, and relating to the agency, usually compiled by staff members, which may contain photographs, announcements, clippings, advertisements, and other items reporting the event, activity, or program.

Retention: Permanent.

Note: Newspaper clippings should be photocopied and originals discarded.

GRS5.7 Public Relations Records
Includes records relating to public relations activities of the agency including, but not limited to, press releases, newsletters, brochures, audiovisual materials, and supporting documentation.

a) Publicity and press releases
Includes newsletters, press releases, brochures, and other items designed to inform the public of the agency's mission, programs, projects, events, or activities.
Retention: Retain one copy of each permanently.

b) Supporting documentation
Includes supporting documentation, such as drafts and research notes, used in the preparation of newsletters, press releases, brochures, and other items created for public relations purposes.
Retention: Retain until of no further administrative value.

GRS5.7 Public Relations Records (continued)

c) Audio/visual records
Includes audio, video, and photographic items in analog or digital format.
Retention: Permanent.

See also: Information Management Records - Website Documentation - Web page content - GRS7-X.Xc.

GRS5.8 Daily and Weekly Reports
Internally generated reports on routine agency activities created on a daily and/or weekly basis. These reports and returns may be used for internal purposes or be shared with other municipal departments and state agencies. This does not include reports that are part of another series (such as reports on receipts and expenditures, which fall under the Fiscal section of this schedule, or vehicle use reports, which fall under GRS4.6).

Retention: Retain one (1) year.

GRS5.9 Monthly, Quarterly, and Periodic Reports
Internally generated reports on agency activities created for any time period of time greater than weekly, but less than yearly/annual. These reports may be used for internal purposes or may be shared with other municipal departments or state agencies. This does not include reports that are part of another series.

Retention: Retain three (3) years.

Note: For Annual Reports, see Executive Records - Statistical Records and Annual Reports - GRS1.5.

GRS5.10 Complaints
Complaints against agency about problems involving delivery of services, job performance of employees, personal interactions with the agency and/or any other difficulties. May include, but are not limited to, letters of complaint, notes from telephone conversations, and agency responses.

Retention: Retain three (3) years.

Note: When this record series appears on agency specific schedule, retain for whichever period is the longer of the two.

GRS5.11 Reference Material
Documents used by staff as sources for reference. May include, but is not limited to, reference books, brochures, published reports, manuals, periodicals, material from websites, and clippings.

Retention: Retain until of no further administrative value.

GRS5.12 Professional Organization Membership Files (Added 4/2009)
Employees of state agencies and local government agencies sometimes join professional organizations and attend meetings and conferences of these organizations. These records document this professional involvement. They may include, but are not limited to, publications of the organization, handouts distributed at conferences and notes taken at conferences.

Retention: Retain until of no further administrative value.

Note: No notification required for destruction

GRS5.13 Outreach and Training Records (New series added 10/2009)
Agencies, as part of their programs, sometimes offer training in certain aspects of their areas of responsibility and expertise. Training and outreach activities include lectures, workshops, and presentations. Documentation of these activities may include, but are not limited to, pamphlets, brochures, guides, guidelines, lecture notes/talking points, evaluation forms and compiled data, electronic presentations and web-based workshops (PowerPoint, webinar etc.).

a) Evaluation Forms and Compiled Data
Retention: Retain until of no further administrative value.

b) Electronic Presentations
Retention: Retain each substantive version permanently.

c) All Other Records
Retention: Retain one copy as a permanent record.

See also: GRS5.7 Public Relations Records

GRS5.14 Staff Meeting Minutes (New series added 11/2010)
Periodically, agency staff come together to discuss internal office matters. These records document those meetings. The files include not only meeting minutes, but also any other records used for reference at the meetings and other documents generated as a result of the meetings.

Retention: Retain three (3) years.

Note: For meeting of entire agency or committees within an agency that are more substantive in nature and involve policymaking, see GRS1.7 Meeting Minutes.

Revised April 2009
Revised October 2009
Revised November 2010

APPENDIX B
Digital Photograph Record Collection and Storage Standard Operating Procedure

Digital Photograph Record Collection and Storage SOP
SOP-WR-W-26

1. **APPLICABILITY.** This SOP applies to TMDL, Shellfish, and DEM Ambient Monitoring programs, excluding contactors, in the Office of Water Resources where staff utilizes digital photography, including but not limited to shoreline surveys, environmental monitoring, restoration, or protection projects or any other photo-documentation purposes. Exemption from the use of this SOP for project work shall be allowed for reasons of inapplicability determined by management discretion. This SOP was adapted from DEM SOP-OD-QM-4. The changes to the SOP relate to the amount of metadata that is needed. Since these programs often take pictures for informational purposes only, it is up to the individual to decide (with their supervisor, if necessary), what level of metadata is needed for each set of photographs taken.

2. **PURPOSE.** Photography that has a reasonable probability to be considered for use as legal evidence, historic record or other value to the State must be protected from loss or destruction. This SOP provides a method to collect and store digital photographs and associated documentation data. The use of digital photography for documentation has resulted in a proliferation of data files that can be lost or easily destroyed, since unlike traditional printed-paper, they may not physically exist except in the form of magnetic or optically read media. There are many types of digital cameras, photographic processing software and operating systems in use currently at DEM, however certain common elements can be used as a framework to establish a standard method to assist in preservation of these records for easy retrieval and future use.

3. **DEFINITIONS**
   - **3.1.** WWW - World Wide Web
   - **3.2.** JPG - is a commonly used image file format for photographic images. JPEG is an acronym for the group that invented the format (Joint Photographic Experts Group)[1]. When you create a JPEG or convert an image from another format to a JPEG, you are asked to specify the quality of image you want. Since the highest quality results in the largest file, you can make a trade-off between image quality and file size.
   - **3.3.** GIF- Graphic Interchange Format[2]
   - **3.4.** PNG - Image file format supported on the WWW[3]
   - **3.5.** BLUETOOTH - a telecommunications industry specification that describes how cameras, mobile phones, computers, and personal digital assistants (PDAs) can be easily interconnected using a short-range wireless connection.
   - **3.6.** THUMBNAIL - A reduced file size version of a photographic record used for indexing and previewing of images.

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[1] http://searchwebservices.techtarget.com/sDefinition/0,,sid26_gci212425,00.html
[2] ibid.
[3] ibid

3.7. GPS - The GPS (Global Positioning System) is a "constellation" of 24 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. A basic GPS receiver provides geographic position - longitude and latitude, within 100 meters. Some receivers are equipped with a display screen that shows a map of the position.[4]

3.8. MEDIA - Electronic devise that is designed to store of storing electronic records such as magnetic and optical disks, cards containing microchips etc.

4. RESPONSIBILITIES

4.1. COMPLIANCE - All staff engaged in collecting DEM digital photographic records are responsible to determine applicability of this SOP to their work. See Section 1 above. Supervisors are responsible for ensuring that staff is familiar with and adhere to any SOPs affecting their program functions.

5. GUIDELINE AND PROCEDURES

5.1. CAMERA AND FIELD NOTES

5.1.1. Verify that the date and time on the camera is accurate.

5.1.2. Depending on the purpose of the photograph, the user may activate the visible date and time option such that the recorded image will be imprinted with the date and time of the photo.

5.1.3. Select appropriate resolution quality. The higher the resolution the fewer the images that can be recorded for a given media.

5.1.4. Descriptive documentation should be recorded in sequentially numbered field notes immediately after the images are collected for specific photograph detail recall. (See 5.5.1)

5.2. COMPUTER SUBDIRECTORIES CREATION AND FILE NAME CONVENTIONS

5.2.1. Create a subdirectory on the computer to store the image files.

(A) File name conventions for subdirectory folders may be established to facilitate organization of records by Project, Station or Location.

(B) Multiple photo documentation sessions at a particular station or location should have date coding in the subdirectory name convention.

(C) If applicable, create a print image or report subdirectory to store the print versions of select images.

5.2.2. File name conventions for image files should be established to facilitate organization of records, for example, by: Project, Station or Location, Date, and a unique identifier, if necessary. (i.e. Project_Station_Date_ UniqueIdentifier.jpg).An image taken for the Wood River Basin Monitoring Project at Station #2 on 19 August 2006 could be named "WRB_Station2_19AUG2006.jpg". If multiple pictures were taken at this station on this date, each file name could include a unique identifier (e.g. WRB_Station2_19AUG2006_Looking_Downstream.jpg". Renaming

[4] http://searchmobilecomputing.techtarget.com/sDefinition/0,,sid40_gci213986,00.html

photos may not be needed if it is sufficient to place photos in a directory whose name includes the date the pictures were taken and the location or if a report is created that details photo information.

5.3. COMPUTER IMAGE TRANSFER AND THUMBNAIL PRINT

5.3.1. Transfer the image files to the computer by various methods below:
(A) Connect camera directly to the computer with the supplied cable.
(B) Remove the memory card from the camera and use a card-reading device connected to the computer.
(C) Use of Bluetooth or other wireless transfer protocol.

5.3.2. When the device connection is recognized by the computer you will typically be given the option of storage file location and whether to delete the image files after transfer.
(A) Do not select "delete after transfer" option until you are experienced with successful location and retrieval of your images from a previous photo transfer procedure.
(B) Select the appropriate subdirectory for transfer of the photos.

5.3.3. Validate the transfer of images to the new directory by viewing the directory and comparing file sizes to originals.

5.3.4. Deleting images from the camera or camera media.
(A) If you are confident that the transfer was successful, avoid selecting and deleting the camera image processing files and delete only the camera image files with suffixes .jpg, .gif, or .png.

5.4. IMAGE ENHANCEMENT

5.4.1. Typical digital photography processing software enables simple improvement of images with respect to contrast, brightness and level of detail though special effects. If there is reason to believe that the image may be used for legal purposes, then any image-modified versions must not result in the replacement of the original image. Any modified image should be saved as a new file name encoded in a convention that clearly discloses image enhancement.

5.5. CREATE REPORT OR PRINT IMAGE FROM TEMPLATE

5.5.1. The decision to create a report for photographs is based on the use of those photographs. As mentioned in Section 5.2.2, it may be sufficient to place the photographs in a directory containing the project, the date, and the location of the photographs.

5.5.2. Templates for print out of photographic documentation may include:
(A) Date of photo record.
(B) Originating DEM Office.
(C) Photographer name.
(D) Other DEM staff witnesses to photograph conditions.
(E) Image sequence number.
(F) Location or site of photography, GPS coordinates if available.
(G) Photo description or caption.

5.5.3. Load the template file and "Save–as" a new report name.

5.5.4. Select the best representative images for print out to a template appropriate in size to the level of detail required and copy them into the template.

5.5.5. Fill out section 5.5.1 details in the template from memory and/or field notes.

5.5.6. Print the report and file it with the other project records including the above said thumbnail sheet.

5.6. CREATE DUPLICATE ELECTRONIC RECORD (BACKUP)

5.6.1. To maintain a permanent record and to create an electronic backup of the original photos programs shall adopt some of the mechanisms including but not limited to the following:

- burn a CD of the project work,
- copy to other internal drives,
- emailing them to storage areas,
- use of jump drives.

5.6.2. If available and network storage capacity allows, utilize DEM network to archive image files.

6. REFERENCES

6.1. See Footnotes.

DIGITAL PHOTOGRAPH RECORD COLLECTION AND STORAGE SOP
SOP- WR-W-26

Originator:

Heidi Travers _____ _____ Date: _____
Print Name Signature

APPROVALS:

Quality Team Chair:

Tom Getz _____ _____ Date: _____
Print Name Signature

Assistant Director of Water Resources

Alicia Good _____ _____ Date: _____
Print Name Signature

Deputy Chief of Water Resources

Sue Kiernan _____ _____ Date: _____
Print Name Signature

Deputy Chief of Water Quality Assessments

Elizabeth Scott _____ _____ Date: _____
Print Name Signature

DISTRIBUTION:

(x) TMDL .....By:_____ Date: _____
(x) Shellfish .....By:_____ Date: _____
(x) Surface Water Monitoring and Assessment.....By:_____ Date: _____

APPENDIX C
Procedures for Developing and Approving Standard Operating Procedures

Procedure for Developing and Approving Standard Operating Procedures

1. **APPLICABILITY.** This Standard Operating Procedure (SOP) applies to all programs in the Rhode Island Department of Environmental Management (DEM). This Procedure applies to all staff involved in any task that is appropriate for, or has an established, SOP.

2. **PURPOSE.** Establishing standardized methods for performing common repetitive tasks improves the DEM's efficiency, consistency, verifiability, credibility, and our ability to attain the highest levels of Quality Assurance, Quality Control, and Quality Improvement (QA/QC/QI). This document describes the DEM's procedure for developing, formatting, approving, and distributing standard operating procedures (SOPs).

3. DEFINITIONS

3.1 Director - Refers to the Director of the Rhode Island Department of Environmental Management.

3.2 Originator - Refers to the individual primarily responsible for the development of a SOP, including drafting, review, finalization, and distribution.

3.3 Quality Assurance Manager (QAM) - Refers to the individual at DEM who is the primary point of contact for quality issues and the Quality Management Team (Team).

3.4 Quality Management Team (Team)- The DEM organizes and oversees agency-wide QA/QC/QI functions with a Team. Team members represent the regulatory programs within the DEM.

3.5 Senior Management – Refers to the group of individuals existing at any point in time that oversee the DEM environmental programs.

3.6 Standard Operating Procedure (SOP) – Is the description of a prescribed method that must be used by DEM staff to complete certain routine or repetitive operations, analyses, or actions. SOPs do not establish policy and are not appropriate to describe procedures or requirements that apply to members of the public, other than persons acting as agents of, or under contract with, the DEM.

4. RESPONSIBILITIES

4.1 COMPLIANCE - All staff engaged in operations, analysis or actions subject to or appropriate for the application of a SOP are responsible for becoming familiar, and complying, with the contents of this procedure prior to drafting or revising a SOP. Supervisors are responsible for ensuring that staff is familiar with and adhere to the SOPs affecting their program functions. Any SOP in place before this document's effective date must be scheduled for annual review and periodic renewal by a responsible individual. At the time of any revision after the effective date of this SOP, an existing SOP must be brought into conformance with the provisions of this document. Until revision or renewal occurs, no changes are required to bring currently effective SOPs into conformance with this SOP.

4.2 DEVELOPMENT - The Originator is responsible for initial development. Initial development includes word processing and distribution for review.

4.3 APPROVAL - The Originator is responsible for obtaining preliminary and final approval of a proposed SOP.

4.4 DISTRIBUTION - After all approval signatures have been obtained, the Originator is responsible for distributing the SOP to any affected parties, as evidenced by a completed distribution list on the Coversheet. Members of the Quality Team and the Quality Assurance Manager (QAM) should receive all final SOPs.

4.5 MAINTENANCE - An individual, typically the Originator, will be assigned responsibility for ensuring that a SOP reflects current needs and standards. Consistent with DEM's Quality Management Plan, the responsible individual will annually evaluate SOPs to ensure current needs are being met; likewise, all SOPs will be renewed every five years.

5. GUIDELINES AND PROCEDURES

5.1 ORIGINATION - A staff member, a contractor or an agent of the Department may originate a draft or a concept for a draft SOP for any appropriate procedure or process.

5.2 CONTENTS – All new SOPs developed by DEM should include the following contents in the order outlined below. SOPs that are developed by contractors or agents of DEM shall include the following contents. The DEM project officers shall have the flexibility to waive the order of the contents if the contractor or agent is using a SOP that has been previously developed.

5.2.1 APPLICABILITY - The first section of a SOP contains a brief statement identifying the scope of the SOP and indicates the individuals and programs that are affected by the SOP.

5.2.2 PURPOSE - The second section of a SOP contains a brief statement explaining the objective of the procedure. It indicates what organization, documentation, and/or activities are involved or affected by the procedure, and a concise background description.

5.2.3 DEFINITION - The third section of a SOP lists the meaning of words or groups of words not commonly known to the potential user of the SOP. For example, technical terms and/or acronyms are described in this section.

5.2.4 RESPONSIBILITY - The fourth section of a SOP lists all the individuals or groups responsible for implementing the procedure or performing certain tasks associated with the procedure and their duties.

5.2.5 GUIDELINES AND PROCEDURES - The fifth section of a SOP lists, in detail, all the steps required to perform the particular job task.

5.2.6 REFERENCES - The final section of a SOP lists any written reference materials used in compiling the procedure.

5.3 FORMAT

5.3.1 CONFORMANCE TO STANDARD - All SOPs must at least include the *Page Header Contents* information as detailed in Section 5.3.2 of this SOP. If a contractor or agent of DEM develops the SOP, it will not be required to contain the DEM logo. All other information shall be included in the header. The standard text format detailed in FIGURE 2 of this SOP is required for SOPs that apply DEM-wide. The format is recommended, but not required, for bureau- or program-specific SOPs.

5.3.2 PAGE HEADER CONTENTS. Each page, including the coversheet, shall include a header containing the Department logo in the upper left corner, and a document identifier in the upper right hand corner that contains the following information in nine (9) point bolded type, Arial: SOP No ,Effective Date, Revision No, Last Revision Date, and page number.

5.4 SOP DEVELOPMENT AND APPROVAL PROCESS - The SOP approval process consists of a preliminary draft cycle and a final approval cycle.

