Roseland Lake Nutrient Source Study RFA # 15060
Approved May 15, 2015

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ROSELAND LAKE, WOODSTOCK, CT

NUTRIENT SOURCE STUDY

Quality Assurance Project Plan

Collecting Lake, Stream and Storm Water Samples for Analysis Using a Qualified Laboratory

US EPA RFA # 15060

Eastern Connecticut Conservation District

Approved May 15, 2015

This document outlines the protocols for collecting surface and lake water samples that will be transported to a laboratory for analysis; taking secchi disk readings; and measuring stream flow from a calibrated staff gauge.

This project is funded in part by an US EPA Clean Water Act § 319 NPS grant through the CT DEEP. Project support also provided by the Town of Putnam, CT and The Last Green Valley, Inc.

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A3. Distribution List

Table A3-1 QAPP Distribution List

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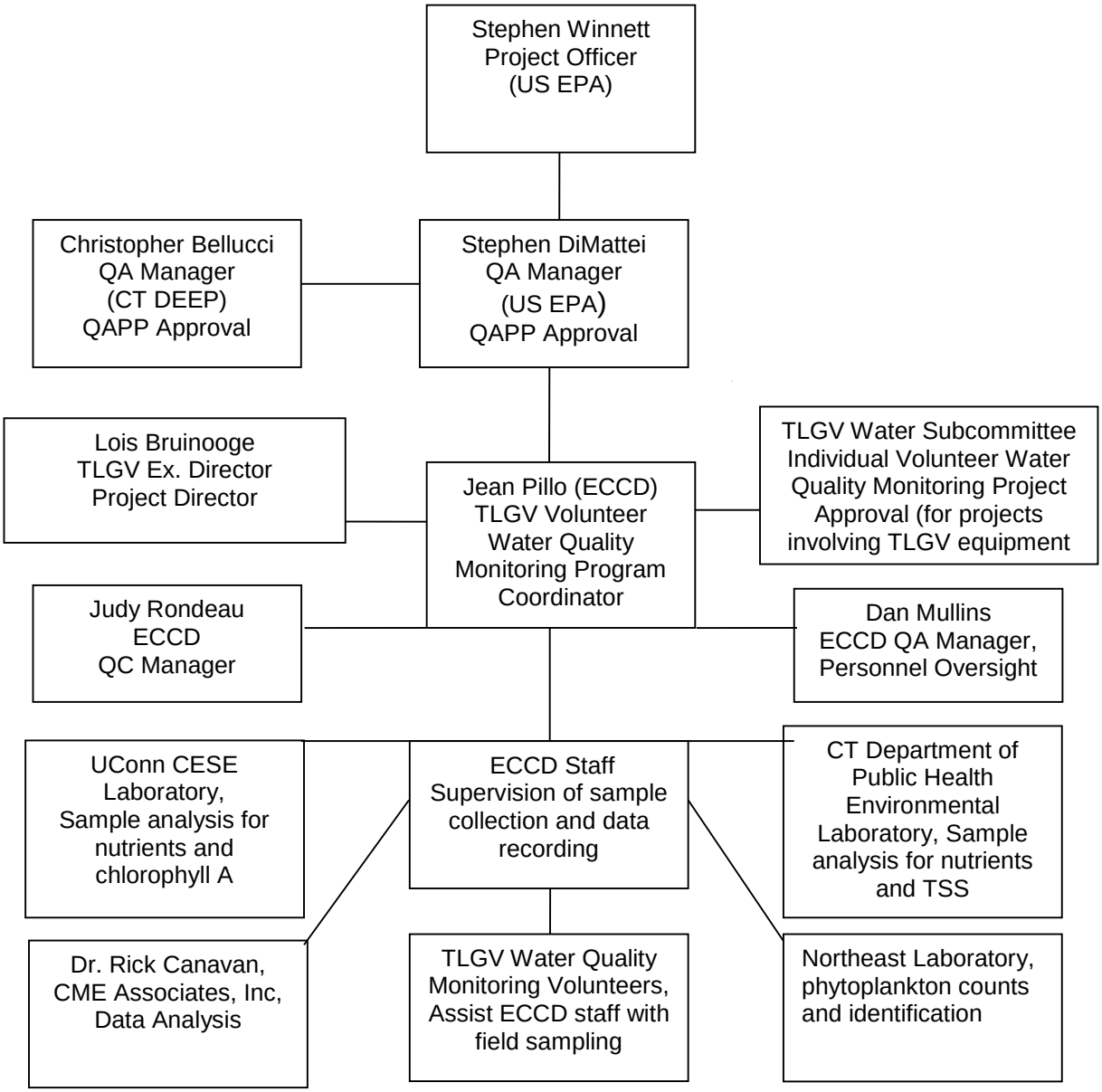
A4. Project Task Organization

The Eastern Connecticut Conservation District (ECCD) will be the lead organization involved with this project. Before the start of any water sample collections, ECCD will organize a meeting with the Technical Advisory Committee to review the proposed monitoring plan for this project to assure the monitoring plan conforms to the project objectives. A Memorandum of Understanding will be obtained from key project partners at the beginning of this project outlining the role of each key organization in the success of this study.

Figure A4-1. Program Organization



Key personnel associated with the project are identified in Figure A4-2

Jean Pillo, Watershed Conservation Project Manager for the Eastern Connecticut Conservation District (ECCD), also acting as The Last Green Valley Volunteer Water Quality Monitoring Coordinator, will be directly responsible for coordination, management, and implementation of the project, and will be assisted by other ECCD staff, volunteers and local project partners (e.g. municipalities, CT DEEP, CT DPH and other data users).

The Last Green Valley, Inc (TLGV) is a non-profit organization. It is the managing entity for the The Last Green Valley National Heritage Corridor. TLGV obtained Van Dorn Samplers and secchi disks through the US EPA Region 1 Equipment Loan Program. TLGV:

- Provides the use of this equipment to trained individual volunteer water quality monitoring groups,
- Provides for the maintenance and upkeep of this equipment, and
- Provides funds to ECCD to staff a part time TLGV Volunteer Water Quality Monitoring Program Coordinator and other support services.
- Assures that data is shared with government agencies, local municipalities and the public.

ECCD provides a qualified staff member to act as TLGV Volunteer Water Quality Monitoring (WQM) Program Coordinator who will work directly with volunteers to meet their training needs based on prior experience and knowledge.

ECCD

- Prepares and update the Quality Assurance Project Plan (QAPP) and assures all protocols are followed equally by all staff and volunteers involved in data collection and recording
- Helps to build a solid volunteer base and delegate tasks within that base.
- Assures there is a volunteer qualified to use the equipment safely and accurately at each monitoring event.
- Is adequately trained in the use of the equipment in order to field trouble shoot minor equipment issues and to recognize equipment failures (data out of range).
- Assures TLGV WQM Program Coordinator receives all raw and associated QC data.
- Assures the equipment is properly handled and maintained.

TLGV WQM Program Coordinator:.

- Recruits and trains new volunteers.
- Oversees equipment calibration and scheduling.
- Keeps a log of equipment maintenance reports and keeps track of the inventory of all consumable supplies.

The Last Green Valley Water Subcommittee:

- Reviews proposed Water Quality Monitoring Projects and site selections for compatibility with the stated goals of the using TLGV equipment prior to the beginning of the monitoring season.

The Last Green Valley Water Subcommittee Advisory Members include:

Lois Bruinooge, Executive Director, The Last Green Valley: approves projects using TLGV equipment.

