Program Plan for the LCI Lake Monitoring Program
Lake Monitoring and Assessment Section

New York State
Department of Environmental Conservation
Division of Water
Bureau of Water Assessment and Monitoring

Prepared by NYSDEC Division of Water

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Table of Contents

List of Tables

List of Figures

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*updates to the QAPP will be available at ftp://ftp.dec.ny.gov/dow/BWAM/LCI/

INTRODUCTION

This document has been prepared to meet the Quality Assurance/Quality Control (QA/QC) requirements for the Lake Classification and Inventory (LCI) monitoring program, which is a component of the Statewide Waters Monitoring Program of the New York State Department of Environmental Conservation Division of Water (NYSDEC). All component projects of this program are covered under the Statewide Waters Monitoring Program Quality Assurance Management Plan (NYSDEC, 2012). While the Management Plan covers goals, objectives, and procedures common to all component projects, this QAPP documents project goals and objectives, standard operating procedures, data review and evaluation procedures, and quality control methods specifically for implementation of the LCI monitoring program.

In 2013, the basins to be sampled are the Lake Champlain, Susquehanna River, and Atlantic Ocean Long Island Sound Basins (Year 1 Screening Sampling) and Chemung, Black, and Lower Hudson Rivers (Year 2 Intensive Sampling).

I. PROJECT MANAGEMENT

1. Organization/Responsibilities

LCI Program Coordinators and Responsibilities

The following outline describes the staff involved with the LCI Monitoring Program and their respective roles.

New York State Department of Environmental Conservation
Division of Water, Bureau of Water Assessment & Monitoring
Lake Monitoring and Assessment Section

I. Lake Classification and Inventory Monitoring Program Management

Scott Kishbaugh, Section Chief & CSLAP Program Director 518-402-8286
David Newman, LCI Program Coordinator 518-402-8201

Responsibilities

1. Overall Management
   a. Determine sampling strategy and overall monitoring network design, including sampling site location, parameter selection, and sampling frequency.
   b. Evaluate new or modified monitoring, processing and assessment techniques, as developed in national resource assessments, academic studies, or other Agency monitoring programs
   c. Coordinate and implement enhanced or special studies on specific program waterbodies as appropriate, in cooperation with other Agency staff
   d. Produce periodic assessments of monitoring results.
   e. Conduct occasional and appropriate program reviews and implement modifications to enhance monitoring effort as necessary.
   f. Coordinate the purchase of equipment, supplies and/or training.
   g. Respond to all inquiries concerning the LCI Monitoring Program.
   h. Draft, maintain and modify (when necessary) the official signed copy of the QAPP

2. Coordination of Sampling Operations.
   a. Produce schedules outlining the collection of samples.
   b. Develop sampling protocols and any necessary modifications to SOPs for Lakes Projects.
   c. Provide sample collection technical support and training to sampling staff, as needed.
   d. Coordinate sampling logistics (including paperwork) between sampling staff and the analytic laboratories.

3. Implementation of Quality Control Measures
   a. Develop quality assurance/quality control plans for the LCI Monitoring Program.
   b. Conduct annual field audits of sampling staff to ensure proper sample collection methods are used and discuss problems and/or needs.
   c. Participate in training sessions offered by EPA or Agency staff related to monitoring, processing, assessment, boating, health and safety, data management or other program elements as needed in support of the broad objectives of the LCI

d. Review water quality and quality control data results for adherence to appropriate specifications.

4. Management of Analytic Data Results
   a. Coordinate receipt of data from laboratory with laboratory staff and Division Quality Assurance officers
   b. Enter all data from sample collection field sheets into the lakes monitoring databases.
   c. Review, edit (if necessary), and store the data generated by the LCI Monitoring Program, interfacing with Division databases (EQuIS) or other Agency or EPA data repositories as appropriate
   d. Provide water quality assessment and expertise in data evaluation.