5.4.1 PRELIMINARY DRAFT DEVELOPMENT - In the preliminary draft cycle, the originator contacts their direct supervisor to gain approval for going forward with drafting a proposed SOP, or one that is being drafted by a contractor or agent of DEM. Upon approval to proceed, the originator should work with appropriate staff to prepare a draft. "Appropriate staff" should include a representative group of individuals who will be affected by the SOP. Any staff member who makes a request to review a draft SOP should be provided that opportunity.

5.4.2 PRELIMINARY DRAFT APPROVAL - The signatures required for preliminary draft approval should be correspond to the scope and applicability of the SOP. SOPs applying to a discrete unit within a Office, at a minimum, need a sign-off from the project and program manager. The preliminary draft must first be submitted to the Originator's project or program manager for comment and approval to proceed with the review process. Upon receiving approval to proceed, if other supervisors on the same management level as the Originator's supervisor have staff affected by provisions in the draft SOP, the draft should then be circulated to them for review and comment. Reviewers are free to use their judgment to include additional individuals and groups whose input they believe would be valuable to the process. All required reviewers must submit a response to the Originator, indicating approval or changes necessary to obtain their approval.

5.4.3 COMMENT RECONCILIATION - The Originator of the draft SOP will resolve any issues raised in comments during the draft review cycle. Upon resolution of the comments, the Originator must obtain approval signatures on the Draft Approval Routing Sheet from any unit supervisor and Division Director whose staff will be affected by the SOP. The completed Draft Approval Routing Sheet should be retained in a file created during the SOP drafting process.

5.4.4 FINAL APPROVAL - As with preliminary draft approval, the signatures necessary for final approval should be commensurate with the SOPs scope and applicability.

(A) PROGRAM SPECIFIC SOPs. Preliminarily approved drafts of program specific SOPs must receive final approval from the relevant Office Chief and sign off from the DEM's QAM. Only these two (2) signatures should be on the SOP Coversheet.

(B) MULTI-PROGRAM / BUREAU SOPs. Preliminarily approved drafts of multi-program SOPs must receive final approval from the appropriate Bureau and Assistant Directors and a sign off from the QAM.

6. REFERENCES

6.1 DEM QUALITY MANAGEMENT PLAN (September 2003)

FIGURE 1 – SAMPLE COVERSHEET

COVERSHEET
STANDARD OPERATING PROCEDURE
APPROVALS:

Quality Team Chair:

_____ _____ Date: _____
Print Name Signature

Assistant Director of Water Resources

_____ _____ Date: _____
Print Name Signature

Assistant Director of Air, Waste and Compliance

_____ _____ Date: _____
Print Name Signature

If Appropriate,
Associate Director of Natural Resources

_____ _____ Date: _____
Print Name Signature

DISTRIBUTION:

( ) Office of Air Resources ..... By: _____ Date: _____
( ) Division of Agriculture ..... By: _____ Date: _____
( ) Office of Waste Management..... By: _____ Date: _____
( ) Office of Compliance and Inspection ..... By: _____ Date: _____
( ) Office of Technical and Customer Assistance ..... By: _____ Date: _____
( ) Groundwater and Wetlands Protection ..... By: _____ Date: _____
( ) Surface Water Protection ..... By: _____ Date: _____
( ) Water Quality and Standards ..... By: _____ Date: _____
( ) Office of the Director ..... By: _____ Date: _____
( ) Quality Management Team ..... By: _____ Date: _____

Title:
Originator Name:

FIGURE 2 – FORMAT SENARIOS

1. SECTION HEADING. Section Text. (see 4.4.2)

1.1 SUB-SECTION HEADING. Subsection text. (see 4.4.3)

1.1.1 PARAGRAPH HEADING. Paragraph text. (see 4.4.4)

(A) SUB-PARAGRAPH HEADING. Sub-paragraph text (see 4.4.5)

The following description establishes the standard format and is required for all DEM-wide SOPs and suggested for any bureau- or program-specific SOPs.

TYPEFACE - All type, except the header, shall be 11 point, Arial.

PAGE MARGINS - Margins will be 1-inch top and bottom, and 1-inch left and right.

COVERSHEET CONTENTS - Each SOP must have a coversheet that contains the following information: (1) the page header described in section 4.3.2 of this SOP; (2) title; (3) Originator's name; (4) approval sign-off; and (5) a distribution check-off (see FIGURE 1, appended).

DRAFT APPROVAL SHEET - A SOP Draft Approval Sheet is used to track the review and approval of preliminary SOP drafts (see FIGURE 3, appended).

SECTIONS - The first level of written division in a SOP document is referred to as a "section". Single digit numbers are used to identify a section. The heading of a section must have the "SOP SECTION HEADING" *character style* applied to it and the text of the section, including its heading must have the "SOP Section Text" *paragraph style* applied to it. By applying these *styles* to the heading and body, each will automatically be formatted and indented to its appropriate position. A tab between the section number and heading activates the hanging indent, and two spaces between header title and any paragraph text are used to separate the heading from the body.

SUB-SECTIONS - The second level of written division in a SOP document that is part of, but separate from, a section is referred to as a "sub-section". Two numbers, separated by a period, identify a sub-section. The numbers and words in the heading of a sub-section must have the "SOP SUB-SECTION HEADING" *character style* applied to it, and the text of the sub-section, including its heading, must have the "SOP Sub-section Text" *paragraph style* applied to it. By applying these *styles* to the heading and body, each will automatically be formatted and indented to its appropriate position. A tab between the sub-section number and heading activates the hanging indent, and two spaces between end of the header title and beginning of any sub-section text are used to separate the heading from the body.

PARAGRAPHS - The third level of written division in a SOP document that is part of, but separate from, a sub-section is referred to as a "paragraph". Three numbers, separated by periods, identify a paragraph. The numbers and words in the heading of a paragraph must have the "SOP PARAGRAPH HEADING" *character style* applied to it, and the text of the paragraph,

including its heading, must have the "SOP Paragraph Text" *paragraph style* applied to it. By applying these *styles* to the heading and body, each will automatically be formatted and indented to its appropriate position. A tab between the paragraph number and heading activates the hanging indent, and two spaces between end of the heading title and beginning of any paragraph text are used to separate the heading from the body.

SUB-PARAGRAPHS - The fourth and final level of written division used in a SOP document is part of, but separate from, a paragraph is referred to as a "sub-paragraph". An uppercase letter enclosed in parentheses identifies a sub-paragraph. The letter and any words in the heading of sub-paragraph must have the "SOP SUB-PARAGRAPH HEADING" *character style* applied to it, and the text of the sub-paragraph, including its heading, must have the "SOP Sub-paragraph Text" *paragraph style* applied to it. By applying these *styles* to the heading and body, each will automatically be formatted and indented to its appropriate position. A tab between the subparagraph letter and heading activates the hanging indent, and two spaces between end of the heading title and beginning of the sub-paragraph text are used to separate the heading from the body.

TABLES AND FIGURES - The inclusion of illustrative tables and figures is appropriate in SOPs. Since the format of these items will vary, no prescribed method is established herein. All tables and figures must be identified with a number and title that will have the "SOP Tables and Figures Id." *paragraph style* applied to it. By applying this *style* to the number and title, it will automatically be formatted and centered to its appropriate position.

FIGURE 3 – DRAFT APPROVAL ROUTING FORM

DRAFT APPROVAL ROUTING FORM
STANDARD OPERATING PROCEDURE

Date in Process:
Operation Title:
Identification No.:
Revision No.:
Originator Name:

****

The attached draft is forwarded for your evaluation and comment. Suggested changes should be concise and reasons specific. Return to sender.

Supervisor:

_____ q redraft based on comments q OK
Print Name Initials Date

Office Director:

_____ q redraft based on comments q OK
Print Name Initials Date

FIGURE 4 – IDENTIFICATION AND CODING SYSTEM

Office of the Director (OD)
OD-QM..... Quality Manager

Bureau of Environmental Protection (BEP)
BEP-AWC ..... Air, Waste & Compliance
BEP-WR..... Water Resources

AIR Resources (A)

A-A..... Administration
A-I..... Inspection
A-M ..... Monitoring
A-MS..... Mobile Sources
A-P ..... Permitting
A-T ..... Toxics

Waste Management (WM)

WM-B..... Brownfields
WM-FF..... Federal Facilities
WM-MW.....Medical Waste
WM-SR..... Site Remediation
WM-SW..... Solid Waste
WM-SF..... Superfund
WM-LUST..... Leaking Underground Storage Tanks
WM-UST ..... Underground Storage Tanks

Water Resources (WR)

WR-GWC..... Ground Water Certification
WR-W ..... Watersheds TMDL
WR-WQC ..... Water Quality Certifications
WR-WRR ..... Water Resource Regulation

Information Management Unit (IMU)

Agriculture (AG)

AG-P ..... Pesticides

APPENDIX D
Standard Operating Procedures
Secchi Disk Measurements

Standard Operating Procedure for Secchi Disk Measurements

SOP-WR-W-7

APPROVALS:

Deputy Chief of Water Resources:

Sue Kiernan	Sue Kiernan	5/11/11
Printed Name	Signature	Date

Quality Assurance Manager:

Connie Carey	Connie Carey	5/11/11
Printed Name	Signature	Date

DISTRIBUTION

(x) Surface Water Monitoring & Assessment (Connie Carey) ..... By: cgc Date : 5/11/11
(x) TMDL Program (Elizabeth Scott) ..... By: [illegible] Date : 6/1/11
(x) Quality Assurance Manager (Tom Getz) ..... By: [illegible] Date : 6/1/11

Title: Standard Operating Procedure for Secchi Disk Measurements
Originator Name: Jane Sawyers

TABLE OF CONTENTS

Standard Operating Procedure for Secchi Disk Measurements

1. APPLICABILITY

This SOP applies to all Office of Water Resources (OWR) staff involved in collecting water clarity measurements in lakes, ponds, reservoirs, and slow moving, deep rivers using a Secchi disk. Exemption from the use of this SOP for project work shall be allowed for reasons of inapplicability determined by management discretion.

2. PURPOSE

This SOP establishes a standardized method for performing semi-quantitative field measurements of water clarity in lakes, ponds, reservoirs, and slow-moving, deep rivers using a Secchi disk. It sets a consistent protocol to ensure the quality of OWR's data collection—resulting in improved uniformity, reproducibility, verifiability, and defensibility of the data, as well as increased program credibility.

3. DEFINITIONS

3.1 RIDEM – Rhode Island Department of Environmental Management

3.2 OWR – RIDEM Office of Water Resources

3.3 SOP – Standard Operating Procedures

3.4 Secchi disk – A black and white disk lowered by hand into the water to determine water clarity.

3.5 QA – Quality Assurance refers to a systematic process to ensure production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.6 QC – Quality Control refers to the activities performed to affirm production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.7 QI – Quality Improvement refers to any act or process performed to enhance the value, accuracy, reliability, reproducibility or defensibility of environmental data collected by RIDEM OWR.

4. RESPONSIBILITIES

4.1 TRAINING

Any RIDEM/OWR personnel collecting Secchi disk measurements for a RIDEM project or program should have completed RIDEM's Quality System Awareness Training Program with appropriate documentation from the Quality Assurance Manager. This training ensures the field analyst recognizes the importance of proper data collection and management and he/she comprehends the

significance of the environmental decisions that may be made with the data. It is suggested that field analysts have also completed the USEPA Water Quality Standards Academy Basic Course and Supplemental Topic Modules online, but does not require any additional special training or certification.

To properly employ the Secchi disk, the field analyst must be familiar with and comply with the data collection techniques stated in this SOP. The field analyst is required to read and understand this SOP. The field analyst should complete and submit any required training forms and/or field assessments for project and/or program QAPPs to document proficiency with this procedure. Any field analyst not familiar with the use of the Secchi disk should be assisted by OWR staff who are accustomed to using the equipment.

4.2 RESPONSIBILITIES OF FIELD ANALYST

The field analyst is responsible for checking the required equipment in the Sampling Center at the beginning of the sampling event before taking measurements in the field. The field analyst is responsible for verifying that the Secchi disk is in proper operating condition prior to use (i.e. no cracks in the disk; black and white pattern apparent; securely attached to measuring tape) and communicating to the project manager when equipment is in need of repair or replacement. The field analyst is also responsible for ensuring that all supplementary equipment (weight, measuring tape, canoe or kayak, etc.) is present and in working condition. The field analyst is also responsible for using best professional judgment to determine if site conditions are safe for performing the procedure. The field analyst is accountable for employing proper measurement procedures and data recording in accordance with this SOP.

4.3 RESPONSIBILITIES OF PROJECT OR PROGRAM MANAGER

The project or program manager is responsible for providing the materials, resources, and/or guidance necessary to perform the measurements in accordance with this SOP. The project manager is responsible for ensuring that the field analyst operates the Secchi disk correctly in accordance with this SOP and that any additional, project-specific requirements are communicated to the project team. The project manager is responsible for ensuring the Secchi disk is maintained in proper operating condition annually. This includes ensuring the Secchi disk is not cracked, the weight is attached, the measuring tape or rope is attached, and repairing it or reordering equipment when necessary. The project manager will determine and communicate with field analysts what procedures and order of procedures are to be accomplished during each sampling event to a sampling location. If the measurement is being done on a river that is not accessible by boat, the project manager will determine if the measurement can be done from another structure. Further, the project manager shall ensure annual renewal and periodic revisions to this SOP as necessary to reflect current needs and standards as well as renew this SOP every five years.

5. GUIDELINES AND PROCEDURES

5.1 PROPER USE OF SECCHI DISK

5.1.1 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- Secchi disk with attachment clip/structure (Figure 1, similar to Forestry Suppliers Item Number 77912)
    - Extra weight (optional)
- AquaVue™ tube (Figure 1, similar to Wildco Item Number 79-015)
- Fiberglass Measuring tape (0.1 m increments) (Figure 1, similar to Grainger Item Number 3VZJ6)
- Datasheet or field notebook printed on waterproof paper (paper similar to Grainger Item Number 3XFR7)
- Clipboard
- Pencil or Rite in the Rain Pen (similar to Forestry Suppliers Item Number 49237)
- Boat, canoe or kayak
- Paddles and motor
- Anchors
- Lifejackets
- Depth finder

5.1.2 USING THE SECCHI DISK IN THE FIELD

For most purposes, the Secchi disk is used specifically for in situ water clarity measurements taken directly in the field, in lake, ponds, reservoirs, and slow-moving, deep rivers. This method does not require sample containers or preservation.

5.1.3 RECORDING PARAMETER UNITS

The following units should be used when recording measurements taken with the Secchi disk:

Secchi depth.....meter

5.2 FIELD MEASUREMENT PROCEDURES

5.2.1 DETERMINE FIELD PROCEDURE SCHEDULE

Prior to departure, the project manager will communicate with the field analysts what procedures should be accomplished for each sampling trip to the sampling location and the order the field procedures should be completed. Prior to performing this analysis, the field analyst should ensure the Secchi disk measurement is taken at an appropriate time of day and in the correct order. This procedure may disrupt fish and microscopic organisms, such as phytoplankton and zooplankton, which can interfere with other field procedures and sample collections in lakes, ponds, reservoirs, and slow-moving, deep rivers. Secchi disk measurements should be measured after these samples have been collected. However, Secchi disk measurements should be taken before any sampling procedure or activity that may disturb bottom sediments to avoid increasing turbidity at the location. The field analyst should note any disturbance to the bottom sediment in the Comment/Notes section of the field datasheet (Figure 2) or appropriate field notebook. Secchi disk measurements should be made between approximately 10 AM and 2 PM to capture phytoplankton and other biological organisms' diurnal movements.

5.2.2 POSITION THE BOAT AT THE DEEPEST POINT OR DESIRED DEPTH

If a bathymetric map is available, the field analyst should use the map and distinguishing land characteristics (i.e. outfall structures, points, inlets, boat launch) to find the general location of the deepest spot or desired depth in the lake or river. The field analyst should verify the location by confirming several depth locations with the depth finder around the general location of the deepest spot or desired depth. Once the deepest location or desired depth is established, the field analyst should carefully lower the anchor so that bottom sediment is not disturbed into the water column. The field analyst should record the depth of the deepest location or desired depth to the nearest tenth of a meter on the field datasheet (Figure 2) or appropriate field notebook. For monitoring section sampling events, the field analyst should fill out the information at the top of the field datasheet (Figure 2) prior to collection of a water sample with the integrated sampler.

5.2.3 TAKING THE SECCHI DEPTH MEASUREMENT

The field analyst should remove sunglasses (prescription or non-prescription) but continue to wear any clear prescription glasses. Determine which side of the boat is exposed to the sun. The measurement should be taken on the **shaded** side of the boat to reduce glare. Where there is no shade, keep your back toward the sun to block glare/reflection. When taking a measurement the Secchi disk should remain in the water directly below your hand holding the measuring tape/line attached to the Secchi disk. If the current or wind causes the disk to drift, extra weight should be added to the disk to avoid skewed measurements when read at an angle.

- Unwind the measuring tape attached to the Secchi disk to equal the deepest spot or desired depth. Place your foot gently on the measuring tape wheel in the bottom of the boat in case you drop the equipment.

- In one hand, hold the AquaVue™ tube by the handle and lower the end with the lens approximately 4 inches into the water. In your other hand, hold the measuring tape with the Secchi disk (securely attached) over the water.

