I. PROJECT MANAGEMENT

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Quality Assurance Project Plan for
Rhode Island Ambient River Monitoring Program

State of Rhode Island and Providence Plantations

Rhode Island Department of Environmental Management (DEM)

Office of Water Resources

December 2010

USEPA Project Manager	Katrina Kipp
Signature/Date	Katie Kipp 1/4/11
USEPA QA Officer	Stephen DiMattei
Signature/Date	Steph DiMatt 01-04-11
RIDEM Program Manager	Susan Kiernan
Signature/Date	Susan Kiernan 01-13-11
RIDEM Project Manager	Katie DeGoosh
Signature/Date	Katie DeGoosh 1-10-11

Quality Assurance Manager: Connie Carey

Signature/Date: Connie Carey 1/10/11

Chemical Analysis Project Lead: Henry Leibovitz

Signature/Date: 2/7/2011

Field Data Collection Team Lead: Katie DeGoosh

Signature/Date: Katie DeGoosh 1-10-11

RIDEM Quality Assurance Manager: Thomas Getz

Signature/Date: 1/18/11

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3. Distribution List

QAPP Recipients	Responsibilities	Organization
Steve DiMattei	EPA Quality Assurance Officer	United States Environmental Protection Agency 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	United States Environmental Protection Agency 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 Program Manager	RI Department of Environmental Management Office of Water Resources 235 Promenade St. Providence, RI 02908 Phone: 401-222-4700 Ext. 7600 FAX: 401-222-3564 susan.kiernan@dem.ri.gov
Katie DeGoosh	RIDEM Project Manager	RI Department of Environmental Management Office of Water Resources 235 Promenade Street Providence, RI 02908 Phone: 401-222-3961 Ext. 7211 FAX: 401-222-3564 katie.degoosh@dem.ri.gov
Connie Carey	Quality Assurance Manager	RI Department of Environmental Management Office of Water Resources 235 Promenade St. Providence, RI 02908 Phone: 401-222-4700 Ext. 7239 FAX: 401-222-3564 connie.carey@dem.ri.gov
Henry Leibovitz	Chemical Analysis Project Lead	RI State Health Laboratories 50 Orms Street Providence, RI 02904 Phone: 401-222-5578 Fax: 401-222-6985 henry.leibovitz@health.ri.gov

Katie DeGoosh	Field Data Collection Team Leader	RI Department of Environmental Management Office of Water Resources 235 Promenade Street Providence, RI 02908 Phone: 401-222-3961 Ext. 7211 FAX: 401-222-3564 katie.degoosh@dem.ri.gov
Thomas Getz, P.E.	RIDEM Quality Assurance Manager	RI Department of Environmental Management Office of the Director 235 Promenade Street Providence, RI 02908 Phone: 401-2224700 Ext 2417 Fax: (401) 222-6802 Thomas.getz@dem.ri.gov

4. Project/Task Organization

Rhode Island Department of Environmental Management, Office of Water Resources (RIDEM/OWR) will conduct ambient water quality monitoring of rivers and streams as part of the on-going RIDEM/OWR Ambient River Monitoring (ARM) Program in Rhode Island. In this on-going program, RIDEM/OWR will execute the fieldwork using permanent, contractual and seasonal personnel to collect field data and water samples and will contract with the Rhode Island Department of Health (HEALTH) to execute the laboratory analyses portion of the program. The organizational chart (Figure 1) describes the principal officials from RIDEM, HEALTH and the US Environmental Protection Agency (USEPA) associated with the project and illustrates the pathways of communication that will be utilized during the program.

Sue Kiernan of RIDEM/OWR will serve as the RIDEM Program Manager to oversee fiscal matters, contract agreements between RIDEM/OWR and HEALTH, and general progress of the program. Katie DeGoosh of RIDEM/OWR will serve as the RIDEM Project Manager to coordinate field data collection and laboratory analysis, and will serve as the primary point of contact for the program. She will review field and laboratory data and provide regular written or verbal progress updates to Sue Kiernan. Katie DeGoosh will be responsible for updates, modifications and maintenance of the official, approved QAPP. Katie DeGoosh will serve as Field Data Collection Team Leader and will be in charge of organizing sample and field data collection. She 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. Seasonal technicians, and, as resources allow, other personnel from RIDEM/OWR (as needed) will also assist with collection of field data and water samples as members of the Field

Data Collection Team. Connie Carey of RIDEM/OWR will serve as Quality Assurance Manager (QA Manager) to ensure all involved personnel are properly trained in all appropriate protocols associated with field data collection. She will verify the accuracy and correctness of procedures and protocols described in the QAPP and will confirm that data reporting requirements are met with respect to time of delivery and product quality. Henry Leibovitz, Ph.D. (HEALTH) will serve as the Chemical Analysis Project Lead and will ensure all involved HEALTH personnel are properly trained in appropriate protocols associated with the laboratory analyses. All laboratory chemical analyses will be executed by HEALTH with the exception of total ammonia (NH_3-N) and total Kjeldahl nitrogen (TKN). For these analyses, HEALTH will subcontract with an authorized state vendor for analytical laboratory services, currently ESS Laboratories (A Division of Thielsch Engineering) located in Cranston, RI. Results from ESS will be communicated to RIDEM/OWR via HEALTH.

5. Problem Definition/Background

A. Goals of RIDEM/OWR Ambient River Monitoring Program

Water quality monitoring provides an integral function in adaptive resource management by validating the environmental outcomes of management programs, tracking ecosystem conditions and detecting changes in water quality over time. The objective of the RIDEM/OWR Ambient River Monitoring Program is to characterize the water quality conditions in rivers and streams in Rhode Island via the measurement of physical and chemical water quality indicators. The data collected are intended to represent the ambient (steady-state) conditions of the rivers of the state under dry weather conditions. The data collected by this program are used to aid water quality management at the watershed scale and are also an integral part of the RIDEM/OWR Water Quality Standards and Water Quality Assessment Programs. The Water Quality Standards Program may use monitoring data to refine certain water quality criteria. The river monitoring data, often in combination with biological data, are also used to assess and report on, the water quality status of rivers and streams as required under Sections 305(b) and 303(d) of the Clean Water Act (CWA). These assessments are published in the Integrated Water Quality Monitoring and Assessment Report (Integrated Report) that is issued periodically by RIDEM to USEPA pursuant to the federal Clean Water Act. Data requirements and applicable criteria needed to make assessment decisions for the Integrated Report are explained in the state's 2010 Consolidated Assessment and Listing Methodology (CALM, http://www.dem.ri.gov/programs/benviron/water/quality/pdf/finlcalm.pdf , RIDEM/OWR, 2009). The data also may be used to support permitting programs, TMDL development and to assess progress toward water quality restoration.

B. Background and historical context of water quality monitoring in RI rivers

Historically, USGS was contracted by RIDEM to conduct water quality monitoring on three large rivers in Rhode Island: the Blackstone, Pawcatuck, and Pawtuxet Rivers. In 1991, RI DEM/OWR contracted the Civil and Environmental Engineering Department (CVE) at the University of Rhode Island (URI) to establish a Baseline Monitoring Program to supplement the limited number of rivers being sampled by USGS. The Baseline Monitoring Program collected water quality data on smaller rivers in Rhode Island and established a long-term water quality database. The program conducted seasonal (quarterly) water chemistry sampling of 25 river stations throughout the state of Rhode Island (Table 1). This program successfully collected quarterly samples approximately eight times over the course of twelve years, from 1991 through March 2003.

In 2003, as part of the overall effort to develop a comprehensive statewide water monitoring strategy, RIDEM/OWR contracted an outside consultant, Midwest Biodiversity Institute (MBI) to review and make recommendations for establishing a river monitoring strategy based on a sampling design that would better fulfill all the state water quality management needs for the next several years (MBI, 2003a). The resulting MBI report recommended the use of a rotating basin approach and a geometric sampling design to incorporate biological, chemical and physical data collection (MBI, 2003b).

The rotating basin approach to ambient river monitoring includes the regular, systematic and intensive data collection (including multiple sites located on multiple rivers) within specific watershed basins to aid monitoring and assessment. Monitoring of targeted watershed basins (at the HUC-10 and HUC 12 digit watershed size) is typically done on a regular rotating schedule every three to five years (MBI, 2003a). Under this approach, station locations are selected using

the geometric sampling design to locate monitoring stations intensively in a specified basin by positioning sites successively in a stratified pattern within the watershed. The first station is located at the mouth of the mainstem river, and the next station is located at a point that drains ½ of the drainage basin area (then another station at ¼, then at ⅛ and 1/16 the size of the area, etc.). Gaps in coverage for specific sources or sections of interest may be added as needed. The geometric sampling design provides robust spatial coverage to allow comparison of larger areas and reveal patterns of stressor effects when streams are grouped by size class, geographic position, or biological quality. The strategy aids water quality management like TMDL development and implementation, to ecosystem restoration and protection (MBI, 2003a).

In cooperation with the RI Environmental Monitoring Collaborative, RIDEM published the state's Water Monitoring Strategy (http://www.ci.uri.edu/Projects/RI-Monitoring/Docs/DEM_WQ_Oct_14_05.pdf) that was subsequently approved by the RI Bays, Rivers and Watersheds Coordination Team (RIDEM, 2005a). The Monitoring Strategy incorporated the rotating basin approach and recommended a five-year rotational cycle. Having assumed the recommended three to four person monitoring team would be available, the monitoring strategy identified an initial rotating basin schedule that, if fully implemented, would enable RIDEM to thoroughly sample and assess all watershed basins within Rhode Island in a five-year timeframe. In 2004, RIDEM proceeded to implement a pilot program working within the constraints of its existing resources.

The pilot program began with the 2004-2005 sampling season, and for the water chemistry component of this program, RIDEM/OWR contracted with URI-CVE to collect and analyze samples from 32 stations (Table 2) for 23 constituents (Table 3) in the Wood River Basin (~90 mi^2). Stations were established using the geometric sampling design (to a resolution of 1 mi^2) and certain supplemental stations were added to bracket known or potential pollution

sources (URI-CVE, 2004). URI-CVE developed a QAPP (Quality Assurance Project Plan) for the program, which was approved by EPA (URI-CVE, 2004). URI-CVE then collected data in the Wood River Basin in August 2004, May 2005 and again in July 2005 (URI-CVE, 2006).

In the second year (2005-2006) of the rotating basin cycle, RIDEM contracted URI-CVE to sample in the Pawcatuck River Basin, covering approximately 117 mi^2 (including the Chipuxet and Beaver river HUC-12 basins). Samples were collected at 45 stations using the geometric sampling design to a resolution of 1 mi^2 (Table 4). In the third year (2006-2007) of the rotating basin cycle, URI-CVE sampled four HUC-12 basins: Queen River basin, Flat River basin, Big River basin, and South Branch of the Pawtuxet River basin (covering ~109 mi^2 in total; Table 5). Samples were collected at 51 stations using the geometric sampling design, also to a resolution of 1 mi^2, and supplemental stations were added to bracket known or potential pollution sources.

During planning of the 2007-2008 sampling season, the ARM Program instituted a drainage size restriction on station placement and eliminated sampling streams that drained less than 5 mi^2. It has been documented that these small streams often undergo periods of zero flow and/or complete desiccation in the summer. During development of the RI Aquatic Base Flow (ABF) standards, reviews of historical USGS data demonstrated that, during the summer, streams draining less than 5 mi^2 had significantly lower flows than those that drained greater than 5 mi^2 throughout Rhode Island. This was attributed to the inclusion of data from streams in the smaller drainage group that were intermittent or dry streams (zero flow; RIDEM, 2005b). A subsequent project conducted by RIDEM/OWR involving stream flow monitoring of several small, first order streams draining less than five square miles, also indicated most study streams were intermittent, experiencing periods of zero flow during the summer. The drainage size

restriction ensured water samples were collected at perennial streams that most likely maintained the RI aquatic base flow throughout the year. The ARM Program then prioritized the focus of water quality monitoring toward these perennial streams. Establishment of this station placement criterion also improved the spatial efficiency of the rotation cycle by increasing the proportion of area covered in Rhode Island over the course of a year.

Near the end of the 2006-2007 sampling season, the agreement between RIDEM/OWR and URI-CVE was phased out by mutual agreement, and the duties of fieldwork data collection were transferred to RIDEM/OWR, while RIDEM/OWR contracted HEALTH to assume the task of chemical analyses for up to 20 constituents (Table 6). In 2007-2008, stations were selected using the geometric design (with the drainage size restriction at 5 mi^2), and supplemental stations were added to bracket pollution sources or where water chemistry stations had been previously sampled in the Pawtuxet River basin (URI, 1985; ASA, 1991; Table 7). Thirty-six stations were sampled covering approximately 158 mi^2 of the basin. In the 2008-2009 sampling was conducted at 58 stations throughout the Clear, Chepachet, Branch, Woonasquatucket, Moshassuck, Blackstone, Abbott Run, Upper Moosup, Hunt, and Saugatucket River HUC-12 basins (covering approximately 355 mi^2, Table 8). At the end of the 2008-2009 season, water quality monitoring will be completed for all rivers and streams within Rhode Island which drain greater than 5mi^2 (Figure 3, Table 9).

6. Project Description

A. Objectives

RIDEM/OWR will conduct a dry-weather, ambient water chemistry monitoring program for rivers and streams, according to a rotating basin schedule that aligns with related biological monitoring per the state's Water Monitoring Strategy. Generally, a maximum of 60 river

stations per year will be sampled using the geometric sampling approach with additional sampling stations added as needed upon request by stakeholders or other programs in the RIDEM/OWR, to address specific concerns. All stations will be sampled three times (three separate sampling events) over the course of twelve months, with two additional sampling events during the summer swimming season specifically to monitor for pathogens.

The RIDEM/OWR will perform all fieldwork with laboratory analyses conducted by HEALTH in Providence, Rhode Island. HEALTH will contract with an authorized state vendor for analytical laboratory services to conduct laboratory analyses of total Kjeldahl-nitrogen (TKN) and total ammonia (NH_3-N).