Therese Beaudoin, Massachusetts Department of Environmental Protection Watershed Coordinator: provides advice on all matters related to water quality monitoring in the Massachusetts portion of the watershed;

Eric Thomas, Connecticut Department of Energy and Environmental Protection Watershed Manager: provides advice on water quality issues in the Connecticut portion of the watershed;

Dr. Mauri Pelto, Nichols College Science Department Chair: arranges for installation and calibration of staff gauges, receives staff gauge data, and reports on flow data.

Dr. Richard Canavan, CME Associates: provides guidance on lake assessments.

Marc Cohen, Source Water Program Manager, Atlantic States Rural Water and Wastewater Association: provides guidance on sampling locations within the Little River watershed.

Technical Advisory Committee:

Steve DiMattei, Environmental Protection Agency New England Region: reviews the QAPP and changes thereto for accuracy and completeness, and approves the QAPP;

Christopher Bellucci, Supervisory Environmental Analyst, CT DEEP: reviews the QAPP and changes thereto for accuracy and completeness, and approves the QAPP for compliance with Connecticut DEEP requirements.

Charles Lee, Supervisory Environmental Analyst, CT DEEP: provides guidance on lake assessments within the Connecticut portion of the watershed. Will receive quarterly project updates.

Jon Morrison, CT Office Chief, USGS Water Science Center: provides expertise in data interpretation, especially related to sediment core sampling. USGS will be hired to collect, analyze and interpret sediment core samples from select locations of Roseland Lake. The sediment collection and analysis QAPP and standard operating procedures will be presented independent of this nutrient study QAPP.

Dr. Richard Canavan, CME Associates: provides guidance on lake assessments and will assist with the development of the monitoring plans specific to Roseland Lake, Woodstock, CT. ECCD will subcontract with Dr. Canavan for data interpretation.

Marc Cohen, Source Water Program Manager, Atlantic States Rural Water and Wastewater Association: provides guidance on sampling locations within the Little River watershed.

Eric McPhee, Supervisor, CT Department of Public Health Source Water Protection Unit: acts as liaison between ECCD and CT DPH laboratory. Will receive quarterly project updates.

Eric Thomas, Connecticut Department of Energy and Environmental Protection Watershed Manager: US EPA NPS grant coordinator, will review project reports and provide guidance throughout the project period. Will receive quarterly project updates.

Dr. Mauri Pelto, Nichols College Science Department Chair: arranges for installation and calibration of staff gauges, receives staff gauge data, and reports on flow data. Dr. Pelto, with

his students, will install and calibrate stream flow curves for this project to be used for load calculations.

Jerry Beausoleil, Supervisor, Putnam Public Works Department: Oversees the Putnam Drinking Water Treatment Plant and will act as project liaison for the Town of Putnam. Will receive quarterly project updates.

Project Meetings and Communications

Prior to the initiation of the water quality monitoring sampling season, ECCD will communicate with all project partners and stakeholders and organize a Roseland Lake Stakeholders Meeting. All partners with an active role in the project will be required to sign a Memorandum of Understanding defining their role in the project.

This QAPP will be distributed to all persons listed in Section A3. The labs at the University of Connecticut Center for Environmental Science and Engineering, Storrs, CT, Northeast Laboratories, Incorporated, Berlin, CT, CT Department of Public Health Environmental Laboratory, Rocky Hill, CT or other pre-approved water analysis lab will be notified in advance with an estimate of the expected number and timing of samples to be delivered for analysis.

The Project Manager will be in regular contact with all stakeholders during the course of this project to insure project progress. By contract, ECCD will provide quarterly project updates to the CT DEEP in their role as US EPA Clean Water Act § 319 NPS Grant managers. These quarterly project reports will also be shared with the CT DPH and the Town of Putnam as they are significant project sponsors.

A5. Problem Definition, Background Information and Goals

A5.1 Problem Definition:

Roseland Lake, located in the Little River watershed in Woodstock, CT, is listed as impaired for recreation in the CT DEEP Water Quality Assessment Report, most recently in 2014. The functional definition of recreation is swimming, water skiing, surfing or other full body contact activities (primary contact), as well as boating, canoeing, kayaking, fishing, aesthetic appreciation or other activities that do not require full body contact (secondary contact). The impairment category for Roseland Lake is Nutrient/Eutrophication and Biological Indicators.

A5.2 Background Information:

There are no public bathing beaches in Roseland Lake. CT Public Health Codes prohibit swimming in Roseland Lake as it is within two miles of a public drinking water supply surface water intake. Therefore, the lake is not routinely assessed for indicator bacteria during the summer bathing season.

Roseland Lake is in the Little River watershed, and is approximately two miles upstream of the surface water intake of a drinking water supply serving approximately 4000+ people in the neighboring town of Putnam. The Putnam Water and Sewer Department has been managing

Roseland Lake for excess algal growth by treatment with copper sulfate. Their staff has been using a subjective method to decide when to apply the algaecide. Copper sulfate is commonly applied several times during the summer months. Improper application of copper sulfate can be both damaging the aquatic habitat and can actually exacerbate the problem they are trying to treat. Roseland Lake is observed to experience numerous algae blooms during the warm weather season, including blue green algae blooms. Identification of the types and concentration of algae in Roseland Lake is important to protect recreational boaters and fishermen from coming in contact with potentially toxic harmful algae blooms and is important data for developing appropriate treatment methods for control of algae blooms.

A 1984 study on the Side Effects of 58 Years of Copper Sulfate Treatment of Fairmont Lakes, Minnesota (Stephan, 1984) is summarized in the Executive Summary of the report:

> "The shallow Fairmont Lakes in southern Minnesota have been treated with copper sulfate for 58 years to reduce excessive algal growth. Data collected since treatment of the Fairmont Lakes began in 1921 provide alarming insights into lake responses to sustained chemical treatment with copper sulfate. Short-term and long-term effects have occurred. Short-term effects include: a) the intended temporary killing of algae, b) dissolved oxygen depletion by decomposition of dead algae, c) accelerated phosphorus recycling from the lake bed and recovery of the algal population within 7 to 21 days, and d) occasional fish kills due to oxygen depletion or copper toxicity or both. Long-term effects are shown to include: a) copper accumulation in the sediments, b) tolerance adjustments of certain species of algae to higher copper sulfate dosages, c) shift of species from green to blue-green algae and from game fish to rough fish, d) disappearance of macrophytes, and e) reductions in benthic macroinvertebrates. The conclusion is that while copper sulfate treatments enjoy great popularity because they kill and remove algae almost instantaneously, other immediate or cumulative side effects can be harmful to many other aquatic organisms."

Data needed for alternate treatment methods for management of the Roseland Lake as a drinking water supply is currently not available. If alternate treatment options for algae blooms are to be considered, an evaluation of the upper watershed nutrient contributions as well as in-lake source analysis is essential. The in-lake source analysis needs to include an evaluation of the phosphorus load in the lake bottom sediments through the analysis of a set of bottom sediment samples. An outcome of this project will be that the data generated will improve Putnam's ability to manage the upstream waters as a public drinking water supply and to consider alternate treatment methods in the lake, such as an Alum treatment, that will have long term benefits with less environmental impacts.

The Little River/Muddy Brook/Roseland Lake Watershed Based Plan was prepared by ECCD in 2009 in advance of an expected fuller watershed study to be conducted by the USDA Natural Resources Conservation District (NRCS). The watershed review conducted by ECCD relied on scarce data from secondary sources. The fuller watershed study by NRCS was never completed.

