Quality Assurance Project Plan

University of Rhode Island Watershed Watch Ambient and Marine Field Assays

Date: September 2005
Prepared for: U.S. Environmental Protection Agency N.E. Region 1
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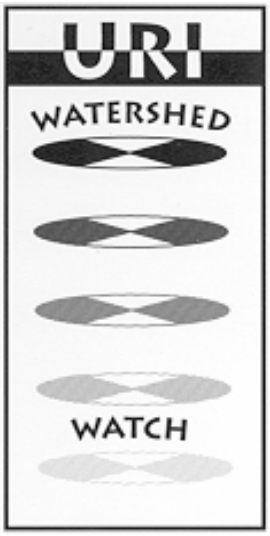
Quality Assurance Project Plan

University of Rhode Island
Watershed Watch
Analytical Laboratory



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URI WATERSHED WATCH TECHNICAL REPORT NO. 5

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List of Abbreviations

Abbreviation	Definition
BOD	Biochemical Oxygen Demand
CA	Corrective Action
%D	Percent Difference
DI	Deionized Water
DQIs	Data Quality Indicators
DO	Dissolved Oxygen
DQO	Data Quality Objectives
EPA-NE	Environmental Protection Agency – New England District (Region 1)
g	Gram
HDPE	High Density Poly-Ethylene
L	Liter
LCS	Laboratory Control Standard (standard analyzed as a sample)
MDL	Method Detection Limit
mL	Milliliter
mg	Milligram
MS	Matrix spike
NA	Not Applicable
ppb	Parts per billion (µg/L)
ppm	Parts per million (mg/L)
ppt	Parts per thousand
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control

List of Abbreviations (continued)

Abbreviation	Definition
%RPD	Replicate Percent Difference
RIDEM	Rhode Island Department of Environmental Management
RL	Reporting Limit (Quantitation Limit)
SOP	Standard Operating Procedure
TSS	Total Suspended Solids
µg	Microgram
URIWW	University of Rhode Island Watershed Watch

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1.0 PURPOSE AND DESCRIPTION

The University of Rhode Island Watershed Watch Program (URIWW) is a Cooperative Extension Water Quality Program in the Department of Natural Resources Science, College of the Environment and Life Sciences. The program is located in the Coastal Institute building on the URI Kingston campus. Begun in 1988, the URIWW program is a statewide volunteer monitoring program with over 300 volunteers. The program focuses on providing current information on the water quality of surface water resources throughout Rhode Island. It is a service provider to statewide and local decision-makers and is the sole source of long-term lake water quality data for Rhode Island. The URIWW Laboratory provides analytical services to the Rhode Island Department of Environmental Management (RIDEM) and the Environmental Protection Agency, New England District (Region 1) (EPA-NE) as well as other URI researchers. It is a resource for volunteers working with municipal boards and is linked with all Cooperative Extension water quality activities. The program is intended to encourage communities and shoreline residents to understand the need to cooperatively manage and improve the water quality of all the water bodies within a watershed.

Information describing the URIWW program, program fact-sheets, water quality data as well as monitoring protocols are maintained at the following web-site: www.uri.edu/ce/wq. Basic information describing URIWW is also available in Appendix C.

The purpose of this Quality Assurance Project Plan (QAPP) is to provide guidance on the field procedures and quality assurance/quality control (QA/QC) tasks performed in marine and ambient waters as part of the URIWW program. Ambient waters are considered fresh surface waters (lakes, ponds and rivers). Field tasks are completed both by professional URIWW staff and volunteers. Field tasks may include the collection of filtered and whole water samples for laboratory analysis of fecal coliforms, *Escherichia coli*, enterococci, total suspended solids (TSS), alkalinity, pH, salinity, biochemical oxygen demand (BOD), chlorophyll-a, chloride, ammonia-N, orthophosphate-P, nitrate + nitrite-N and total phosphorus and nitrogen. Additionally, Secchi disk transparency and water temperature are often determined in the field using instruments, and dissolved oxygen and salinity may be determined in the field using test kits. The actual suite of analytical procedures completed in the field and the actual number and type of samples collected in the field depends upon specific program requirements. This QAPP describes general collection procedures for ambient and marine samples utilized by the URIWW program and does not provide information on project-specific details or goals.

The Standard Operating Procedures (SOPs) contained in this QAPP form the basis of the various URIWW Monitoring Manuals which as of this writing include: Lake and Pond Monitoring Manual, Narrow River Monitoring Manual, Block Island and Green Hill Pond Monitoring Manual, Greenwich Bay Monitoring Manual and Wadable Streams Monitoring Manual. The Monitoring Manuals include approved field SOPs from this QAPP as well as a Sampling Plan and water quality fact sheets. The Sampling Plan includes a monitoring schedule, a step by step sampling guide referring to the SOPs and the recommended order of completing monitoring tasks.

This QAPP does not describe laboratory analytical procedures; this information is found in the University of Rhode Island Watershed Watch Laboratory Program QAPP. A cross-reference between the information required by EPA-NE and this QAPP is provided in the table below. Note that information found in narrative format instead of in an EPA-NE table is listed as “in narrative”.

Required Information Checklist

EPA-NE Work-sheet number	Worksheet Title	Location In URIWW Field QAPP
1	Title and approval	In narrative
2	Table of contents & document format	In narrative
3	Distribution list	In narrative
4	Project personnel sign-off sheet	All relevant personnel are included on the approval page
5a	Organizational chart	Figure 1
5b	Communication pathway	Section 1.2 in narrative
6	Personnel responsibilities and qualification	Section 1.2 and 1.2.1 in narrative
7	Special personnel training requirements	Section 1.2.2 in narrative
8a	Project scoping meeting attendance sheet, agenda	NA
8b	Problem definition/site history & background	Section 1.0 in narrative
9a	Project description	Section 1.0 in narrative
9b	Contaminants of concern	Section 2.6.1
9c	Field & QC sample summary	Section 2.6.2
10	Project schedule timeline	Section 1.3 in narrative
11a	Project quality objectives/decision statements	Section 2.0 in narrative
11b	Measurement performance criteria table	Section 2.6.3
12a	Sampling design & rationale	NA
12b	Sampling locations, methods, SOP requirements table	Section 2.6.4