B. Specific Task Descriptions

In the spring, before each sampling season, the Ambient River Monitoring Program will develop a sampling plan that will identify the stations to be sampled and will assign the suite of parameters to be analyzed for each station. Each dry weather water sample will be analyzed for 12-20 constituents depending on the sampling suite chosen for the station (Table 6). As defined in Table 6, all collected samples will be analyzed for a suite of parameters including conventionals, nutrients and enterococci (identified as "Suite 1"). Water samples may also be analyzed for dissolved metals and additional sites may be added, if there are known sources or reasonable potential sources of metals (and/or total iron) contamination near the station (identified as "Suite 2"). Additionally, samples may be analyzed for BOD and/or fecal coliform (Suite 3) on large rivers to aid the RIDEM/OWR permitting programs, or additional parameters may be added if there are known impairments to the waterbody (to aid the RIDEM/OWR TMDL Program). Development of each sampling plan will allow RIDEM/OWR to seek input from TMDL and permitting programs, as well as other interested entities as time allows, and to

incorporate any changes in the rotating basin schedule. A sampling plan will be drafted, reviewed and finalized early each year before sampling begins. Changes to the sampling plan and/or station lists will become future addendums to this program QAPP.

Sampling station reconnaissance will be performed prior to sampling to identify any obstacles to sampling and refine driving directions to each site. Fieldwork preparations will include requisition and/or organization of field gear, data sheets, chain of custody forms, and the placement, pick up, and sorting of bottle orders from the HEALTH State Laboratories. Once received, bottle orders will be checked and separated in the RIDEM/OWR Sampling Center. The majority of sites selected for sampling will be wadeable rivers and streams. However, as part of collecting data from a given watershed, RIDEM may choose to sample non-wadeable rivers.

On three separate sampling events over a 12-month period, all stations will be sampled following a 48 hour antecedent dry period (total precipitation less than 0.1 inches). Samples will be analyzed for chemical constituents as specified in the sampling plan. Samples will also be analyzed for pathogens at each station during two separate, additional sampling events in the summer (June and July).

During each of the five sampling events, field data (% Oxygen Saturation, Dissolved Oxygen, Temperature, Conductivity, Specific Conductance, and Salinity) will be measured at each station using a handheld YSI 85 and recorded on the YSI Data Collection Sheet in accordance with the RIDEM/OWR YSI 85 SOP (Appendix A). A digital camera will be used to photo document site conditions at each station, and pictures will be maintained in accordance with the RIDEM Digital Photography Record Collection and Storage SOP (Appendix B). An

adequate volume of water will be collected from each station according to the RIDEM SOP for metals sampling (Appendix C). Any changes to the field-sampling methods will be reported in a modified QAPP. All samples will be kept on ice during the sampling event and prior to delivery to the HEALTH State Laboratories.

The various suite of parameters analyzed by HEALTH (or a certified laboratory subcontracted by HEALTH) include: Conventional constituents include: chloride (Cl), sodium (Na), hardness (Ca and Mg as $CaCO_3$), pH, turbidity, and total suspended solids (TSS); nutrients include: total ammonia (NH_3-N), dissolved nitrate-nitrite ($N0_3$-NO_2-N), total Kjeldahl nitrogen (TKN), calculated total nitrogen (TN as ($N0_3$-NO_2-N) + (TKN)), dissolved orthophosphate (PO_4-P), and total phosphorous (TP); dissolved metals include: cadmium (Cd), copper (Cu), lead (Pb), and zinc (Zn); total metals include iron (Fe); pathogens include: Fecal coliform and enterococci; and unfiltered five-day biological oxygen demand (BOD_5).

Water samples will be delivered to the HEALTH State Laboratories accompanied by chain of custody forms (Figure 2). The HEALTH State Laboratories will analyze the water samples for the parameters specified by RIDEM/OWR in accordance with EPA-approved Standard Methods (Table 6). Changes in the laboratory analysis procedures will be reported in an addendum to this QAPP. All data generated in this project will be managed as described in Sections I.9 and II.10 of this document.

C. Project Timetable

The program activities are centered on the preparation and execution of sampling events, laboratory analyses and data management. These activities are not expected to change within the program; however, project start and end dates will vary on an annual basis in accordance with the rotating basin schedule as noted in the state's Water Monitoring Strategy. Changes in the Project Timetable will be modified annually with the sampling plan as addendums to this QAPP. For each annual sampling program, the activity start and end dates will in general follow the timetable show in the chart below.

Activity	Projected Start Date	Anticipated Date of Completion
1. Update program QAPP	October (year prior to executing fieldwork)	April
2. Design sampling plan and set project timetable	March	April
3. Prepare for fieldwork	April	May
4. Execute fieldwork	May	September
5. Report and manage field data	May	September
6. Analyze laboratory samples	May	October
7. Report laboratory data	May	October
8. Review and validate data	November	January (year following execution of fieldwork)

D. Rotating Basin Schedule and Sampling Station Locations

The initial five-year rotating basin rotation schedule began in 2004 and was completed at the end of the 2009 sampling cycle, as described in Table 9 and depicted in Figure 3. All sampling locations are given in Tables 1, 2, 4, 5, 7 and 8; with the sampling suites analyzed for

each station. The next schedule for this program will be refined as part of an update to the RI Water Monitoring Strategy tentatively scheduled for spring 2011, and future revisions to the sampling plan will be reflected in addendums to this QAPP.

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, and 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 the RIDEM/OWR ARM program, the intended purpose of the data collection is to characterize ambient water quality conditions and provide information to support management decisions and water quality assessments. The quality of the data required to use the information to support water quality assessments is outlined in the state's CALM. This QAPP outlines the proper data 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 our data quality objectives, the following quality assurance

measures will be employed to verify the use of proper, consistent field procedures, handling measures, laboratory analyses and database management activities:

- Standard Operating Procedures (SOPs) will be implemented during sampling and field data collection (see Appendices).
- EPA-approved, standardized methods will be adhered to for all chemical analysis procedures (See Tables 3 & 6, and Appendix G);
- 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 both the RIDOH Laboratories as well as the authorized state vendor for analytical laboratory services. (Figure 2);
- When using s Teflon bucket to sample off a bridge for non-wadeable river stations, a field equipment blank will be collected at 10% of these stations;
- One trip blank (sample bottles filled with DI water in the lab) for each day of sampling will be transported by each field crew ensure there is no contamination of sampling containers in the field during transportation; and
- Duplicate sample collections will be taken at 15-20% of the sampling stations to ensure precise, reproducible results. 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 our quality objectives, the data quality indicators are compared against predetermined standards deemed *measurement performance criteria* (Appendix G) as discussed below for each DQI.

I. 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. To ensure precise sampling, samples will be collected in duplicate at 20% of sampling stations. Duplicates sample analyses are run in the laboratory and the relative percent difference (RPD) is measured. Any RPD greater than 20% will require the sample to be re-analyzed. If the data results from the duplicate samples are not within the acceptable RPD range, the data will not be used from these samples.

II. Accuracy (Method Sensitivity)

Accuracy is the overall agreement of measurement to a known value. This relates to the method sensitivity, or capability of the laboratory instrument or analysis method to report measured concentrations in agreement with the actual concentration of a parameter. Use of EPA-approved, standardized, repeatable sample collection methods and chemical analysis procedures will be used to ensure accuracy. The accuracy of each laboratory method is established by the laboratory calibration and use of its pre-determined method detection limit (MDL) and the quantitation level (QL) as noted in Table 6. The accuracy is monitored by the recovery of analytes from laboratory fortified blanks and laboratory fortified samples that are associated and analyzed with batch of samples tested (Appendix G). A quantitation limit is the minimum concentration of a substance that can be reliably identified, measured, and reported with confidence it is accurate. The method detection limit 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, i.e. greater than zero.

III. Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction (ie., the expected sample measurement is different from the sample's true value). EPA-approved, standardized, repeatable sample collection methods and chemical analysis procedures will be used at each site to avoid sampling bias. However, use of trip blanks and method blanks in laboratory analyses will also be used to indicate the presence of sampling or analytical bias caused by some type of 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.

IV. Data Representativeness

Representativeness is the measure of the degree to which data accurately and precisely represent an environmental condition. All sample locations will be chosen such that the samples collected during each dry survey will be representative of the site conditions on the day and time of collection, and will reflect the general ambient (steady-state) conditions of the watershed. RIDEM will exclude sites that would not be expected to be representative of ambient river conditions including those known to be significantly affected by hydromodifications such as impoundments, or within close proximity to a wastewater discharge into the river or stream. Should site conditions differ from the antecedent dry-period requirements for ambient river monitoring, the deviation shall be noted in the field, and communicated to the RIDEM Quality Assurance Manager. The representativeness of the study will be measured as the percentage of total samples collected that were considered representative of ambient conditions. A minimum

of 90 % of samples must have been collected under ambient conditions to accurately report the results as representative of ambient water quality conditions.

V. Sampling completeness

Completeness is the measure of the amount of valid data obtained from sampling. On occasion, some sampling containers taken at particular stations may be lost, broken or contaminated due to an unexpected field circumstance. Data may also be invalid if the sample cannot be analyzed due to an unforeseen laboratory error or equipment malfunction, or failure to meet measurement performance criteria. The completeness of the study will be measured as the percentage of total samples collected that were completely analyzed. A minimum of 90 % of samples must be collected, analyzed and judged valid to maintain quality, acceptable data. If this completeness requirement is not met, statistical procedures (power analysis) and best professional judgment will be applied to decide whether use of the remaining data will produce correct data interpretations and conclusions. In some situations and for some data quantity needs, if a sample cannot be collected or is determined to be invalid, it may be necessary to collect an additional sample on an alternate sample date.

VI. Data Comparability

The data may be compared against both the range of values from those samples that were collected during the twelve years of the Baseline Monitoring Program, as well as to the range of values collected from within the watershed. While not all watersheds in Rhode Island are represented in the Baseline database, there is a significant possibility that a number of the Baseline stations will be within the boundaries of each watershed sampled in this Ambient River Monitoring program. If so, the data is available for comparison and will be utilized to identify any outlying data points and relative data variability.

8. Special Training Requirements

A. Training Arrangements and Responsibilities

All fieldwork will be performed by the Field Data Collection Team under the training and supervision of the Project Manager (or a qualified designee). The Project Manager will train RIDEM scientists performing any fieldwork in "clean hands/dirty hands" methods of sample collection. The QA Manager will keep a list of all individuals trained and verify personnel are properly trained in all appropriate protocols associated with field data collection. This list will include the names of the individuals trained, who trained them, and the date. Other than previous academic study in an environmental science related field, the Field Data Collection Team will require no additional training or certification courses in preparation for this project.

All laboratory work will be performed under the supervision of the Chemical Analysis Project Lead at Rhode Island Department of Health State Laboratories. Laboratory workers will receive hands-on training supervised by the Chemical Analysis Project Lead (or someone designated as a qualified trainer) prior to any work being performed. A qualification record will be kept on site to track the training and performance of those personnel assigned to laboratory tasks.

9. Documentation and Records

The RIDEM Project Manager will be responsible for the proper compilation of all recorded data collected in the field and data reported by the HEALTH State Laboratories. The RIDEM Project Manager will maintain project files of original field notes, YSI data sheets,

copies of chain of custody forms (Figure 2), and laboratory results (paper forms and/or electronic copies). Chain of custody forms and hard copies of the lab results from each of the three to five sampling events will be compiled into one manila folder per sampling location. Station folders will then be organized alpha-numerically (BSN02, BSN06, BSN07, etc.) in larger, brown file-pockets for each year in the rotation cycle. Hard copies of YSI data, field notes and driving directions also will be compiled and separated by sampling-event and placed into one folder for each year in the rotation cycle. All electronic data (transcribed YSI data and data received via email from HEALTH) will be formatted in Microsoft Excel. The Project Manager will ensure these documents and electronic data will be permanently retained in accordance with the State of RI General Record Retention Schedule (Appendix D) to allow future comparisons and trend analysis. All electronic data and metadata are backed up in triplicate on a RIDEM/OWR computer, CD, and in database servers (onsite and externally).

The RIDEM Project Manager will be responsible for future updates to this QAPP, and any required addendums. Individuals involved in the project, including those mentioned in section I. 3 will receive the most current copy of the approved QAPP in the form of an Adobe .pdf file attachment, emailed by the RIDEM Project Manager. Should it be requested, a hard copy will be available for their records.

II. DATA GENERATION AND AQUISITION

1. Sampling Design Process

A. Rationale for Selection of Sampling Sites

As noted above in section I. 5.B., the sampling sites will be chosen in accordance with the geometric sampling design and rotating basin approach published in the State's Water Monitoring Strategy (RIDEM, 2005a). In addition to the geometrically determined stations, a number of targeted stations may be added within the basin as determined by specific concerns of other RIDEM programs and stakeholders, as feasible. All sample locations will be chosen such that the samples collected during each dry survey will be representative of the site conditions on the day and time of collection, and will reflect the general ambient (steady-state) conditions of the watershed. Most stations will be near road crossings, or in areas that will be easily accessible by foot via public property. Should a sampling station become inaccessible, field crews will contact the Field Data Collection Team Leader to decide how to proceed, and the Field Data Collection Team Leader will schedule a return visit to the station when conditions allow access, or relocate the station to a more accessible location.

B. Sampling Schedule and Logistics

The first five-year rotating basin monitoring cycle ran from 2004-2009 (Table 9). The next schedule for this program will be refined, as part of an update to the RI Water Monitoring Strategy tentatively scheduled for spring 2011, and future revisions to the sampling plan will be reflected in addendums to this QAPP. The sampling stations will vary by year according to the rotating basin schedule and will be finalized by RIDEM before the beginning of each sampling

season. Each year, full sampling suites will be collected in May, August and September, with two additional sampling events in June and July, specifically for collection of pathogen data. For each year in the rotation cycle there will be a maximum of 60 stations, with up to an additional 12 duplicate samples and up to 8 trip blanks (dependent upon number of field days required to finish sampling). The maximum number of water samples per year, based on a formula [((# stations) x (# parameters) x (#events))], will not exceed 5120 laboratory analyses (calculated as [((60+12+8) x 20 x 3) + ((60+12+8) x 2 x 2)]) and 2160 field measurements (calculated as [((60 + 12) x 6 x 5)]). The sampling schedule will take into account both weather patterns of precipitation, and sampling time constraints in accordance with HEALTH's sample receiving policies. To allow for appropriate holding times (Table 10), HEALTH will not accept samples for analysis of unfiltered five-day biochemical oxygen demand (BOD_5) on Tuesdays or Wednesdays, and will not accept any samples received after 12:00 p.m. on Fridays. All samples submitted to HEALTH will be delivered to the receiving area by 3:00 p.m. Monday through Thursday.