- Look through the viewing end of the AquaVue™ tube

- Using the measuring tape, slowly lower the Secchi disk over the side of the boat into the water and watch through the AquaVue™ tube until it disappears from view or hits the bottom (if completely clear).

    - Note: If the Secchi disk hits the bottom and is still visible, record the depth at the water surface and write "VOB" indicating the Secchi disk is visible on bottom on the datasheet or appropriate field notebook. Do not continue with steps listed below.

- Read aloud the depth at the water surface to the nearest tenth of a meter to the second field analyst, and then lower the Secchi disk deeper (another 0.3 meters).

    - Note: The second field analyst should record this number on the datasheet or appropriate field notebook.

- Slowly begin to raise the Secchi disk. When you can make out the Secchi disk pattern, stop raising the Secchi disk.

- Place the AquaVue™ tube back in the boat and read aloud the depth at the water surface to the second field analyst.

    - Note: The second field analyst should record this number on the datasheet or appropriate field notebook.

- The second field analyst should determine the average of the two recorded depths and round to the nearest tenth of a meter. The average value should be recorded on the datasheet.

- Remove all equipment from the water and repeat the entire measurement process as detailed above and record the second set of Secchi depth measurements on the datasheet. If the two average Secchi measurements are not within 5%, repeat the measurement a third time.

    - Calculate the 5% error by multiplying Secchi measurement 1 by 0.05 and rounding to the nearest tenth. Adding and subtracting the resulting value to the first reading will give the range of acceptable second readings. If the second reading falls in this range, then the reading is accepted. If the second reading does not fall in this range, then a third Secchi measurement should be taken.

- Example: Secchi 1 = 6.5; Secchi 2 = 6.7

  6.5 * 0.05 = 0.325 (rounded 0.3)

  Acceptable range = 6.2 to 6.8

  Secchi values are accepted

- If the third reading is also out of the acceptable range, then the field analyst should check the depth meter to make sure the boat is still located at the deepest spot. If the boat has drifted, the field analyst should pull up the anchor and move back to the deepest spot or desired depth. The procedure should then be repeated. The QC issue will be noted on the field datasheet or appropriate field notebook and reported to the project manager.

6. QUALITY CONTROL

6.1 QUALITY CONTROL

Quality control will be assessed by calculating the 5% error as described in Section 5.2.3. This will give a measure of precision for the procedure.

6.2 QUALITY ASSURANCE PLANNING CONSIDERATIONS

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. Unless specified otherwise in a site or project-specific work plan, Quality Assurance Project Plan (QAPP), Quality Assurance Program Plan (QAPP) or laboratory Quality Assurance Manual (QAM), all data collected following the protocols set forth in this document will be collected in accordance with the minimum QAQC requirements of Section 6.1. Further quality assurance requirements will be defined in project specific work plans and may include duplicate or replicate measurements or confirmatory analyses.

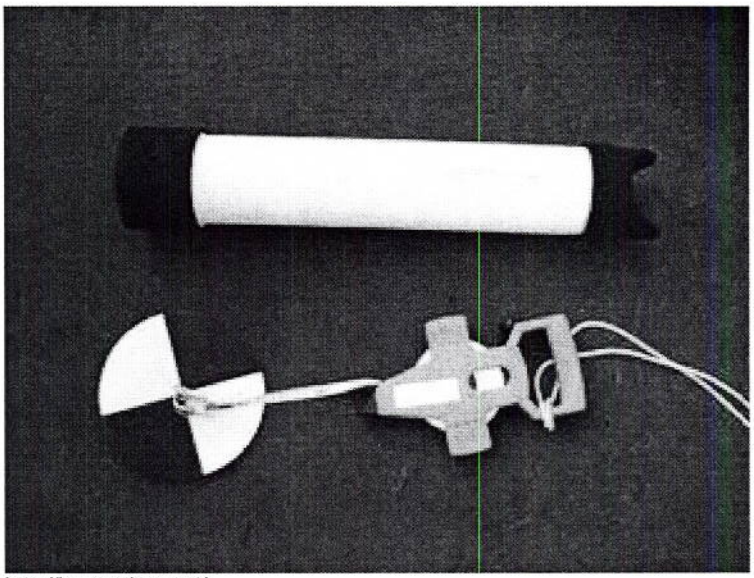
7. REFERENCES

Green, L.T., E.M. Herron, and A.J. Gold. 2010. *URI Watershed Watch Revised Lake and Pond Monitoring Manual*. College of the Environmental and Life Sciences, University of Rhode Island. Contribution #5047.

USEPA. 1997. *Volunteer Stream Monitoring: A Methods Manual*. Office of Water Resources, U.S. Environmental Protection Agency. EPA 841-B-97-003. www.epa.gov/volunteer/stream/155.html

Wetzel, R.G. and Likens, G.E. 2001. *Limnological Analyses*, 3rd ed. New York: Spring Science and Business Media, Inc., 429 pp.

Figure 1. Secchi Disk and Associated Equipment



http://baunegbeg.net/

Figure 2. Lake Datasheet for Monitoring Section Sampling Events

Lake Sampling Datasheet

Lake Name: _____ Town: _____

Date: _____ Military Time: _____ Collectors: _____

Meter # _____ _____

Max Depth: _____ m

Weather: (Circle one) Clear Partly Cloudy Overcast Raining Windy Sunny

Air Temperature: _____ °C

Comments/Notes:

Secchi Depth #1	_____ m		
Secchi Depth #2	_____ m		
QC Range (5%)	_____ m	Accepted?	_____
Secchi Depth #3	_____ m	Action?	_____
Secchi Depth #1 redo	_____ m		
Secchi Depth #2 redo	_____ m		

			QC Measurement (20% of sites)
Water Column Readings (reading taken at 1m)	Temperature	_____ °C	_____ °C
	pH	_____	_____
	Specific Conductivity	_____ µS/cm	_____ µS/cm
	Dissolved Oxygen	_____ mg/L	_____ mg/L
		_____ %	_____ %

APPENDIX E
Standard Operating Procedure
Macrophyte Cover –
Lakes, Ponds, and Reservoirs

Standard Operating Procedure for Macrophyte Cover Lakes, Ponds, and Reservoirs

SOP-WR-W-31

APPROVALS:

Deputy Chief of Water Resources:

Sue Kiernan (Printed Name) — Susan Kiernan (Signature) — 9/2/11 (Date)

Quality Assurance Manager:

Connie Carey (Printed Name) — Connie Carey (Signature) — 9/2/11 (Date)

DISTRIBUTION

(x) Surface Water Monitoring & Assessment (Connie Carey) ..... By: cgc Date : 9/2/11

(x) TMDL Program (Elizabeth Scott) ..... By:_____ Date :_____

(x) Quality Assurance Manager (Tom Getz) ..... By:_____ Date :_____

Title: Standard Operating Procedure for Macrophyte Cover – Lakes, Ponds, and Reservoirs
Originator Name: Jane Sawyers

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Standard Operating Procedure for Macrophyte Cover in Lakes

1. APPLICABILITY

This SOP applies to all Office of Water Resources (OWR) staff involved in collecting macrophyte cover estimates in lakes, ponds, and reservoirs. Exemption from the use of this SOP for project work shall be allowed for reasons of inapplicability determined by management discretion.

2. PURPOSE

This SOP establishes a standardized method for performing semi-quantitative field estimates of macrophyte cover in lakes, ponds, and reservoirs. It sets a consistent protocol to ensure the quality of OWR's data collection—resulting in improved uniformity, reproducibility, verifiability, and defensibility of the data, as well as increased program credibility.

3. DEFINITIONS

3.1 RIDEM – Rhode Island Department of Environmental Management

3.2 OWR – RIDEM Office of Water Resources

3.3 SOP – Standard Operating Procedures

3.4 Macrophyte – Forms of aquatic vegetation that are visible without magnification

3.4.1 Emergent macrophyte – Macrophytes that are rooted in the substratum, but leaves and stems extend out of the water (cattail, arrowhead, pickerel weeds, sedges, and rushes)

3.4.2 Floating-leaved macrophyte – Macrophytes that are rooted in the substratum, but possess leaves that float on the water surface (water lilies, watershield, water chestnut)

3.4.3 Submersed macrophyte – Macrophytes that are rooted in the substratum, but possess stems and leaves that grow entirely under water (coontail, bladderworts, water-milfoils)

3.4.4 Freely floating macrophyte – Macrophytes typically not rooted to the substratum, but live unattached within or upon the water (duckweed, *Wolffia*, *Azolla*, *Eichhornia*)

3.5 QA – Quality Assurance refers to a systematic process to ensure production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.6 QC – Quality Control refers to the activities performed to affirm production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.7 QI – Quality Improvement refers to any act or process performed to enhance the value, accuracy, reliability, reproducibility or defensibility of environmental data collected by RIDEM OWR.

4. RESPONSIBILITIES

4.1 TRAINING

Any RIDEM/OWR personnel collecting macrophyte cover estimates for a RIDEM project or program should have completed RIDEM's Quality System Awareness Training Program with appropriate documentation from the Quality Assurance (QA) Manager. This training ensures the field analyst recognizes the importance of proper data collection and management and he/she comprehends the significance of the environmental decisions that may be made with the data. It is suggested that field analysts have also completed the USEPA Water Quality Standards Academy Basic Course and Supplemental Topic Modules online, but does not require any additional special training or certification.

To properly estimate macrophyte cover, the field analyst must be familiar with and comply with the data collection techniques stated in this SOP. The field analyst is required to read and understand this SOP. The field analyst should complete and submit any required training forms and/or field assessments for project and/or program QAPPs to document proficiency with this procedure. Any field analyst not familiar with the estimation of macrophyte cover should be assisted by OWR staff who are accustomed to performing the procedure.

4.2 RESPONSIBILITIES OF FIELD ANALYST

The field analyst is responsible for checking the required equipment in the Sampling Center at the beginning of the sampling event before taking measurements in the field. The field analyst is responsible for verifying that the canoe or kayak is in proper operating condition prior to use and communicating to the project manager when equipment is in need of repair or replacement. The field analyst is also responsible for using best professional judgment to determine if site conditions are safe for performing the procedure. The field analyst is accountable for employing proper estimation procedures and data recording in accordance with this SOP.

4.3 RESPONSIBILITIES OF PROJECT OR PROGRAM MANAGER

The project or program manager is responsible for providing the materials, resources, and/or guidance necessary to perform the measurements in accordance with this SOP. The project manager is responsible for ensuring that the field analyst estimates macrophyte coverage correctly in accordance with this SOP and that any additional, project-specific requirements are communicated to the project team. The project manager is responsible for ensuring the canoe or kayak is maintained in proper operating condition annually. This includes repairing it or reordering equipment when necessary. The project manager will

determine and communicate with field analysts what procedures and order of procedures are to be accomplished during each sampling event to a sampling location. Further, the project manager shall ensure annual renewal and periodic revisions to this SOP as necessary to reflect current needs and standards as well as renew this SOP every five years.

5. GUIDELINES AND PROCEDURES

5.1 PROPER MAPPING OF MACROPHYTE COVER

5.1.1 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- Bathymetric map, lake outline or field notebook printed on waterproof paper (paper similar to Grainger Item Number 3XFR7)
    - Bathymetric map (if available: S:\COMMON\Jane\Bathymetric Maps) or Lake outline (if available: S:\COMMON\Jane\Lake Outlines)
- Clipboard
- Pencil or Rite in the Rain Pen (similar to Forestry Suppliers Item Number 49237)
- Boat, canoe or kayak
- Paddles and motor
- Anchors
- Lifejackets
- Depth finder

5.1.2 ESTIMATING MACROPHYTE COVER IN THE FIELD

For most purposes, estimation of macrophyte cover will be taken directly in the field, in lake, ponds, and reservoirs. This method does not require sample containers or preservation.

5.1.3 RECORDING PARAMETER UNITS

The following units should be used when calculating recorded measurements taken while estimating macrophyte cover:

Macrophyte cover.....%

Available substrate.....rank

5.2 FIELD MEASUREMENT PROCEDURES

5.2.1 DETERMINE FIELD PROCEDURE SCHEDULE

Prior to departure, the project manager will communicate with the field analysts what procedures should be accomplished for each sampling trip to the sampling location and the order the field procedures should be completed. Prior to performing this analysis, the field analyst should ensure the macrophyte cover estimate is taken at an appropriate time of year and in the correct order. This procedure may disrupt fish and microscopic organisms, such as phytoplankton and zooplankton, which can interfere with other field procedures and sample collections in lakes, ponds, and reservoirs. Macrophyte cover estimates should be measured after these samples have been collected. Macrophyte cover estimates should be made later in the growing season, after July 1, and can continue as late as October. This will capture full annual growth and coverage of macrophytes in the lake, pond, or reservoir.

5.2.2 POSITION THE BOAT AT THE DEEPEST POINT OR DESIRED DEPTH

If a bathymetric map is available, the field analyst should use the map and distinguishing land characteristics (i.e. outfall structures, points, inlets, boat launch) to find the general location of the deepest spot or desired depth in the lake or river. The field analyst should verify the location by confirming several depth locations with the depth finder around the general location of the deepest spot or desired depth. Once the deepest location or desired depth is established, the field analyst should carefully lower the anchor so that bottom sediment is not disturbed into the water column. The field analyst should record the depth of the deepest location or desired depth to the nearest tenth of a meter on the bathymetric map, lake outline, or appropriate field notebook. For monitoring section projects, the field analyst should note the date, time, and field analysts performing the procedure at the top of the bathymetric map or lake outline.

5.2.3 ESTIMATING MACROPHYTE COVER IN THE FIELD

The field analyst recording the data should position themselves to be able to see major landmarks throughout as much of the basin as possible.

- On the bathymetric map or lake outline, the field analyst should note any major landmarks that can be seen from the boat. See key for major landmark symbols (Figure 1).
    - Any landmarks the field analyst determines are important to the map but do not have a symbol denoted, should be clearly labeled with a written description.
- The field analysts will slowly canoe or use a trolling motor to survey the lake.

- The recording field analyst will continue to observe and record macrophyte observations during the survey, assisting with paddling or navigation as needed.

- The non-recording field analyst will paddle and navigate the survey route during the survey, assisting with macrophyte observations as needed.

    - At 5% of lakes, the non-recording field analyst will also complete the mapping procedures on a separate bathymetric map or lake outline for QC measurement of bias.

- The survey route is determined by the shape the lake and best professional judgment.

    - In nearly round or oblong lakes with the deepest spot in the middle, the survey route will cover two transects (Figure 2).

        - Each transect will be established running parallel to the longest shore length.

    - In round or oblong lakes with the deepest spot at one end, the survey route will cover one transect (Figure 3).

        - The transect will be established running parallel to the longest shore length.

    - In lakes with the deepest spot at one end with two inlet arms, the survey route will cover two transects (Figure 4).

        - The transects will be established running parallel to the shore of each arm.

    - The survey route will deviate from this transect establishment guidelines when the field analysts determine that the macrophyte cover present is not visible from the survey route.

        - The field analysts, based on best professional judgment, may navigate away from the survey route to detail observations in coves, boat ramps or inlets that are not clearly observable from the survey route.

        - The field analysts, based on best professional judgment, may navigate away from the survey route to detail observations in dense patches of macrophyte growth to differentiate between the different macrophyte growth forms.

- The recording field analyst will observe patches of macrophyte growth and sketch on the bathymetric map or lake outline the geographic extent of the growth.

- The previously drawn shore landmarks and lake shoreline should be used by the recording field analyst as points of reference to draw on the bathymetric map or lake outline.

- The recording field analyst will then rank the macrophyte patches using the following scale:
  - Sparse = 0 – 25% plant density
  - Moderate = >25 – 50% plant density
  - Dense = >50 – 75% plant density
  - Very dense = >75 – 100% plant density
- The recording field analyst will then indicate the rank on the bathymetric map or lake outline using the following markings in the sketched macrophyte patches (Figure 4):
  - Sparse = no markings (only outline of the patch)
  - Moderate = dotting (::::::::)
  - Dense = hatched lines (////////)
  - Very dense = cross-hatched lines (XXXXX)
- The recording field analyst will then clearly write the dominant macrophyte growth form on top of each sketched and ranked macrophyte patch using the following markings:
  - Emergent macrophyte = Emergent
  - Floating-leaved macrophyte = Floating
  - Submersed macrophyte = Submersed
  - Freely-floating macrophyte = Free

5.2.4 ESTIMATING THE AVAILABLE SUBSTRATE

At four random locations during the macrophyte survey, the field analyst will estimate the percent rank of the available substrate. The four random locations should be chosen in areas where the bottom of the lake is visible or the total depth is less than 12 feet, as checked by a depth finder.

Any available rocky substrate will be ranked using a general geomorphic classification of bedrock; boulders; cobbles; gravel; sand; silt, clay, or muck. Organic debris substrate will be ranked using intact large woody debris (branches, sticks, etc.) or decaying organic matter (leaf pack, general detritus) designations.