EPA-NE Work-sheet number	Worksheet Title	Location In URIWW Field QAPP
13	Project sampling SOP table	Appendix A
14	Field equipment calibration	Section 2.6.5
15	Field equipment maintenance	Section 2.6.6
16	Sampling handling, tracking, custody	Section 3.0 in narrative and Section 3.2
17	Field method /SOP	Section 2.6.7
18	Field calibration	Relevant data summarized in Section 2.6.5 in Worksheet #14
19	Field maintenance	Relevant data summarized in Section 2.6.6 in Worksheet #15
20	Fixed lab. analytical , SOP reference table	NA
21	Lab instrument maintenance & calibration table	NA
22a	Field sampling QC	Section 2.6.8
22b	Field sampling QC continued	NA
23a	Field analytical QC	Section 2.6.9
23b	More field QC	NA
24a	Lab analytical QC	NA
24b	More lab analytical QC	NA
25	Non-direct measurement criteria	NA
26	Project documentation and records	Section 4.0 in narrative
27a	Assessment and response	NA
27b	Project assessment	NA
27c	Project assessment plan	NA
28	QA management reports	Section 4.0 in narrative

EPA-NE Work-sheet number	Worksheet Title	Location In URIWW Field QAPP
29a	Data evaluation process	NA
29b	Data validation summary	NA
29c	Data validation modifications	NA
30	Data usability assessment	NA

Notes:
NA – Not applicable to this QAPP. This QAPP provides information regarding general field protocols only. No project-specific information is contained in this general QAPP. No laboratory analysis information is provided in this QAPP, refer to "Quality Assurance Project Plan – University of Rhode Island Watershed Watch Laboratory Program" for laboratory specific QA/QC information.

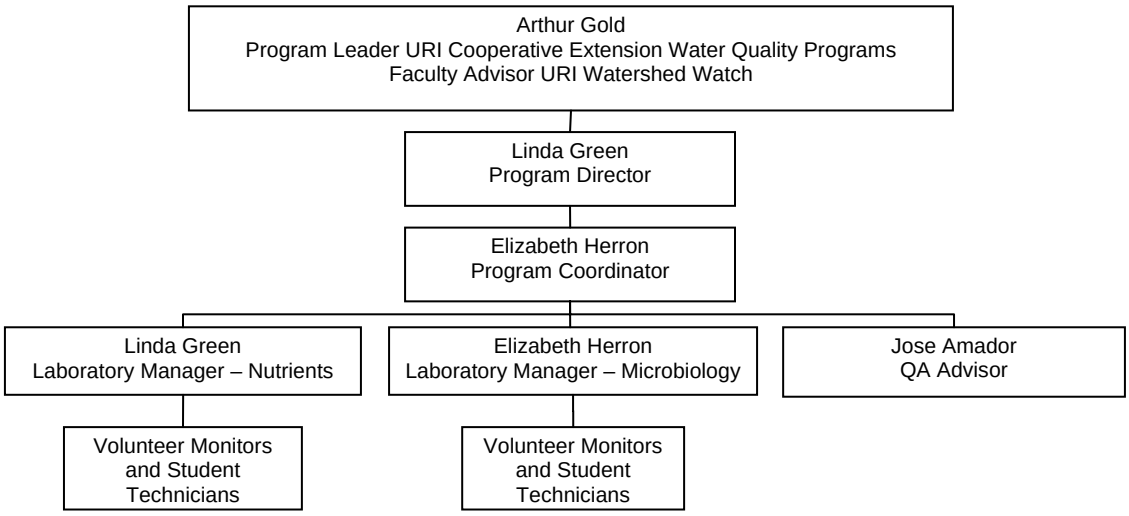
1.1 Quality Assurance Project Plan (QAPP) Objectives

The objective of this QAPP is to present the organization, objectives and specific QA/QC procedures associated with URIWW field analysis and sample collection protocols. Guidance on the field analysis procedures for the following assays is provided in this document: temperature, Secchi depth transparency, DO and salinity. Guidance on the field collection procedures for filtered, unfiltered and bacterial samples are also included in this QAPP. Specific QA/QC criteria as well as documentation are outlined in individual Field SOPs located in Appendix A. This QAPP does not describe any laboratory analysis procedures; this information is provided in the University of Rhode Island Watershed Watch Laboratory Program QAPP.

1.2 Organization and Communication

Dr. Arthur Gold is the Program Leader of the Cooperative Extension Water Quality Program and faculty advisor to the URIWW program. He will provide overall guidance related to projects performed by the URIWW program (figure 1). Linda Green is the URIWW Program Director as well as the overall Laboratory Project Manager and Laboratory Manager for nutrient analyses. As such she is responsible for overall operation of the laboratory as well as the QA/QC of all non-microbiological related assays. Elizabeth Herron is the URIWW Program Coordinator and Laboratory Project Manager for microbiological analysis. She is responsible for the analysis and QA/QC of microbiological assays. Dr. Jose Amador will provide QA/QC guidance. Ms. Herron and Ms. Green are both responsible for the supervision and training of volunteers collecting samples and data as part of the URIWW program. All changes to the QAPP or specific SOPs will completed only after review and acceptance by Ms. Green or Ms. Herron.

Figure 1 - University of Rhode Island Watershed Watch Laboratory Structure



1.2.1 Personnel Qualifications

A brief description of the experience of principal laboratory personnel is described here. Resumes of key personnel are located in Appendix B. Dr. Arthur Gold is a watershed hydrologist and Professor in the Department of Natural Resources Science at URI. He has over 20 years of experience in the field of water resources; has published over 60 refereed journal articles and has served on numerous national and international committees dealing with water resources. Currently, Dr. Gold is the associate director of the URI Coastal Institute and is the program leader for the URI Cooperative Extension.

Linda Green is a Research Association IV in the Department of Natural Resources Science at URI. Ms. Green has over 25 years of analytical laboratory related experience and has been the director of URIWW for over 18 years. She is the recipient of numerous awards and grants related to her work with the URIWW program and has authored numerous articles and technical publications. Ms. Green has hosted workshops on QA/QC in volunteer monitoring programs and is the sole volunteer monitoring representative on the National Water Quality Monitoring Council as well as a co-founding member of the Rhode Island Volunteer Monitoring Steering Committee.

Elizabeth Herron is a Research Associate II in the Department of Natural Resources Science at URI. Ms. Herron has over 15 years of experience in the field and is a former director of the North American Lake Management Society as well as a co-founding member of the Rhode Island Volunteer Monitoring Steering Committee. She has authored numerous articles and technical publications and has presented workshops and technical papers throughout the United States.