2. Sampling Methods

As previously described in Section I. 6. B., samples will be collected following a 48 hour antecedent dry period (precipitation not to meet or exceed 0.1 inches) using the "clean hands-dirty hands" sampling protocol for metals as described in the RIDEM/OWR DRAFT SOP, Ambient River Monitoring Program – Standard Operating Procedures for the Collection of Ambient Water Samples for Metals Analysis (Appendix C). This method is a modification of the EPA method described in EPA's Standard Operating Procedure for the Collection of Low Level Metals Ambient Water Samples ECASOP-Metals2, Low Level Metals Sampling, Revision #: 2, 5/21/07.

Prior to each field day, materials (see list, Figure 4) will be compiled and prepared in the RIDEM/OWR Sampling Center. The Field Data Collection Team will depart as close to 8:00 a.m. as possible each day. For non-wadeable rivers, samples will be taken from a bridge in the middle of the river or as close to the middle where flow is least obstructed. A clean Teflon bucket will used to collect ambient water samples from these locations. The bucket will be rinsed three times with water from the particular station by the 'dirty hands person' before the sample is collected and transferred into the prepared bottles held by the 'clean hands person'. However, during the 2011 sampling season, if DEM is able to obtain the equipment, the program will use a basket sampler as a refinement to the collection technique. If this basket sampler is not available, a field Teflon bucket equipment blank will be collected as described below. For wadeable locations, the person collecting the sample will wade out to the middle of the river and dip sampling bottles into the water facing upstream to allow water to flow into the sample bottle. The collector will tilt the neck of the bottle slightly downward when immersing the bottle, and will be careful to avoid entrapment of debris in the sample container.

Clean sample bottles will be filled first and used to distribute the water sample to bottles containing preservative. One half-gallon bottle with no preservative will be completely filled to the top for analysis of dissolved chloride, pH, turbidity, TSS, dissolved orthophosphate, sodium and hardness. One 500 mL sample bottle with H_2SO_4 preservative will be filled for analysis of total phosphorus. A half gallon bottle preserved with H_2SO_4 will be filled for analysis of total Kjeldahl nitrogen and total ammonia. One sterilized 250 mL bottle will be filled for analysis of Fecal coliform and enterococci, leaving some airspace at the top. One 1L bottle preserved with nitric acid will be filled for analysis of metals and one other (unpreserved) half gallon bottle will be filled, leaving some airspace at the top, for analysis of BOD_5. All sampling bottles will be

labeled using a Sharpie pen with the date collected, Station ID, River Name, and HEALTH Client name (DEM-WRE) along with a unique three-digit bottle number assigned by RIDEM-OWR. For every day of sampling, field crews will carry trip blanks for all constituents, and duplicate samples will be collected at 20% of randomly selected stations. All duplicate samples will be processed following the identical procedures used with the original samples. If a Teflon bucket is used to collect samples off a bridge for non-wadeable river stations, a field Teflon bucket equipment blank will be collected at 10% of these stations. Following the protocol outlined above for collecting a sample with the Teflon bucket, DI water from the lab will be used to rinse the bucket three times. The fourth DI water rinse will be transferred into a prepared equipment blank bottle.

Field measurements will be taken using a Handheld YSI Model 85 Instrument according to the procedures outlined in the RIDEM SOP in Appendix A (RIDEM-OWR Standard Operating Guidelines for the measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity). The instrument will be calibrated for dissolved oxygen each day as described in the SOP prior to sampling as well as at the end of the day after sampling has been completed. If the calibrated value of dissolved oxygen (mg/L) falls within 5% of the ideal value at the given temperature (see table in SOP), the calibration will be accepted and recorded on the YSI data sheet and in the YSI calibration log in the sampling center. Temperature and conductivity readings will be verified with a system calibration according to the YSI-85 operations manual at a frequency of 10% of the dissolved oxygen calibrations (every 10 DO calibrations, there will be a system calibration for conductivity and temperature). If the calibrated value for conductivity falls within 5% of the standard value (YSI Conductivity Calibration Solution 1000 microns/cm, product number 3167) the calibration will be accepted and recorded in the YSI calibration log in

the sampling center. Temperature will be verified using a NIST traceable thermometer and if the YSI temperature reading falls within 5% of the NIST thermometer reading, the verification will be accepted and recorded in the YSI calibration log in the sampling center. If any calibration/verification value (dissolved oxygen, conductivity or temperature) falls outside of the 5% range, the instrument will be re-calibrated. All field data will be recorded on the YSI Data Collection Sheet (Appendix A). Written mistakes made inadvertently will be crossed out using a single line through the mistake with the initials of the individual who made them. Duplicate field measurements will also be taken with the YSI at stations designated for duplicate water chemistry analyses. A digital camera will be used to photo document site conditions at each station, and pictures will be maintained in accordance with the RIDEM Digital Photography Record Collection and Storage SOP (Appendix B).

3. Sampling Handling and Custody

All samples will be collected in the field and transported on ice in a cooler under the supervision of the Project Manager or a qualified designee. All samples (labeled in accordance with Section II.2 above) will be delivered to the HEALTH State Laboratories in Providence accompanied by a complete, signed Chain of Custody form (Figure 2). As soon as the samples are received, sample bottles from each station will be assigned a unique alphanumeric identifier code (one HEALTH LIMS number for each station) printed on twelve stickers by HEALTH staff. One sticker with the unique LIMS code for a station will be applied to each sample bottle from the same station, as well as the corresponding chain of custody form for that particular sampling station. A representative from RIDEM OWR and the HEALTH State Laboratories will sign the Chain of Custody form to verify the bottle exchange. HEALTH will retain the chain of

custody forms, and make copies for RIDEM before logging the samples into the HEALTH tracking system. Sample maximum holding times prior to analyses are noted in Table 10. At the end of the sampling day, all equipment (coolers, waders, bucket etc.) will be rinsed and left to dry in the RIDEM OWR Sampling Center. Other materials will be put away, paperwork will be filed, and digital photographs will be downloaded, renamed and organized into folders (at the end of the sampling day, or soon thereafter).

4. Analytical Methods

HEALTH will conduct all laboratory analyses in accordance with Standard EPA-approved methods (for water matrix) and the associated HEALTH SOP (Table 6) and QAPP (Appendix F). Standard operating procedures will be used by the authorized state vendor for analytical laboratory services to run TKN and total ammonia analyses as noted in Table 6 with the SOP document number and EPA method.

5. Quality Control Requirements

The laboratories will apply the following general rules for all analyses conducted with the exception of total suspended solids (TSS), BOD_5, turbidity, pH, and constituents measured in the field (see Appendix F and G).

1. Initial calibration with 3 to 5 standards and a reagent blank will be run for all analytical methods.
2. Calibration curves will be checked with an initial calibration verification standard (ICV), and continuing calibration standards (CCV) will be conducted at intervals that are 5% of the sample number analyzed.
3. Reagent blanks will be run with the samples, one per sample set.

4. Procedural or method blanks will be run with all samples that require pretreatment prior to the analysis.

5. Fortified laboratory blanks and fortified sample matrix (spikes) will be run for every set of samples analyzed, and all samples are sampled in duplicate to check the precision of the analyses.

Spiked samples will be prepared and measured for trace metals, chloride, and all nutrients. The samples will be selected at random and will be spiked with a known standard concentration. Percent recovery of analytes from laboratory fortified blanks and sample matrix spikes will be expected to be between laboratory control limits.

6. Instrument/Equipment Testing, Inspection and Maintenance

All instrument and equipment testing, inspection and maintenance procedures will be documented in the standard operating procedures maintained at the HEALTH State Laboratories. Maintenance logs for the equipment and analysis instruments will be maintained in the HEALTH State Laboratories as detailed in the HEALTH Quality Assurance Plan (HEALTH, 2010, Appendix F).

7. Instrument Calibration and Frequency

The instrument calibration procedures and frequency will be documented in the standard operating procedures maintained at the HEALTH State Laboratories as detailed in the HEALTH Quality Assurance Plan (HEALTH, 2010, Appendix F).

8. Inspection for Supplies and Consumables

All sample bottles with preservative received from HEALTH 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. Sample bottles that have lost preservative will not be used to ensure retainment of the appropriate amount of preservative. 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. At the conclusion of each sampling season, the Project Manager and Field Data Collection Team Leader will take stock of all supplies, and re-order as necessary.

Certificates of Analysis for reagent chemicals and standards are maintained by HEALTH State Laboratories and checked by the Laboratory Chemical Analysis Lead or qualified designee. A master chemical list is maintained by the HEALTH State Laboratories and a copy is on file on the premises as detailed in the HEALTH Chemical Hygiene Plan (HEALTH, 2009).

9. Non-direct Measurements

The decision to sample on a given day following scattered rain or possible showers will be based on data retrieved online from the NOAA National Weather Service (NWS). The NWS provides real-time access to a selection of official weather observations and forecasts from U.S. government sources for use by the national and international community. This data is available

using a computer connected to the Internet to access the NOAA website. NOAA maintains its own documentation on their procedures to gain, inspect and validate the data.

Each day before fieldwork commences, a member of the Field Data Collection Team will check the three-day weather histories at stations in Smithfield, RI (http://www.weather.gov/data/obhistory/KSFZ.html), at the Providence, Green State Airport station (http://www.weather.gov/data/obhistory/KPVD.html) and Westerly State Airport (http://www.weather.gov/data/obhistory/KWST.html). Within 48 hours of the beginning of the field day, precipitation accumulating greater than or equal to 0.1 inch in the area of sampling locations will result in postponement of the sampling day. No sampling will occur until at least 48 hours have elapsed since the last rainfall (resulting in precipitation greater than or equal to 0.1 inches).

10. Data Management

A. Data Acquisition Requirements

TKN and Ammonia test results from the authorized state vendor for analytical laboratory services will be compiled by the HEALTH Chemical Analysis Lead and hard copies and/or electronic copies of those data, along with results from the HEALTH State Laboratories will be sent to the Project Manager at RIDEM.

B. Data Management

The RIDEM Project Manager will be responsible for the proper compilation of data analyses, preparation, review and transmission of results. The RIDEM Project Manager will review all analytical data for accuracy (in accordance with Section III.1 of this document and Appendix E) and will maintain hardcopies of the data in the project file at RIDEM/OWR as

noted in Section I.9 of this document. Other data management processes discussed in Section 1.9 of this QAPP will also be followed.

III. DATA VALIDATION AND USABILITY

1. Data Review, Verification and Validation

The RIDEM Project Manager will review all data for completeness and accuracy. The project manager will review field notes, Chain of Custody forms as well as proofread the data entry for any errors, and make corrections as necessary. This data review process will follow the procedures indicated in the RIDEM "Summary Guidance for Reviewing Environmental Monitoring Data" SOP # BEP-WR-1 (Appendix E). Outliers and inconsistencies will be flagged for further review with the RIDEM/OWR QA Manager. Laboratory results will be reviewed internally in accordance with HEALTH procedures to verify that values and data quality indicators meet criteria and are within the acceptable ranges for each parameter (Table 10 and Appendix G). Note that the MDLs are statistically derived values. New MDL studies are conducted annually by the HEALTH State Laboratories to demonstrate the statistical limits of detection. The outcome of the MDL study varies from study to study, year to year. The MDLs are updated annually based on the studies. The new MDLs are submitted by the HEALTH State Laboratories to DEM/OWR during the annual Memorandum of Agreement renewal.

2. Verification and Validation Methods

Analytical data provided by HEALTH will be reviewed and validated internally to provide information on whether data are acceptable, qualified or should be rejected. The RIDEM/OWR Project Manager will be responsible for reviewing the laboratory reports and data packages, as well as data entries and transmittals, for completeness and adherence to QA requirements. Data packages will include, to the extent possible, sample receipt and tracking information, chain of

custody forms, tabulated data summary forms, and raw analytical data for all field samples, standards, QC checks, and other project specific documents. Along with the procedures set forth in the RIDEM environmental data review SOP (Appendix E), data quality will be assessed by comparing entered data to original data or by comparing results with measurement performance criteria (Table 10). Decisions to qualify, accept or reject data will be discussed by the RIDEM/OWR Program and Project Managers and the QA Manager. The RIDEM Program Manager will make the final determination to reject data and remove any unusable data. If fewer than 90% of the data are judged valid (completeness requirement), statistical procedures (power analysis) and best professional judgment will be applied to decide whether use of the remaining data will produce correct data interpretations and conclusions. 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 Project Goals

The RIDEM/OWR Quality Assurance Manager will decide if the data collected meet the measurement performance criteria (Table 10) and verify that all the SOPs have been followed, to determine if the data meet the project quality objectives. If data collected meet the data quality objectives for the project the data are considered accepted or qualified, whereas noncompliant data that cannot be reconciled will be rejected. If the criteria have not been met, the project team will determine if additional data need to be collected, and/or specify limitations on the data use. Invalid assumptions, uncertainties and limitations in the use of these data and interpretation of the results will be reconciled if possible, or otherwise documented and communicated to data users.

IV. ASSESSMENT AND OVERSIGHT

1. Assessment and Response Actions

Field data collection efforts, field notes, laboratory data and maps generated as part of this project will be periodically assessed throughout the annual sampling season 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 is properly calibrated, data are recorded in a consistent manner, sampling methodology is being conducted in accordance with the respective standard operating procedures, samples are properly stored and transferred to custody of HEALTH, and documentation records are properly stored. The RIDEM/OWR Project Manager will review field and laboratory data, including field-sampling data, water quality parameter measurements, duplicate sample measurements, and other data quality indicators to ensure that appropriate methodology is adhered to and reported data is within the accepted range for each parameter. If inconsistencies are detected or perceived, the RIDEM/OWR Project Manager will discuss field instrument calibration, data collection with field personnel, and/or chemical analysis with the Chemical Analysis Project Lead, and the RIDEM/OWR Quality Assurance Manager. Any outlier data discovered will be reported, and the ability to retake and or re-analyze the sample will be assessed. Potential sources of error will be considered, described and documented to convey any limitations of the results to data users or decision makers.