The field analyst will observe the area on the bottom of the lake equaling the length of the watercraft until approximately one meter out from the watercraft. The field analyst will rank the percent availability of the different types of substrate. The following ranking will be used to estimate the percent cover of available substrate:

- 0 = 0%
- 1 = <10%
- 2 = 10 – 30%
- 3 = 31 – 50%
- 4 = 51 – 70%
- 5 = 71 – 90%
- 6 = 100%

The field analyst will say out loud the ranking of each type of available substrate. The recording field analyst will circle the appropriate ranking of each type of substrate for each of the four sites observed (Figure 5) or record the information in the appropriate field notebook. The recording field analyst will also observe and record the GPS location of the substrate sites.

If the bottom is not visible due to high biological growth, turbidity, or suspended solids, the field analyst will use an oar to touch the nearby bottom. The field analyst should investigate the substrate by probing the bottom for the rocky or organic debris. The field analyst will use best professional judgment to rank the available substrate. The recording field analyst should note that the bottom was not visible at the site on the datasheet or appropriate field notebook.

5.2.5 CALCULATING TOTAL MACROPHYTE COVER

The project manager will calculate the total macrophyte cover using the bathymetric map or lake outline observations collected by the field analysts in the field.

- The project manager will overlay a see-through square grid pattern (¼") on top of the scale located on the bathymetric map or lake outline.
- The project manager will determine the conversion of boxes:distance on the scale and calculate the area equal to 1 box.
  - For example, ¼" (1 box) = 300 ft (scale)

$$(¼")^2 = (300\ ft)^2$$

$$1\ box = 900\ ft^2$$

- The project manager will overlay the see-through square grid pattern (¼") on top of each sketched macrophyte patch.
- The project manager will count the number of squares covered by each macrophyte patch for each macrophyte growth form.
- The project manager will calculate the area covered by each macrophyte patch and calculate the total coverage for each macrophyte growth form, converting to the correct units as necessary.
- To determine the percent (%) cover of each macrophyte growth form, the project manager will divide the total area coverage for each macrophyte growth form by the known total lake area.

6. QUALITY CONTROL

6.1 QUALITY CONTROL

At 5% of mapped lakes, the non-recording field analyst will also follow the mapping procedure during the survey route to produce two (2) macrophyte maps of the same lake, pond, or reservoir. This quality control procedure will give a measure of bias. The project manager will calculate the total macrophyte cover from each map and compare the percent (%) cover of each macrophyte growth form between the maps. A percent difference of greater than 10% in any macrophyte growth form will indicate that bias is being introduced into the procedure.

At 10% of lakes surveyed, the recording field analyst will also observe and rank the available substrate. A weighted average of the available substrates at the four sites will be calculated. A different greater than 20% relative percent different between the weighted average of the analysts will indicate that bias is being introduced into the procedure.

6.2 QUALITY ASSURANCE PLANNING CONSIDERATIONS

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. Unless specified otherwise in a site or project-specific work plan, Quality Assurance Project Plan (QAPP), Quality Assurance Program Plan (QAPP) or laboratory Quality Assurance Manual (QAM), all data collected following the protocols set forth in this document will be collected in accordance with the minimum QAQC requirements of Section 6.1. Further quality assurance requirements will be defined in project specific work plans and may include duplicate or replicate measurements or confirmatory analyses.

7. REFERENCES

PADEP. 2009. *Aquatic Macrophyte Procedures for Lake Assessments*. Pennsylvania Department of Environmental Protection. http://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/Methodology/AquaticMacrophyteCover_2009AM.pdf

USEPA. 2007. Survey of the Nation's Lakes: Field Operation's Manual. EPA-841-B-07-004. U.S. Environmental Protection Agency, Washington, D.C.

Wetzel, R.G. and Likens, G.E. 2001. *Limnological Analyses*, 3rd ed. New York: Spring Science and Business Media, Inc., 429 pp.

Figure 1. Topographic Symbols for Designating Landmarks

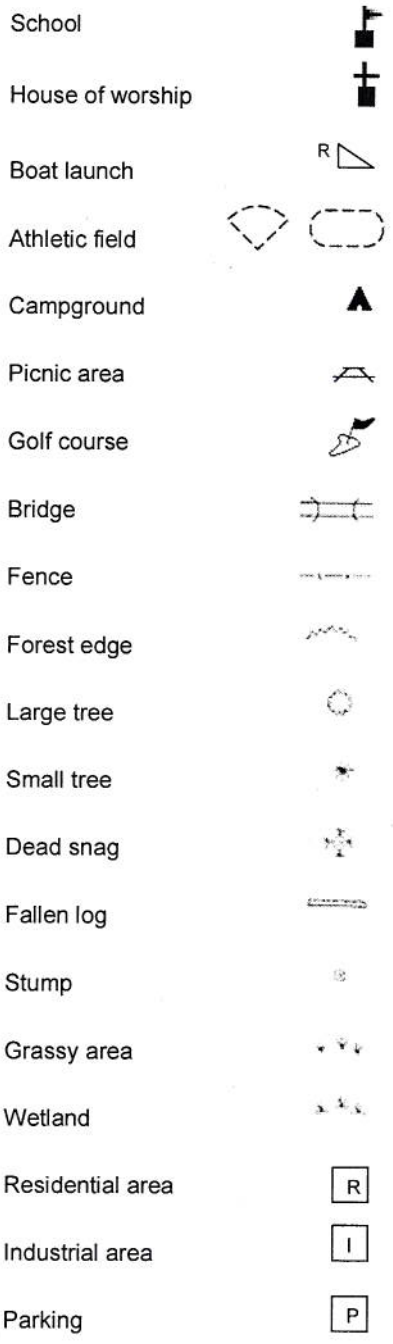

Figure 2. Middle Deep Spot Survey Route

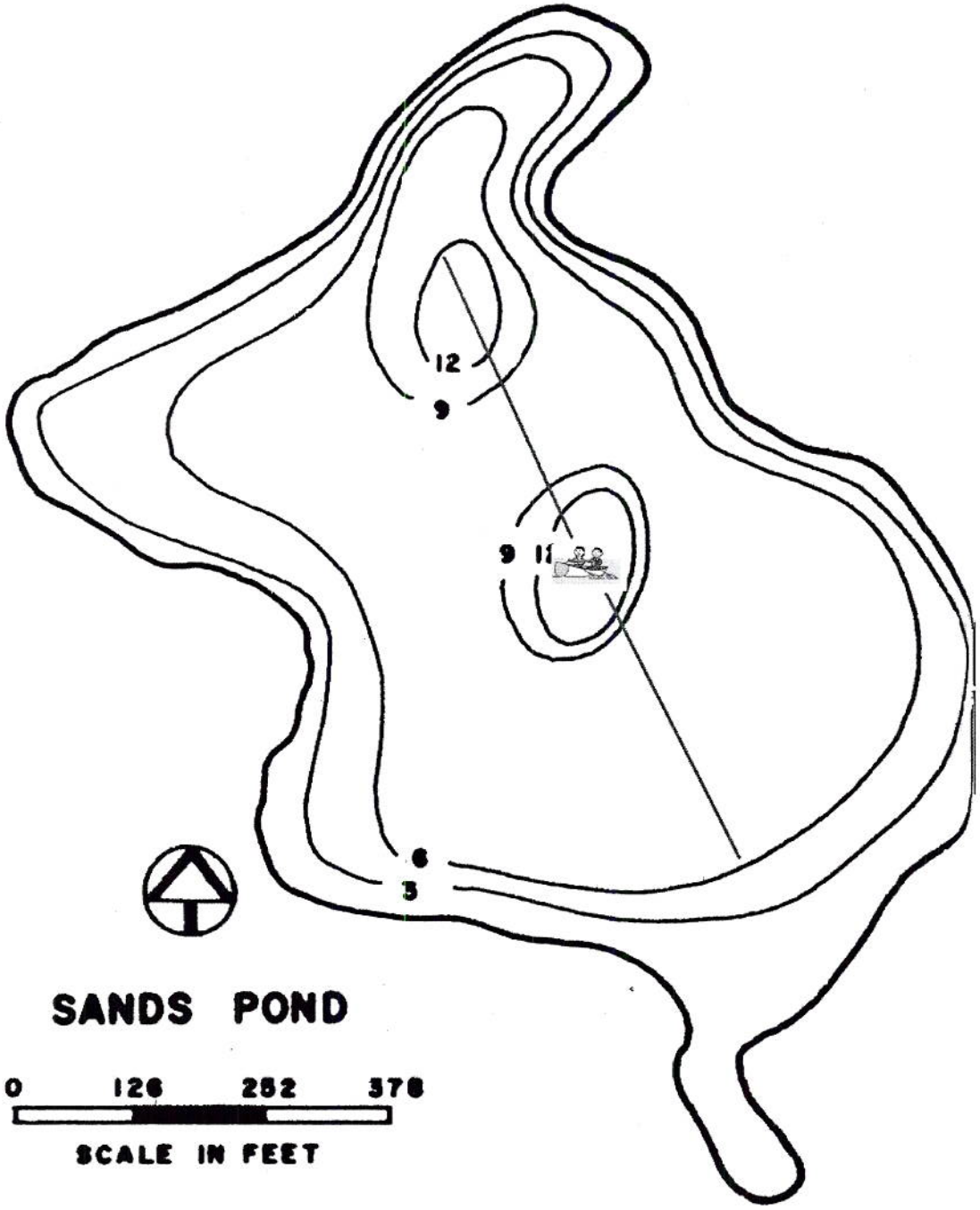

Figure 3. One End Deep Spot Survey Route

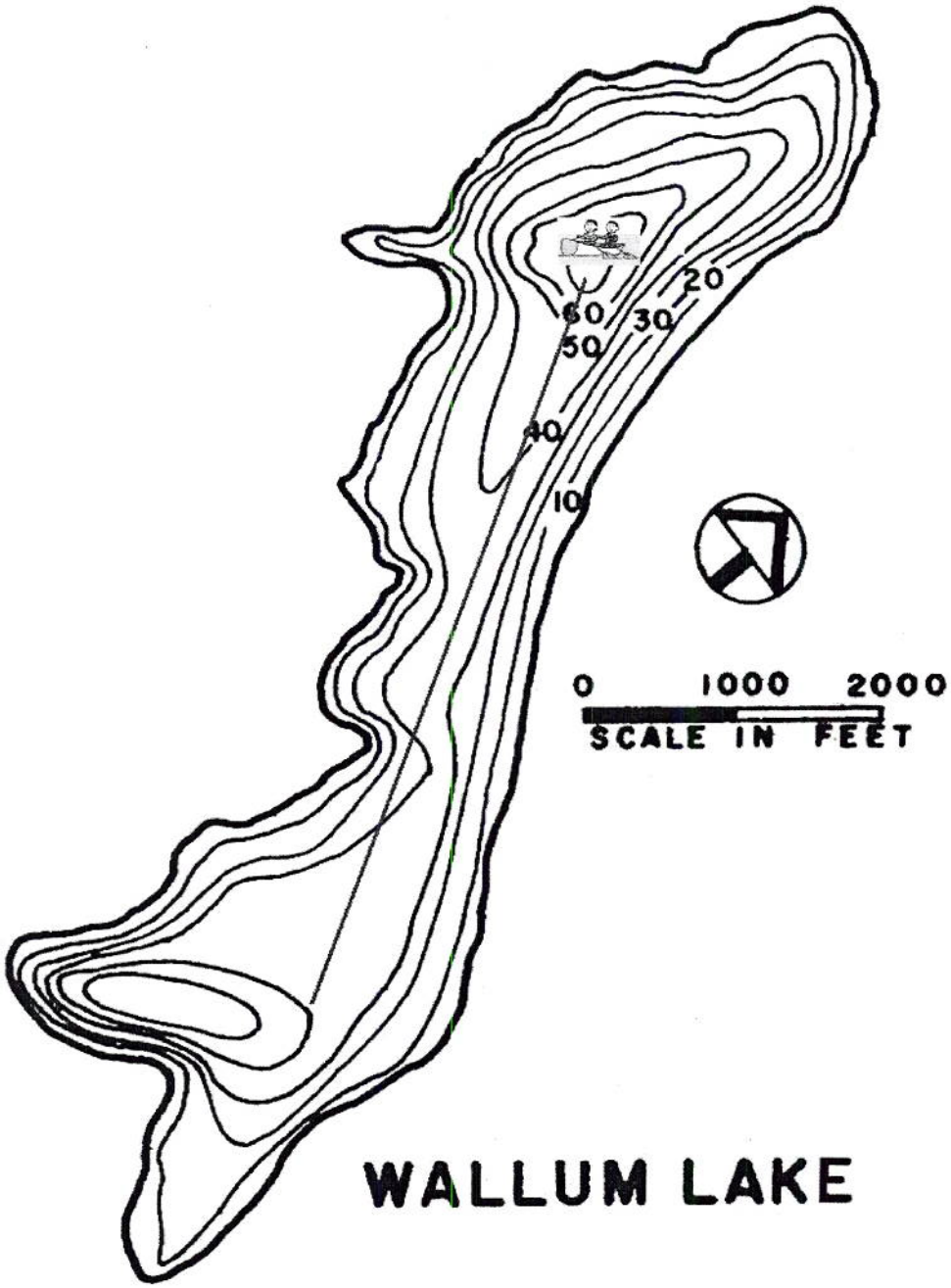

Figure 4. Two Inlet Arms Survey Route

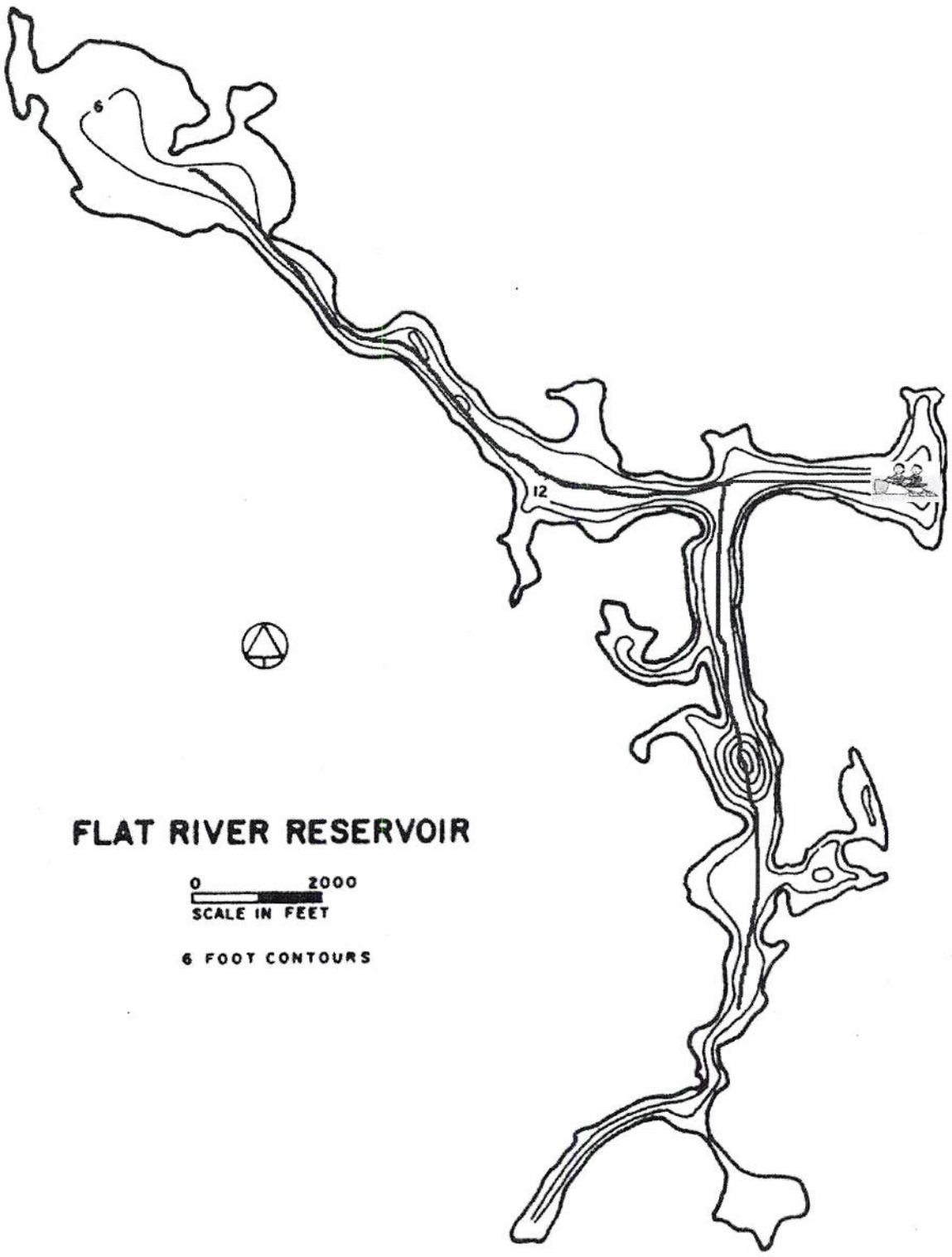

Figure 5. Available Substrate Datasheet for Monitoring Section Sampling Events

Substrate Sampling Datasheet

Lake Name: _____ Town: _____

Date: _____ Time: _____ Collectors: _____

Site 1 Type	GPS: Size	Lat Comparable Size	Long Rank					Bottom Visible? Yes	No
			0%	<10%	10 – 30%	31 – 50%	51 – 70%	71 – 90%	100%
Bedrock	>4000mm	Bigger than a car	0	1	2	3	4	5	6
Boulders	250 - 4000mm	basketball - car	0	1	2	3	4	5	6
Cobble	64-250mm	tennis ball - basketball	0	1	2	3	4	5	6
Gravel	2 - 64mm	ladybug - tennis ball	0	1	2	3	4	5	6
Sand	0.6 - 2mm	gritty btwn fingers	0	1	2	3	4	5	6
Silt, clay, muck	<0.6mm	not gritty btwn fingers	0	1	2	3	4	5	6
Woody debris		branches, logs	0	1	2	3	4	5	6
Organic		leaves, detritus	0	1	2	3	4	5	6