Dr. Jose Amador has 20 years of experience in the field of soil science, microbiology and nutrient chemistry. He has published over 40 peer reviewed articles. He is currently a Professor of microbial ecology and soil science in the Department of Natural Resources Science at URI.

1.2.2 Training

Training of volunteer monitoring personnel and student technicians is conducted by Linda Green, Elizabeth Herron and URIWW staff. Training is provided on limnologic principles, water sample collection and method-specific details for the collection of basic physical and chemical parameters in the field (temperature, Secchi depth transparency, DO and salinity). Training consists of classroom and field workshops conducted by Ms. Green and Ms. Herron. The workshops provide verbal and hands-on training with the collection apparatus and the analysis of water samples. Each volunteer is provided with a copy of the relevant Monitoring Manual which contains written instructions for the collection and analysis of field samples. Attendance of at least one field training session is mandatory and attendance of a classroom workshop is strongly encouraged. Workshop attendance records are retained by the URIWW group.

1.3 Schedule/Time-Line

This QAPP does not relate to a specific project, therefore no specific time-line or schedule is offered. Specific monitoring schedules are found in the specific Monitoring Manuals a described in Section 1.0 of this QAPP. A schedule for the Great Salt Pond and its tributaries is included below as an example of a typical monitoring schedule (figure 2). Note that most sampling activities take place in the summer and fall months.

Figure 2 - Example of a Typical Monitoring Schedule

URI WATERSHED WATCH
2002 WATER QUALITY MONITORING SCHEDULE
Great Salt Pond and its Tributaries

Week Ending	Biweekly monitoring: Secchi depth, temperature, chlorophyll, dissolved oxygen, salinity	WATER COLLECTION DATES: Fill water bottles & bring with frozen chlorophyll filters to BI ferry for shipment to URI Watershed Watch lab for analysis of pH, nutrients, bacteria, suspended solids
June 15	**X**	**Train new volunteers, replenish supplies, start up of 2002 season, Wednesday June 12**
June 22		
June 29	**X**	
July 6		Participate in '02 Great American Secchi Dip-In
July 13	X	
July 20		
July 27	**X**	**FIRST COLLECTION: THURSDAY July 25**
August 3		
August 10	X	
August 17		AUGUST 12 IS VICTORY DAY
August 24	**X**	**SECOND COLLECTION: THURSDAY Aug. 22**
August 31		SEPTEMBER 2 IS LABOR DAY
September 7	X	
September 14		
September 21	X	**THIRD COLLECTION: Sept. 19**
September 28		
October 5	X	
October 12		OCTOBER 14 IS COLUMBUS DAY
October 19	**X**	**Scheduled sampling postponed due to weather** ***Participate in National Water Monitoring Day***
October 26		
November 2		
November 9		
November 16	Return all supplies	**FOURTH COLLECTION: Nov.12**

Monitoring is scheduled for every other week, but you may monitor weekly if you choose to! **Monitor between 6 AM and 9 AM** ***It is better to collect the water samples earlier rather than later.*** After collection immediately bring the water samples on ice in a cooler to the central collection area for transport to the BI ferry. The water samples will be shipped on a midday ferry

2.0 FIELD QUALITY OBJECTIVES AND MEASUREMENT PERFORMANCE CRITERIA

High quality data is the goal of all URIWW field analytical and sample collection procedures. Specific data quality objectives have been set for field analytical procedures on a method basis for method detection limits (MDL), precision, accuracy, comparability and completeness. Values specific to each of these objectives are located in the following Section. Since this document is a general QAPP for field assays only, there are no specific if/then statements linking field criteria to project decisions.

2.1 Method Detection Limits (MDL) and Reporting Limit (RL)

The MDL is the analyte concentration where there is 99% confidence that the sample concentration is different from zero. Below the MDL it is uncertain if the concentration is not zero. The reporting limit (RL) is the value above which data have definable accuracy and precision. Each field assay has a specific MDL and RL value. These values are located in worksheet 9b (see Section 2.6.1).

2.2 Precision

Precision is a measure of the degree to which two or more measurements are in agreement as well as a measurement of random error. Precision of field assays will be assessed through the measurement of duplicate samples and subsequent calculation of the relative percent difference (%RPD) as described below.

$$\%RPD = \frac{\left| \text{Result of Replicate 1} - \text{Result of Replicate 2} \right|}{\text{Average of Result of Replicate 1 and Result of Replicate 2}} \times 100$$

Objectives for precision are located in worksheets 11b and 23a, Section 2.6.3 and 2.6.9, respectively.

2.3 Accuracy

Accuracy is an evaluation of the degree to which a measured value and a known reference value or true value are in agreement. This is a measurement of systematic error and is often referred to as “bias”. Accuracy of field analytical procedures is determined by the analysis of reference material and comparison of the resulting value to that of the accepted value. The difference between the accepted and reference value is the percent difference (%D). The %D is calculated as follows:

$$\%D = \frac{\left| \text{Known Value of Reference Material} - \text{Calculated Value of Reference Material} \right|}{\text{Known Value of Reference Material}} \times 100$$

Objectives for accuracy are located in worksheet 11b, 14 and 22a (see Section 2.6.3, 2.6.5 and 2.6.8, respectively).

2.4 Comparability

All field analytical procedures and sample collection methods utilized by the URIWW program are based on procedures found in the following sources:

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

U.S. Environmental Protection Agency. Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003. Washington D.C.: Office of Water, Nov. 1997.

U.S. Environmental Protection Agency. Volunteer Lake Monitoring: A Methods Manual, EPA 440/4-91-002. Washington D.C.: Office of Water, Dec. 1991.

Carlson, R. and J. Simpson. A Coordinator's Guide to Volunteer Lake Monitoring Methods. North American Lake Management Society (NALMS), Feb. 1996.

U.S. Environmental Protection Agency. Volunteer Estuary Monitoring: A Methods Manual. 2nd ed. U.S. Environmental Protection Agency and Center for Marine Conservation, No Date Listed.