2. Reports to Management

Quality management reports serve as confirmation that the expected quality and type of data are collected to meet project goals. To ensure all members of the project organization are

informed of the project status, the RIDEM/OWR Project Manager will coordinate electronic or verbal communications to document project milestones and will keep Program Manager and Quality Assurance Manager up to date regarding project progress (commencement and conclusion of sampling events, completion of chemical analysis, delivery and acceptance of data or significant QA problems and recommended solutions). Should the reported communications specify required actions, report recipients may be expected to discuss options and respond as requested by the RIDEM/OWR Project Manager to reconcile circumstances with data quality objectives. Data quality concerns and any discrepancies will be discussed by the RIDEM Project Manager and/or Chemical Analysis Project Lead, Program Manager and QA Manager to assess the need to retake, and or re-analyze the sample. Copies of electronic communications will be retained indefinitely to maintain records of the quality management documentation (Appendix D).

V. REFERENCES

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URI-CVE (University of Rhode Island; R. Wright). 2006. DRAFT Final Report. URI Department of Civil and Environmental Engineering, South Kingstown, RI.

FIGURES

Figure 1: Organizational Chart for RIDEM Ambient River Monitoring Program

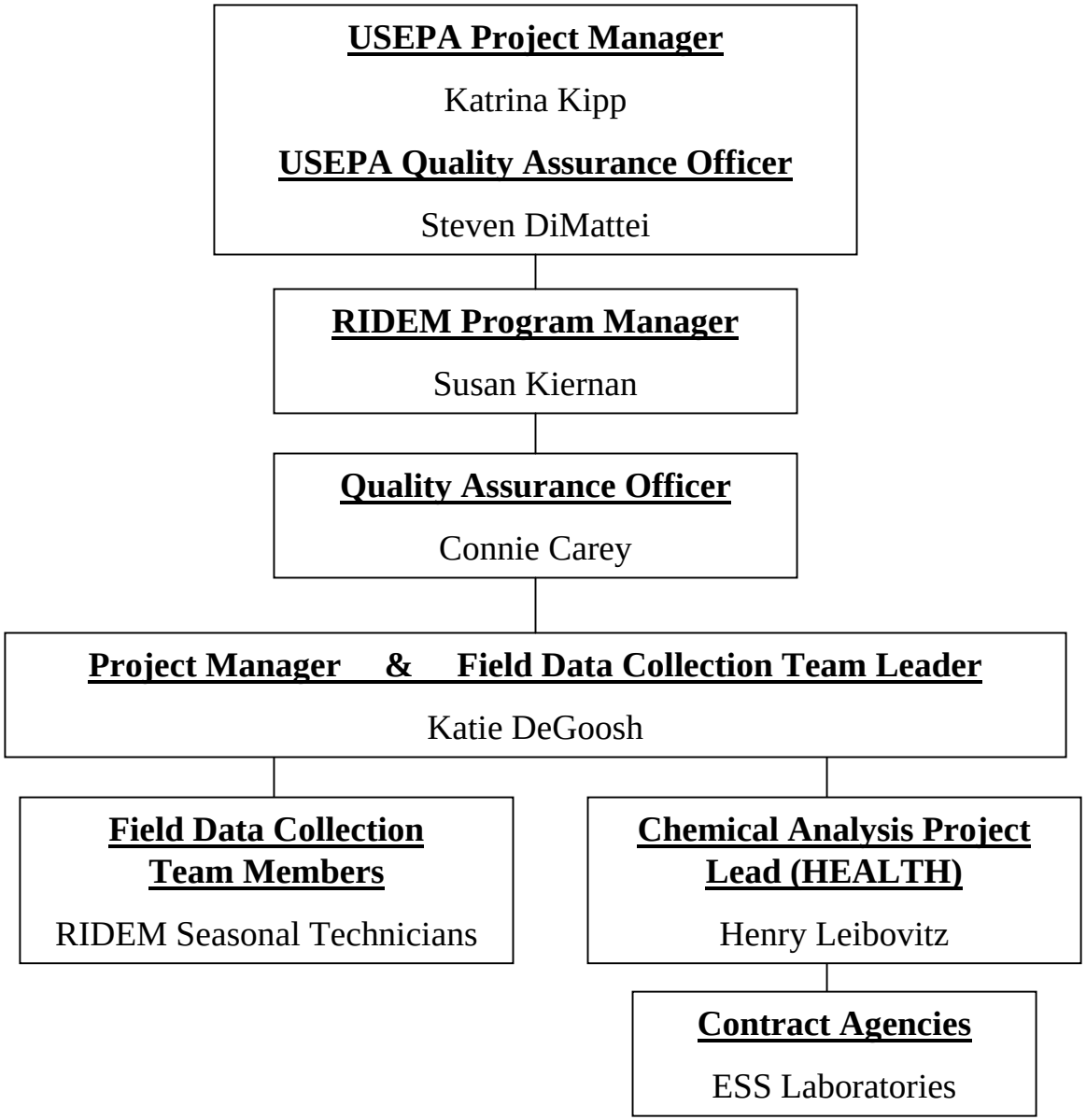


Figure 2.

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

Sample Submission Number

ICED FOR TRANSPORT

Legal Sample | |
Client: DEM - WRE Ambient River Monitoring

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

Mail Report To: **RI DEM Office of Water Resources**
Street: **235 Promenade Street**
City: **Providence, RI 02908**
Report To (Agency/Person) : **ERIC SCHNEIDER**

Collected By: DEM OWR 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	
X WL7 Total Suspended Solids	
X 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_____	
___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 Berylljum	
___WL81 Chromium	
___WL84 Nickel	
___WL76 Arsenic	
___WL85 Selenium	
___WL79 Cadmium	
___WL75 Antimony	
___WL77 Barium	
____WL87 Thallium	

Organics Lab	FB
___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)	
___TO_____	

Sanitary Microbiology
___SM2 – MF Total Coliform
___SM3 – SPC
___SM34 – Colilert
___SM36 – Pres./Abs.
X 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

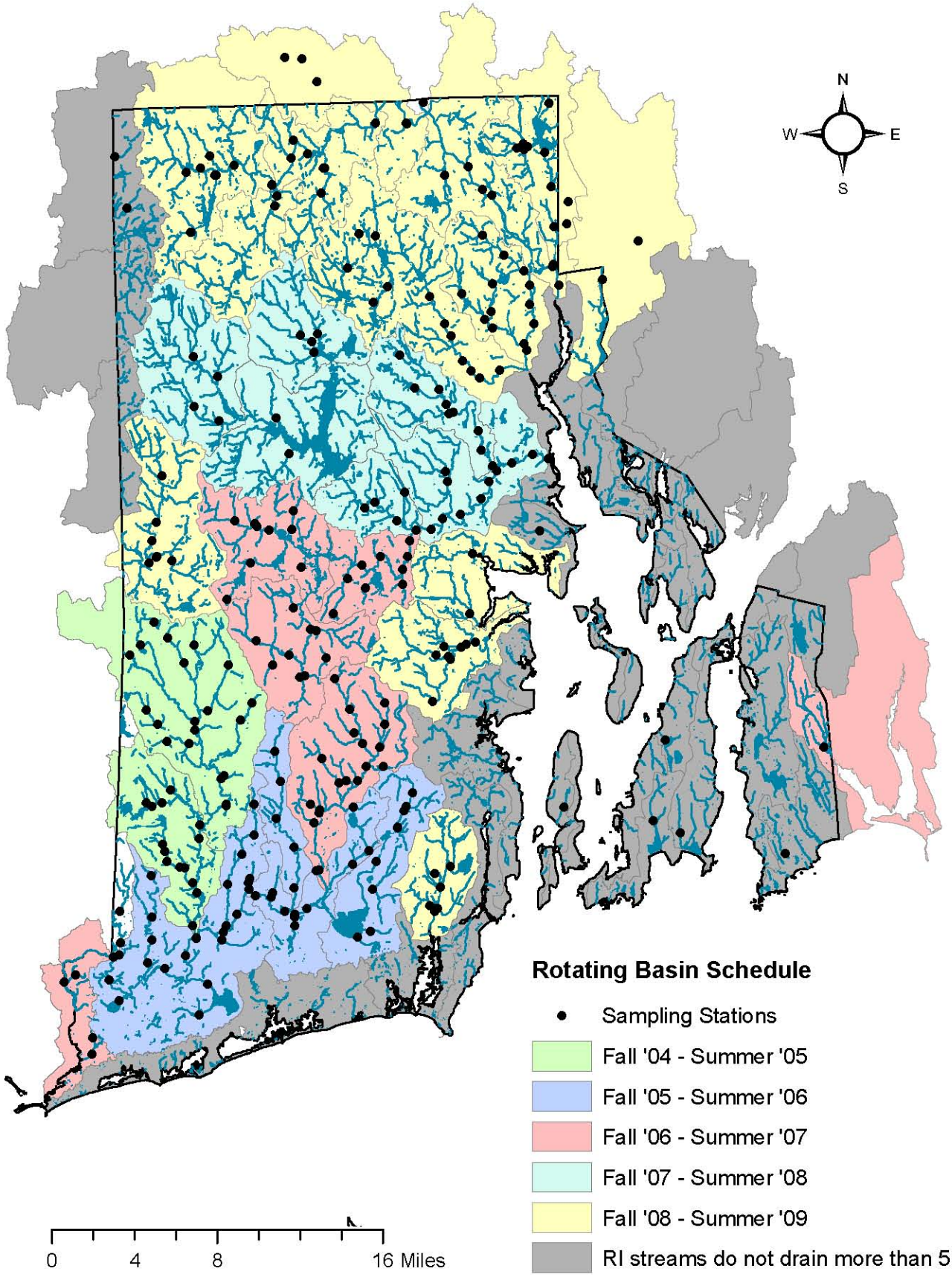
Chain of Custody

Relinquished By	**Date**	**Time**	**Received By**	**Date**	**Time**	**Comments**

SAMPLE SUBMISSION FORM (rev. DEM 09/28/2007)

RIDEM Surface Water Monitoring Program
Chemical and Biological Sampling
2002-2008 Stations

Figure 3



*Although watershed basin lines extend beyond state borders, targeted sites were located within state boundaries.

Figure 4: Materials for Ambient River Monitoring – Chemistry Sampling

- ❑ Map/atlas
- ❑ Directions
- ❑ Metal Clipboard :
  - ❑ HEALTH Chain of Custody Forms
  - ❑ Labels for bottles
  - ❑ YSI Data collection sheets
  - ❑ Writing implement (pencil/pen)
  - ❑ Sharpies
- ❑ Coolers
- ❑ ICE
- ❑ Sample Bottles
- ❑ Waders
- ❑ Bucket and Rope
- ❑ YSI 85
- ❑ Extra Batteries for YSI 85
- ❑ POWDER FREE Disposable Gloves
- ❑ Camera w/ charged battery
- ❑ Car Keys
- ❑ Cell phone*
- ❑ Lunch*
- ❑ Technu*
- ❑ Bugspray*
- ❑ Clippers*
- ❑ Towel*
- ❑ Garbage bag*

* denotes non-essential item

TABLES

Table 1. Baseline Monitoring Stations

Sampling station locations of the RIDEM Baseline Monitoring Program sampled by URI-CVE Fall 1991–2003.

				Water Chemistry Suite[A] analyzed by URI-CVE				
Station ID	**River Name**	**Latitude**	**Longitude**	**Fall**	**May**	**June**	**July**	**August**
BL01	Abbott Run Brook	41.97950561	-71.39280686	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL02	Abbott Run Brook	41.92848924	-71.37309604	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL03	Ashaway River	41.42495125	-71.7897009	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL04	Hardig Brook	41.69920749	-71.46594989	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL05	Bailey's Brook	41.51103632	-71.29329962	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL06	Beaver River	41.464093	-71.62783557	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL07	Big River	41.64464764	-71.61267319	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL08	Canonchet Brook	41.47764956	-71.72934934	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL09	Chipuxet River	41.50624245	-71.53130254	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL10	Maskerchugg River	41.65013912	-71.45761491	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL11	Dundery Brook	41.48758677	-71.17033727	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL12	Falls River	41.5801877	-71.7212028	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL13	Hunt River	41.63436693	-71.46787077	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL14	Jamestown Brook	41.52058849	-71.37679698	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL15	Keach Brook	41.9378544	-71.78177949	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL16	Maidford River	41.50209306	-71.26811639	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL17	Meadow Brook	41.4663957	-71.69003551	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL18	Round Top Brook	42.0009945	-71.69653102	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL19	Parris Brook	41.56487196	-71.72587265	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL20	Pascoag River	41.9632619	-71.70216008	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL21	Queens River	41.53915777	-71.56843447	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL22	Bucks Horn Brook	41.69544362	-71.75681878	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL23	Clear River	41.96048922	-71.65005609	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL24	Tomaquag Brook	41.41109043	-71.76380898	URI-BL	URI-BL	URI-P	URI-P	URI-BL
BL25	Wood River	41.52225692	-71.69152395	URI-BL	URI-BL	URI-P	URI-P	URI-BL

[A] URI-BL = Full suite of parameters sampled by URI-CVE for the Baseline Monitoring Program

URI-P = Only pathogens sampled (Fecal coliform and/or enterococci) by URI-CVE for the Baseline Monitoring Program