The National Water Quality Initiative (NWQI), which commits to improving impaired waterways nationwide, is a program of NRCS. NRCS manages the initiative by making funds

available to farmers and forest landowners in selected watersheds. The Little River Watershed was chosen in 2012 to receive special NWQI status and continues to maintain that status. In partnership with the CT Department of Energy and Environmental Protection (CT DEEP), ECCD and NRCS have been involved in several agricultural and stormwater quality improvement implementation projects in the watershed. There is no numerical water quality data to evaluate the effectiveness of those efforts on the water quality conditions involving nutrient or sediment concentrations in Muddy Brook or Little River, and limited information on water quality in Roseland Lake. The most current comprehensive review of the watershed, *Suspended-Sediment Characteristics of Muddy Brook at Woodstock, CT* (Kulp, 1991) was based on water quality data collected in the early 1980s. The watershed upstream of Roseland Lake includes eight active dairy farms and other land used for grazing large livestock. There has been a significant reduction in the number of active dairy farms upstream of Roseland Lake and several of the remaining dairy farms have installed Best Management Practices to reduce non-point source (NPS) pollution runoff with federal funding assistance. Other NPS reduction strategies have also been implemented in the drainage area for Roseland Lake, including the installation of a bio-retention rain garden and a vegetated riparian buffer installation along a stream that drains through a golf course. The 1991 USGS report provides a baseline for comparison of the water quality condition in the watershed, but does not reflect the current conditions in the watershed.

CT DEEP sampled Roseland Lake as part of the National Lakes Assessment Program in 2007 and in 2012. The most recent data was expected to be ready for review in 2014 but has not yet been released. As part of this assessment, none of the tributaries flowing to Roseland Lake were evaluated for nutrient or sediment contributions to the lake. Lake bottom core samples collected during these surveys were not evaluated for phosphorus or copper concentrations.

Through invitation by ECCD, the Connecticut Agricultural Experiment Station (CAES) conducted an aquatic weed survey of Roseland Lake in 2012. The complete results of that study are available at http://www.ct.gov/caes/cwp/view.asp?a=2799&q=514228. Their evaluation of the lake on June 19, 2012 included water sampling in a representative deeper area of the lake. The surface water sample (0.5 meter) for Total Phosphorus measured 0.082 mg/L, which would be categorized at highly eutrophic when compared to lake trophic categories included in the Connecticut Water Quality Standards most recent 2011 update. The Total Phosphorus of the sample collected at 5 meters measured 0.334 mg/L. The dissolved oxygen concentration at 5 meters indicated anoxic conditions. The lake depth at their monitoring location was not indicated. The maximum lake depth indicated on the attached Roseland Lake bathymetry map is 18 feet or approximately 5.5 meters.

The CAES field data also indicated that a total of twelve aquatic plant species were located during this survey and none of those species are listed as invasive in Connecticut. However their aquatic plant transect analysis indicated that species diversity along the ten transects were limited to seven species and no aquatic vegetation was indicated at a depth greater than 0.7 meters.

Parameters and Defining Ranges for Trophic State of Lakes in Connecticut		
Trophic State Based on Water Column Data	Parameters	Defining Range
Oligotrophic	Total Phosphorus	0-10 ug/l spring and summer
	Total Nitrogen	0-200 ug/l spring and summer
	Chlorophyll-a	0-2 ug/l mid-summer
	Secchi Disk Transparency	6 + meters mid-summer
Mesotrophic	Total Phosphorus	10-30 ug/l spring and summer
	Total Nitrogen	200-600 ug/l spring and summer
	Chlorophyll-a	2-15 ug/l mid-summer
	Secchi Disk Transparency	2-6 meters mid-summer
Eutrophic	Total Phosphorus	30-50 ug/l spring and summer
	Total Nitrogen	600-1000 ug/l spring and summer
	Chlorophyll-a	15-30- ug/l mid-summer
	Secchi Disk Transparency	1-2 meters mid-summer
Highly Eutrophic	Total Phosphorus	50 + ug/l spring and summer
	Total Nitrogen	1000 + ug/l spring and summer
	Chlorophyll-a	30 + ug/L mid-summer
	Secchi Disk Transparency	0-1 meters mid-summer

Table A5-1 Parameters and Defining Ranges for Trophic States of Lakes In Connecticut

Roseland Lake is categorized as highly eutrophic based on recent snapshot data. The trophic state of a lake is determined by measurements of Total Phosphorus, Total Nitrogen, Chlorophyll a and Secchi Disk Transparency. The ranges for determining trophic state are presented in the table A5-1 titled "Parameters and Defining Ranges for Trophic State of Lakes in Connecticut".

This table is reproduced from the Connecticut Water Quality Standards updated in 2011. The listed parameters are assessed collectively to determine the trophic state of a lake. In addition to water column data, the trophic state of a lake shall be determined by the percentage of the surface area covered by macrophytes in accordance with subsection (b) of this section. For the purpose of determining consistency with the Connecticut Water Quality Standards, the natural trophic state of a lake shall be compared with the current trophic state to determine if the trophic state of the lake has been altered due to excessive anthropogenic inputs. Lakes in advanced trophic states which exceed their natural trophic state due to anthropogenic sources shall be considered to be inconsistent with the Connecticut Water Quality Standards.

Macrophytes are aquatic plants large enough to be seen without magnification. In Connecticut, the macrophyte distribution and abundance data are also reviewed in conjunction with the water column data to determine the trophic states of lakes and ponds.

- If macrophyte growth is very extensive (75 - 100% of water body area) and dense, the trophic state of a lake or pond shall be considered "highly eutrophic" regardless of the water column data.
- If macrophyte growth is extensive (30 - 75% of water body area) and dense, the trophic state shall be considered "mesotrophic" when the water column indication is oligotrophic, and the trophic state shall be considered "eutrophic" when the water column indication is mesotrophic or eutrophic.

CT DEEP has not determined specific limits for nutrient concentrations for rivers and streams. CT DEEP is in the process of evaluating phosphorus concentrations that adequately support aquatic life uses in non-tidal streams.

River sample data will be compared to historical data collected from 1980-1983 to determine if there has been any significant change over time.

A5-3 Project Goals:

1. Conduct water quality monitoring in Roseland Lake to determine trophic state and gather data to be used in nutrient mass balance analysis by a qualified limnologist. Data to be collected includes nutrients and a depth profile of temperature and dissolved oxygen in the lake over the deepest part. Alkalinity data will also be collected as recommended as part of the data required for determining future algae treatment alternatives in Roseland Lake. After quality control review, data will provided to a qualified limnologist for interpretation. Data will also be presented to CT DEEP in a predetermined format.
2. Make recommendations for algae treatment by evaluating upper watershed nutrient load and in lake sources. Alkalinity data from Roseland Lake will be collected to assure there would not be an adverse effect to lake biota if an alum treatment is recommend.
3. Collect algae samples to determine predominant algae taxa and concentrations during the summer months to determine the relative proportion of potential toxin producing Cyanobacteria present in Roseland Lake during the summer months.
4. Conduct water quality monitoring in Muddy Brook, Mill Brook and outlet of Roseland Lake (Little River) repeating the sampling stations utilized in the 1991 Kulp report to assess if there has been any significant change in upstream nutrient and sediments loads in Muddy Brook and Mill Brook.
5. Conduct water quality monitoring for nutrients and sediments near the outlets of the main local watershed stream outlets upstream of Muddy Brook with stream flow data to determine loading from those local watersheds in order to prioritize future BMP investments upstream of Roseland Lake.

ECCD will collect water quality data from Roseland Lake and tributary streams in order to determine existing water chemistry, and nutrient and sediment concentrations. ECCD will partner with Nichols College to collect tributary stream flow data in order to determine nutrient and sediment loading. This data will be used to characterize existing water quality conditions in Roseland Lake and assist lake managers with lake management decisions.