Field Test Kit Instructions from the manufacturer (LaMotte) at www.lamotte.com

2.5 Completeness

Completeness is a measure of the amount of valid data obtained from the field analytical procedures as well as a measure of the number of valid samples collected in the field compared to the number expected to be obtained under normal conditions. Greater than 80% completeness of field analytical procedures and collection of valid samples is expected. Completeness is calculated as follows:

$$\text{Completeness (Field Analytical Procedures)} = \frac{\text{Number of Valid Field Analytical Measurements}}{\text{Number of Field Analytical Measurements Planned}} \times 100$$

And

$$\text{Completeness (Collection of Field Samples)} = \frac{\text{Number of Valid Field Samples Collected}}{\text{Number of Field Samples Planned}} \times 100$$

2.6 QA/QC Tables

Tables summarizing the QA/QC objectives for each field analytical procedure performed as well as any objectives related to the collection of field samples for later analysis by the URIWW Laboratory are provided on the following pages. These tables address the Data Quality Indicators (DQIs) or the procedures to be followed to provide assurance that a field analytical procedure is returning valid results. Each DQI has a specific result that must be met before the data is considered acceptable. Maintenance and calibration procedures for each piece of equipment/instrument are provided for field analytical procedures and sample collection methods as well as preservation and required sample volume. The person(s) responsible for assessing problems relating to field analytical procedure DQIs and/or maintenance of field equipment are also listed within the tables.

2.6.1 Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table) - Worksheet #9b

EPA-NE QAPP Worksheet #9b - Rev. 10/99

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	Reporting Units	Project Action Limit (Units) (wet or dry weight)	Project Quantitation Limit (Units) (wet or dry weight)	Analytical Method		Achievable Field Analytical Limits	
				MDLs	Method RLs	MDLs	RLs
Field Analytical Procedures							
Secchi Depth	meters	NA – This is a generic QAPP for field procedures		0.1	0.1	0.1	0.1
Temperature	°C			0.0	0.0	0.0	0.0
Dissolved Oxygen	mg/L O_2			0.0	0.2	0.0	0.2
Salinity	ppt			0.0	<0.4	0.0	<0.4
Wind Speed	Code – See Field SOP 003			NA	NA	NA	NA
Light				NA	NA	NA	NA
Rain				NA	NA	NA	NA
State of Tide				NA	NA	NA	NA
Field Sample Collected							
Filters for chlorophyll-a analysis	NA			NA – Samples filtered in field, then kept frozen until analyzed by the URIWW Laboratory. Refer to URIWW Laboratory QAPP for QA/QC information on chlorophyll-a analysis.			
Filtered Water Sample (for chloride and dissolved nutrients: ammonia-N, orthophosphate-P and nitrate + nitrite-N^2)	NA			NA – Sample analyzed by the URIWW Laboratory. Refer to URIWW Laboratory QAPP for QA/QC information on analyses.			

EPA-NE QAPP Worksheet #9b - Rev. 10/99

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	Reporting Units	Project Action Limit (Units) (wet or dry weight)	Project Quantitation Limit (Units) (wet or dry weight)	Analytical Method		Achievable Field Analytical Limits	
				MDLs	Method RLs	MDLs	RLs
Unfiltered Water Sample (for pH, alkalinity and salinity[1])	NA			NA – Sample analyzed in the URIWW Laboratory. Refer to URIWW Laboratory QAPP for QA/QC information on analyses.			
Unfiltered Water Sample (for TSS and BOD)	NA			NA – Sample analyzed in the URIWW Laboratory. Refer to URIWW Laboratory QAPP for QA/QC information on analyses.			
Unfiltered Water Sample (for total nitrogen and phosphorus[3])	NA			NA – Sample analyzed in the URIWW Laboratory. Refer to URIWW Laboratory QAPP for QA/QC information on analyses.			
Unfiltered water sample (for fecal coliforms, *Escherichia coli* and enterococci)	NA			NA – Samples filtered in field and then analyzed in the URIWW Laboratory. Refer to URIWW Laboratory QAPP for QA/QC information on analyses.			

Notes:
[1]Salinity may be analyzed in the field or in the laboratory using a test kit. Refer to the URIWW Laboratory QAPP for further information on the laboratory analysis of salinity using a test kit.
[2]Samples are analyzed jointly for nitrate-N (NO_3-N) + nitrite-N (NO_2-N) because nitrite levels are generally very low and the method for separating the two species requires several extra steps.
[3]The total nitrogen and phosphorus analysis provides a value for all the nitrogen and phosphorus in a sample. This is in contrast to the analysis for nitrate + nitrite-N, ammonia-N, and orthophosphate-P; these analyses only provide values for specific dissolved species.

2.6.2 Field and Quality Control Sample Summary Table – Worksheet #9c

EPA-NE QAPP Worksheet #9c - Rev. 10/99

Field and Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	Total No. of Samples to Lab
Field Analytical Procedures									
NA	Secchi Depth	Ambient and Marine waters[1]	Field SOP 005	NA	2 – (measured 4 times)	NA	NA	NA	0 –Field measurement
NA	Temperature	Ambient and Marine waters	Field SOP 006	NA	0	NA	NA	NA	0 – Field Measurement
Unfiltered Water Sample	Dissolved Oxygen	Ambient and Marine waters	Field SOP 010	Deep (Hypolimnion)	2 (titrate 2 aliquots of each sample = 4 measurements)	NA	NA	NA	0 – Field Measurement
				Shallow (1 meter)	1 (titrate 2 aliquots of sample = 2 measurements)				
Unfiltered Water Sample	Salinity	Ambient and Marine waters	Field SOP 013	NA	1 (titrate 2 aliquots of sample = 2 measurements)	NA	NA	NA	0 – Field Measurement
NA	Wind Speed	NA	Field SOP 003	NA	NA	NA	NA	NA	0 – Field Measurement
NA	Light	NA	Field SOP 003	NA	NA	NA	NA	NA	0 – Field Measurement
NA	Rain	NA	Field SOP 003	NA	NA	NA	NA	NA	0 – Field Measurement

EPA-NE QAPP Worksheet #9c - Rev. 10/99

Field and Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	Total No. of Samples to Lab
NA	State of Tide	NA	Field SOP 003	NA	NA	NA	NA	NA	0 – Field Measurement
Field Samples Collected									
Filter	Chlorophyll-a	Ambient and Marine waters	Field SOP 007	NA	2 (filter 2 aliquots of each sample = 4 filters total)	0	0	0	4 filters
Filtered Water Sample	Chloride, Ammonia-N, Orthophosphate-P and Nitrate + Nitrite-N	Ambient and Marine waters	Field SOP 007	NA	0	0	0	0	1 bottle
Unfiltered Water Sample	pH, Alkalinity and Salinity	Ambient and Marine waters	Field SOP 009	NA	0	0	0	0	1 bottle
Unfiltered Water Sample	BOD and TSS	Ambient and Marine waters	Field SOP 009	NA	0	0	0	0	1 bottle
Unfiltered Water Sample	Total Nitrogen and Phosphorus	Ambient and Marine waters	Field SOP 009	NA	0	0	0	0	1 bottle
Unfiltered Water Sample	fecal coliforms *Escherichia coli* and enterococci	Ambient and Marine waters	Field SOP 008	NA	0	0	0	0	1 bottle

Note:
This QAPP deals with the field collection and analysis of samples only. Laboratory QA/QC is dealt with in the URIWW Laboratory QAPP. Additionally, due to the nature of the analyses performed by the laboratory there is no need to collect additional sample volume for MS and duplicate analyses, they come from the same bottle. Therefore, the MS column has been eliminated from this table.