Table 2. Ambient River Monitoring Stations 2004-2005

Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2004 – Summer 2005. See Table 3 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by URI-CVE				
Station ID	**River Name**	**Latitude**	**Longitude**	**Sep-04**	**May-05**	**Jun-05**	**Jul-05**	**Aug-05**
WRB01	Wood River	41.4287	-71.7192	URI-CVE	URI-CVE	P	P	URI-CVE
WRB02	Wood River	41.4371	-71.7224	URI-CVE	URI-CVE	P	P	URI-CVE
WRB03	Wood River	41.4602	-71.7186	URI-CVE	URI-CVE	P	P	URI-CVE
WRB04	Canonchet Brook	41.4776	-71.7293	URI-CVE	URI-CVE	P	P	URI-CVE
WRB05	Canonchet Brook	41.4780	-71.7345	URI-CVE	URI-CVE	P	P	URI-CVE
WRB06	Canonchet Brook	41.4825	-71.7463	URI-CVE	URI-CVE	P	P	URI-CVE
WRB07	Canonchet Brook	41.4945	-71.7505	URI-CVE	URI-CVE	P	P	URI-CVE
WRB08	Wood River	41.4984	-71.7163	URI-CVE	URI-CVE	P	P	URI-CVE
WRB09	Brushy Brook	41.5078	-71.7159	URI-CVE	URI-CVE	P	P	URI-CVE
WRB10	Moscow Brook	41.5209	-71.7609	URI-CVE	URI-CVE	P	P	URI-CVE
WRB11	Moscow Brook	41.5236	-71.7511	URI-CVE	URI-CVE	P	P	URI-CVE
WRB12	Brushy Brook	41.5323	-71.7435	URI-CVE	URI-CVE	P	P	URI-CVE
WRB13	Outlet of Canob Pond	41.5212	-71.6915	URI-CVE	URI-CVE	P	P	URI-CVE
WRB14	Wood River	41.5223	-71.6915	URI-CVE	URI-CVE	P	P	URI-CVE
WRB15	Wood River	41.5404	-71.6961	URI-CVE	URI-CVE	P	P	URI-CVE
WRB16	Baker Brook	41.5423	-71.6932	URI-CVE	URI-CVE	P	P	URI-CVE
WRB17	Wood River	41.5741	-71.7205	URI-CVE	URI-CVE	P	P	URI-CVE
WRB18	Parris Brook	41.5649	-71.7259	URI-CVE	URI-CVE	P	P	URI-CVE
WRB19	Woody Hill Brook	41.5663	-71.7468	URI-CVE	URI-CVE	P	P	URI-CVE
WRB20	Parris Brook	41.5783	-71.7557	URI-CVE	URI-CVE	P	P	URI-CVE
WRB21	Parris Brook	41.5885	-71.7660	URI-CVE	URI-CVE	P	P	URI-CVE
WRB22	Falls River (Wood River)	41.5802	-71.7212	URI-CVE	URI-CVE	P	P	URI-CVE
WRB23	Breakheart Brook	41.5879	-71.7092	URI-CVE	URI-CVE	P	P	URI-CVE
WRB24	Roaring Brook	41.5813	-71.6784	URI-CVE	URI-CVE	P	P	URI-CVE

Table 2 (continued). Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2004 – Summer 2005. See Table 3 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by URI-CVE				
Station ID	**River Name**	**Latitude**	**Longitude**	**Sep-04**	**May-05**	**Jun-05**	**Jul-05**	**Aug-05**
WRB25	Roaring Brook	41.5934	-71.6674	URI-CVE	URI-CVE	P	P	URI-CVE
WRB26	Breakheart Brook	41.6199	-71.6897	URI-CVE	URI-CVE	P	P	URI-CVE
WRB27	Phillips Brook	41.6213	-71.7310	URI-CVE	URI-CVE	P	P	URI-CVE
WRB28	Acid Factory Brook	41.6340	-71.7219	URI-CVE	URI-CVE	P	P	URI-CVE
WRB29	Phillips Brook	41.6390	-71.7461	URI-CVE	URI-CVE	P	P	URI-CVE
WRB30	Coney Brook	41.6496	-71.7592	URI-CVE	URI-CVE	P	P	URI-CVE
WRB31	Coney Brook	41.6335	-71.7720	URI-CVE	URI-CVE	P	P	URI-CVE
WRB32	Falls River (Wood River)	41.6264	-71.7816	URI-CVE	URI-CVE	P	P	URI-CVE
WRBA	Canonchet Brook	41.4827	71.7467	URI-CVE	URI-CVE	P	P	URI-CVE
WRBB	Canonchet Brook	41.5000	71.7511	URI-CVE	URI-CVE	P	P	URI-CVE
WRBE	Canonchet Brook	41.5002	71.7513	URI-CVE	URI-CVE	P	P	URI-CVE
WRBF	Canonchet Brook	41.4873	71.7497	URI-CVE	URI-CVE	P	P	URI-CVE
WRBG	Canonchet Brook	41.4672	71.7254	URI-CVE	URI-CVE	P	P	URI-CVE

[A] URI-CVE = Suite of parameters (conventionals, nutrients, metals, pathogens, BOD) as given in Table 3

P = only enterococci samples were collected and analyzed

Table 3. Parameters analyzed by URI-CVE

Parameters, analytical methods and measurement performance criteria for analyses run by URI-CVE to analyze water samples for the RIDEM – Ambient River Monitoring Program, August 2004 -- August 2007.

Parameter		Units	Method	Maximum holding time	Quantitation Limit	Method Detection Limit
Conventionals						
Chloride	Cl	mg/L	Orion Instrument Manual Model 720 A	28 days	1.00	0.10
Sodium	Na	mg/L	EPA 200.7	6 months	0.15	0.08
Hardness		mg/L	EPA 200.7	6 months	0.062	0.006
pH		pH units	EPA 150.1 SM 4500-H-B	immediately	–	–
Turbidity		NTU	EPA 180.1 SM 2130 B	24 hours	0.20	0.02
Total Suspended Solids	TSS	mg/L	EPA 160.2 SM 2540 D	3 days	0.50	0.01
Volatile Suspended Solids	VSS	mg/L	EPA 160.4 SM 2540 E	3 days	0.50	0.01
Nutrients						
Total ammonia	NH_3-N	mg/L	EPA 350.1 SM 4500 NH3-G	7 days	0.010	0.004
Total nitrogen	N	mg/L	SM 4500 – N org D	28 days	0.025	NA
Nitrate-nitrite	NO_3-N	mg/L	EPA 353.2 SM 4500-NO3-G	28 days	0.010	0.002
Ortho-phosphate	PO_4-P	mg/L	EPA 365.1 SM 4500-P-F	28 days	0.010	0.001
Total Phosphorus	TP	mg/L	EPA 365.1 SM 4500-P-F	28 days	0.020	0.002
Pathogens						
Enterococci [A]		Entercocci /100 mL	EPA M-1600	6 hours	10	NA
Fecal Coliform [A]		MPN	SM 9213-D	6 hours	10	1
Other						
Five-day Biological Oxygen Demand [A]	BOD_5 (unfiltered)	mg/L	EPA 405.1 SM 5210 B	1 day	0.50	0.50
Metals						
Cadmium	Cd [B]	µg/L	EPA 200.7	6 months	0.70	0.20
Copper	Cu [B]	µg/L	EPA 200.7	6 months	1.2	0.9
Lead	Pb [B]	µg/L	EPA 200.7	6 months	0.8	0.20
Total Iron	Fe [B]	µg/L	EPA 200.7	6 months	2.5	0.50

[A] Samples are analyzed by a laboratory certified in Rhode Island to test these parameters in non-potable water.

[B] Samples were analyzed by RI DOH (see Table 6 for Analytical Methods).

Note: Dissolved oxygen, water temperature, conductivity, and flow were measured in the field.

Table 4. Ambient River Monitoring Stations 2005-2006

Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2005 – Summer 2006. See Table 3 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by URI-CVE				
Station ID	**River Name**	**Latitude**	**Longitude**	**Sep-05**	**May-06**	**Jun-08 [B]**	**Jul-08 [B]**	**Aug-06**
PAW-01	Pawcatuck River	41.397500	-71.841583	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-02	Pawcatuck River	41.445633	-71.681283	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-03	Pawcatuck River	41.449667	-71.615817	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-04	Tomaquag Brook	41.410917	-71.763817	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-05	Chipuxet River	41.506167	-71.531117	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-06	Poquiant Brook	41.396033	-71.708250	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-07	Beaver River	41.512567	-71.644500	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-08	Tomaquag Brook	41.427467	-71.760417	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-09	Chickasheen Brook	41.490017	-71.558483	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-10	Beaver River	41.538617	-71.641117	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-11	Mile Brook	41.416450	-71.790550	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-12	Ashaway River	41.425000	-71.789800	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-13	Parmenter Brook	41.443350	-71.796217	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-14	Aguntaug Brook	41.384550	-71.790717	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-15	Tomaquag Brook	41.460517	-71.775833	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-16	Tomaquag Brook	41.472400	-71.761033	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-17	Perry Healy Brook	41.374650	-71.716200	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-18	Cedar Swamp Brook	41.427067	-71.695033	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-19	Meadow Brook	41.437600	-71.691300	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-20	Meadow Brook	41.466367	-71.690183	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-21	Meadow Brook	41.487383	-71.676567	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-22	Meadow Brook	41.500917	-71.665283	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-23	Meadow Brook	41.525817	-71.665533	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-24	White Rock Brook	41.467150	-71.670417	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-24A	White Rock Brook	41.470433	-71.669200	URI-CVE	URI-CVE	P	P	URI-CVE

Table 4 (continued). Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2005 – Summer 2006. See Table 3 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by URI-CVE				
Station ID	**River Name**	**Latitude**	**Longitude**	**Sep-05**	**May-06**	**Jun-08 [B]**	**Jul-08 [B]**	**Aug-06**
PAW-25	Taney Brook	41.460583	-71.647817	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-26	Pasquiset Brook	41.443733	-71.626833	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-27	Pasquiset Brook	41.437517	-71.627317	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-28	Beaver River	41.464100	-71.627967	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-29	Beaver River	41.492533	-71.628500	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-30	Beaver River	41.559200	-71.646417	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-31	Chickasheen Brook	41.480383	-71.573450	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-32	Chickasheen Brook	41.520850	-71.572367	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-33	Mink Brook	41.433517	-71.556700	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-34	Alewife Brook	41.429233	-71.568450	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-35	Chipuxet River	41.475133	-71.555433	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-36	Chipuxet River	41.517917	-71.525583	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-37	Chipuxet River	41.530250	-71.517333	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-38	Pawcatuck River	41.407333	-71.748200	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-39	Pawcatuck River	41.399233	-71.799933	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-40	Pawcatuck River	41.445217	-71.626933	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-41	Pawcatuck River	41.447650	-71.636650	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-42	Pawcatuck River	41.458417	-71.663750	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-43	Pawcatuck River	41.432883	-71.694100	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-44	Pawcatuck River	41.416133	-71.728800	URI-CVE	URI-CVE	P	P	URI-CVE
PAW-45	Wood River	41.437833	-71.722317	URI-CVE	URI-CVE	P	P	URI-CVE

[A] URI-CVE = Suite of parameters (conventionals, nutrients, metals, pathogens, BOD) as given in Table 3

P = only enterococci samples were collected and analyzed

Note: In 2005-2006, hardness and metals analyses were not run at URI-CVE, but instead brought to RIDOH for analysis.

[B] Pathogen samples were run not taken in June or July of 2006, and instead collected in June and July 2008 and all analyses were run at RIDOH .

Table 5. Ambient River Monitoring Stations 2006-2007

Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2006 – Summer 2007. See Tables 3 & 6 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A]				
Station ID	**River Name**	**Latitude**	**Longitude**	**Oct-06**	**Jun-07**	**Jun-07**	**Jul-07**	**Aug-07**
SBP-01	Mishnock River	41.65586	-71.59117	URI-CVE	URI / DOH	P	P	URI / DOH
SBP-02	Mishnock River	41.68043	-71.57836	URI-CVE	URI / DOH	P	P	URI / DOH
SBP-03	Unnamed Tributary to Tiogue Lake	41.67434	-71.56175	URI-CVE	URI / DOH	P	P	URI / DOH
SBP-04	South Branch Pawtuxet River	41.68972	-71.56536	URI-CVE	URI / DOH	P	P	URI / DOH
SBP-05	Hawkinson Brook	41.67646	-71.52688	URI-CVE	URI / DOH	P	P	URI / DOH
SBP-06	South Branch Pawtuxet River	41.69611	-71.52222	URI-CVE	URI / DOH	P	P	URI / DOH
SBP-07	South Branch Pawtuxet River	41.71442	-71.51464	URI-CVE	URI / DOH	P	P	URI / DOH
SBP-AA	Dam Ponds Outlet	41.69597	-71.54791	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-01	Bear Brook	41.65988	-71.62857	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-03	Nooseneck River	41.63667	-71.65886	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-04	Raccoon Brook	41.61978	-71.64804	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-05	Congdon River	41.61178	-71.62292	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-06	Tributary to Congdon River	41.61289	-71.61816	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-07	Tributary to Sweet Pond	41.62526	-71.59785	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-08	Capwell Mill Pond Outlet	41.64404	-71.60764	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-09	Nooseneck River	41.62677	-71.63289	URI-CVE	URI / DOH	P	P	URI / DOH
BGR-10	Big River	41.64495	-71.61281	URI-CVE	URI / DOH	P	P	URI / DOH
QN-01	Usquepaug River	41.47599	-71.60713	URI-CVE	URI / DOH	P	P	URI / DOH
QN-02	Tributary to Glen Rock Resevoir	41.50959	-71.60916	URI-CVE	URI / DOH	P	P	URI / DOH
QN-03	Glen Rock Brook	41.52221	-71.61242	URI-CVE	URI / DOH	P	P	URI / DOH
QN-04	Sherman Brook	41.51821	-71.60405	URI-CVE	URI / DOH	P	P	URI / DOH
QN-05	Locke Brook	41.55467	-71.60220	URI-CVE	URI / DOH	P	P	URI / DOH
QN-06	Locke Brook	41.53762	-71.58581	URI-CVE	URI / DOH	P	P	URI / DOH
QN-07	Queen River	41.54905	-71.56077	URI-CVE	URI / DOH	P	P	URI / DOH
QN-08	Sodom Brook	41.56500	-71.56408	URI-CVE	URI / DOH	P	P	URI / DOH
QN-09	Queen River	41.56257	-71.54817	URI-CVE	URI / DOH	P	P	URI / DOH
QN-10	Queens Fort Brook	41.54903	-71.54474	URI-CVE	URI / DOH	P	P	URI / DOH