Site 2 Type	GPS: Size	Lat Comparable Size	Long Rank					Bottom Visible? Yes	No
			0%	<10%	10 – 30%	31 – 50%	51 – 70%	71 – 90%	100%
Bedrock	>4000mm	Bigger than a car	0	1	2	3	4	5	6
Boulders	250 - 4000mm	basketball - car	0	1	2	3	4	5	6
Cobble	64-250mm	tennis ball - basketball	0	1	2	3	4	5	6
Gravel	2 - 64mm	ladybug - tennis ball	0	1	2	3	4	5	6
Sand	0.6 - 2mm	gritty btwn fingers	0	1	2	3	4	5	6
Silt, clay, muck	<0.6mm	not gritty btwn fingers	0	1	2	3	4	5	6
Woody debris		branches, logs	0	1	2	3	4	5	6
Organic		leaves, detritus	0	1	2	3	4	5	6

Substrate Sampling Datasheet

Lake Name: _____

Site 3 Type	GPS: Size	Lat Comparable Size	Long Rank					Bottom Visible? Yes	No
			0%	<10%	10 – 30%	31 – 50%	51 – 70%	71 – 90%	100%
Bedrock	>4000mm	Bigger than a car	0	1	2	3	4	5	6
Boulders	250 - 4000mm	basketball - car	0	1	2	3	4	5	6
Cobble	64-250mm	tennis ball - basketball	0	1	2	3	4	5	6
Gravel	2 - 64mm	ladybug - tennis ball	0	1	2	3	4	5	6
Sand	0.6 - 2mm	gritty btwn fingers	0	1	2	3	4	5	6
Silt, clay, muck	<0.6mm	not gritty btwn fingers	0	1	2	3	4	5	6
Woody debris		branches, logs	0	1	2	3	4	5	6
Organic		leaves, detritus	0	1	2	3	4	5	6

Site 4 Type	GPS: Size	Lat Comparable Size	Long Rank					Bottom Visible? Yes	No
			0%	<10%	10 – 30%	31 – 50%	51 – 70%	71 – 90%	100%
Bedrock	>4000mm	Bigger than a car	0	1	2	3	4	5	6
Boulders	250 - 4000mm	basketball - car	0	1	2	3	4	5	6
Cobble	64-250mm	tennis ball - basketball	0	1	2	3	4	5	6
Gravel	2 - 64mm	ladybug - tennis ball	0	1	2	3	4	5	6
Sand	0.6 - 2mm	gritty btwn fingers	0	1	2	3	4	5	6
Silt, clay, muck	<0.6mm	not gritty btwn fingers	0	1	2	3	4	5	6
Woody debris		branches, logs	0	1	2	3	4	5	6
Organic		leaves, detritus	0	1	2	3	4	5	6

APPENDIX F
Standard Operating Procedure
Water Column Profile –
Lakes, Ponds, and Reservoirs

Standard Operating Procedure for Water Column Profile Lakes, Ponds, and Reservoirs

SOP-WR-W-30

APPROVALS:

Deputy Chief of Water Resources:

Sue Kiernan	Susan Kiernan	8/4/11
Printed Name	Signature	Date

Quality Assurance Manager:

Connie Carey	Connie Carey	8/4/11
Printed Name	Signature	Date

DISTRIBUTION

(x) Surface Water Monitoring & Assessment (Connie Carey) ..... By: cgc Date : 8/4/11

(x) TMDL Program (Elizabeth Scott) ..... By:_____Date :_____

(x) Quality Assurance Manager (Tom Getz) ..... By:_____Date :_____

Title: Standard Operating Procedure for Water Column Profile – Lakes, Ponds, and Reservoirs
Originator Name: Jane Sawyers

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Standard Operating Procedure for Water Column Profile
Lakes, Ponds, and Reservoirs

1. APPLICABILITY

This SOP applies to all Office of Water Resources (OWR) staff involved in collecting water column profile measurements in lakes, ponds, and reservoirs using a multi-probe meter. Exemption from the use of this SOP for project work shall be allowed for reasons of inapplicability determined by management discretion.

2. PURPOSE

This SOP establishes a standardized method for performing quantitative field measurements of a water column profile in lakes, ponds, and reservoirs, using a multi-probe meter. It sets a consistent protocol to ensure the quality of OWR's data collection—resulting in improved uniformity, reproducibility, verifiability, and defensibility of the data, as well as increased program credibility.

3. DEFINITIONS

3.1 RIDEM – Rhode Island Department of Environmental Management

3.2 OWR – RIDEM Office of Water Resources

3.3 SOP – Standard Operating Procedures

3.4 Multi-probe meter – An instrument that measures water quality data, such as temperature, dissolved oxygen, specific conductivity, and pH, in a waterbody.

3.5 QA – Quality Assurance refers to a systematic process to ensure production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.6 QC – Quality Control refers to the activities performed to affirm production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.7 QI – Quality Improvement refers to any act or process performed to enhance the value, accuracy, reliability, reproducibility or defensibility of environmental data collected by RIDEM OWR.

4. RESPONSIBILITIES

4.1 TRAINING

Any RIDEM/OWR personnel collecting water column profile measurements using a multi-probe meter for a RIDEM project or program should have completed RIDEM's Quality System Awareness Training Program with appropriate

documentation from the Quality Assurance Manager. This training ensures the field analyst recognizes the importance of proper data collection and management and he/she comprehends the significance of the environmental decisions that may be made with the data. It is suggested that field analysts have also completed the USEPA Water Quality Standards Academy Basic Course and Supplemental Topic Modules online, but does not require any additional special training or certification.

To properly measure water column profile data with a multi-probe meter, the field analyst must be familiar with and comply with the data collection techniques stated in this SOP. The field analyst is required to read and understand this SOP. The field analyst should complete and submit any required training forms and/or field assessments for project and/or program QAPPs to document proficiency with this procedure. Any field analyst not familiar with the use of the multi-probe meter to measure water column profile data should be assisted by OWR staff who are accustomed to using the equipment.

4.2 RESPONSIBILITIES OF FIELD ANALYST

The field analyst is responsible for checking the required equipment in the Sampling Center at the beginning of the sampling event before taking measurements in the field. The field analyst is responsible for verifying that the multi-probe meter is in proper operating condition prior to use (i.e. batteries have enough power for the sampling event; multi-probe securely attached to handheld display) and communicating to the project manager when equipment is in need of repair or replacement. As delegated by the project manager, the field analyst may be responsible for calibrating the multi-probe meter according to SOP WR-W-14 Standard Operating Procedure for the Measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity using a Handheld YSI Model 85 Instrument (SOP WR-W-14) prior to departure and at the end of the sampling event. If responsibility is delegated to the field analyst, the field analyst will be responsible for adhering to the calibration and verification procedures and schedule in SOP WR-W-14. The field analyst is also responsible for ensuring that all supplementary equipment (canoe or kayak, etc.) is present and in working condition. The field analyst is also responsible for using best professional judgment to determine if site conditions are safe for performing the procedure. The field analyst is accountable for employing proper measurement procedures and data recording in accordance with this SOP.

4.3 RESPONSIBILITIES OF PROJECT OR PROGRAM MANAGER

The project or program manager is responsible for providing the materials, resources, and/or guidance necessary to perform the measurements in accordance with this SOP. The project manager is responsible for ensuring that the field analyst operates the multi-probe meter correctly in accordance with this SOP and that any additional, project-specific requirements are communicated to the project team. The project manager is responsible for ensuring the multi-probe meter is maintained in proper operating condition according to the calibration and verification schedule and procedures in SOP WR-W-14. At the project manager's discretion, this responsibility may be designated to the field analyst. The project manager will ensure that the field analyst is proficient in the requirements of SOP WR-W-14 prior to designation of the responsibility to the

field analyst. The project manager will ensure that this training is documented as required in the project and/or program QAPP(s). The project manager will determine and communicate with field analysts what procedures and order of procedures are to be accomplished during each sampling event to a sampling location. Further, the project manager shall ensure annual renewal and periodic revisions to this SOP as necessary to reflect current needs and standards as well as renew this SOP every five years.

5. GUIDELINES AND PROCEDURES

5.1 PROPER MEASUREMENT OF WATER COLUMN PROFILE

5.1.1 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- Multi-probe meter with cable marked with depth (Figure 1, similar to YSI Model 85 or ProPlus)
- Handheld display (Figure 1, similar to YSI Model 85 or ProPlus)
- Datasheet or field notebook printed on waterproof paper (paper similar to Grainger Item Number 3XFR7)
- Clipboard
- Pencil or Rite in the Rain Pen (similar to Forestry Suppliers Item Number 49237)
- Boat, canoe or kayak
- Paddles and motor
- Anchors
- Lifejackets
- Depth finder

5.1.2 USING THE MULTI-PROBE METER IN THE FIELD

For most purposes, the multi-probe meter is used specifically for in situ water quality measurements taken directly in the field, in lake, ponds, and reservoirs. This method does not require sample containers or preservation.

5.1.3 RECORDING PARAMETER UNITS

The following units should be used when recording measurements taken with the multi-probe meter:

Dissolved Oxygen %.....% saturation

Dissolved Oxygen .....mg/L

Specific Conductance.....µS/cm

Temperature.....°C

pH (if available).....None

5.2 FIELD MEASUREMENT PROCEDURES

5.2.1 DETERMINE FIELD PROCEDURE SCHEDULE

Prior to departure, the project manager will communicate with the field analysts what procedures should be accomplished for each sampling trip to the sampling location, the order of the field procedures, and whether quality control procedures should be completed. Prior to performing this analysis, the field analyst should ensure the water column profile measurement is taken at an appropriate time of day and in the correct order. This procedure may disrupt fish and microscopic organisms, such as phytoplankton and zooplankton, which can interfere with other field procedures and sample collections in lakes, ponds, and reservoirs. Water column profile measurements with a multi-probe meter should be measured after these samples have been collected, unless the biological collection requires determination of a thermocline. Furthermore, water column profile measurements with a multi-probe meter should be taken before any sampling procedure or activity that may disturb bottom sediments to avoid increasing turbidity at the location. The field analyst should note any disturbance to the bottom sediment in the Comment/Notes section of the field datasheet (Figure 2) or appropriate field notebook.

5.2.2 POSITION THE BOAT AT THE DEEPEST POINT OR DESIRED DEPTH

If a bathymetric map is available, the field analyst should use the map and distinguishing land characteristics (i.e. outfall structures, points, inlets, boat launch) to find the general location of the deepest spot or desired depth in the lake, pond, or reservoir. The field analyst should verify the location by confirming several depth locations with the depth finder around the general location of the deepest spot or desired depth. Once the deepest location or desired depth is established, the field analyst should carefully lower the anchor so that bottom sediment is not disturbed into the water column. The field analyst should record the depth of the deepest location or desired depth to the nearest tenth of a meter on the field datasheet (Figure 2) or appropriate field notebook. For

monitoring section sampling events, the field analyst should fill out the information at the top of the field datasheet (Figure 2) prior to measurement of a water column profile.

5.2.3 TAKING THE WATER COLUMN PROFILE MEASUREMENTS

When taking water column profile measurements the multi-probe meter should remain in the water directly below your hand holding the cable attached to the multi-probe meter.

NOTE: The second field analyst should record all numbers read aloud on the datasheet (Figure 2) or appropriate field notebook.

- Unwind the cable attached to the multi-probe to equal the deepest spot or desired depth. Place your foot gently on the cable not unwound in the bottom of the boat in case you drop the equipment.
- In one hand using the cable, hold the multi-probe over the water. In your other hand, hold the handheld display (securely attached).
- Using the cable, slowly lower the multi-probe over the side of the boat into the water until the top of the multi-probe is just under the surface of the water.
- Press MODE until a "%" appears on the right side at the top of the LCD screen.
- Allow instrument at least 6 seconds to stabilize the measurement and read aloud the % dissolved oxygen displayed.
- Below the % dissolved oxygen, the field analyst should observe a "°C"
- Read aloud the temperature displayed.
- Press MODE and read aloud the next parameter displayed.
    - Note: If the unit is reading specific conductance in mS (indicated by a small number), press enter to change the units back to µS/cm.
    - Note: The "°C" should be flashing when specific conductance is read. If "°C" is not flashing, then press MODE.
- Continue until all parameters have been recorded.
- Slowly lower the multi-probe to the 0.5 meter marking on the cable.
- Read aloud the depth to the nearest tenth of a meter to the second field analyst.
- Repeat the steps above until all parameters have been recorded for the 0.5 meter depth.
- Slowly lower the multi-probe to the 1.0 meter marking on the cable.

- Read aloud the depth to the nearest tenth of a meter to the second field analyst.
- Repeat the steps above until all the parameters have been recorded for the 1.0 meter depth.
- For lakes greater than 5 meters at maximum depth, continue to lower the multi-probe at 1 meter intervals. For lakes less than 5 meters at maximum depth, continue to lower the multi-probe at 0.5 meter intervals.
    - For example, the next reading in a lake greater than 5 meters would be at the 2.0 meter marking on the cable, and the next reading in a lake less than 5 meters would be at the 1.5 meter marking on the cable.
- Continue to take water quality measurements at each interval for all parameters until the multi-probe is 1.0 meters above the maximum depth.
- Slowly bring the multi-probe to the surface.
    - At 15-20% of sites as designated by the project manager, a second reading of water quality parameters will be completed by stopping at the 1.0 meter depth and taking another compete set of water quality parameter readings. Following this reading, remove all equipment from the water and rewind the cable.

6. QUALITY CONTROL

6.1 QUALITY CONTROL

Quality control will be assessed by calculating the 5% error of the repeated measurements at the 1.0 meter depth. This will give a measure of precision for the procedure.

6.2 QUALITY ASSURANCE PLANNING CONSIDERATIONS

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. Unless specified otherwise in a site or project-specific work plan, Quality Assurance Project Plan (QAPP), Quality Assurance Program Plan (QAPP) or laboratory Quality Assurance Manual (QAM), all data collected following the protocols set forth in this document will be collected in accordance with the minimum QAQC requirements of Section 6.1. Further quality assurance requirements will be defined in project specific work plans and may include duplicate or replicate measurements or confirmatory analyses.

7. REFERENCES

YSI Model 85: Handheld Oxygen, Conductivity, Salinity, and Temperature System Operations Manual. YSI incorporated. Yellow Springs Ohio, USA.

Wetzel, R.G. and Likens, G.E. 2001. *Limnological Analyses*, 3rd ed. New York: Spring Science and Business Media, Inc., 429 pp.