[1] Ambient water refers to fresh surface water (rivers, ponds, lakes). Marine water refers to estuarine and marine waters.

2.6.3 Measurement Performance Criteria Table – Worksheet #11b

EPA-NE QAPP Worksheet #11b - Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	Field QC Sample and/or Field Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Field SOP Number	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Field Analytical Procedures					
Secchi Depth	Complete field measurement 4 times	Not greater than 0.25 m difference between all readings	Precision	005	A
	Calibrate yearly	Less than 10%D in gradation of measurement line	Accuracy	005	A
Temperature	Calibrate yearly	Difference less than +/- 1 °C from reference	Accuracy	006	A
Dissolved Oxygen (Unfiltered Water Sample)	Duplicate titration	Difference between measurements not greater than 1 mg/L DO	Precision	010	A
	Field Sample Duplication of deep water samples	Difference between measurements not greater than 1 mg/L DO	Precision	010	A & S
	Analysis of known sample (LCS)[1]	Value less than +/- 1 ppm different from known value	Accuracy	010	A&S
Salinity (Unfiltered Water Sample)	Analysis of known sample (LCS) [1]	Value less than +/- 2 ppt different from known value	Accuracy	013	A&S
	Duplicate titration	Difference between measurements not greater than 2 ppt	Precision	013	A

EPA-NE QAPP Worksheet #11b - Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	Field QC Sample and/or Field Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Field SOP Number	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Wind Speed	NA	NA	NA	003	NA
Light	NA	NA	NA	003	NA
Rain	NA	NA	NA	003	NA
State of Tide	NA	NA	NA	003	NA
Field Samples Collected					
Chlorophyll-a	Field duplicate pair	See URIWW Laboratory QAPP	Precision	007	S
	Filter each field sample twice	See URIWW Laboratory QAPP	Precision	007	S
	Sampling and processing of a sample in the laboratory[2]	Used to evaluate if persons collecting samples are processing samples correctly and the precision between samples of the same water collected by different persons.	Precision	007	007
Chloride, Ammonia-N, Orthophosphate-P and Nitrate + Nitrite-N	None (See URIWW Laboratory QAPP for QA/QC information)				
pH, Alkalinity and Salinity	None (See URIWW Laboratory QAPP for QA/QC information)				
BOD and TSS	None (See URIWW Laboratory QAPP for QA/QC information)				

EPA-NE QAPP Worksheet #11b - Rev. 10/99

Measurement Performance Criteria Table

Sampling Procedure	Field QC Sample and/or Field Activity Used to Assess Measurement Performance	Measurement Performance Criteria	Data Quality Indicators (DQIs)	Field SOP Number	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Total Nitrogen and Phosphorus	None (See URIWW Laboratory QAPP for QA/QC information)				
fecal coliforms, *Escherichia coli* and enterococci	None (See URIWW Laboratory QAPP for QA/QC information)				

Notes:
[1] Analysis of a known sample (LCS) is completed by volunteer monitors when they drop samples off at the URIWW Laboratory. A known sample of water is provided and the monitor is observed by a member of the URIWW Laboratory staff to ensure that they are completing the sampling and analysis procedures correctly. Ideally every volunteer monitor will process one LCS each year for DO and salinity, this is not always the case.
[2] Collection and filtration of a laboratory provided sample is completed by volunteer monitors when they drop samples off at the URIWW Laboratory. A sample of water is provided and the monitor is observed by a member of the URIWW Laboratory staff to ensure that they are completing the sampling and filtration procedures correctly. This sample is not a LCS as the URIWW Laboratory does not know the concentration of chlorophyll-a in the provided sample. Rather, after each volunteer monitor has completed the sampling exercise the samples are analyzed and the results compared to determine if there are any major differences among the volunteer monitor's samples.

2.6.4 Sampling Locations, Sampling and Analysis Method/SOP Requirements Table – Worksheet #12b

EPA-NE QAPP Worksheet #12b - Rev. 10/99

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location & Depth	Parameter	Matrix	# Samples	Field SOP	Lab. SOP	Sample Volume	Containers (number, size and type)	Preservation	Max Holding time
Field Analytical Procedures									
Various – Project Specific	Secchi Depth	NA	4	005	NA	NA	NA	NA	NA
	Temperature	NA	1	006	NA	NA	NA	NA	Analyze sample as soon as collected
	Dissolved Oxygen	Unfiltered Water Sample	Deep -2 (Titrated 2 times)	010	NA	60 mL	2, 60 mL glass DO bottles	Ice/4 °C	1 hour
		Unfiltered Water Sample	Shallow – 1 (titrated 2 times)	010	NA	60 mL	1, 60 mL glass DO bottle	Ice/4 °C	1 hour
	Salinity	Unfiltered Water Sample	2 (titrate sample 2 times)	013	NA	2 mL	1, 125 mL plastic bottle	none	none
	Wind Speed	NA	NA	003	NA	NA	NA	NA	NA
	Light	NA	NA	003	NA	NA	NA	NA	NA
	Rain	NA	NA	003	NA	NA	NA	NA	NA
	State of Tide	NA	NA	003	NA	NA	NA	NA	NA