Table 5 (continued). Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2006 - Summer 2007. See Tables 3 & 6 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A]				
Station ID	**River Name**	**Latitude**	**Longitude**	**10/09/06**	**06/12/07**	**06/26/07**	**07/09/07**	**08/09/07**
QN-11	Queen River	41.57871	-71.54313	URI-CVE	URI / DOH	P	P	URI / DOH
QN-12	Queen River	41.59373	-71.54341	URI-CVE	URI / DOH	P	P	URI / DOH
QN-13	Dutemple Brook	41.57235	-71.57206	URI-CVE	URI / DOH	P	P	URI / DOH
QN-14	Fisherville Brook	41.58906	-71.57597	URI-CVE	URI / DOH	P	P	URI / DOH
QN-15	Fisherville Brook	41.61047	-71.58977	URI-CVE	URI / DOH	P	P	URI / DOH
QN-AA	Unnamed Brook	41.53897	-71.57955	URI-CVE	URI / DOH	P	P	URI / DOH
QN-AB	Queen River	41.53900	-71.56862	URI-CVE	URI / DOH	P	P	URI / DOH
FL-01	Boyd Brook	41.71496	-71.63008	URI-CVE	URI / DOH	P	P	URI / DOH
FL-02	Boyd Brook	41.72793	-71.62871	URI-CVE	URI / DOH	P	P	URI / DOH
FL-03	Flat River	41.71461	-71.65177	URI-CVE	URI / DOH	P	P	URI / DOH
FL-04	Whaley Brook	41.71664	-71.66306	URI-CVE	URI / DOH	P	P	URI / DOH
FL-05	Whaley Brook	41.71931	-71.66518	URI-CVE	URI / DOH	P	P	URI / DOH
FL-06	Flat River (Negro Sawmill Brook)	41.72096	-71.68393	URI-CVE	URI / DOH	P	P	URI / DOH
FL-07	Carr Pond Tributary	41.66568	-71.69092	URI-CVE	URI / DOH	P	P	URI / DOH
FL-08	Quidnick Brook	41.69068	-71.66835	URI-CVE	URI / DOH	P	P	URI / DOH
FL-09	Tributary to Flat River Resevoir	41.68848	-71.62158	URI-CVE	URI / DOH	P	P	URI / DOH
LPK-01	Spring Brook	41.40252	-71.83067	URI-CVE	URI / DOH	P	P	URI / DOH
LPK-02	Mastuxet Brook	41.35839	-71.81504	URI-CVE	URI / DOH	P	P	URI / DOH
LPK-03	Mastuxet Brook	41.34677	-71.81543	URI-CVE	URI / DOH	P	P	URI / DOH
ESS-09	Tucker Brook	41.98763	-71.63031	URI-CVE	URI / DOH	P	P	URI / DOH
ESS-20	Lawton Brook	41.52335	-71.28168	URI-CVE	URI / DOH	P	P	URI / DOH
ESS-43	Bucks Horn Brook	41.69508	-71.56991	URI-CVE	URI / DOH	P	P	URI / DOH
ESS-45	Maidford River	41.50196	-71.26830	URI-CVE	URI / DOH	P	P	URI / DOH
WD-REF	Wood River	41.54444	-71.70583	URI-CVE	URI / DOH	P	P	URI / DOH

[A] URI-CVE = Suite of parameters (conventionals, nutrients, metals, pathogens, BOD) as given in Table 3

URI / DOH = same as URI-CVE, except metal samples were analyzed by RI DOH (see Table 6 for methods) and Sodium (Na) was not analyzed

P = only enterococci samples were collected and analyzed

Table 6. Parameters analyzed by HEALTH

Chemical parameters, analytical methods and Standard Operating Procedure Documents followed by RI State Health Laboratories to analyze water samples for the RI DEM – Ambient River Monitoring Program (September 1, 2007)

Parameter	Abbreviation	Units	Method	Standard Operating Procedure Document
Conventionals				
Chloride	Cl	mg/L	EPA 300.0 Rev. 2.1 Ion Chromatography Lachet	RIDOH SOP WL20 rev. 3 Chloride
Sodium	Na	mg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Hardness		mg/L	SM2340 C Titration	RIDOH SOP WL22 rev. 4 Hardness
pH	pH	pH units	SM 4500-H+ B Electrode Orion Instrument model 720 A	RIDOH SOP WL13 rev. 6 PH
Turbidity		NTU	EPA 180.1 Nephelometric Turbidimeter	RIDOH SOP WL1 Turbidity
Total Suspended Solids	TSS	mg/L	SM2540 D Gravimetric	RIDOH SOP WL 7 SOLIDS rev. 3 TSS
Nutrients				
Total ammonia [A]	NH_3-N (total)	mg/L	EPA 350.1 Rev. 2.0 Semi-automated Colorimetry	ESS Laboratory SOP 40_0024L
Total Kjeldahl Nitrogen [A]	TKN	mg/L	EPA 351.2 Semi-automated Colorimetry	ESS Laboratory SOP 40_0019B Total Kjeldahl Nitrogen
Nitrate-Nitrite as Nitrogen, Dissolved	$NO_2 + NO_3$-N	mg/L	EPA 353.2 Rev. 2.0 Autoanalyzer – Lachet	RIDOH SOP WL16 rev. 4 nitrate & RIDOH SOP WL56 rev. 5 nitrite
Ortho-phosphate	PO4-P	mg/L	EPA 300.0 Rev. 2.1 Ion Chromatography	RIDOH SOP WL17 Ortho-phosphate
Total Phosphorus	TP	mg/L	SM 4500 P B.5 & E Persulfate Digestion and Ascorbic Acid Method	RIDOH SOP WL12 rev. 3 Total Phosphorus
Pathogens				
Enterococci		Entercocci/ 100 mL	Enterolert	RIDOH SOP SM 37 Enterolert
Fecal coliform		MPN	MPN Method	RIDOH SOP SM1 F. Coliform MPN
Other				
Five-day Biological Oxygen Demand	BOD_5 (unfiltered)	mg/L	SM 5210 B Membrane Electrode – YSI Model 57	RIDOH SOP WL10 rev. 4 BOD_5
Metals				
Cadmium	Cd (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Copper	Cu (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Lead	Pb (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Zinc	Zn (dissolved)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1
Total Iron	Fe (total)	µg/L	EPA 200.8 ICP-MS	RIDOH SOP WL ICPMS rev. 1

[A] Samples are analyzed by a laboratory certified in Rhode Island to test these parameters in non-potable water.

Note: Dissolved oxygen, water temperature, conductivity, specific conductance, and salinity are measured in the field. Total Nitrogen is reported as the addition of the following fractions: (NO_3-N) + (TKN)

Parameters will be grouped into suites and each station will be sampled for a specific suite of parameters.

Suite 1 = Conventionals, Nutrients, enterococci
Suite 2 = Conventionals, Nutrients, enterococci, metals, fecal
Suite 3 = Conventionals, Nutrients, enterococci, metals, fecal, BOD_5

Table 7. Ambient River Monitoring Stations 2007-2008

Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2007 – Summer 2008. See Table 6 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by HEALTH				
Station ID	**River Name**	**Latitude**	**Longitude**	**Oct - Nov 2007**	**May - June 2008**	**June - July 2008**	**July 2008**	**Aug 2008**
NBP02	North Branch Pawtuxet River	41.73410	-71.55270	1+metals	1+metals	P1	P1	1+metals
NBP03	North Branch Pawtuxet River	41.72087	-71.53209	2	2	P2	P2	2
NBP04	North Branch Pawtuxet River	41.72990	-71.56274	1+metals	1+metals	P1	P1	1+metals
NBP05	Lippit Brook	41.74139	-71.52480	1	1	P1	P1	1
PBR02	Hemlock Brook	41.79068	-71.69850	1	1	P1	P1	1
PBR03	Dolly Cole Brook	41.82222	-71.70045	1	1	P1	P1	1
PBR04	Windsor Brook	41.83611	-71.72262	1	1	P1	P1	1
PBR05	Hemlock Brook	41.80079	-71.72235	1	1	P1	P1	1
PCT01	Pocassett River	41.81303	-71.49319	1	1	P1	P1	1
PCT02	Pocassett River	41.80273	-71.48578	1	1	P1	P1	1
PCT03	Simmons Brook	41.79628	-71.48374	3+Fe	3+Fe	P2	P2	3+Fe
PCT04	Pocassett River	41.79692	-71.47937	2	2	P2	P2	2
PCT05	Pocassett River	41.78416	-71.45606	3	3	P2	P2	3
PCT06	Pocassett River	41.77066	-71.45361	3	3	P2	P2	3
PCT07	Pocassett River	41.75973	-71.44334	3	3	P2	P2	3
PCT08	Dry Brook	41.81421	-71.51534	1+fecal	1+fecal	P2	P2	1+fecal
PCT09	Pocassett River	41.83696	-71.52942	1	1	P1	P1	1
PXT01	Meshanticut Brook	41.74864	-71.48486	1	1	P1	P1	1
PXT02	Furnace Hill Brook	41.75571	-71.48686	1	1	P1	P1	1
PXT03	South Branch Pawtuxet River	41.68730	-71.52677	3	3	P2	P2	3
PXT04	South Branch Pawtuxet River	41.70723	-71.52043	3	3	P2	P2	3
PXT05	Mainstem Pawtuxet River	41.71494	-71.50020	3	3	P2	P2	3
PXT06	Mainstem Pawtuxet River	41.72258	-71.48935	3	3	P2	P2	3
PXT07	Mainstem Pawtuxet River	41.72570	-71.47239	3	3	P2	P2	3
PXT08	Mainstem Pawtuxet River	41.73667	-71.45392	3	3	P2	P2	3
PXT09	Mainstem Pawtuxet River	41.74871	-71.44648	3	3	P2	P2	3
PXT10	Mainstem Pawtuxet River	41.75605	-71.43926	3	3	P2	P2	3

Table 7 (continued). Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2007 – Summer 2008. See Table 6 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by HEALTH				
Station ID	**River Name**	**Latitude**	**Longitude**	**Oct - Nov 2007**	**May - June 2008**	**June - July 2008**	**July 2008**	**Aug 2008**
PXT11	Mainstem Pawtuxet River	41.76176	-71.42478	3	3	P2	P2	3
PXT12	Mainstem Pawtuxet River	41.76761	-71.40519	3	3	P2	P2	3
PXT13	Mainstem Pawtuxet River	41.76447	-71.39107	3	3	P2	P2	3
RMR02	Mosquitohawk Brook	41.84666	-71.61173	1	1	P1	P1	1
RMR03	Rush Brook	41.83928	-71.61001	1	1	P1	P1	1
RMR04	Peeptoad Brook	41.85238	-71.60628	1	1	P1	P1	1
SBP06	South Branch Pawtuxet	41.71448	-71.51444	3	3	P2	P2	3
SCI01	Wilbur Hollow Brook	41.76813	-71.63315	1	1	P1	P1	1
SCI02	Cork Brook	41.79304	-71.64538	1	1	P1	P1	1

[A] Suite 1 = Conventionals, nutrients, enterococci
Suite 2 = Conventionals, nutrients, enterococci, metals, Fecal colifrom
Suite 3 = Conventionals, nutrients, enterococci, metals, Fecal colifrom, BOD
Suite P1 = enterococci
Suite P2 = enterococci and Fecal coliform.
For complete list of parameters, see Table 6

Table 8. Ambient River Monitoring Stations 2008-2009

Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2008 – Summer 2009. See Table 6 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by HEALTH				
Station ID	**River Name**	**Latitude**	**Longitude**	**Sep-08**	**May-09**	**Jun-09**	**Jul-09**	**Aug-09**
BNC01	Branch River	41.99984	-71.55265	1	1	P	P	1
BNC02	Branch River	41.97816	-71.61591	1	1	P	P	1
BNC03	Tarkiln Brook	41.96805	-71.60107	1	1	P	P	1
BNC04	Branch River	41.97530	-71.63140	1	1	P	P	1
BNC05	Tarkiln Brook	41.95060	-71.60360	1	1	P	P	1
BSN01	Abbott Run	41.92920	-71.37266	1 + Metals	1 + Metals	P	P	1 + Metals
BSN02	Abbott Run	41.97905	-71.39368	1 + Metals	1 + Metals	P	P	1 + Metals
BSN06	Cherry Brook	41.99977	-71.52325	1 + Fecal	1 + Fecal	P	P	1 + Fecal
BSN07	Crookfall Brook	41.96306	-71.48757	1 + Fecal	1 + Fecal	P	P	1 + Fecal
CHP01	Chepachet River	41.94855	-71.64491	1 + Metals	1 + Metals	P	P	1 + Metals
CLR01	Brandy Brook	41.92279	-71.72598	1	1	P	P	1
CLR02	Pascoag River	41.96331	-71.70348	1	1	P	P	1
CLR03	Clear River	41.96780	-71.71690	1	1	P	P	1
CLR05	Clear River	41.97000	-71.68530	1 + Metals	1 + Metals	P	P	1 + Metals
CLR06	Clear River	41.95670	-71.64970	2	2	P	P	2
GNB01	Maskerchugg River	41.65576	-71.46392	2	2	P	P	2
HNT02	Hunt River	41.62385	-71.48174	1 + Fecal	1 + Fecal	P	P	1 + Fecal
HNT03	Frenchtown Brook	41.62572	-71.48416	1 + Fecal	1 + Fecal	P	P	1 + Fecal
HNT04	Hunt River	41.63610	-71.45860	2	2	P	P	2
HNT05	Fry Brook	41.6332	-71.488	1 + Fecal	1 + Fecal	P	P	1 + Fecal
HNT07	Scrabbletown Brook	41.5945	-71.4988	1 + Fecal	1 + Fecal	P	P	1 + Fecal
MLL01	Burnt Swamp Brook	42.01379	-71.38960	1	1	P	P	1
MLL02	East Sneech Brook	41.98353	-71.40982	1	1	P	P	1
MLL03	Abbott Run	41.94463	-71.37166	1 + Metals	1 + Metals	P	P	1 + Metals