The Eastern Connecticut Conservation District (ECCD) will hire a qualified limnologist to interpret the in-lake profile data, lake sediment phosphorus concentrations and the in-stream data all collected during the same monitoring period to determine the proportion of externally versus internally derived nutrient sources in Roseland Lake. This quality assurance project plan (QAPP) is only for collecting and evaluating nutrient and total suspended solids, secchi disk data, algae enumeration and identification, determining stream flow and reporting the data after all Quality Assurance procedures outlined in this QAPP have been performed. ECCD will contract with professional environmental consultants who will prepare the Standard Operational Procedures and Quality Assurance Project Plans for the task they are hired to complete. The United States Geological Survey (USGS) Connecticut Water Science Center, will be responsible for collecting and analyzing the Roseland Lake sediment samples, reporting the outcomes of the study, and preparing the QAPP for that process. The outcomes of the sediment sampling, plus the QC checked chemical and physical data collecting during the study will be provided to a second qualified consultant, Richard Canavan of CME Engineering, who will review all data collected during this project and develop a mass balance analysis for nutrients in Roseland Lake.

Data needed for alternative management strategies of the Roseland Lake as a drinking water supply is currently not available. If alternate treatment options for algae blooms are to be considered a full evaluation of the upper watershed nutrient contributions as well as in-lake source analysis is essential. The in-lake source analysis needs to include an evaluation of the phosphorus load in the lake bottom sediments through the analysis of a sediment samples from the lake bottom. Lake bottom sediment sampling will be described further in QAPP and monitoring plan prepared by the contractor hired to complete that task. Water column data including pH and alkalinity are required parameters to assess before an alum treatment can be considered an environmentally safe alternative. "Guidelines for alum application require that the pH remain with the 5.5-9.0 range. The treatment of lakes with alkalinities above 75 mg/L as CaCO3 are not expected to have chronic or acute effects to biota." (Wisconsin Department of Natural Resources, 2003)

Data provided through this study can also be utilized by CT DEEP in the development of a Total Maximum Daily Load TMDL for nutrient and sediment load concentrations in the watershed. The data will provide better guidance on the use of federal funding for future BMP installations with the watersheds and to help to focus on the areas of greatest need for these programs.

A6. Project/Task Description & Schedule

The field parameters recorded during each sampling event on Roseland Lake will include Secchi disk transparency, and a depth profile of water temperature, dissolved oxygen, pH, turbidity and conductivity at half meter intervals will be determined using an In-situ Troll 9500 (EPA RFA 11057A In-situ Troll 9500 Approved March 31, 2011). Each non-frozen month for one year, a lake water sample will be collected at one half meter for laboratory analysis of nitrogen and phosphorus components as listed in Table A7-2. Chlorophyll *a* will be added to the surface sample parameter list, and samples at designated depths will be collected for nitrogen and phosphorus components. The alkalinity of the lake water will also be assessed. If the lake is not stratified, samples will be collected near the surface, at mid-depth and near bottom of the lake. If the lake is stratified, samples will be collected near surface, at the metalimnion (thermocline) and

hypolimnion as determined by temperature data on the date of sampling. Additional water samples may be collected in July, August and September and sent to an approved lab for phytoplankton analysis to determine the dominant taxa and the approximate number of cells/mL. All water column nutrient sampling will be conducted at the deepest section of the lake and the sampling location will be geolocated by use of a global positioning system (GPS).

In addition to in-lake sampling, ECCD will collect samples from tributary streams upstream of Roseland Lake to determine if significant nutrient loading in the lake continues to be contributed from those sources. Refer to the Roseland Lake Monitoring Plan in Appendix C. Little River will also be sampled at the outlet of the lake. Procedures for point sampling in a stream are included in the **Standard Operating Procedure for Collection of Water Samples for Shipment to a Laboratory for Analysis and Secchi Disk** found in Appendix B**.** The **Standard Operating Procedure for Collecting Storm Water Samples** can also be found in Appendix B. The Standard Operating Procedure to Set up and calibrate staff gauge rulers and pressure transducers for measuring stream flow can also be found in Appendix B.

A7. Quality Objectives and Criteria

Water chemistry and chlorophyll data must be of sufficient quality to accurately characterize the trophic state of each lake when compared to 2011 Connecticut Water Quality Standards and Classifications. For purposes of the Roseland Lake Nutrient Source Study, there is also an interest in the dominant phytoplankton taxa and their approximate cells/mL during the summer season. All data must meet quality objectives for completeness, representativeness, and comparability, and also meet measurement performance criteria for accuracy and precision.

Completeness: It is expected that each Individual Volunteer Monitoring Team will collect samples monthly from May to October, or during the period before strong temperature stratification develops to the period when lake temperature stratification ends.

Representativeness and Comparability: Water sampling sites are selected to characterize water quality for selected streams. Lakes are to be sampled at the deepest hole. Samples will be collected from the same location at each sampling event. Sampling will be conducted monthly during ice free conditions on the lake. Sampling on pre-determined dates provides for random differences in sampling conditions (weather), unless extreme conditions (e.g. drought) are experienced. In place of monthly sampling in the tributaries of Roseland Lake, a passive stormwater collection series may be substituted to measure pre-precipitation event conditions, first flush of stormwater conditions, and post precipitation event conditions. The Standard Operating Procedures for collecting a passive stormwater collection series is available in Appendix A. A minimum of three passive stormwater collection series would be performed. Intermittent streams that drain significant watershed areas will be sampled via the passive stormwater method as long as flow allows.

Data Accuracy and Precision: Data accuracy (conformity to the true value) will be ensured by routine Quality Assurance (QA) procedures (e.g., inspection, maintenance and calibration of instruments), and Quality Control (QC) checks (e.g., analysis of laboratory blanks, standards and spiked samples). Precision (repeatability of measurements) will be ensured by consistent

methods and practices, and evaluated by field and laboratory replicate samples. Accuracy and precision goals for parameters to be measured for this study are provided in Tables A7-1 and A7-2 for laboratory tests.

Table A7-1 Accuracy measures and goals for Phytoplankton Counts (Northeast Laboratories)

Parameter	QC Sample Type	Accuracy Goal (+/-)	Precision Goal (+/-)**	Frequency
Phytoplankton Counts	Duplicate counting of same slide	NA	10%	Each sample

** Northeast Laboratories does not have a formal program for collecting and analyzing duplicates; splitting samples for biological testing is difficult. In terms of microscopic analysis, they perform duplicate counting of the same slide, as used by the FDA 2400 Forms and Standard Methods for the Examination of Dairy Products, with the following as criteria:

a) One analyst counting the same slide should duplicate his/her own count within 8%.
b) Two analysts should agree within 10%.
c) Three or more analysts should use the RpSm (Least Significant Differences) technique. At Northeast Laboratory, two analysts typically performing this testing.

Table A7-2. Accuracy measures and goals for laboratory analysis.

Parameter	QC Sample Type	Accuracy Goal (+/-)	Precision Goal (+/-)*	Frequency
Chlorophyll a	Lab standard Lab duplicate	N/A	15% <25%	Once every 20 samples Once every 20 samples
	Lab blank	Non-detect	N/A	Each 20 samples plus end of run
Total phosphorus	Matrix spike Lab blank Field blank	15% non-detect non-detect	N/A	10% of samples plus end of run PQL sample run
Orthophosphorus	Matrix spike Lab blank Field blank	15% non-detect non-detect	N/A	10% of samples plus end of run PQL sample run
NOx Ammonia-N Nitrite-N Total Nitrogen	Matrix spike Lab blank Field blank	N/A non-detect non-detect	15% 20%	10% of samples plus end of run PQL sample run
Total Suspended Solids	Matrix spike Lab blank Field blank	10% non-detect non-detect	N/A	10% of samples plus end of run PQL sample run

* Precision is measured by the relative percent difference (RPD) between replicates

Table A7-3. Accuracy measures and goals for pressure transducers

Model	Parameter	Range	Accuracy (+/-)	Resolution
Micro-Diver DI 610 10 meter water column	Pressure	10 mH_2O	+/- 1.0 cmH_2O	0.2 cmH_2O
Micro-Diver DI 620 20 meter water column	Pressure	20 mH2O	+/- 2.0 cmH2O	0.4 cmH2O
Micro-Diver DI 610/620	Temperature	-20 – 80 ˚C	+/- 0.1 ˚C	0.01 ˚C

A8. Special Training/Certification

Training Methodology

Training of any water quality monitoring volunteers who assist with sample collection, storage and analysis will be provided by ECCD staff. ECCD staff will accompany sampling teams during all sampling events. Volunteers who do not receive this training will be able to participate in water sampling provided they receive an orientation before the collection of water samples in the field and will be accompanied by experienced leaders in the field. While in the field, they will be provided with on-the-job-training and required to demonstrate proficiency in use of the proper sampling techniques and use of the equipment, and in recording data.