EPA-NE QAPP Worksheet #12b - Rev. 10/99

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location & Depth	Parameter	Matrix	# Samples	Field SOP	Lab. SOP	Sample Volume	Containers (number, size and type)	Preservation	Max Holding time
Field Samples Collected									
	Chlorophyll-a	Filter	4 filters (2 water samples)	007	012	100 mL from each of 2 250 mL bottles	Aluminum foil packet	Place in zip-lock plastic bag with desiccant chips and freeze	6 months
	Chloride, Ammonia-N, Orthophosphate-P and Nitrate + Nitrite-N	Filtered Water Sample	1	007	013, 014 & 015	60 – 125 mL	1, 60 – 125 mL brown glass bottle	Ice/4 °C	Chloride – 1 year; Ammonia-N, Orthophosphate -P and Nitrate + Nitrite-N 30 days
	pH, Alkalinity and Salinity	Unfiltered Water Sample	1	009	010 & 017	200 mL	1, 500 mL white HDPE bottle	Ice/4 °C	pH and Alkalinity - 24 hours Salinity -1 year
	BOD and TSS	Unfiltered Water Sample	1	009	011 & 009	500 mL	1, 500 mL HDPE bottle	Ice/4 °C	BOD – 24 hours TSS – 1 week
	Total Nitrogen and Phosphorus	Unfiltered Water Sample	1	009	016	100 mL	1, 125 – 250 mL brown glass bottle	Ice/4 °C	30 days
	fecal coliforms, *Escherichia coli* and enterococci	Unfiltered Water Sample	1	008	007	100 mL	1, 250 – 500 mL sterile white plastic bottle	Ice/4 °C	6 hours

2.6.5 Field Sampling Equipment Calibration Table - Worksheet #14

EPA-NE QAPP Worksheet #14 - Rev. 10/99

Field Sampling Equipment Calibration Table

Equipment	Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Secchi Disk	Check gradations on calibrated line attached to Secchi Disk	Yearly	Less than 10% difference between line and reference	Replace calibrated line	URIWW Laboratory Staff	005
Thermometer	Check thermometer against standard thermometer	Yearly	Less than +/- 1 °C difference between thermometer and reference	Replace or repair thermometer	URIWW Laboratory Staff	006
Deep Sampler	Check calibrated line	Yearly	Less than 10% difference between line and reference	Replace calibrated line	URIWW Laboratory Staff	012

2.6.6 Field Equipment Maintenance, Testing and Inspection Table – Worksheet #15

EPA-NE QAPP Worksheet #15 - Rev. 10/99

Field Equipment Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	SOP Reference
Secchi Disk	Rinse with tap water after use and allow to dry	NA	Make sure line is attached securely to Secchi disk	Person(s) collecting sample	Before each use	Securely attached	Attach line securely.	005
Thermometer	Rinse with tap water after use and allow to dry	Electronic thermometers only: Make sure that thermometer turns on	Electronic thermometers: make sure probe is not damaged. Spirit thermometers: Make sure spirit is continuous in the thermometer (no breaks in internal fluid) and that the probe is not damaged.	Person(s) collecting sample	Before each use	Electronic thermometers: thermometer turns on and probe is not damaged. Spirit thermometer: Spirit is continuous and probe is not damaged.	Electronic thermometers: replace battery if probe does not turn on. If still not operational call URIWW Laboratory for a replacement thermometer. Spirit thermometer: Call URIWW Laboratory for a replacement thermometer.	006
Filter housings, syringe	Rinse with tap water after use and allow to dry	NA	Check that filter housing and syringe are not cracked or damaged.	Person(s) collecting sample	Before each use	Filter housing and syringe are not damaged.	Call URIWW Laboratory for a replacement filter housing and/or syringe.	007

EPA-NE QAPP Worksheet #15 - Rev. 10/99

Field Equipment Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	SOP Reference
DO test kit	Rinse all syringes and glassware with tap water after use, allow to dry	NA	•Check that enough reagent is available for the next round of sampling and that it is the correct color (color change indicates reagent needs replacement). • Make sure there is no precipitate in the reagent bottles. Precipitate indicates that reagent must be replaced. •Check that syringes and glassware are not damaged.	Person(s) collecting sample	Before each use	No equipment is damaged and enough good reagent is available for next sampling round.	Call URIWW Laboratory for replacement equipment or more reagent.	010
DO test kit	Replace all reagents and clean test kit components	NA	NA	URIWW Laboratory Staff	Yearly	NA	NA	010
Shallow water sampler	Rinse with tap water after use and allow to dry	NA	Ensure that the primer bulb is not cracked and the tubing is securely attached to the sampler.	Person(s) collecting sample	Before each use	Equipment is not damaged.	Call URIWW Laboratory for replacement sampler.	011

EPA-NE QAPP Worksheet #15 - Rev. 10/99

Field Equipment Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	SOP Reference
Deep water sampler	Rinse with tap water after use and allow to dry	NA	Ensure the sampler is operational, that all lines are securely attached to sampler and the weight is attached to the sampler. Also check that the tube that goes into the DO bottle is present. If it is not there replace it using the barrel of a round Bic® pen cut to the appropriate length.	Person(s) collecting sample	Before each use	Equipment is not damaged, line is securely attached and tube leading into the DO bottle is present.	Call URIWW Laboratory for a replacement sampler and/or re-attach sampler line.	012
Salinity test kit	Rinse all syringes and glassware with tap water after use, allow to dry	NA	Check that enough reagent is available for the next round of sampling, that syringes and glassware are not damaged.	Person(s) collecting sample	Before each use	No equipment is damaged and enough reagent is available for next sampling round.	Call URIWW Laboratory for replacement equipment or more reagent.	013
	Replace all reagents and clean test kit components	NA	NA	URIWW Laboratory Staff	Yearly	NA	NA	013

2.6.7 Field Analytical Method/SOP Reference Table (Test Kits and Instruments) –Worksheet #17

EPA- NE QAPP Worksheet #17 – Rev. 10/99

Field Analytical Method/SOP Reference Table

Reference Number (Field SOP Number)	Title, Revision Date and/or Number	Analytical Parameter	Instrument
001	Safety First, 3/05	None	None
002	Where We Monitor: Pin-Pointing Your Monitoring Location, 3/05	Location of Monitoring	None
003	Monitoring Postcard Instructions, 3/05	Wind Speed, Light, Rain, State of Tide	None
004	Handling and Transporting Water Samples, 3/05	None	None
005	Secchi Depth Transparency, 3/05	Secchi Depth	Secchi Disk
006	Water Temperature, 3/05	Water Temperature	Thermometer
007	Chlorophyll (Algae) And Dissolved Nutrients, 3/05	Chlorophyll-a, Chloride, Ammonia-N, Orthophosphate-P and Nitrate + Nitrite-N	Filter Housing and Syringe
008	Bacterial Monitoring, 3/05	enterococci, fecal colifroms and E. coli	None
009	Collecting Unfiltered Water Samples, 3/05	pH, Alkalinity, BOD, TSS, Salinity, Total Nitrogen and Phosphorus	None
010	Dissolved Oxygen Monitoring, 3/05	Dissolved Oxygen	DO Test Kit
011	Shallow Water Sampler Operation, 3/05	None	Shallow Water Sampler
012	Deep Water Sampler Operation, 3/05	None	Deep Water Sampler
013	Monitoring Salinity, 3/05	Salinity	Salinity Test Kit

2.6.8 Field Sampling QC Table – Worksheet 22a

Note that other collected samples: nutrients (ammonia-N, orthophosphate-P & nitrate + nitrite-N), pH, alkalinity, TSS, salinity, BOD, total nitrogen and phosphorus and bacteria (*Escherichia coli,* fecal coliforms and enterococci) do not have any associated field sampling QC. All QC procedures (duplicate analyses, blanks, etc.) are completed in the laboratory. Therefore, there are no field sampling QC tables (Worksheet #22a) for these parameters.