Table 8 (continued). Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2008 –Summer 2009. See Table 6 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by HEALTH				
Station ID	**River Name**	**Latitude**	**Longitude**	**Sep-08**	**May-09**	**Jun-09**	**Jul-09**	**Aug-09**
MLL05	Abbott Run	41.90073	-71.38564	1 + Metals	1 + Metals	P	P	1 + Metals
MLL06	Abbott Run	41.95550	-71.38743	1 + Metals	1 + Metals	P1	P	1 + Metals
MLL07	East Sneech Brook	41.9821	-71.4202	1	1	P1	P	1
MLL08	Long Brook	41.9816	-71.4129	1	1	P1	P	1
MSK01	Moshassuck River	41.90700	-71.43215	1	1	P1	P	1
MSK02	Moshassuck River	41.88592	-71.40763	1 + Metals	1 + Metals	P1	P	1 + Metals
MSK03	Moshassuck River	41.87256	-71.40828	1 + Metals	1 + Metals	P1	P	1 + Metals
MSK04	Moshassuck River	41.85939	-71.40365	1 + Metals	1 + Metals	P1	P	1 + Metals
MSK05	Moshassuck River	41.84082	-71.41029	1 + Metals	1 + Metals	P1	P	1 + Metals
MSK06	West River	41.84522	-71.41362	1 + Metals	1 + Metals	P1	P	1 + Metals
MSK07	West River	41.86209	-71.45034	1	1	P1	P	1
MSK08	Moshassuck River	41.89641	-71.41345	1	1	P1	P	1
MSK09	Moshassuck River	41.92119	-71.45233	1	1	P1	P	1
MSK10	Unnamed trib to West River	41.86757	-71.44409	1	1	P1	P	1
MSK11	West River	41.88030	-71.47161	1 + Metals	1 + Metals	P1	P	1 + Metals
MSK12	Unnamed trib to West River	41.88707	-71.44237	1	1	P1	P	1
MSK13	West River	41.85626	-71.44244	1 + Metals	1 + Metals	P1	P	1 + Metals
SAU01	Saugatucket River	41.44773	-71.49679	1 + Metals	1 + Metals	P1	P	1 + Metals
SAU02	Saugatucket River	41.46470	-71.49140	1 + Metals	1 + Metals	P1	P	1 + Metals
SAU03	Fresh Meadow Brook	41.47909	-71.48247	1	1	P1	P	1
SAU04	Indian Run Brook	41.4498	-71.4955	1 + Metals	1 + Metals	P1	P	1 + Metals
SAU05	Rocky Brook	41.4517	-71.5016	1	1	P1	P	1
SAU06	Mitchell Brook	41.4739	-71.4966	1	1	P1	P	1
UMR03	Bucks Horn Brook	41.69550	-71.75645	1 + Metals	1 + Metals	P1	P	1 + Metals

Table 8 (continued). Station location and date of water chemistry samples collected for RIDEM – Ambient River Monitoring Program Fall 2008 –Summer 2009. See Table 6 for explanation of analytical methods for conventionals, nutrients, metals, pathogens, and BOD.

				Water Chemistry Suites[A] analyzed by HEALTH				
Station ID	**River Name**	**Latitude**	**Longitude**	**Sep-08**	**May-09**	**Jun-09**	**Jul-09**	**Aug-09**
UMR04	Moosup River	41.70646	-71.76150	1 + Metals	1 + Metals	P1	P	1 + Metals
UMR06	Moosup River	41.75219	-71.75200	1	1	P1	P1	1
WON01	Woonasquatucket River	41.92085	-71.55265	1	1	P1	P1	1
WON02	Woonasquatucket River	41.87849	-71.50158	2	2	P2	P2	2
WON03	Woonasquatucket River	41.85916	-71.48741	2	2 + zinc	P2 + zinc	P2 + zinc	2 + zinc
WON04	Woonasquatucket River	41.83293	-71.47057	1 + Metals	1 + Metals	P1	P1	1 + Metals
WON05	Woonasquatucket River	41.82652	-71.43572	2	2	P2	P2	2
WON06	Stillwater River	41.87444	-71.55460	1	1	P1	P1	1
WON07	Stillwater River	41.88494	-71.54125	1 + Metals	1 + Metals	P1	P1	1 + Metals
WON08	Woonasquatucket River	41.82650	-71.46250	2	2	P2	P2	2
WON09	Woonasquatucket River	41.85067	-71.48165	2	2 + zinc	P2 + zinc	P2 + zinc	2 + zinc
WON10	Nine Foot Brook	41.8981	-71.5789	1 + Metals	1 + Metals	P1	P1	1 + Metals
WON11	Latham Brook	41.9223	-71.5675	1 + Metals	1 + Metals	P1	P1	1 + Metals
WON12	Woonasquatucket River	41.82140	-71.45470	2	2	P2	P2	2
WONWR3A	Woonasquatucket River	41.87364	-71.49718	not sampled	zinc	zinc	zinc	zinc
WONWR5	Woonasquatucket River	41.86536	-71.49230	not sampled	zinc	zinc	zinc	zinc

[A] Suite 1 = Conventionals, nutrients, enterococci
Suite 2 = Conventionals, nutrients, enterococci, metals, Fecal colifrom
Suite 3 = Conventionals, nutrients, enterococci, metals, Fecal colifrom, BOD
Suite P1 = enterococci
Suite P2 = enterococci and Fecal coliform.
For complete list of parameters, see Table 6

Table 9. Rotating Basin Schedule 2004-2009

Rhode Island watershed basins (HUC-12) sampled over a five-year rotation 2004-2009.

Fall '04-Summer '05	Fall '05-Summer '06	Fall '06-Summer '07	Fall '07-Summer '08	Fall '08-Summer '09
Upper Wood River	Chipuxet River	Big River	Regulating & Moswansicut Res.	Clear River
Lower Wood River	Beaver River	Flat River Reservoir	Ponagansett & Barden Res.	Chepachet River
	Upper Pawcatuck River	S. Branch Pawtuxet	Scituate Reservoir	Branch River
	Pawcatuck Mainstem	Queen River	N. Branch Pawtuxet River	Blackstone - West
		L. Pawcatuck River	Pocassett River	Blackstone - Peters
			Pawtuxet R. Mainstem	Woonasquatucket River
				Upper Moosup
				Moshassuck River
				Saugatucket River
				Abbott Run
				Hunt River
				Greenwich Bay

Table 10. Holding Times and Measurement Performance Criteria

Sample holding times, lab quantitation limits, and method detection limits of each parameter analyzed by RI State Health Laboratories for the RI DEM – Ambient River Monitoring Program (September 1, 2007).

Parameter	Abbreviation	Units	Max holding time	Quantitation Limit* (QL)	Method Detection Limit* (MDL)
Conventionals					
Chloride	Cl	mg/L	28 days	0.2	0.046
Sodium	Na	mg/L	6 months	1	0.05
Hardness	Hardness	mg/L	6 months	–	–
pH	pH	pH units	immediately	–	–
Turbidity	Turbidity	NTU	24 hours	0.2	–
Total Suspended Solids	TSS	mg/L	3 days	1.0	–
Nutrients					
Total ammonia [A]	NH3-N (total)	mg/L	7 days	0.05	0.02
Total Kjeldahl Nitrogen [A]	TKN	mg/L	28 days	0.2	–
Nitrate-Nitrite as Nitrogen, Dissolved	NO3-N	mg/L	28 days	0.05	0.005
Ortho-phosphate	PO4-P	mg/L	28 days	0.02	0.011
Total Phosphorus	TP	mg/L	28 days	0.02	0.007
Pathogens					
Enterococci	Enterococci	Entero. per 100 mL	6 hours	< 1	–
Fecal coliform	Fecal coliform	MPN	8 hours	–	–
Other					
Five-day Biological Oxygen Demand	BOD5 (unfiltered)	mg/L	1 day	1.0	NA
Metals					
Cadmium	Cd	µg/L	6 months	0.48	0.48
Copper	Cu	µg/L	6 months	0.47	0.47
Lead	Pb	µg/L	6 months	0.35	0.35
Zinc	Zn	µg/L	6 months	3.82	3.82
Total Iron	Fe (total)	µg/L	6 months	1.63	10

[A] Samples are analyzed by a laboratory certified in Rhode Island to test these parameters in non-potable water.

Note: Dissolved oxygen, water temperature, conductivity, specific conductance, and salinity are measured in the field.
Total Nitrogen is reported as the addition of the following fractions: (NO_3-N) + (TKN)

Parameters will be grouped into suites and each station will be sampled for a specific suite of parameters.
Suite 1 = Conventionals, Nutrients, enterococci
Suite 2 = Conventionals, Nutrients, enterococci, metals, fecal
Suite 3 = Conventionals, Nutrients, enterococci, metals, fecal, BOD5

* MDLs and QLs are derived annually by the HEALTH State Laboratories and negotiated in an MOU with DEM/OWR.

APPENDICIES

APPENDIX A

Handheld YSI Model 85
Standard Operating Procedure

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 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

RIDEM-OWR ARM Program
Collection of Ambient Water Samples
For Metals Analysis
Standard Operating Procedure

RIDEM-OWR Ambient River Monitoring Program – Standard Operating Procedure for the Collection of Ambient Water Samples For Metals Analysis

Purpose: This document describes SOP for collecting ambient water samples for metal analyses conducted during May 2008 field sampling for the Ambient River Monitoring Program.

References:
(1) Methods below are similar to the EPA document:
Standard Operating Procedure for the Collection of Low Level Metals Ambient Water Samples
ECASOP-Metals2, Low Level Metals Sampling, Revision #: 2, 5/21/07
This document is referenced in the Ten Mile TMDL and is saved as: "EPA Metals SOP Final.pdf"

1.0 Sample Collection from the Shore or Using Waders

1.1 Equipment and supplies

1.1.1 For this sampling procedure, it is a recommended a sampling kit be made ahead of time. The kits should contain all equipment for sampling at each site. They should be assembled in the lab ahead of time by a handler wearing gloves. Each kit will contain

1.1.2 One 1 L bottle. This bottle does not contain any preservatives. Sample contained in this bottle will be analyzed for: Na, Hardness, Cd (dis), Cu (dis), Pb (dis), Zn (dis), Fe (total).

1.1.3 One pair of "powder free" gloves that have been stored in a sealed Zip-Lock plastic bag.

1.2.0 You will also need:
1.2.1 A box of regular powder-free gloves.
1.2.2 Chest waders with belt, hip boots (if necessary)
1.2.3 General equipment: Site logbooks, indelible marker, waterproof pen, field data sheets, chain of custody forms.

2.0 Sample collection procedure for total metals from the shore or using waders

2.1.0 Don waders with belt

2.1.1 Where there is flow or current, always approach the sampling location slowly from the downstream. Once you have reached the sampling location allow the water to return to a pre-disturbed condition. Avoid contacting the bottle with the bottom or adjacent rocks and stream debris. If the water depth is less than 1 ft (30.5 cm), record this condition and sample the water at mid depth.

2.1.2 Sampling for total metals can be done in teams of two. The person taking the sample is designated the "clean hands" person (CHP), and the assistant is designated the "dirty hands" person (DHP). The CHP is not to touch anything except the sampling bottle until sampling is complete. The DHP should only touch the bags and bottles until sampling is complete.

2.1.3 Immediately before collecting the sample, the DHP dons regular powder-free gloves. They then opens the sample kit, extracts the bag containing the gloves and opens it, allowing the CHP to take them out and put them on.

2.1.4 The CHP remove sample container cap. Reaching up stream or up-current, the CHP plunges the container (with the opening facing directly toward the water) quickly though water surface to avoid surface scum. If there is significant surface scum, record this in the field notes and follow the procedure in

2.1.5 The sampler will submerge the container 25 cm and allow the container to fill. Avoid contacting the sample bottle with the bottom or adjacent rocks and stream debris.

2.1.6 The CHP brings the bottle up and immediately caps the container.

2.1.7 An alternative to this method is for the CHP to submerge capped container to 25cm and then remove cap, allowing container to fill, and then recapping at the same depth.

2.1.8 *Not applicable for this sampling run; however, in the future we may want to collect Field Blanks and the following documents how such blanks should be handles.*

> The total metals blank sample should be collected using the same sampling technique used to collect the water sample. If collecting samples by wading into a stream or river you may conduct the blank on the stream bank. Choose a location on the stream bank that has similar condition to the stream or river sampling location. (i.e there should not be any immediate sources of dust or fugitive emissions). For the total metals blank, the DHP first hands the CHP the bottle containing the blank water. The CHP then pours the blank water into the sample container that the DHP is holding. The DHP then caps the sample container. When conducting sampling in the stream or collecting the blank movement should be kept to a minimum to avoid suspending sediment or dust. At least one total metals blank should be collected during every sampling event and by each sampling team. For sampling event greater than 10 samples, EPA recommends 10% of the samples are filter blanks.

2.1.9 Field duplicate samples should be collected by the sampling crew immediately after the sample collection using the same sample collection procedure. EPA recommends 10% of the samples are duplicate samples.

3.0 Sample Collection from a bridge using a Teflon Bucket

3.1 Equipment and supplies

3.1.1 For this sampling procedure, it is a recommended a sampling kit be made ahead of time. The kits should contain all equipment for sampling at each site. They should be assembled in the lab ahead of time by a handler wearing gloves. Each kit will contain

3.1.2 One 1 L bottle. This bottle does not contain any preservatives. Sample contained in this bottle will be analyzed for: Na, Hardness, Cd (dis), Cu (dis), Pb (dis), Zn (dis), Fe (total).

3.1.3 One pair of "powder free" gloves that have been stored in a sealed Zip-Lock plastic bag.

3.2 You will also need:
3.2.1 A box of regular powder-free gloves.
3.2.2 General equipment: Site logbooks, indelible marker, waterproof pen, field data sheets, chain of custody forms.
3.2.3 Teflon bucket attached to a rope

4.0 Sample collection procedure for total metals from a bridge using a Teflon Bucket

4.1.1 Position all sampling equipment (see above) at a safe sapling location on the bridge.

4.1.2 Sampling for metals can be in teams of two. The person is handling eh sampling container is designated the "clean hands" person (CHP), and the assistant handling the bucket and rope is designated the "dirty hands" person (DHP). The CHP is not to touch anything except the sampling bottle until sampling is complete. The DHP should only touch the bags, bucket and rope until sampling is complete.