Description of Training

In order to be qualified to collect samples for laboratory analysis, each training event will consist of the following items:

- Distribution of a Standard Operating Procedures Field Guidebook (In-situ Troll 9500 Data Collection SOP, Nutrient Data Collection SOP and Phytoplankton Sampling SOP - attached);
- A background presentation about the monitoring program, how tasks fit in, and why it is significant;
- A briefing on field safety guidelines;
- A description of the field data sheets and how to record data in the field;
- A demonstration on the proper way to prepare a clean sample bottle prior to sampling.
- A demonstration on the proper way to label a sample bottle;
- A demonstration by a qualified trainer on test equipment, test procedures, and actual data collection in the field;
- Practice water sampling by volunteers at a test field location;
- A demonstration of the proper sample labeling, storage and transportation to the analysis site, including maximum time limits for sample storage;
- Feedback by the qualified trainer to volunteers on their performance; and
- Formal acknowledgement of successful completion of the training for each volunteer.

Trainer Qualifications

Project Manager: Jean Pillo, MS Biology, ECCD Watershed Conservation Coordinator; TLGV WQM Program Coordinator since 2006; 6 years of experience in a biochemistry laboratory.

Quality Control Manager: Judy Rondeau, MS Water Resources, ECCD Natural Resource Specialist; 7 years of experience in water resource management.

Training Record Keeping

After each training activity, the qualified trainer will record the type of training provided, the trainee's name, the date the training was delivered, and the name of the trainer providing the

training. ECCD staff will oversee all volunteers conducting field sample collection and data management.

A9. Documents and Records

Water sample field data will be collected on **Field Sheets for Nutrient Water Samples** as shown in the **Standard Operating Procedure for Collection of Water Samples for Shipment to a Laboratory for Analysis and Secchi Disk (**Appendix B**).** For each laboratory that samples are sent to, a **Chain of Custody** sheet indicating the sample identification number, number of samples, date and time of sampling and analysis(es) requested will be prepared. All data will be filled in before leaving the site, and initialed by the person making the entries. Field blanks and field duplicates will be noted on the data sheet and sample bottles.

Each field monitoring station will be identified on the sample data sheet with the site identification code of the testing location and the date and time the water quality monitoring event took place. Sampling locations and site identification codes are predetermined during the development of monitoring plan.

Water sample bottles will be labeled with the site location, date and time of sampling and name of the sampling group.

The Project Manager will sign off on all activities performed during a sampling event, with any notations, that the functions have been performed in accordance with the SOP.

The Quality Control Manager will then review all the data and sign off as the reviewer, resolving any questions with the submitters. The data will be reviewed for meeting the sample age time limits and RPD limits as outlined in Element 7. The data will then be entered into an EXCEL data base in a predetermined format as designated by CT DEEP. The person performing this function must verify accurate entry of each item before signing off that data been entered.

Hard copies of all completed **Field Sheets for Nutrient Water Samples** and lab reports from offsite testing facilities as well as back-up disks of electronically entered data will be maintained by ECCD for three years. Yearend data summaries will be submitted to the TLGV WQM Coordinator and will be stored indefinitely.

Prior to field work, the Project Coordinator will provide a copy of this QAPP to all persons on the distribution list. Updates will be provided as needed, and will be identified by the revision number and date on the header of each page, as well as a revision date on the title page.

Sample site selection for the Roseland Lake, Woodstock, CT Nutrient Source Study were made in consultation with CT DEEP, USGS, Atlantic States Rural Water and Wastewater Association (ASRWWA), and the project consultant, Dr. Rick Canavan of CME and are presented in Appendix C. Upstream tributary testing sites were selected to include sampling of significant tributary streams as close to their convergence with the main stem river as is practical and also include an upstream reference point as well as a downstream cumulative point.

Field measurements will be recorded by hand on respective data sheets (Appendix B). ECCD staff or trained volunteers will enter field and laboratory data into an Excel electronic database.

- *Field measures*: station id, stream or lake name, date, time, depth, equipment, parameter, result, unit of measure.

- *Sample collection*: station id, stream or lake name, date, time, sample identification number, collection date, time, depth, parameter and equipment.

- *Analytical Results*: For chlorophyll *a*, total phosphorus, orthophosphorus, nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, Kjeldahl Nitrogen (Calculated) or TSS, volunteer team leaders will provide the following information: parameter name, result with unit of measure, analytical method, and Minimum Detection Limit to the ECCD QC Manager.

ECCD or a designated trained volunteer will perform an internal review of data for completeness and accuracy. A second person check entries before forwarding information to CT DEEP and/or other project partners. Hard copies of field datasheets will be retained on file at the Eastern Connecticut Conservation District office located at 139 Wolf Den Road, Brooklyn, CT.

Each sampling location will have a unique identification number for each water sample for nutrient analysis and this number will be recorded on the standard chain of custody (COC) form for the lab where the analysis will take place. For nutrient and chlorophyll a samples collected from Roseland Lake and from the sampling stations nearest to the Roseland Lake perennial inlet streams and outlet stream, the water samples will be sent to the Center for Environmental Sciences and Engineering (CESE) laboratory lab located in Storrs, CT. For nutrient and total suspended solid samples collected at all other tributary streams and the outlet stream, the water samples will be sent to the Connecticut Department of Health laboratory located in Rocky Hill, CT. Phytoplankton counts will be completed at NE Laboratories in Berlin, CT. Sample bottles will be color coated with a colored sticky dot to differentiate which lab at which they will be analyzed. Lab analysis order forms will serve as the Chain of Custody form. Examples of these forms can be found in Appendix B.

When nutrient test results are received, the Quality Control Manager will add the test results to the database. The Quality Control Manager will review data for completeness and outliers. If missing or questionable results are encountered, the Quality Control Manager will contact the appropriate laboratory to resolve any issues. If there are any modifications to analytical results, the Project Coordinator will notify the Database Manager.

<u>Center for Environmental Sciences and Engineering (CESE)</u>: When water samples are received for nutrient analyses, CESE will assign a LIMS number to each sample and record that information on the COC before photocopying. CESE will send nutrient test results to ECCD in both electronic form as soon as tests are complete and as a hardcopy within 45 days of sample submittal. The hardcopy will include a cover letter from the lab that notes any problems (*e.g.*, lab accident, QA standard or holding times exceeded) or unusual results and any action taken to confirm such values (*e.g.*, re-analyze the sample). The hardcopy data package will include a copy of the original COC.