EPA-NE QAPP Worksheet #22a - Rev. 10/99 - Field Sampling QC Table

Chlorophyll (algae)

Sampling SOP	Field SOP 007	Analytical Method/SOP Reference	Laboratory SOP 012
Medium/Matrix	Filter / Ambient or Marine Waters	Sampler's Name	Various
Analytical Parameter	Chlorophyll-a	Field Sampling Organization	NA
Concentration Level (undiluted sample)	Ambient and marine samples: <0.2 – 100 µg/L chlorophyll-a	No. of Sample Locations	NA

Field QC:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Field Duplicate Pair (raw water)	100%	See Laboratory QAPP	See Laboratory QAPP	URIWW Staff	Precision
Field Filtration Duplicate	100%	See Laboratory QAPP	See Laboratory QAPP	URIWW Staff	Precision
Sampling and processing of a provided sample in the laboratory	1 - yearly	Used to evaluate program and if person(s) collecting samples are processing samples correctly.	Re-train person(s) collecting samples if needed	URIWW Staff	Precision

Note:
No measurement performance criteria are provided in this table as this QAPP is for general field procedures and not associated with a specific project

2.6.9 Field Analytical QC Table – Worksheet 23a

EPA-NE QAPP Worksheet #23a - Rev. 10/99 - Field Analytical QC Table

Secchi Depth

Sampling SOP	Field SOP 005	Analytical Method/SOP Reference	NA – Field Measurement
Medium/Matrix	Ambient or Marine Waters	Sampler's Name	Various
Analytical Parameter	Secchi Depth	Field Sampling Organization	NA
Concentration Level	NA	No. of Sample Locations	NA

Field QC:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Field Duplicate Measurements	100%	Not greater than 0.25 meter difference between all readings	Flag data as inconsistent	L. Green, E. Herron	Precision
Calibrate measurement line	Yearly	Less than 10%D in gradation of measurement line	Replace calibrated line	URIWW Staff	Accuracy

Note:
No measurement performance criteria are provided in this table as this QAPP is for general field procedures and not associated with a specific project.

EPA-NE QAPP Worksheet #23a - Rev. 10/99 - Field Analytical QC Table

Temperature

Sampling SOP	Field SOP 006	Analytical Method/SOP Reference	NA – Field Measurement
Medium/Matrix	Ambient or Marine Waters	Sampler's Name	Various
Analytical Parameter	Temperature	Field Sampling Organization	NA
Paramter Level	0 -100 °C	No. of Sample Locations	NA

Field QC:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Calibrate	Yearly	Difference less than +/- 1 °C from reference	Replace or repair thermometer	URIWW Staff	Accuracy

Note:
No measurement performance criteria are provided in this table as this QAPP is for general field procedures and not associated with a specific project

EPA-NE QAPP Worksheet #23a - Rev. 10/99 - Field Analytical QC Table

Dissolved Oxygen

Sampling SOP	Field SOP 010	Analytical Method/SOP Reference	NA – Field Test Kit
Medium/Matrix	Ambient or Marine Waters	Sampler's Name	Various
Analytical Parameter	Dissolved Oxygen	Field Sampling Organization	NA
Concentration Level	0 – 10 mg/L O_2	No. of Sample Locations	NA

Field QC:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)
Duplicate Titration	100%	Results not more than 1 mg/L O_2 different	Complete a third titration and record results	Sampler	Precision
Collect field duplicate pair (deep water samples only)	100%	Results not more than 1 mg/L O_2 different	Complete a third titration and record results	Sampler	Precision
Analysis of known sample (LCS)	Yearly	Value less than +/- 1 ppm different from known value	Sampler is re-trained in how to complete analysis	L. Green or E. Herron	Accuracy

Note:
No measurement performance criteria are provided in this table as this QAPP is for general field procedures and not associated with a specific project

EPA-NE QAPP Worksheet #23a - Rev. 10/99 - Field Analytical QC Table

Salinity

Sampling SOP	Field SOP 013	Analytical Method/SOP Reference	NA – Field Test Kit
Medium/Matrix	Marine Waters	Sampler's Name	Various
Analytical Parameter	Salinity	Field Sampling Organization	NA
Concentration Level	<0.4 – 40 ppt	No. of Sample Locations	NA

Field QC:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for A	Data Quality Indicator (DQI)
Analysis of known sample (LCS)	Yearly	Value less than +/- 2 ppt different from known value	Sampler is re-trained in how to complete analysis	L. Green or E. Herron	Accuracy

Note:
No measurement performance criteria are provided in this table as this QAPP is for general field procedures and not associated with a specific project

3.0 SAMPLE HANDLING, TRACKING AND CUSTODY REQUIREMENTS

Data collected using field analysis procedures (Secchi depth, temperature, DO, salinity, wind speed, light, rain and state of tide) are returned to the URIWW Laboratory on monitoring postcards (see Field SOP 003) or a similar document. The postcard includes the date and time of sampling, sampling location and monitor(s) name(s) as well as the project data.

Collected samples are transported to the URIWW Laboratory by the sampler. When dropping off the samples at the laboratory the sampler signs their name on the sample log sheet, provides the date and time the samples were collected and alerts laboratory staff if the required samples were not collected. Sample log sheets provided by the URIWW Laboratory act as the project chain of custody and are retained by the URIWW Laboratory in the project file (figure 3).