Figure 1. YSI 85 and Associated Equipment

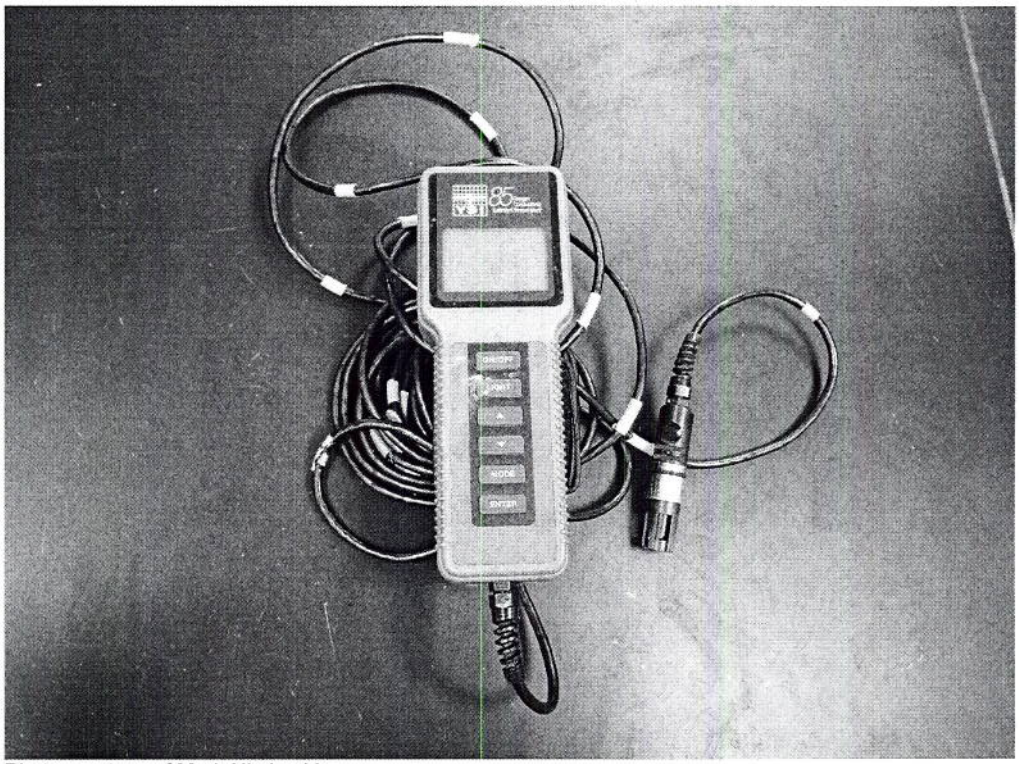

Photo courtesy of Mark Nimiroski

Figure 2. Lake Datasheet for Monitoring Section Sampling Events

Lake Sampling Datasheet

Lake Name: _____ Town: _____

Date: _____ Military Time: _____ Collectors: _____

Meter # _____

Max Depth: _____ m

Weather: (Circle one) Clear Partly Cloudy Overcast Raining Windy Sunny

Air Temperature: _____ °C

Comments/Notes:

Secchi Depth #1	_____ m		
Secchi Depth #2	_____ m		
QC Range (5%)	_____ m	Accepted?	_____
Secchi Depth #3	_____ m	Action?	_____
Secchi Depth #1 redo	_____ m		
Secchi Depth #2 redo	_____ m		

			QC Measurement (20% of sites)
Water Column Readings (reading taken at 1m)	Temperature	_____ °C	_____ °C
	pH	_____	_____
	Specific Conductivity	_____ µS/cm	_____ µS/cm
	Dissolved Oxygen	_____ mg/L	_____ mg/L
		_____ %	_____ %

RIDEM Office of Water Resources – Standard Operating Procedures for Water Column Profile – Lakes, Ponds, and Reservoirs

Figure 2. (cont.) Lake Datasheet for Monitoring Section Sampling Events

Water Column Profile Readings

Depth	Temp	pH	SpCond	DO

Macrophyte Survey Complete?	YES	NO
Water Collection Complete?	YES	NO

RIDEM Office of Water Resources – Standard Operating Procedures for Water Column Profile – Lakes, Ponds, and Reservoirs

APPENDIX G
Standard Operating Procedure
Collection of Bottle-Direct Water Samples –
Lakes, Ponds, and Reservoirs

Standard Operating Procedure for Bottle-Direct Water Samples Lakes, Ponds, and Reservoirs

SOP-WR-W-32

APPROVALS:

Deputy Chief of Water Resources:

Sue Kiernan	Susan Kiernan	8/4/11
Printed Name	Signature	Date

Quality Assurance Manager:

Connie Carey	Connie Carey	8/1/11
Printed Name	Signature	Date

DISTRIBUTION

(x) Surface Water Monitoring & Assessment (Connie Carey) ..... By: CgC Date : 8/1/11

(x) TMDL Program (Elizabeth Scott) ..... By:_____Date :_____

(x) Quality Assurance Manager (Tom Getz) ..... By:_____Date :_____

Title: Standard Operating Procedure for Bottle-direct Water Samples – Lakes, Ponds, and Reservoirs
Originator Name: Jane Sawyers

TABLE OF CONTENTS

Standard Operating Procedure for Bottle-direct Water Samples
Lakes, Ponds, and Reservoirs

1. APPLICABILITY

This SOP applies to all Office of Water Resources (OWR) staff involved in collecting bottle-direct water samples in lakes, ponds, and reservoirs. Exemption from the use of this SOP for project work shall be allowed for reasons of inapplicability determined by management discretion.

2. PURPOSE

This SOP establishes a standardized method for performing field collections of bottle-direct water samples in lakes, ponds, and reservoirs. It sets a consistent protocol to ensure the quality of OWR's data collection—resulting in improved uniformity, reproducibility, verifiability, and defensibility of the data, as well as increased program credibility.

3. DEFINITIONS

3.1 RIDEM – Rhode Island Department of Environmental Management

3.2 OWR – RIDEM Office of Water Resources

3.3 SOP – Standard Operating Procedures

3.4 Bottle-direct – A procedure to collect water samples without a sampling device.

3.5 QA – Quality Assurance refers to a systematic process to ensure production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.6 QC – Quality Control refers to the activities performed to affirm production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.7 QI – Quality Improvement refers to any act or process performed to enhance the value, accuracy, reliability, reproducibility or defensibility of environmental data collected by RIDEM OWR.

4. RESPONSIBILITIES

4.1 TRAINING

Any RIDEM/OWR personnel collecting bottle-direct water samples for a RIDEM project or program should have completed RIDEM's Quality System Awareness Training Program with appropriate documentation from the Quality Assurance

Manager. This training ensures the field analyst recognizes the importance of proper data collection and management and he/she comprehends the significance of the environmental decisions that may be made with the data. It is suggested that field analysts have also completed the USEPA Water Quality Standards Academy Basic Course and Supplemental Topic Modules online, but does not require any additional special training or certification.

To properly collect bottle-direct water samples, the field analyst must be familiar with and comply with the data collection techniques stated in this SOP. The field analyst is required to read and understand this SOP. The field analyst should complete and submit any required training forms and/or field assessments for project and/or program QAPPs to document proficiency with this procedure. Any field analyst not familiar with the collection of bottle-direct water samples from a lake, pond, or reservoir should be assisted by OWR staff who are accustomed to performing the procedure.

4.2 RESPONSIBILITIES OF FIELD ANALYST

The field analyst is responsible for checking the required equipment (correct bottle(s) or sampling container(s)) in the Sampling Center at the beginning of the sampling event before taking measurements in the field. The field analyst is responsible for ensuring that all supplementary equipment (bottles, canoe or kayak, etc.) are present and in working condition. The field analyst is also responsible for using best professional judgment to determine if site conditions are safe for performing the procedure. The field analyst is accountable for employing proper measurement procedures and data recording in accordance with this SOP.

4.3 RESPONSIBILITIES OF PROJECT OR PROGRAM MANAGER

The project or program manager is responsible for providing the materials, resources, and/or guidance necessary to perform the bottle-direct water sample collections in accordance with this SOP. The project manager is responsible for ensuring that the field analyst collects bottle-direct water samples correctly in accordance with this SOP and that any additional, project-specific requirements are communicated to the project team. The project manager is responsible for ensuring the supplementary equipment is maintained in proper operating condition annually. The project manager will determine and communicate with field analysts what procedures and order of procedures are to be accomplished during each sampling event to a sampling location. Further, the project manager shall ensure annual renewal and periodic revisions to this SOP as necessary to reflect current needs and standards as well as renew this SOP every five years.

5. GUIDELINES AND PROCEDURES

5.1 PROPER COLLECTION OF BOTTLE-DIRECT WATER SAMPLES

5.1.1 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- Datasheet or field notebook printed on waterproof paper (Figure 1, paper similar to Grainger Item Number 3XFR7)
- Clipboard
- Pencil or Rite in the Rain Pen (similar to Forestry Suppliers Item Number 49237)
- Bottles or sample containers (number and size will depend on project requirements)
- Boat, canoe or kayak
- Paddles and motor
- Anchors
- Lifejackets
- Depth finder

5.1.2 COLLECTING BOTTLE-DIRECT WATER SAMPLES IN THE FIELD

For most purposes, the procedure for bottle-direct water sample collection is used specifically for in situ water sample collections taken directly in the field, in lakes, ponds, and reservoirs. This method does specifically require bottles or sample containers, but it is not appropriate for bottles or sample containers that contain preservative. If the preservative is added after collection, this procedure may be used when collecting analytes that require preservative.

5.2 FIELD COLLECTION PROCEDURES

5.2.1 DETERMINE FIELD PROCEDURE SCHEDULE

Prior to departure, the project manager will communicate with the field analysts what procedures should be accomplished for each sampling trip to the sampling location, the order of the field procedures, and whether quality control procedures should be completed. Prior to performing this analysis, the field analyst should ensure the water sample is collected at the appropriate time of day and in the correct order. This procedure may disrupt fish and microscopic organisms, such as phytoplankton and zooplankton, which can interfere with other field procedures and sample collections in lakes, ponds, and reservoirs. Bottle-direct water samples

should be collected after these samples. However, bottle-direct water sample collections should be taken before any sampling procedure or activity that may disturb bottom sediments to avoid increasing turbidity at the location. The field analyst should note any disturbance to the bottom sediment in the Comment/Notes section of the field datasheet (Figure 1) or appropriate field notebook.

5.2.2 POSITION THE BOAT AT THE DEEPEST POINT OR DESIRED DEPTH

If a bathymetric map is available, the field analyst should use the map and distinguishing land characteristics (i.e. outfall structures, points, inlets, boat launch) to find the general location of the deepest spot or desired depth in the lake, pond, or reservoir. The field analyst should verify the location by confirming several depth locations with the depth finder around the general location of the deepest spot or desired depth. Once the deepest location or desired depth is established, the field analyst should carefully lower the anchor so that bottom sediment is not disturbed into the water column. The field analyst should record the depth of the deepest location or desired depth to the nearest tenth of a meter on the field datasheet (Figure 1) or appropriate field notebook. For monitoring section sampling events, the field analyst should fill out the information at the top of the field datasheet (Figure 1) prior to collection of water samples.

5.2.3 TAKING THE BOTTLE-DIRECT WATER SAMPLE

If a water column profile is being collected, the bottle-direct water sample should be collected on the same side as the water column. If a water column is not being collected, then either side of the boat can be used. No homogenization, compositing, splitting, or filtering of the water sample is required.

- The field analyst should confirm which side of the boat the water column profile was collected, if performed.
- The field analyst should confirm that the bottle or sampling container is correctly labeled for the site being sampled.
- The field analyst should uncap the bottle or sampling container.
- The field analyst should plunge the bottle or sampling container into the water upside down as far as possible.
- In one motion, turn the bottle or sampling container up and scoop forward bringing the full bottle to the surface.
- Cap the bottle or sampling container and place it in a cooler filled with ice.

6. QUALITY CONTROL

6.1 QUALITY CONTROL

Quality control will be assessed by duplicates collected at 15-20% of monitoring locations.

6.2 QUALITY ASSURANCE PLANNING CONSIDERATIONS

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. Unless specified otherwise in a site or project-specific work plan, Quality Assurance Project Plan (QAPP), Quality Assurance Program Plan (QAPP) or laboratory Quality Assurance Manual (QAM), all data collected following the protocols set forth in this document will be collected in accordance with the minimum QAQC requirements of Section 6.1. Further quality assurance requirements will be defined in project specific work plans and may include duplicate or replicate measurements or confirmatory analyses.

7. REFERENCES

Green, L.T., E.M. Herron, and A.J. Gold. 2010. *URI Watershed Watch Revised Lake and Pond Monitoring Manual*. College of the Environmental and Life Sciences, University of Rhode Island. Contribution #5047.

RIDEM. *Field Sampling with Bottles not Containing Preservatives*. Office of Water Resources, Rhode Island Department of Environmental Management. WR-W-22. http://www.dem.ri.gov/pubs/sops/wrw22.pdf

Figure 1. Lake Datasheet for Monitoring Section Sampling Events

Lake Sampling Datasheet

Lake Name: _____ Town: _____

Date: _____ Military Time: _____ Collectors: _____

Meter # _____ _____

Max Depth: _____ m

Weather: (Circle one) Clear Partly Cloudy Overcast Raining Windy Sunny

Air Temperature: _____ °C

Comments/Notes:

Secchi Depth #1	_____ m		
Secchi Depth #2	_____ m		
QC Range (5%)	_____ m	Accepted?	_____
Secchi Depth #3	_____ m	Action?	_____
Secchi Depth #1 redo	_____ m		
Secchi Depth #2 redo	_____ m		

			QC Measurement (20% of sites)
Water Column Readings (reading taken at 1m)	Temperature	_____ °C	_____ °C
	pH	_____	_____
	Specific Conductivity	_____ µS/cm	_____ µS/cm
	Dissolved Oxygen	_____ mg/L	_____ mg/L
		_____ %	_____ %

APPENDIX H
Standard Operating Procedure for the Measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity using a Handheld YSI Model 85 Instrument

Rhode Island Department of Environmental Management

Standard Operating Guidelines for the Measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity using a Handheld YSI Model 85 Instrument

1.0 INTRODUCTION

1.1 Purpose and Applicability

These Standard Operating Guidelines (SOG) provide basic instructions for routine calibration and operation of a Handheld YSI Model 85 Instrument that will be used during this study. This SOG for this meter addresses measurements taken for dissolved oxygen, temperature, conductivity, specific conductance and salinity in drinking, surface, and saline waters, domestic and industrial wastes, and acid rain.

1.2 Quality Assurance Planning Considerations

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. These quality assurance requirements will be defined in the site-specific workplan or Quality Assurance Project Plan (QAPP) (hereafter referred to as the project plan) or laboratory Quality Assurance Manual (OAM) and may include duplicate or replicate measurements or confirmatory analyses.

2.0 RESPONSIBILITIES

2.1

The analyst is responsible for verifying that the YSI Model 85 meter is in proper operating condition prior to use and for implementing the calibration and measurement procedures in accordance with this SOG and the project plan.

2.2

The project manager is responsible for ensuring that project-specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the measurements in accordance with this SOG and the project plan.

3.0 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- YSI Model 85 meter
- YSI Model 85 manufacturer's instruction manual
- Lint-free tissues
- YSI data sheets or logbooks

4.0 METHOD

4.1 Sample Handling, Preservation, and General Measurement Procedures

4.1.1

Use of the YSI Model 85 for this project is specifically for measurements taken in the field, in lotic or lentic surface waters.

4.1.2

The following units should be used for measurements taken with the YSI 85:

Dissolved Oxygen %..... % saturation

Dissolved Oxygen ..... mg/L

Conductivity ..... µS/cm

(Measurement of conductive material without regard to temperature)

Specific Conductance..... µS/cm

(Temperature compensated conductivity)

Temperature..... °C

Salinity ..... mg/L

4.2 Calibration Procedures

4.2.1

The YSI Model 85 Meter must be calibrated for dissolved oxygen measurements each time it is turned on. Each time it is turned off, it is necessary to re-calibrate before taking measurements. All calibrations should be completed at a temperature that is as close as possible to the sample temperature. If sampling sites are relatively close together, it is acceptable to leave the meter on until all measurements are recorded to avoid recalibration. (System calibration (for conductivity/specific conductance) is rarely required because of the factory calibration of the YIS Model 85. However, from time to time it is wise to check the system calibration and make adjustments as necessary. See YSI meter Operations manual.)

4.2.2

Ensure that the sponge inside the instrument's calibration chamber is damp. Insert the probe into the calibration chamber.

4.2.3

Turn the meter on using the ON/OFF button, and the instrument will activate all segments of the display for a few seconds, which will be followed by a self-test

procedure that will last for several more seconds. During this power on self-test sequence, the instrument's microprocessor is verifying that the instrument is working properly.

4.2.4

Press the MODE button until dissolved oxygen is displayed in mg/L or %. Wait for the dissolved oxygen and temperature readings to stabilize (usually fifteen minutes required.)

4.2.5

Use two fingers to press and release both the UP ARROW and DOWN ARROW buttons at the same time.

4.2.6

The LCD screen will prompt you to enter the local altitude in hundreds of feet. Use the arrow to increase or decrease the altitude as necessary. When proper altitude appears on the LCD, press the ENTER button once.

4.2.7

The LDC should now display CAL in the lower left of the display, the calibration value should be displayed in the lower right of the display and the current % reading (before calibration) should be on the main display. Make sure that the current % reading (large display) is stable, then press the ENTER button. The display should read SAVE then should return to the normal operation mode.

4.2.6

Record the stabilized, calibrated dissolved oxygen (mg/L) measurement and the temperature on attached YSI data sheet.

4.2.7

Ensure that the calibrated dissolved oxygen measurement falls within 5% of the ideal value for dissolved oxygen (mg/L; according to the oxygen solubility table below) at the temperature recorded. If the calibrated dissolved oxygen measurement exceeds 5% of the value, recalibrate the YSI 85 Model. If problem persists, contact the manufacturers.