4.1.3 Immediately before collecting the sample, the DHP dons regular powder-free gloves. They then open the sample kit, extracts the bag containing the gloves and opens it, allowing the CHP to take them out and put them on.

4.1.4 The DHP then removes dirty gloves and dons clean powder-free gloves from a zip-lock bag of clean gloves. The DHP slowly lowers the Teflon bucket over the side of the bridge into the water, being careful not to contact the rope or bucket with the guardrail or bridge. After the bucket fills with water, the bucket is raised using the same care that it was lowered and the water is dumped out (back into the river). As the bucket is raised, the DHP must ensure that the rope is placed back in the rope contained, without contacting the bridge.

4.1.5 This procedure is repeated 2 more times, so that the bucket is triple rinsed before the sample is collected.

4.1.6 After the bucket has been triple rinse, the DHP follows the same procedure to lower/retrieve the bucket contain water for the metals sample.

4.1.7 When the DHP has received the bucket, they carfull hold the bucket by the sides so that their hands are not in contact with any area that sample water could slash, or come in contact with.

4.1.8 The CHP remove sample container cap and hold the sample contained below the rim of the bucket.

4.1.9 The DHP pours the sample into the sample contained, without allowing the bucket and sample container to come in contact with one another.

4.1.10 When the bottle is nearly full, the DHP stops pouring and the CHP caps the bottle.

4.1.11 *Not applicable for this sampling run; however, in the future we may want to collect Field Blanks and the following documents how such blanks should be handles.*

The total metals blank sample should be collected using the same sampling technique used to collect the water sample. If collecting samples by wading into a stream or river you may conduct the blank on the stream bank. Choose a location on the stream bank that has similar condition to the stream or river sampling location. (i.e there should not be any immediate sources of dust or fugitive emissions). For the total metals blank, the DHP first hands the CHP the bottle containing the blank water. The CHP then pours the blank water into the sample container that the DHP is holding. The DHP then caps the sample container. When conducting sampling in the stream or collecting the blank movement should be kept to a minimum to avoid suspending sediment or dust. At least one total metals blank should be collected during every sampling event and by each sampling team. For sampling event greater than 10 samples, EPA recommends 10% of the samples are filter blanks.

4.1.12 Field duplicate samples should be collected by the sampling crew immediately after the sample collection using the same sample collection procedure. EPA recommends 10% of the samples are duplicate samples.

APPENDIX D

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.

APPENDIX E

RI DEM
Summary Guidance for
Reviewing Environmental Monitoring Data
Standard Operating Procedure

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 _____ Connie Carey _____ Date: 7/27/07
Print Name Signature

APPROVALS:

Quality Team Chair:

Tom Getz _____ _____ Date: 7/27/07
Print Name Signature

Assistant Director of Water Resources

Alicia Good _____ _____ Date: 8/15/07
Print Name Signature

Assistant Director of Air, Waste and Compliance

Terry Gray _____ _____ Date: 8/1/07
Print Name Signature

Associate Director of Natural Resources

Larry Mouradjian _____ _____ Date: 8/6/07
Print Name Signature

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(x) Quality Management Team ..... By: MDG Date: 8/20/07
(X) DOA MIS Liaison .....By: mcc Date: 8-20-07

APPENDIX F

Quality Assurance Plan for The Rhode Island Department of Health Laboratories in support of Drinking Water Quality and Water Pollution Programs

QUALITY ASSURANCE PLAN FOR

THE RHODE ISLAND DEPARTMENT OF HEATH LABORATORIES

IN SUPPORT OF

DRINKING WATER QUALITY AND WATER POLLUTION PROGRAMS

REVISION 12.0

REVISED 07/12/2010

QUALITY ASSURANCE PLAN

FOR

THE RHODE ISLAND DEPARTMENT OF HEATH

STATE HEALTH LABORATORIES

IN SUPPORT OF

DRINKING WATER QUALITY AND WATER POLLUTION PROGRAMS

REVISION 12.0

Revision Dates

September 1984	August 2002
October 1988	March 2004
October 1991	July 2005
January 1995	April 2006
February 1998	February 2007
February 2001	January 2010

Approval Signatures:

Nicole Duffy Date: 7/23/10
Quality Assurance Officer

Date: 07/23/2010
Section Chief (Chemistry)

Date: 8/5/2010
Section Chief (Microbiology)

Date: 7/23/2010
Laboratory Director

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HEALTH Analytical Measurement Performance Criteria Tables

Sampling SOP	RIDOH SOP WL ICPMS rev. 2			
Medium/Matrix	Surface Water			
Analytical Parameter	Metals - Cd, Cu, Pb, Fe, Zn, Na			
Reporting Limit Concentration	Cd, Cu, Pb, 1ug/L, Fe 10ug/L, Zn 20ug/L, Na 1mg/L			
QC Sample and/or Activity Used to Assess Measurement Performance	**Analytical Method/ SOP Reference/ Laboratory**	**Measurement Performance Criteria**	**Data Quality Indicator**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)**
Laboratory Reagent Blank	EPA 200.8	Cd, Cu, Pb < 1ug/L, Fe <10ug/L, Zn <20ug/L, Na <1mg/L	Accuracy/bias Contamination	A
Laboratory Fortified Blank (spike)	EPA 200.8	85-115% Recovery	Accuracy/bias Contamination	A
Lab Duplicates	EPA 200.8	<20%RPD	Precision	A
Field Duplicates	EPA 200.8	<20%RPD	Accuracy	S/A
Quality Control Sample - QCS	EPA 200.8	Quantitation within limits set by manufacturer	Accuracy/bias Contamination	A
Data Review 100%	EPA 200.8	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL16 nitrate rev. 6 and RIDOH SOP WL56 nitrite rev. 5
Medium/Matrix	Surface Water
Analytical Parameter	Nitrate -Nitrite -N
Reporting Limit Concentration	0.05 mg/L

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Laboratory Reagent Blank	EPA 353.2	<0.05 mg/L	Accuracy/bias Contamination	A
Laboratory Fortified Blank (spike)	EPA 353.2	90 -110% Recovery	Accuracy/bias Contamination	A
Lab Duplicates	EPA 353.2	<20%RPD	Precision	A
Field Duplicates	EPA 353.2	<20%RPD	Accuracy	S/A
Quarterly Control Sample - QCS	EPA 353.2	Quantitation within limits set by manufacturer	Accuracy/bias Contamination	A
Data Review 100%	EPA 353.2	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	ESS Laboratory SOP 40_0024L
Medium/Matrix	Surface Water
Analytical Parameter	Ammonia Nitrogen
Reporting Limit Concentration	0.10 mg/L

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Method Blank	EPA 350.2 /SM 4500 –NH3 B G	<0.2 mg/L	Accuracy/bias Contamination	A
Laboratory Control Sample -LCS	EPA 350.2 /SM 4500 –NH3 B G	80 -120% Recovery	Accuracy/bias Contamination	A
Lab Duplicates	EPA 350.2 /SM 4500 –NH3 B G	<20% RPD	Precision	A
Field Duplicates	EPA 350.2 /SM 4500 –NH3 B G	<20% RPD	Accuracy	S/A
Data Review 100%	EPA 350.2 /SM 4500 –NH3 B G	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	ESS Laboratory SOP 40_0019B			
Medium/Matrix	Surface Water			
Analytical Parameter	Total Kjeldahl Nitrogren			
Reporting Limit Concentration	0.20 mg/L			
QC Sample and/or Activity Used to Assess Measurement Performance	**Analytical Method/ SOP Reference/ Laboratory**	**Measurement Performance Criteria**	**Data Quality Indicator**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)**
Method Blank	EPA 351.2	<0.2 mg/L	Accuracy/bias Contamination	A
Laboratory Control Sample -LCS	EPA 351.2	80 -120% Recovery	Accuracy/bias Contamination	A
Lab Duplicates	EPA 351.2	<20%RPD	Precision	A
Field Duplicates	EPA 351.2	<20%RPD	Accuracy	S/A
Data Review 100%	EPA 351.2	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL12 rev. 4			
Medium/Matrix	Surface Water			
Analytical Parameter	Total Phosphorous and Phosphate			
Reporting Limit Concentration	<0.02 mg/L			
QC Sample and/or Activity Used to Assess Measurement Performance	**Analytical Method/ SOP Reference/ Laboratory**	**Measurement Performance Criteria**	**Data Quality Indicator**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)**
Laboratory Reagent Blank	SM 4500 P B.5 E	<0.02 mg/L	Accuracy/bias Contamination	A
Laboratory Fortified Blank (spike)	SM 4500 P B.5 E	90 -110% Recovery	Accuracy/bias Contamination	A
Lab Duplicates	SM 4500 P B.5 E	<20%RPD	Precision	A
Field Duplicates	SM 4500 P B.5 E	<20%RPD	Accuracy	S/A
Data Review 100%	SM 4500 P B.5 E	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL57 rev. 5
Medium/Matrix	Surface Water
Analytical Parameter	Chloride
Reporting Limit Concentration	0.2 mg/L

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Laboratory Reagent Blank	EPA 300	<0.2 mg/L	Accuracy/bias Contamination	A
Laboratory Fortified Blank (spike)	EPA 300	90 -110% Recovery	Accuracy/bias Contamination	A
Lab Duplicates	EPA 300	<20%RPD	Precision	A
Field Duplicates	EPA 300	<20%RPD	Accuracy	S/A
Data Review 100%	EPA 300	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL SOLIDS (DEM) rev. 4
Medium/Matrix	Surface Water
Analytical Parameter	Total Suspended Solids - TSS
Reporting Limit Concentration	0.1 mg/L

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Laboratory Reagent Blank	SM2540 D	<0.1 mg/L	Accuracy/bias Contamination	A
Quality Control Sample - QCS	SM2540 D	Quantitation within manufacturer's limits	Accuracy/bias Contamination	A
Lab Duplicates	SM2540 D	<20%RPD	Precision	A
Field Duplicates	SM2540 D	<20%RPD	Accuracy	S/A
Data Review 100%	SM2540 D	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL 13 rev. 6
Medium/Matrix	Surface Water
Analytical Parameter	pH
Reporting Range	pH 1-14 in 0.1 units

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Laboratory Reagent Blank	SM4500 H^+ B	0.1 pH units	Accuracy/bias Contamination	A
Quality Control Sample - QCS	SM4500 H^+ B	Quantitation within limits	Accuracy/bias Contamination	A
Lab Duplicates	SM4500 H^+ B	<20%RPD	Precision	A
Field Duplicates	SM4500 H^+ B	<20%RPD	Accuracy	S/A
Data Review 100%	SM4500 H^+ B	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL 22 rev. 5
Medium/Matrix	Surface Water
Analytical Parameter	Hardness
Reporting Limit Concentration	1.0 mg/L

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Laboratory Reagent Blank	SM2340 B	< 1.0 mg/L	Accuracy/bias Contamination	A
Quality Control Sample - QCS	SM2340 B	Quantitation within limits	Accuracy/bias Contamination	A
Lab Duplicates	SM2340 B	<20%RPD	Precision	A
Field Duplicates	SM2340 B	<20%RPD	Accuracy	S/A
Data Review 100%	SM2340 B	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL 01 Revision 11
Medium/Matrix	Surface Water
Analytical Parameter	Turbidity
Reporting Limit Concentration	0.2 NTU

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Laboratory Reagent Blank	EPA 180.1	0.2 NTU	Accuracy/bias Contamination	A
Quality Control Sample - QCS	EPA 180.1	+/- 10 % of true value	Accuracy/bias Contamination	A
Lab Duplicates	EPA 180.1	< 20 %D	Precision	A
Field Duplicates	EPA 180.1	< 20% D	Accuracy	S/A
Data Review 100%	EPA 180.1	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP WL 10 rev. 4
Medium/Matrix	Surface Water
Analytical Parameter	5-Day BOD
Reporting Limit Concentration	1.0 mg/L

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Laboratory Reagent Blank	SM 5210 B	<0.2 mg/L	Accuracy/bias Contamination	A
Quality Control Sample - QCS	SM 5210 B	Quantitation within manufacturer's limits	Accuracy/bias Contamination	A
Lab Duplicates	SM 5210 B	<20%RPD	Precision	A
Field Duplicates	SM 5210 B	<20%RPD	Accuracy	S/A
Data Review 100%	SM 5210 B	Data collected are determined to be useable	Data - Completeness	A

Sampling SOP	RIDOH SOP SM 37 Rev. 3
Medium/Matrix	Surface Water
Analytical Parameter	Enterococci by IDEXX Enterolert
Reporting Limit Concentration	10 MPN / 100mL

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Method Blank	IDEXX Enterolert	10 MPN / 100mL	Accuracy/bias Contamination	A
Quality Control Sample - QCS	IDEXX Enterolert	No false positive/negative controls	Accuracy/bias Contamination	A
Lab Duplicates	IDEXX Enterolert	<90% RPD	Precision	A
Field Duplicates	IDEXX Enterolert	<90% RPD	Accuracy	S/A
Data Review 100%	IDEXX Enterolert	All results recorded properly	Data - Completeness	A

Sampling SOP	RIDOH SOP SM 1 Rev. 10
Medium/Matrix	Surface Water
Analytical Parameter	Total and Fecal Coliform MPN
Reporting Limit Concentration	3 MPN / 100mL

QC Sample and/or Activity Used to Assess Measurement Performance	Analytical Method/ SOP Reference/ Laboratory	Measurement Performance Criteria	Data Quality Indicator	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S/A)
Method Blank	SM 9221 A, B, E	3 MPN / 100mL	Accuracy/bias Contamination	A
Quality Control Sample - QCS	SM 9221 A, B, E	No false positive/negative controls	Accuracy/bias Contamination	A
Lab Duplicates	SM 9221 A, B, E	<90% RPD	Precision	A
Field Duplicates	SM 9221 A, B, E	<90% RPD	Accuracy	S/A
Data Review 100%	SM 9221 A, B, E	All results recorded properly	Data - Completeness	A