The sample log sheet will include the following information:

1. Project Name
2. Project Location
3. Person(s) responsible for transporting samples
4. Date and time of sample collection
5. Sample identification name/number
6. Number and type of sample bottles

A technician will be responsible for checking that the samples listed on the sample log sheet correspond correctly with the samples received. A copy of the sample log sheet will be maintained in the project file. Project files are maintained in the main URIWW laboratory and Linda Green's office, in the URI Coastal Institute. Both locations are locked when staff are not present.

3.1 Acceptance of Expendable Laboratory supplies

All expendable laboratory supplies such as test kit reagents and sample bottles will be inspected upon arrival by either Linda Green or Elizabeth Herron. Packages containing damaged material or packages that were open upon arrival will not be accepted. Chemicals will be marked with the date of acceptance as well as the date they are opened.

Figure 3 - Example sample log sheet

2004 Lakes Log Sheet: THIRD Triseason (October 2004)
You should have all of the bottles/bags listed with your monitoring location.

#	Depth	Monitoring Location	Your name	Date	Time Collected	Plastic Unfiltered	Brown Unfiltered	Brown Filtered	Plastic Sterile	Chl-a baggy	Tributary Bottles
1	S	Almy Pond				1	1	1	1	1	
2	S	Alton Pond				1	1	1	1	1	
3	S	Arnold Pond				1	1	1	1	1	
4	D	Barber Pond				1	2	1	1	1	
5	S	Belleville P - Lower				1	1	1	1	1	
6	S	Belleville P - upper				1	1	1	1	1	
7	S	Blackamore Pond				1	1	1	1	1	
8	S	Bowdish Reservoir				1	1	1	1	1	
9	S	Breakheart Pond				1	1	1	1	1	
10	D	Brickyard Pond				1	2	1	1	1	
11	S	Browning Mill Pond				1	1	1	1	1	
12	D	Carbuncle Pond				1	2	1	1	1	
13	D	Carr Pond (NK)				1	2	1	1	1	
14	D	Carr Pond (WG)				1	2	1	1	1	
15	S	Chapman Pond				1	1	1	1	1	
16	D	Deep Pond				1	2	1	1	1	
17	D	Fenner Pond				1	2	1	1	1	
18	S	Flat River Reservoir				1	1	1	1	1	
19	D	Georgiaville Pond				1	2	1	1	1	
20	D	Handy Pond				1	1	1	1	1	
21	S	Hawkins Pond				1	1	1	1	1	
22	S	Hundred Acre Pond				1	1	1	1	1	
23	D	Indian Lake				1	1	1	1	1	
24	S	Keech Pond				1	1	1	1	1	
25	S	Lake Washington				1	1	1	1	1	
26	S	Lily Pond				1	1	1	1	1	
27	S	Little Pond				1	1	1	1	1	
28	D	Locustville Pond				1	1	1	1	1	
29	S	Long Pond (SK)				1	1	1	1	1	
30	D	Lower Sprague Res.				1	1	1	1	1	
31	S	Mashapaug Pond				1	1	1	1	1	
32	S	Meadowbrook Pond				1	1	1	1	1	

3.2 Sample Handling System – Worksheet 16

EPA-NE QAPP Worksheet #16 - Rev. 10/99 **Sample Handling System**
SAMPLE COLLECTION, PACKAGING AND SHIPMENT
Sample Collection: Various persons Sample Packing: Person(s) responsible for sample collection Coordination of Shipment: Person(s) responsible for sample collection Type of Shipment: Generally the person responsible for sample collection or their designee.
SAMPLE RECEIPT AND ANALYSIS
Responsible Organization: University of Rhode Island Watershed Watch Laboratory (URIWW) Sample Receipt: URIWW Staff Sample Custody and Storage: URIWW Staff Sample Preparation: URIWW Staff Sample Determinative Analysis: URIWW Staff
SAMPLE ARCHIVAL
Field Sample Storage (No. of days from sample collection): Dependent upon analysis – Refer to URIWW Laboratory Program QAPP. Sample Extract/Digestate Storage (No. of days from extraction/digestion): Dependent upon analysis – Refer to URIWW Laboratory Program QAPP.
SAMPLE DISPOSAL
Responsible Organization and personnel: URIWW / URIWW Staff

4.0 PROJECT DOCUMENTATION AND RECORDS

All sample log sheets will be retained by the laboratory in the project files. All hard copy field data sheets will also be retained in the project files. Project files are maintained in the main URIWW laboratory and Linda Green's office, in the URI Coastal Institute by Linda Green and Elizabeth Herron. Both locations are locked when staff are not present. Electronic data are stored on a password protected laboratory computer that is networked to several other password protected computers throughout the URIWW Laboratories and offices. All laboratory data (electronic and hard copy) are retained for at least 10 years.

No general quality management reports are prepared. During the analysis and collection of field samples the volunteer or technician completing sample analysis or collection is responsible for recording any problems with meeting measurement performance criteria (Section 2.6.3) and/or instrument operational issues. Any failure of a sample to meet defined measurement performance criteria should be recorded and the data flagged for further review upon data entry and final data validation.

Data generated by each analysis is internally validated by either Ms. Green or Ms. Herron by comparing the data to criteria in the appropriate tables in Section 2.6. The data validation process starts once the data has been produced and it is entered into Microsoft Excel files. After data has been entered into the appropriate file, URIWW staff complete an initial check to be sure all data was entered correctly. Then, Ms. Green or Ms. Herron check the data entered for errors and correct any. Outliers and inconsistencies are flagged for further review. If data collected by volunteer monitor is flagged, then the monitor is contacted to check that the data sent to the laboratory was correct. Data are compared to values obtained for similar samples analyzed in the past. The decision to discard data will be made by either Ms. Green or Ms. Herron.

Appendix A

Standard Operation Procedures
List of SOPs

Description	SOP Number
Safety First	001
Where We Monitor: Pin-Pointing Your Monitoring Location	002
Monitoring Postcard Instructions	003
Handling and Transporting Water Samples	004
Secchi Depth Transparency	005
Water Temperature	006
Chlorophyll (Algae) And Dissolved Nutrients	007
Bacterial Monitoring	008
Collecting Unfiltered Water Samples	009
Dissolved Oxygen Monitoring	010
Shallow Water Sampler Operation	011
Deep Water Sampler Operation	012
Monitoring Salinity	013

Appendix B

Resumes for Key Laboratory Personnel
List of Resumes

Arthur Gold, PhD

Linda Green, MS

Elizabeth Herron, MA

Jose Amador, PhD

Appendix C

Descriptive Information Regarding
University of Rhode Island Watershed Watch (URIWW)