100% Oxygen Solubility

Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
0.0	**14.62**	**5.0**	**12.77**	**10.0**	**11.29**	**15.0**	**10.08**	**20.0**	**9.09**	**25.0**	**8.26**	**30.0**	**7.56**	**35.0**	**6.95**
0.1	14.58	5.1	12.74	10.1	11.26	15.1	10.06	20.1	9.07	25.1	8.24	30.1	7.55	35.1	6.94
0.2	14.54	5.2	12.71	10.2	11.24	15.2	10.04	20.2	9.06	25.2	8.23	30.2	7.53	35.2	6.93
0.3	14.50	5.3	12.67	10.3	11.21	15.3	10.02	20.3	9.04	25.3	8.21	30.3	7.52	35.3	6.92
0.4	14.46	5.4	12.64	10.4	11.19	15.4	10.00	20.4	9.02	25.4	8.20	30.4	7.51	35.4	6.91
0.5	14.42	5.5	12.61	10.5	11.16	15.5	9.97	20.5	9.00	25.5	8.18	30.5	7.49	35.5	6.89
0.6	14.38	5.6	12.58	10.6	11.13	15.6	9.95	20.6	8.99	25.6	8.17	30.6	7.48	35.6	6.88
0.7	14.34	5.7	12.55	10.7	11.11	15.7	9.93	20.7	8.97	25.7	8.15	30.7	7.47	35.7	6.87
0.8	14.30	5.8	12.51	10.8	11.08	15.8	9.91	20.8	8.95	25.8	8.14	30.8	7.46	35.8	6.86
0.9	14.26	5.9	12.48	10.9	11.06	15.9	9.89	20.9	8.94	25.9	8.12	30.9	7.44	35.9	6.85
1.0	**14.22**	**6.0**	**12.45**	**11.0**	**11.03**	**16.0**	**9.87**	**21.0**	**8.92**	**26.0**	**8.11**	**31.0**	**7.43**	**36.0**	**6.84**
1.1	14.18	6.1	12.42	11.1	11.01	16.1	9.85	21.1	8.90	26.1	8.10	31.1	7.42	36.1	6.83
1.2	14.14	6.2	12.39	11.2	10.98	16.2	9.83	21.2	8.88	26.2	8.08	31.2	7.41	36.2	6.82
1.3	14.10	6.3	12.36	11.3	10.96	16.3	9.81	21.3	8.87	26.3	8.07	31.3	7.39	36.3	6.81
1.4	14.06	6.4	12.33	11.4	10.93	16.4	9.79	21.4	8.85	26.4	8.05	31.4	7.38	36.4	6.80
1.5	14.03	6.5	12.30	11.5	10.91	16.5	9.77	21.5	8.83	26.5	8.04	31.5	7.37	36.5	6.78
1.6	13.99	6.6	12.26	11.6	10.88	16.6	9.75	21.6	8.81	26.6	8.03	31.6	7.36	36.6	6.77
1.7	13.95	6.7	12.23	11.7	10.86	16.7	9.73	21.7	8.79	26.7	8.01	31.7	7.35	36.7	6.76
1.8	13.91	6.8	12.20	11.8	10.83	16.8	9.71	21.8	8.78	26.8	8.00	31.8	7.33	36.8	6.75
1.9	13.87	6.9	12.17	11.9	10.81	16.9	9.69	21.9	8.76	26.9	7.98	31.9	7.32	36.9	6.74
2.0	**13.83**	**7.0**	**12.14**	**12.0**	**10.78**	**17.0**	**9.67**	**22.0**	**8.74**	**27.0**	**7.97**	**32.0**	**7.31**	**37.0**	**6.73**
2.1	13.79	7.1	12.11	12.1	10.76	17.1	9.65	22.1	8.72	27.1	7.96	32.1	7.30	37.1	6.72
2.2	13.76	7.2	12.08	12.2	10.73	17.2	9.63	22.2	8.71	27.2	7.94	32.2	7.28	37.2	6.71
2.3	13.72	7.3	12.05	12.3	10.71	17.3	9.61	22.3	8.69	27.3	7.93	32.3	7.27	37.3	6.70
2.4	13.68	7.4	12.02	12.4	10.68	17.4	9.59	22.4	8.68	27.4	7.91	32.4	7.26	37.4	6.69
2.5	13.65	7.5	11.99	12.5	10.66	17.5	9.57	22.5	8.66	27.5	7.90	32.5	7.24	37.5	6.67
2.6	13.61	7.6	11.96	12.6	10.64	17.6	9.55	22.6	8.64	27.6	7.89	32.6	7.23	37.6	6.66
2.7	13.57	7.7	11.93	12.7	10.61	17.7	9.53	22.7	8.63	27.7	7.87	32.7	7.22	37.7	6.65
2.8	13.53	7.8	11.90	12.8	10.59	17.8	9.51	22.8	8.61	27.8	7.86	32.8	7.21	37.8	6.64
2.9	13.50	7.9	11.87	12.9	10.56	17.9	9.49	22.9	8.60	27.9	7.84	32.9	7.19	37.9	6.63
3.0	**13.46**	**8.0**	**11.84**	**13.0**	**10.54**	**18.0**	**9.47**	**23.0**	**8.58**	**28.0**	**7.83**	**33.0**	**7.18**	**38.0**	**6.62**
3.1	13.43	8.1	11.81	13.1	10.52	18.1	9.45	23.1	8.56	28.1	7.82	33.1	7.17	38.1	6.61
3.2	13.39	8.2	11.78	13.2	10.49	18.2	9.43	23.2	8.55	28.2	7.80	33.2	7.16	38.2	6.60
3.3	13.36	8.3	11.76	13.3	10.47	18.3	9.41	23.3	8.53	28.3	7.79	33.3	7.15	38.3	6.59
3.4	13.32	8.4	11.73	13.4	10.45	18.4	9.39	23.4	8.52	28.4	7.77	33.4	7.14	38.4	6.58
3.5	13.29	8.5	11.70	13.5	10.43	18.5	9.37	23.5	8.50	28.5	7.76	33.5	7.12	38.5	6.57
3.6	13.25	8.6	11.67	13.6	10.40	18.6	9.36	23.6	8.48	28.6	7.75	33.6	7.11	38.6	6.56
3.7	13.22	8.7	11.64	13.7	10.38	18.7	9.34	23.7	8.47	28.7	7.73	33.7	7.10	38.7	6.55
3.8	13.18	8.8	11.62	13.8	10.36	18.8	9.32	23.8	8.45	28.8	7.72	33.8	7.09	38.8	6.54
3.9	13.15	8.9	11.59	13.9	10.33	18.9	9.30	23.9	8.44	28.9	7.70	33.9	7.08	38.9	6.53
4.0	**13.11**	**9.0**	**11.56**	**14.0**	**10.31**	**19.0**	**9.28**	**24.0**	**8.42**	**29.0**	**7.69**	**34.0**	**7.07**	**39.0**	**6.52**
4.1	13.08	9.1	11.53	14.1	10.29	19.1	9.26	24.1	8.40	29.1	7.68	34.1	7.06	39.1	6.51
4.2	13.04	9.2	11.51	14.2	10.26	19.2	9.24	24.2	8.39	29.2	7.66	34.2	7.05	39.2	6.50
4.3	13.01	9.3	11.48	14.3	10.24	19.3	9.22	24.3	8.37	29.3	7.65	34.3	7.03	39.3	6.49
4.4	12.97	9.4	11.45	14.4	10.22	19.4	9.20	24.4	8.36	29.4	7.64	34.4	7.02	39.4	6.48
4.5	12.94	9.5	11.43	14.5	10.20	19.5	9.18	24.5	8.34	29.5	7.62	34.5	7.01	39.5	6.46
4.6	12.91	9.6	11.40	14.6	10.17	19.6	9.17	24.6	8.32	29.6	7.61	34.6	7.00	39.6	6.45
4.7	12.87	9.7	11.37	14.7	10.15	19.7	9.15	24.7	8.31	29.7	7.60	34.7	6.99	39.7	6.44
4.8	12.84	9.8	11.34	14.8	10.13	19.8	9.13	24.8	8.29	29.8	7.59	34.8	6.97	39.8	6.43
4.9	12.80	9.9	11.32	14.9	10.10	19.9	9.11	24.9	8.28	29.9	7.57	34.9	6.96	39.9	6.42
5.0	**12.77**	**10.0**	**11.29**	**15.0**	**10.08**	**20.0**	**9.09**	**25.0**	**8.26**	**30.0**	**7.56**	**35.0**	**6.95**	**40.0**	**6.41**

***Chlorinity: 0** ***Salinity: 0**

4.3 Measurement Procedures

4.3.1

Lower electrode to the desired depth (surface, middle, or bottom of the water column). When recording the bottom measurement, be sure to keep the electrode at least 0.5 ft above the bottom. Be sure not to disturb bottom substrates prior to or during measurement.

4.3.2

Select the dissolved oxygen % measurement mode on the main display. Temperature is always displayed *below* the main display. Allow measurements to stabilize. Record dissolved oxygen % and temperature measurement on YSI data sheet.

4.3.3

Cycle to the next measurement mode and record the next parameter on the YSI data sheet. This step should be continued until measurements for all parameters are recorded.

Selecting another measurement mode is accomplished by simply pressing and releasing the MODE button.

> NOTE: If the instrument is reading specific conductance (temperature compensated), the large numbers on the display will be followed by µS. Additionally, the small portion of the display will show the °C *flashing on and off*. If the instrument is reading conductivity (NOT temperature compensated), the large numbers on the display will be followed by either a µS or an mS; however, the small portion of the display will show the °C NOT flashing.

4.3.4

Place electrode into storage chamber.

4.5 Maintenance

4.5.1

Instrument maintenance should be performed according to the procedures and frequencies required by the manufacturer.

4.5.2

The probe must be stored and maintained according to the manufacturer's instructions.

5.0 QUALITY CONTROL

5.1

The meter must be calibrated each time it is turned on or recalibrated every 12 hours, and will not be used for sample determinations unless the dissolved oxygen value is within 5% of the ideal dissolved oxygen (mg/L) value at the temperature measured according to the oxygen solubility table in section 4.2.7.

5.2

Duplicate measurements of a single sample will be performed at the frequency specified in the project plan. In the absence of project-specific criteria, duplicate measurements should agree within 10%.

5.3

If there are any performance problems with the YSI 85 meter that results in an inability to achieve the acceptance criteria presented in Section 5.0, consult the appropriate section of the meter instruction manual for the checkout and self-test procedures. If the problem persists, consult the manufacturer's customer service department immediately for further instructions.

6.0 DOCUMENTATION

6.1

All calibration and field measurements will be recorded on YSI data collection sheet (attached).

6.2

Calibration documentation must be maintained in a thorough and consistent manner. At a minimum, the following information must be recorded:

- Date and time of calibration
- Instrument identification number/model
- Readings for all continuing calibration checks
- Comments

6.3

Documentation for recorded data must include a minimum of the following:

- Date and time of analysis
- Instrument identification number/model
- Sample identification/station location
- Comments

7.0 TRAINING/QUALIFICATIONS

To properly perform measurement collection, the analyst must be familiar with the calibration and measurement techniques stated in this SOG. The analyst must also be experienced in the operation of the meter.

8.0 REFERENCES

YSI Model 85: Handheld Oxygen, Conductivity, Salinity, and Temperature System Operations Manual. YSI incorporated. Yellow Springs Ohio, USA.

YSI Data Collection Sheet

FIELD CREW:
YSI Instrument (circle one): #1 #2 #3

	1	2	3	4	5	6	7	8	9	10	11
Site ID											
Name											
Date											
Time											
YSI											
% Saturation											
Dis. Oxygen											
Temp (oC)											
Conductivity											
Specific Cond.											
Salinity											

	12	13	14	15	16	17	18	19	20	21	22
Site ID											
Name											
Date											
Time											
YSI											
% Saturation											
Dis. Oxygen											
Temp (oC)											
Conductivity											
Specific Cond.											
Salinity											

APPENDIX I
Standard Operating Procedure for Summary Guidance Reviewing Environmental Monitoring Data

Summary Guidance for Reviewing Environmental Monitoring Data

Standard Operating Procedure # - BEP-WR-1

1. **APPLICABILITY.** This SOP applies to all DEM programs where staff review environmental monitoring data for use in various environmental regulatory decisions. This summary guidance can be applied to the review of environmental data generated by the Department or by entities in fulfillment of environmental regulatory requirements, as well as to secondary data. It is anticipated that individual programs will modify the checklist (Appendix A) as necessary to meet their DQOs. Appendix C is an example of a checklist that focuses on data verification / validation issues.

2. **PURPOSE.** This SOP is intended to serve as a primer on the procedures for reviewing environmental data and data reports for DEM programs. Depending on the needs of the project, the intended use of the final data and the degree of confidence required in the quality of the results, data review can be conducted at many levels. This document provides general guidance on verification and validation procedures and usability assessments and informs staff of available references to utilize. Data verification ensures that reported results accurately depict work performed. Data validation confirms that these verified results meet the overall quality requirements of the project. Usability assessments define acceptance criteria by which environmental data are evaluated for ultimate use in decision-making.

3. **DEFINITIONS.**

Data Quality Objectives (DQOs) – Description of the intended use of the data and some of the requirements that must be attained (quality and quantity) to meet the intended use.

Data Validation – A technical review performed to compare data with established quality criteria to ensure that data are adequate for the intended use. Data validation confirms that the verified results meet the overall quality requirements of the intended use.

Data Verification – The first step in data review, data verification entails an evaluation of the completeness, correctness, consistency and conformance/compliance of a data set against pre-determined requirements given in a document such as the Quality Assurance Project Plan (QAPP), and to ensure that the records associated with a specific dataset actually reflect what was conducted.

Detection Limit (DL)/Method Detection Limit (MDL) – the lowest concentration of a substance that can be measured with 99% confidence that the substance is present in the sample, i.e., greater than zero.

Metadata – Informational data about the data.

Quality Control (QC) –technical activities intended primarily to control errors. The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the established requirements.

Quantitation Level (QL) – (quantification level, practical quantitation level) – the lowest concentration of a substance that can be reliably measured and reported with some degree of confidence.

Secondary Data – Data collected for purposes other than the current intended use.

4. RESPONSIBILITY.

All staff involved in reviewing environmental data are responsible to determine the applicability of this SOP to their work. Supervisors are responsible for ensuring that staff are familiar with and adhere to any SOPs affecting their project or program functions.

5. GUIDELINES AND PROCEDURES

5.1 General

A primary goal of DEM is to ensure that environmental decisions are supported by data of the type and quality needed and expected for their intended use. Data review is the process by which data are examined and evaluated to varying levels of detail and specificity to ensure that only sound data that are of known and documented quality and meet project quality objectives are used in making environmental regulatory decisions. Although a certain level of verification and validation occur during field sampling and analytical procedures in the laboratory prior to data/report submittal to DEM staff, there is an internal need to review submitted data/reports which will ultimately be used to make environmental regulatory decisions.

The review of environmental data occurs in two phases. The first phase consists of 2 steps in reviewing and determining the validity of the analytical data (data verification and validation). The second phase consists of interpreting the data to determine its applicability for an intended use (usability assessment). Generally, the data verification and validation procedures are outlined in the project's QAPP or Quality Assurance (QA) documentation. Details regarding data verification and validation procedures can be found in EPA's *Guidance on Environmental Data Verification and Data Validation* (EPA 2002). Data verification and validation can be conducted using a checklist or other systematic approach (see Appendix A checklist adapted from EPA's *Requirements for Quality Assurance Project Plans, EPA QA/R-5).* (EPA 2001).

When considering the use of secondary data, the metadata associated with the secondary data should be evaluated for consistency with the Data Quality Objectives and quality criteria of the current intended use similarly to the steps outlined below.

5.2 Data Verification

Data verification is the process of evaluating the completeness, correctness, and consistency of a laboratory data package or final data/project report, against specified requirements usually outlined in project/program QAPPs. This completeness check is performed first to determine whether the required information (the complete data package) is available for further review. The process verifies the information for consistency with project/program specifications, including but not limited to:

- Completeness of the data package as prescribed in the QAPP or other QA documentation;
- Inclusion of sample collection records including field logs;
- Sample collection methods, location(s) and list of analytes are reported in accordance with QAPP or other QA documentation requirements, or documentation of deviations;
- Integrity of samples as determined by complete and proper sample chain-of-custody documentation;
- Adherence to appropriate holding times, preservation, transport or handling protocols;
- Proper sample preparation and documentation such as instrument logs, bench notes, calculation worksheets;

- Sample analysis documentation such as methods and instruments utilized;
- Proper and sufficient documentation of quality control measures and criteria including calibration standards, method blanks, duplicate and replicate samples, spiked samples and blanks, precision, accuracy and data qualifier codes;
- Documentation of Detection Limits and Quantification (reporting) Levels including methods of calculation;
- Documentation of all generated data

5.3 **Data Validation**

The primary focus of data validation is the accuracy and integrity of individual data values so that the numbers can be trusted. Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural or contractual compliance (i.e., data verification) to determine the analytical quality of a specific data set. The intensity of the data validation effort can vary depending on the needs of the project, program, and/or use of the data.

Data validation should:

- Establish that required sampling methods were used and that any deviations were noted;
- Ensure that the sampling procedures and field measurements met performance criteria and that any deviations were documented;
- Establish that required analytical methods were used and that any deviations were noted.
- Verify attainment of required QC measures and criteria, and that deviations were documented.
- Review data for the level of precision, accuracy, representativeness, comparability and completeness;
- Determine that the laboratory data qualifiers are defined and applied as specified in methods, procedures, or the QAPP;
- Verify attainment of required DLs and QLs;
- Identify any deviations from procedures and methods that may require corrective actions or limit the use of the data collected.

5.4 Data Usability Assessment

Data Usability Assessments determine the adequacy of the verified and validated data as related to the data quality objectives (DQO) outlined in the QAPP or for the intended use of the data. Many aspects of a project affect data quality, therefore, all types of data and associated information (e.g., sampling design, sampling technique, analytical methodologies) are evaluated to determine if the data appears to be appropriate and sufficient to support decision-making based upon the original project needs.

A Data Usability Assessment has an analytical and a field component. An Analytical Data Usability Assessment is used to evaluate whether analytical data points are scientifically valid and defensible, and of a sufficient level of precision, accuracy, and sensitivity to support the DQOs. The Field Data Usability Assessment evaluates whether the sampling procedure (e.g., sampling method, sample preservation and hold times) ensures that the sample that is collected and delivered to the laboratory is representative of the sampling point.