CT Department of Public Health Environmental Laboratory (CT DPH): Samples are brought to the receiving room and are then brought to the lab with the paperwork. When water samples are received for nutrient analyses, CT DPH will complete the COC form. The lab staff will enter the sample information into the LIMS and a unique Lab ID is generated. After the analysis is complete and a report generated, the hard copy will go to the submitter of record (the DPH Water Supply Section). If there are analytical problems, the DPH lab will call the collector and if the problem can't be resolved it is noted on the report. CT DPH will send nutrient test results to ECCD in both electronic form as soon as tests within 45 days of sample submittal.

NE Laboratories (NEL): When NE Laboratories receives samples for phytoplankton identification and enumeration, NE Laboratories will complete the COC form and will identify and enumerate phytoplankton in the water sample. NE Laboratories will send phytoplankton results electronically to ECCD as soon as the tests are completed. Results will be reported as number of genera represented in the water sample and the number per mL of sample.

Dr. Mauri Pelto of Nichols College will be responsible for setting up staff gauge rulers in predetermined areas on request and to develop a rating curve for each station as outlined in the **SOP Roseland Lake Stream Flow Hydrology Project,** in order to determine discharge from tributary streams. The stream flow data will be used in conjunction with water quality data to be collected in 2015/16 to determine local watershed nutrient loading. Dr. Pelto has previously installed staff gauges in the French River watershed in MA, the Five Mile River watershed in CT and Amos Lake area in Preston, CT. Stations where discharge will be measured are identified in Appendix C.

Micro-Diver pressure transducers/temperature data loggers will deployed by ECCD staff assisted with TLGV Water Quality Monitoring Volunteers and retrieved at the end of the monitoring season. Data will be downloaded and stored as outlined in the SOP. Data will be downloaded at the end of the season and converted to streamflow measures using the flow rating curve developed by Dr. Pelto.

B1. Sampling Process Design (Experimental Design)

ECCD staff, with the assistance of trained volunteers, will conduct the following sampling from the deepest section of Roseland Lake, and analyze or deliver samples as indicated. Refer to Appendix A for laboratory SOPs, and complete field sampling SOPs and Appendix B for datasheets and forms.

a. Use a GPS unit to locate the sampling location in the lake. Record GPS coordinates for the sampling site.

b. Determine the depth of the lake using a weighed metered line. Record the lake depth at the sampling location.

c. Record secchi disk transparency following Standard Operating Procedure Guide for Secchi Disk Readings.

d. Record a depth profile of water temperature, dissolved oxygen, pH, oxidation/reduction potential, turbidity and specific conductance at one-meter intervals following Standard Operating Procedure for the In-situ Troll 9500.

e. If the lake is thermally stratified, determine the depth location of the thermocline, or the layer of water where the temperature of the water changes most rapidly, by graphing the temperature versus depth on a graph. To determine the depth to the thermocline, use the **Field Sheet for Determining the Thermocline Depth in a Lake.**

f. In thermally stratified lakes, collect water samples from near the water's surface at one half meter, at the thermocline and one half meter off the bottom as determined by lowering a weighted metered line prior to sampling. In non-stratified lakes, collect water samples near the surface, at mid-depth and near-bottom. Samples from each depth will be analyzed by a qualified lab for nutrients (TKN, Nitrate-N, Nitrite-N, Ammonia, Total Nitrogen, Total Phosphorus and Orthophosphate) and an additional sample from the near surface will be analyzed by a qualified laboratory for Chlorophyll *a*. In summer months, lake surface samples will also be analyzed for phytoplankton.

- Collect a water sample from near the water's surface at one half meter for chlorophyll a in a brown 250 ml HPDE bottle for analyses by an approved laboratory. This sample will also be analyzed for Total N and P ions (NO_x, NH_3, Nitrite, Orthophosphate) from a single analytical run. Nitrate will calculated by difference between (NO_x-NO_2). TKN is calculated as TN-NO_x. Cap and store the labeled sample container in a cooler with ice packs at 4°C.

- Collect a water sample from just beneath the surface at one half meter in a 250 amber bottle for phytoplankton counts at an approved laboratory. Cap and store the labeled sample container in cooler with ice packs at 4°C. (July- September only).

- Using a Van Dorn sampler, collect a water sample at mid depth (or thermocline) and one half meter off the bottom for nutrient analysis as outlined in the monitoring plan and transfer to a 125 ml HPDE sample bottle. One water sample will be collected in a bottle for analysis of Total Nitrogen series (Total Nitrogen, TKN, Nitrate-N, Nitrite-N, and Ammonia), Total Phosphorus and orthophosphate.

- Cap and store the labeled sample containers in cooler with ice packs at 4°C.

For stream samples, water samples will be collected in a 1.89 liter HDPE sampling container. Each sample will be analyzed for Total P, ortho P, Total N, Ammonia-N, Nitrate-N, Nitrite-N, organic-N, TKN and Total Suspended Solids. All river samples will be processed at the CT DPH laboratory. For quality control purposes, duplicate samples will be collected at the most downstream Muddy Brook (MB-01) sampling location, Mill Brook (Mill-01) and at the Little River lake outlet (LR). Refer to the Roseland Lake Monitoring Plan in Appendix C. One set of samples will be processed at the CT DPH laboratory and the other set processed at the UCONN

CESE laboratory. This way, the sample analysis processes can be compared. Stream flow will be determined by reading the staff gauge at each monitoring site at the time of sample collection.

B2. Sampling Methods

The Secchi disk depth and geographic coordinates will be taken with a 20 cm black and white disk and a Garmin GPS unit, respectively. Secchi depth will be taken in duplicate and recorded on the Secchi Disk Data Sheet (Appendix B) and averaged.

Water samples will be collected using a 2.2 liter horizontal Van Dorn water sampler, near surface, at the thermocline and near bottom for stratified lakes, and near surface, mid-depth and near bottom for unstratified lakes. Temperature measurement SOPs are covered in a separate QAPP (EPA RFA 11057A In-situ Troll 9500 Approved March 31, 2011). Lake stratification will be determined by plotting the temperature versus the depth of water on the **Field Sheet for Determining the Thermocline Depth in a Lake** (Appendix B)

Standard Operating Procedure for Collection of Water Samples for Shipment to a Laboratory for Analysis and Secchi Disk can be found in Appendix A. Water samples will be transferred to polyethylene bottles (Table B3-1), labeled, and immediately stored on ice in a cooler.

B3. Sample Handling and Custody

All water sample collection bottles will be supplied by the CESE will be laboratory acid-washed and triple rinsed with distilled water prior to use by CESE laboratory staff. All samples bottles provided by the DPH lab will be unused disposable containers. Sample containers, preservation and holding times are presented in Table B3-1.

Table B3-1. Sample containers, preservation and holding times

Parameter	Media	Container	Preservation	Holding Time
Chlorophyll a	Whole water	250 ml Nalgene	Chilled	Filtered within 24 hours by contract lab. Filtrate analyzed or frozen up to 28 days
Total Phosphorus	Whole water	125 ml Nalgene or 1.89 HPDE	Chilled Frozen	Up to 24 hours or up to 28 days
Orthophosphate	Whole water	125 Nalgene or 1.89 HPDE	Chilled Frozen	Up to 24 hours or up to 28 days
Total Nitrogen TKN Ammonia-N Nitrate-N Nitrite-N	Whole water	125 ml Nalgene or 1.89 HPDE	Chilled Frozen	Up to 24 hours up to 28 days after filtration
TSS	Whole Water	1.89 l HPDE	Chilled	7 days
Phytoplankton	Whole water	250 ml amber glass	Chilled	Up to 24 hours

All water samples will be labeled with a unique sample identification consisting of the station id and/or depth, plus date, location and parameters to be measured. Samples are stored on ice in the

field until transfer to an approved laboratory. Monitoring schedules will be modified to assure samples are collected to meet the laboratory operating hours

Chlorophyll a samples must be kept in the dark on ice and delivered to the laboratory within 24 hours of collection. Samples will be filtered on the day of delivery. Filtrate will be analyzed immediately or frozen at the lab for up to 28 days before analysis.