Verification and validation processes may result in identifying data that do not meet predetermined QC measures or criteria (e.g., flagging quantitative data that must be considered qualitative only) or in the ultimate rejection of data from its intended use. The Data Usability Assessment considers whether all aspects of the final data meet project/program quality objectives as they relate to the decision to be made, and evaluates whether verified and validated data are suitable for making that decision. Usability of verified and validated data for environmental regulatory decisions is project/program specific and details of the usability criteria may be outlined in the project/program QAPP. Appendix B of this SOP contains the Office of Water Resource's data use rules for water quality assessments.

6. REFERENCES

U.S. EPA, 2001. *EPA Requirements for Quality Assurance Project Plans*, (EPA QA/R-5) EPA/240/B-01/003, March 2001, Office of Environmental Information. (http://www.epa.gov/quality/qs-docs/r5-final.pdf)

U.S. EPA, 2002. *Guidance on Environmental Data Verification and Data Validation*, (EPA QA/G-8), EPA/240/R-02/004, November 2002, Office of Environmental Information. (http://www.epa.gov/quality/qs-docs/g8-final.pdf)

Appendix A

Checklist for Review of Environmental Data and Data Reports

This checklist is based on the elements in *EPA Requirements for QA Project Plans* (QA/R-5) (EPA, 2001). This checklist can be used to review a final data report developed in accordance with a QAPP or other QA documentation.

PROJECT TITLE: _____

Date Submitted for Review: _____ **Date of Review:** _____

Preparer: _____ **Organization:** _____

Reviewer: _____ **Organization:** _____

☐ Accepted as is	☐ Accepted, if minor issues addressed	☐ Major revision needed

Reviewer Signature _____

Note: A = Acceptable U = Unacceptable NI = Not Included NA = Not Applicable

Element	A	U	NI	NA	Page #/ Section #	Comments
A1. Title and Approval Sheet						
Contains project title						
Indicates revision number, if applicable						
Indicates Organization's name						
Dated signature of organization's project manager						
Dated signature of organization's QA manager						
Other signatures as needed						
A.2. Table of Contents						
Lists QA Project Plan information sections						
Document Control Information indicated						
A.3. Distribution List						
Includes all individuals who are to receive a copy of the QA Project Plan and identifies their organization						

Element	A	U	NI	NA	Page #/ Section #	Comments
A.4. Project/Task Organization						
Identifies key individuals involved in all major aspects of the project, including contractors						
Discusses their responsibilities						
Project QA Manager position indicates independence from unit generating data						
Identifies individual responsible for maintaining the official, approved QA Project Plan						
Organizational chart shows lines of authority and reporting responsibilities						
A.5. Problem Definition/Background						
States decision(s) to be made, actions to be taken, or outcomes expected from the information to be obtained						
Clearly explains the reason (site background or historical context) for initiating this project						
Identifies regulatory information, applicable criteria, action limits, etc., necessary to the project						
A.6. Project/Task Description						
Summarizes work to be performed, for example, measurement to be made, data files to be obtained, etc., that support the project's goals						
Provides work schedule indicating critical project points, e.g., start and completion dates for activities such as sampling, analysis, data or file reviews, and assessments						
Details geographical locations studied/sampled, including maps where possible						
A.7. Quality Objectives and Criteria						
Identifies performance/ measurement criteria for all information collected and acceptance criteria for information obtained from previous studies, including project action limits and lab detection limits and range of anticipated concentrations of each parameter of interest						
Discusses precision						

Element	A	U	NI	NA	Page #/ Section #	Comments
Addresses bias						
Discusses representativeness						
Identifies the need for completeness						
Describes the need for comparability						
Discusses desired and achieved method sensitivity						
A.8. Special Training/Certifications						
Identifies any project personnel specialized training or certifications						
Discusses how and if this training was provided						
Indicates personnel responsible for assuring these are satisfied						
Identifies where this information is documented						
A.9. Documentation and Records						
Identifies report format and summarizes all data report package information						
Lists all other project documents, records, and electronic files that will be produced						
Identifies where project information is kept and for how long						
Discusses back up plans for records stored electronically						
States how individuals identified in A3 will receive the most current copy of the approved QAPP, identifying the individual responsible for this						
B.1. Sampling Process Design (Experimental Design)						
Describes and justifies design strategy, indicating size of the area, volume, or time period to be represented by a sample						
Details the type and total number of sample types/matrix or test runs/trials expected and needed						
Indicates where samples should be taken, how sites will be identified/located						
Discusses what to do if sampling sites become inaccessible						
Identifies project activity schedules such as each sampling event, times samples should be sent to the lab, etc.						

Element	A	U	NI	NA	Page #/ Section #	Comments
Specifies what information is critical and what is for informational purposes only						
Identifies sources of variability and how this variability should be reconciled with project information						
B.2. Sampling Methods						
Identifies all sampling SOPs by number, date, and regulatory citation, indicating sampling options or modifications to be taken						
Indicates how each sample/matrix type should be collected						
If *in situ* monitoring, indicates how instruments should be deployed and operated to avoid contamination and ensure maintenance of proper data						
If continuous monitoring, indicates averaging time and how instruments should store and maintain raw data, or data averages						
Indicates how samples are to be homogenized, composited, split, or filtered, if needed						
Indicates what sample containers and sample volumes should be used						
Identifies whether samples should be preserved and indicates methods that should be followed						
Indicates whether sampling equipment and samplers should be cleaned and/or decontaminated, identifying how this should be done and by-products disposed of						
Identifies any equipment and support facilities needed						
Addresses actions to be taken when problems occur, identifying individual(s) responsible for corrective action and how this should be documented						
B.3. Sample Handling and Custody						
States maximum holding times allowed from sample collection to extraction and/or analysis for each sample type and, for *in situ* or continuous monitoring, the maximum time before retrieval of information						

Element	A	U	NI	NA	Page #/ Section #	Comments
Identifies how samples or information should be physically handled, transported, and then received and held in the laboratory or office (including temperature upon receipt)						
Indicates how sample or information handling and custody information should be documented, such as in field notebooks and forms, identifying individual responsible						
Discusses system for identifying samples, for example, numbering system, sample tags and labels, and attaches forms to the plan						
Identifies chain-of-custody procedures and includes form to track custody						
B.4. Analytical Methods						
Identifies all analytical SOPs (field, lab and/or office) that should be followed by number, data, and regulatory citation, indicating options or modifications to be taken, such as sub-sampling and extraction procedures						
Identifies all analytical SOPs (field, laboratory and /or office) that should be followed by number, date, and regulatory citation, indicating options or modifications to be taken, such as sub-sampling and extraction procedures						
Identifies equipment or instrumentation needed						
Specifies any specific method performance criteria						
Identifies procedures to follow when failures occur, identifying individual responsible for corrective action and appropriate documentation						
Identifies sample disposal procedures						
Specifies laboratory turnaround times needed						
Provides method validation information and SOPs for nonstandard methods						

Element	A	U	NI	NA	Page #/ Section #	Comments
B.5. Quality Control						
For each type of sampling, analysis, or measurement technique, identifies QC activities which should be used, for example, blanks, spikes, duplicates, etc., and at what frequency						
Details what should be done when control limits are exceeded, and how effectiveness of control actions will be determined and documented						
Identifies procedures and formulas for calculating applicable QC statistics, for example, for precision, bias, outliers and missing data						
B.6. Instrument/Equipment Testing, Inspection, and Maintenance						
Identifies field and laboratory equipment needing periodic maintenance, and the schedule for this						
Identifies testing criteria						
Notes availability and location of spare parts						
Indicates procedures in place for inspecting equipment before usage						
Identifies individual(s) responsible for testing, inspection and maintenance						
Indicates how deficiencies found should be resolved, re-inspections performed, and effectiveness of corrective action determined and documented						
B.7. Instrument/Equipment Calibration and Frequency						
Identifies equipment, tools, and instruments that should be calibrated and the frequency for this calibration						
Describes how calibrations should be performed and documented, indicating test criteria and standards or certified equipment						
Identifies how deficiencies should be resolved and documented						

Element	A	U	NI	NA	Page #/ Section #	Comments
B.8. Inspection/Acceptance for Supplies and Consumables						
Identifies critical supplies and consumables for field and laboratory, noting supply source, acceptance criteria, and procedures for tracking, storing and retrieving these materials						
Identifies the individual(s) responsible for this						
B.9. Non-direct Measurements						
Identifies data sources, for example, computer databases or literature files, or models that should be accessed and used						
Describes the intended use of this information and the rationale for their selection, i.e., its relevance to project						
Indicates the acceptance criteria for these data sources and/or models						
Identifies key resources/support facilities needed						
Describes how limits to validity and operating conditions should be determined, for example, internal checks of the program and Beta testing						
B.10. Data Management						
Describes data management scheme from field to final use and storage						
Discusses standard record-keeping and tracking practices, and the document control system or cites other written documentation such as SOPs						
Identifies data handling equipment/procedures that should be used to process, compile, analyze, and transmit data reliably and accurately						
Identifies individual(s) responsible for this						
Describes the process for data archival and retrieval						
Describes procedures to demonstrate acceptability of hardware and software configurations						
Attaches checklists and forms that should be used						

Element	A	U	NI	NA	Page #/ Section #	Comments
C.1. Assessments and Response Actions						
Lists the number, frequency, and type of assessment activities that should be conducted, with the approximate dates						
Identifies individual(s) responsible for conducting assessments, indicating their authority to issue stop work orders, and any other possible participants in the assessment process						
Describes how and to whom assessment information should be reported						
Identifies how corrective actions should be addressed and by whom, and how they should e verified and documented						
C.2. Reports to Management						
Identifies what project QA status reports are needed and how frequently						
Identifies who should write these reports and who should receive this information						
D.1. Data Review, Verification, and Validation						
Describes criteria that should be used for accepting, rejecting, or qualifying project data						
D.2. Verification and Validation Methods						
Describes process for data verification and validation, providing SOPs and indicating what data validation software should be used, if any						
Identifies who is responsible for verifying and validating different components of the project data/information, for example, chain-of-custody forms, receipt logs, calibration information, etc.						
Identifies issue resolution process, and methods and individual responsible for conveying these results to data users						
Attaches checklists, forms, and calculations						

D.3. Reconciliation with User Requirements						
Describes procedures to evaluate the uncertainty of the validated data						
Describes how limitations on data use should be reported to the data users						

Appendix B

Final Decisions on Use of Low Level Ambient Data for Water Quality Assessments

January 24, 2007

Definitions

- Ambient data result/value – analytical results as determined by the laboratory with data qualifiers (ie, additional associated information that must be taken into account during any interpretation of the result).
- Reported value – final data results/values after consideration of DLs and QLs as described below. Reported values are to be used for assessments, TMDLs and other analyses by OWR.
- DL/MDL – detection limit/method detection limit – the lowest concentration of a substance that can be measured with 99% confidence that the substance is present in the sample, i.e., greater than zero. The MDL is determined through analyses of at least seven replicate samples containing the target analyte(s) at a concentration near the estimated detection capabilities of the method. To calculate the MDL value, the standard deviation of the replicate measurements is multiplied by critical values from the Student t-statistic table for the 99 percent confidence level (1-tailed) with n-1 degrees of freedom. For example, in the case of 7 replicates, the critical value for the 99% confidence level with 6 degrees of freedom (n-1), is 3.143.
- QL – quantitation level – the lowest concentration of a substance that can be reliably measured and reported with some degree of confidence. (EPA's current working definition - The smallest detectable concentration of an analyte greater than the detection limit where the required accuracy (precision & bias) is achieved for the intended purpose.) No standard methodology for QL determination exists but most current approaches follow a calibration procedure similar to, or even based upon, the MDL determination.

Environmental Data Review for Water Quality Assessments:

1. QAPPs will describe: the analytical method to be used for each parameter; the MDL for each parameter (preferably generated through a minimum of 7 replicate samples as noted above), including results of the MDL calibration determination; the QL for each parameter, including how the QL was determined (Because a standardized methodology for determination of the QL does not exist, a complete description of the approach followed should be submitted.)

2. QAPPs should ensure that adequately sensitive analytical techniques are utilized to meet a project's data quality objectives. The analytical method implemented and MDLs and QLs which must be achieved will be driven by the criteria for each parameter analyzed. In other words, OWR staff should ensure that every attempt is made to choose and utilize the analytical method and the lowest detection limit needed to evaluate results relative to criteria. In addition, the lab should achieve quantitation levels as low as possible and as low as necessary to evaluate results relative to criteria. The MDLs and QLs should be routinely achievable by HEALTH certified laboratories to assure the reliability of the measurements and be cost effective for the OWR project.

3. Due to the low hardness of many RI freshwaters, metals criteria may be extremely low in some waterbodies. To account for this issue and implement consistency in metals data review, QLs of at least the following values should be achieved for the listed metals of concern:

Metal	Required QL
a. Dissolved Cd	1.0 ug/l
b. Dissolved Pb	1.0 ug/l
c. Dissolved Cu	1.0 ug/l
d. Dissolved Zn	2.5 ug/l

4. Ambient data resulting in a value below detection limit (i.e. <DL), will be reported as zero. This guideline is in accordance with the determination of the MDL/DL as defined above, where the variance associated with results observed at these levels is such that the concentration cannot be distinguished as different from zero.

5. Ambient data resulting in values which are equal to or greater than the DL but less than the QL, constitute uncertain values. Such data will be deemed invalid and excluded from analyses (e.g. assessments) because the measured concentrations do not meet the required accuracy for the intended purpose(s)/data quality objectives.

6. All ambient data results/values will be submitted to OWR (along with the DL and QL). OWR staff will be responsible for determining the reported values including the validity of the data as described above. OWR staff will maintain both the ambient data value and the reported value within RISWIMS.

7. The aquatic life criteria were developed by reliable EPA laboratories and will be used to evaluate all valid ambient data results even if the criteria is less than DL or less than QL for a given parameter.

Appendix C

Checklist for Review of Environmental Data & Data Reports

Project Title: Date Submitted for Review: Date of Review:

Preparer: Organization:
Reviewer: Organization:

☐ Accepted as is ☐ Accepted with minor revisions ☐ Major revision required

Please respond to each question. Indicate if any question is not applicable to this set of environmental data being reviewed.

Checklist for Review of Data Verification Issues in Environmental Data & Data Reports				
	Data Verification Issues			
No.	Question	Comment	Yes	No
1	Was all the information/data included in data package?			
1a	If no, identify any missing data.			
2	Were sample collection records/chain of custody /sample loss included in data package?			
2a	If no, identify any missing data.			
3	Were all samples collected and analyzed?			
3a	If no, identify any missing samples.			
4	Were holding times and preservation of samples and transportation and handling protocols met?			
4a	If no, identify any nonconformance.			
5	Is all analytical documentation included in the data package?			
5a	If no, identify any missing documentation.			
6	Were the correct analyses performed and were the correct reporting limits (quantitation and detection) reported?			
6a	If no, identify any nonconformance.			
7	Is QC information provided (i.e. duplicates, spikes, blanks, surrogates) with acceptance criteria?			
7a	If no, identify any nonconformance.			
8	Can the decisions be made for the project DQOs based on this environmental data report?			
8a	If no, have the field and/or lab personnel been contacted to obtain any missing information or data.			
9	Has a data usability report/narrative been completed? (i.e., can you complete/close this project?)			
9a	If no, should any missing data be collected in order to complete the report?			

Checklist for Review of Data Validation Issues in Environmental Data & Data Reports

	Data Validation Issues			
No.	**Question**	**Comment**	**Yes**	**No**
1	Were required sampling methods used?			
1a	If no, note deviations from sampling methods used.			
2	Were there any deviations noted in the sampling methods used?			
2a	If yes, note deviations from the sampling methods.			
3	Did the sampling procedures and field measurements meet performance criteria?			
3a	If no, document any deviations from the performance criteria.			
4	Were the required analytical methods used on the samples?			
4a	If no, note deviations from the analytical methods.			
5	Were attainment of required QC measures and criteria verified?			
5a	If no, document any deviations from the required QC measures and criteria.			
6	Did the data review indicate the level of precision, accuracy, representativeness, comparability and completeness were met?			
6a	If no, note deviations found in the review.			
7	Were the laboratory data qualifiers defined and applied as specified in methods, procedures, or in the QAPP?			
7a	If no, explain why they were not defined and applied as specified in methods, procedures, or in the QAPP			
8	Was attainment of the required detection limits and quantification limits verified?			
8a	If no, indicate problems found in the review of the data.			
9	Were there any deviations from procedures and methods that may require corrective actions or limit the use of the data collected?			
9a	If yes, indicate corrective actions conditions that limit the use of the data collected.			

Summary Guidance for Reviewing Environmental Monitoring Data

Standard Operating Procedure # - BEP-WR-1

Originator:

Connie Carey (Print Name) Connie Carey (Signature) Date: 7/27/07

APPROVALS:

Quality Team Chair:

Tom Getz (Print Name) (Signature) Date: 7/27/07

Assistant Director of Water Resources

Alicia Good (Print Name) Alicia Good (Signature) Date: 8/15/07

Assistant Director of Air, Waste and Compliance

Terry Gray (Print Name) Terry Gray (Signature) Date: 8/1/07

Associate Director of Natural Resources

Larry Mouradjian (Print Name) (Signature) Date: 8/6/07

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