Nutrient samples must be delivered to the laboratory within 24 hours of collection and either analyzed on the day of delivery or frozen at the lab and analyzed within 28 days. Nitrogen samples will be filtered prior to freezing.

Phytoplankton samples will packed in ice and delivered to NE Laboratory on the day of collection for analysis on the day of delivery.

B4. Analytical Methods

Water Sample Analysis Contract laboratories will analyze water samples for total phosphorous and nitrogen series and chlorophyll a using methods specified in table B4-1 or B4-2 or B4-3 and Standard Operating Procedures for each parameter included in Appendix A.

Table B4-1. Methods and detection limits for project analyses. (CESE)

Parameter	Method ID	Method Name	MDL	Lab PQL
Chlorophyll a	EPA 445.0	Flourometric analysis	---	1 *u*g/l*
Total Phosphorus Total Dissolved Phosphorus	EPA 365.1 Standard Methods 4500-P A, B, and H	Automated Colorimetry	0.002 mg/l 0.002 mg/l	0.01 mg/l** 0.01 mg/l**
Orthophosphate	EPA 365.1 Standard Methods 4500-P A, B, and G	Automated Colorimetry	0.001mg/l	0.010mg/l**
Total Nitrogen Total Dissolved Nitrogen	EPA 353.2 SM 4500-N C	Automated Colorimetry	0.004mg/l	0.05 mg/l
Ammonia-N	EPA 350.1 SM 4500-NH3 G	Automated Colorimetry	0.002 mg/l	0.01 mg/l
NO_x-N NO_2^--N	EPA 353.2 SM 4500 NO_2^-, NO_3^-, and N_{org}	Automated Colorimetry Nitrate calculated by difference (NOx-NO2)	0.002 mg/l 0.003 mg/l	0.01 mg/l 0.01 mg/l
Organic N		Calculation TN-(NOx-N + NH_3-N)	----------	----------
TKN		TKN calculated as TN-NOx	----------	----------
TSS	EPA 160.2 SM2540 A&D	Non-Filterable Residue	2mg/L	5mg/L

* Concentrations less than 1 *u*g/l may be reported if more than 1 liter of lake water is filtered.
** It is advised that the lab(s) be requested to report down to the minimum detection limit (MDL) for TP/orthoP in order to quantify (albeit with some additional uncertainty) levels < 10 ug/l)[1]

[1] Communication with Richard F. Chase, MA DEP

Table B4-2. Methods and detection limits for project analyses. (CT DPH)

Parameter	Method ID	Method Name	Minimum Reporting Limit
Total N		Calculation	
Nitrate N	EPA 300.0	Ion chromatography	0.10 mg/L
Nitrite N	EPA 300.0	Ion chromatography	0.10 mg/L
Ammonia N	SM4500 F	Ammonia nitrogen in water by electrode	0.05 mg/L
TKN	EPA 351.2	colorimetry	0.6 mg N/L
Organic N		Calculation	
ortho-P	EPA 300.0	Ion chromatography	0.25 mg/L
Alkalinity	SM 2320 B	titration	10 mg/L
TSS	USGS I 3765	Gravimetric analysis	4 mg/L
Total P	EPA 365.1	colorimetric	.003 mg/L

Table B4-3. Methods and detection limits for project analyses. (Northeast Laboratories)

Parameter	Method ID	Method Name	Minimum Reporting Limit
Phytoplankton Counts	NORTHEAST LABORATORIES, INC. METHOD #NEL090331	Identification and enumeration of microscopic algae in water samples	NA

B5. Quality Control

Field measures: Depth readings obtained with the In-Situ Troll 9500 are compared against a metered line (tape measure). Secchi depth and GPS readings are repeated until there are two consecutive readings within the precision goal. Quality control measures for the In-situ Troll 9500 for determining the temperature profile of a lake are outlined in the QAPP for that device. In general, at least once per season (or 10% of the sampling events), the depth/temperature profile of the lake is repeated. Precision is measured by the relative percent difference (RPD) between replicates and compared to the goals for the instrument used.

Water sample laboratory analyses: Precision and accuracy checks and goals are specified in Table A7-1 and A7-2, and outlined specifically in the SOP for each parameter being quantified (Appendix A). Quality control measures include initial and continuing calibration, matrix spikes, lab blanks and lab duplicates. Precision and accuracy goals that are exceeded are noted and the sample is retested if possible. If a retest is not possible, the laboratory makes note of the exceedance and conveys that information as hard copy of the data to ECCD.

The UConn CESE and DPH laboratories are required to undergo a blind audit / proficiency test exercise every year to verify their lab procedures. This is required to retain their certification. The results of their audits are provided on request.

ECCD data check: If upon receipt of data from contract laboratories, ECCD's QC Manager notes any exceedance of QC goals (e.g., field duplicate precision exceeded), ECCD will contact the laboratory immediately to try to resolve the problem. If the problem can be traced to a

transcription error, the error will be corrected. Else, the sample will be retested if still available. If the problem cannot be rectified, then the data will be qualified or not used.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

Refer to TASK 8 Shipment of Samples and Forms and Equipment Cleanup in **Standard Operating Procedure for Shipment to a Laboratory for Analysis and Secchi Disk** located in **Appendix A.**

B7. Instrument/Equipment Calibration and Frequency

The secchi disk and Van Dorn sampler metered lines are re-measured once a season to check for line shrinkage or stretch, and re-marked or replaced if necessary.

Micro-Diver pressure transducers/temperature data loggers are factory calibrated. Prior to deployment, each unit will be checked for accuracy following the SOPs outlined in the Roseland Lake Stream Flow Standard Operating Procedures by ECCD staff assisted by CME Engineering Staff (owners of the units). Units not meeting Quality Control standards will not be deployed. At the end of the monitoring season, following data download, each units will be checked for accuracy again. Data from units not meeting accuracy standards will be qualified.

B8. Inspection/Acceptance of Supplies and Consumables

CESE: All sample bottles are acid-washed and triple rinsed with distilled water at the CESE laboratory before use and provided to ECCD for sample collection.
CT DPH: Unused disposable chemistry grade sample containers are provided for each sampling event.
Northeast Laboratories: Sample bottles and shipping containers will be provided ready for use.

It is the responsibility of ECCD to acquire sample containers from each contract laboratory.

C1. Assessments and Response

The ECCD Project Manager and/or the Project Quality Assurance Manager will accompany and observe volunteers for all sampling events. This oversight will be to insure conformance to procedures and specifications outlined in this QAPP and shall constitute technical audits. If any nonconformity is noted, it is brought to the attention of the volunteers and corrected or reconciled as necessary.

C2. Reports to Management

A quarterly report of project activities will be complied and distributed in March, June, September and December to CT DEEP, CT DPH and the Town of Putnam.

A final end of season data summary will be submitted to CT DEEP at the completion of the monitoring season to indicated the completion of the data collection and laboratory analysis task requirement of this project.

CESE/CT DPH/Northeast Laboratories: With each submission of hardcopy results, the contract laboratory will include a summary of quality control results, exceedances of QC goals or other problems encountered, and any corrective action taken.

D1. Data Review, Verification and Validation

Data are verified for completeness, proper format and content, and validated for conformance to quality goals for all components of this project including: field measurements, sample collection, sample analysis, data transfer and storage. Verification and validation methods are described below, Section D2.

D2. Verification and Validation Methods

Verification

Sample Collection and field measurements: ECCD conducts or observes all sample collection and storage of water samples, and checks container labeling and COC forms for completeness and accuracy before leaving the site. The field datasheet is also checked for accuracy and completeness before leaving the site.

Laboratory analysis: CESE, CT DPH, Northeast Laboratories and ECCD will conduct internal verification that correct procedures are followed and that datasets are complete with correct content and format.

Validation

Laboratory analyses: Each contracted laboratory and the ECCD will validate laboratory analysis data by evaluation of results from lab blanks, duplicates and matrix spikes as described in Sections A7 and B5.

D3. Reconciliation with User Requirements

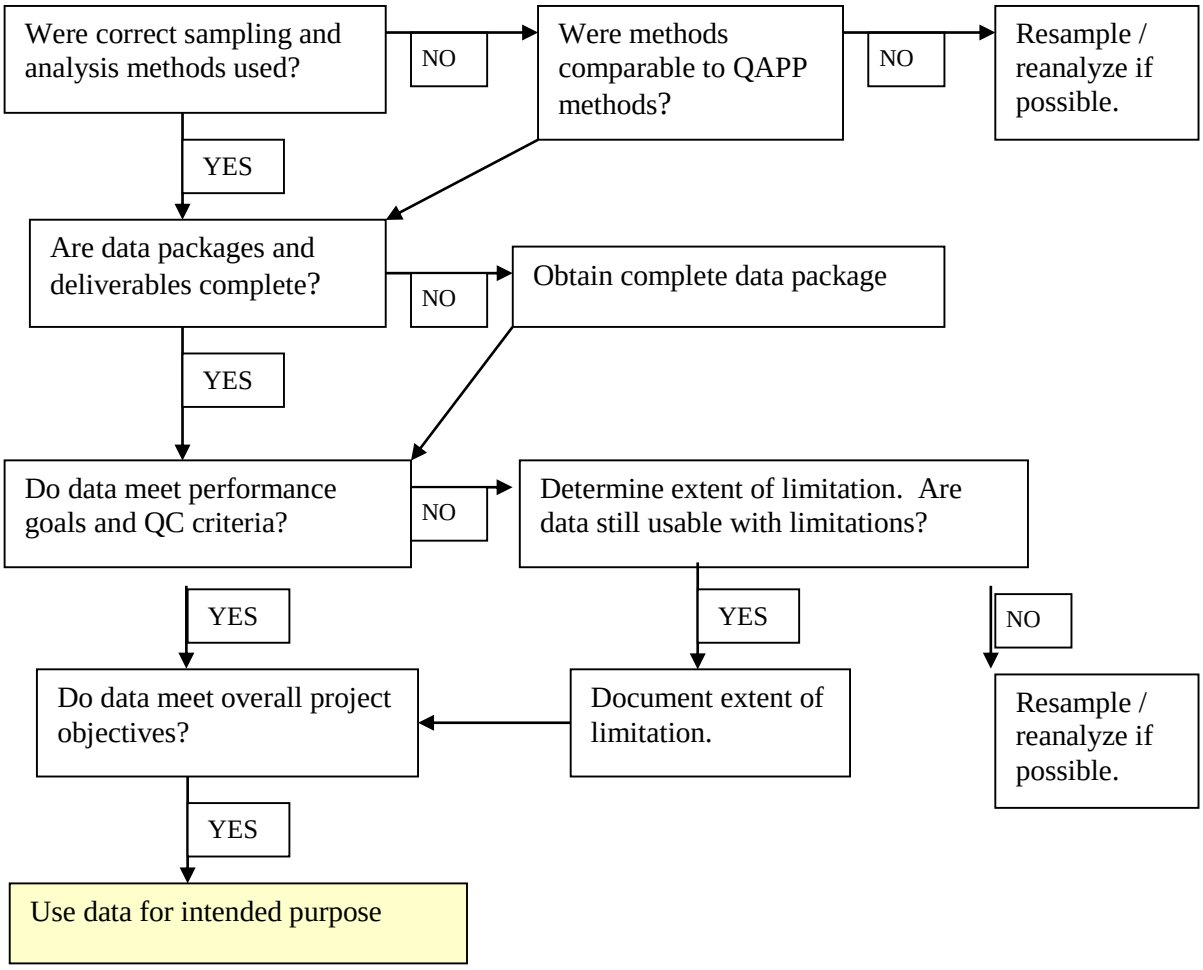
Data generated by this project must be of sufficient quality to determine the trophic condition of the sampled lakes and/or water quality of streams. The contracted laboratory and ECCD will conduct internal data verification and validation as described above. Potentially compromised data are noted in a cover letter summary that accompanies each batch of test results. If there is evidence of a significant discrepancy (Relative Percent Difference $\geq$ 20% of field duplicates) or contamination of blanks, the lab is notified, and the sample is tracked via its unique identification number. If a discrepancy cannot be accounted for as a data entry error, the chemical test is rerun providing the original sample is still available. If a retest is not possible, samples are recollected if possible. If this is not feasible, the data are qualified or not used. In all cases, the problem is investigated and the source of the error, whether related to sampling protocol, analytical method, or equipment failure, determined and corrected.

Before data is reported and distributed, the ECCD will:

- ✓ Verify that TLGV equipment calibrations were performed and QAPP tolerances were met
- ✓ Verify that samples were delivered to the lab in the appropriate time frame (see COC form)
- ✓ Verify that data reports for each parameter were provided (compare field sheet to lab reports)
- ✓ Verify that field blanks were negative (see lab report)
- ✓ Verify that field duplicates were in the correct RPD range (see lab report)
- ✓ Verify that the lab samples were analyzed or frozen in the appropriate time frame (see COC form)
- ✓ Verify that if samples were frozen, they were analyzed within 28 day limit (see COC form)
- ✓ Verify that lab blanks were negative (see lab report)
- ✓ Verify that lab duplicates were in the correct RPD range (see lab report)

If the lab qualifies data for any reason according to their QC procedures, then this information will be included in the data summary for the sampling event.

Figure D3-1. Preliminary Decision Tree for Data Review



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Roseland Lake

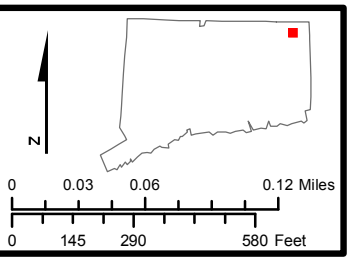
Woodstock, CT

Connecticut Department of Energy & Environmental Protection

This map shows lake depth. It is intended for general informational purposes only. Lake bathymetry contour lines may not align well with other features on the map. Please refer to the Boating or Angler's Guide for current boating regulations. Map date September 2011.

Lake acreage: 96.11

- Lake depth (ft)
- Trail
- Dam
- DEEP car top/carry-in launch
- DEEP trailered launch



List of Appendices

Appendix A. List of Standard Operating Procedures

CESE SOPs – Nitrogen series, Total-P and orthophosphate, alkalinity, Chlorophyll a, TSS
DPH SOPs – Nitrogen series, Total-P and orthophosphate, TSS
Northeast Laboratories SOP – Phytoplankton
Roseland Lake Stream Flow Hydrology Project
Standard Operating Procedure for Shipment to a Laboratory for Analysis and Secchi Disk
Standard Operating Procedure for Storm Water Sampling and Passive Stormwater Collection

Appendix B. List of Data sheets and Forms

CESE Chain of Custody Form
CT DPH Inorganic Chemistry Routine Non Potable Water Form
Northeast Lab Chain of Custody Form
Northeast Lab Data Sheet
TLGV Field Sheet for Nutrient Analysis
TLGV Secchi Disk Data Form
Field Sheet for Determining the Thermocline in a Lake
Troll Field Data Sheet for Lakes

Appendix C. ECCD Roseland Lake Monitoring Plan