II. Central Office Primary Samplers

David Newman, 518-402-8201(*djnewman@gw.dec.state.ny.us*)
Brad Wenskoski, 518-402-8282 (*bxwensko@gw.dec.state.ny.us*)
Cliff Callinan, 518-402-8135 (*cwcallin@gw.dec.state.ny.us*)
Scott Kishbaugh, 518-402-8286 (*sakishba@gw.dec.state.ny.us*)
Chandler Rowell, 518-402-8194(*cxrowell@gw.dec.state.ny.us*)
Jim Swart, 518-402-8288 (*jmswart@gw.dec.state.ny.us*)

Responsibilities

1. Sample Collection
   a. Collect lake samples in assigned geographic areas as scheduled following prescribed sampling procedures and quality assurance methods.
   b. Collect biological (algal bloom, plant, etc.) samples following prescribed procedures and quality assurance methods
   c. Process samples as scheduled following prescribed sampling procedures and quality assurance methods
   d. Transport samples to the appropriate laboratory following prescribed procedures and quality assurance methods
   e. Maintain LCI Monitoring Program field equipment.

III. Central Office Secondary Samplers

Pieter Bridge, 518-402-8242 (*pmbridge@gw.dec.state.ny.us*)
Diane English, 518-402-8195 (*dmenglis@gw.dec.state.ny.us*)
Steve Gladding, 518-402-8207 (*smgladdi@gw.dec.state.ny.us*)
Alene Onion, 518-402-8166 (*amonion@gw.dec.state.ny.us*)
Erik Posner, 518-402-8259 (*ewposner@gw.dec.state.ny.us*)
Ben Sears, 518-402-8268 (*brsears@gw.dec.state.ny.us*)
Karen Woodfield, 518-402-8196 (*klwoodfi@gw.dec.state.ny.us*)
(*this list is of people who may be called upon to act as a secondary sampler)

Responsibilities

1. Sample Collection
   a. Aid primary sampling staff in the collection of lake samples following prescribed sampling procedures and quality assurance methods.
   b. Maintain LCI Monitoring Program field equipment.

IV. Quality, Standards & Analytical Management Section

Jason Fagel, QA Officer and QAPP review/approval, 518-402-8156 (*jrfagel@gw.dec.state.ny.us*)
Rose Ann Garry, Assistant Quality Assurance Officer, 518-402-8159 (*rxgarry@gw.dec.state.ny.us*)

Responsibilities

1. Conduct as-needed field and laboratory audits.
2. Provide expertise regarding analytical and QA/QC issues.
3. Review the QA project plan to verify that those elements outlined in the *EPA Requirements for QA Project Plans (QA/R-5)* were successfully discussed.

IV. DEC Regional Office Personnel

Region 4 Division of Water- Schenectady
Carrie Buetow, 518-357-2268 (*ccbuetow@gw.dec.state.ny.us*)
Region 5 Division of Water- Warrensburg, Raybrook
Fred Dunlap - Raybrook 518-897-1241 (*fddunlap@gw.dec.state.ny.us*)
Andrew Luce - Warrensburg 518-623-1229 (*alluce@gw.dec.state.ny.us*)
Tamara Venne - Ray Brook 518-897-1243 (*tjvenne@gw.dec.state.ny.us*)
Region 7 Division of Water- Syracuse
Scott Cook, 315-426-7502 (*sdcook@gw.dec.state.ny.us*)
Region 8 Division of Fish Wildlife & Marine Resources- Avon
Web Pearsall, 585-226-5339 (*wepearsa@gw.dec.state.ny.us*)

Responsibilities

1. Sample Collection
   a. Collect lake samples in assigned geographic areas as scheduled following prescribed sampling procedures and quality assurance methods.
   b. Transmit field data to program coordinator.
   c. Maintain assigned LCI Monitoring Program field equipment.
   d. Communicate problems and/or needs concerning sample collection to program coordinator.
2. Provide Site Selection Guidance to Central Office as requested.

V. Analytical Laboratories

The complete list of laboratories used in this monitoring program appears in Section II, Data Generation and Acquisition.

Responsibilities

1. Provide sample containers and paper work as needed.
2. Provide expertise in sample collection protocols.
3. Provide expertise in analytic methods.
4. Analyze water quality samples and report results.
    a. Provide analysis of specified parameters for water column, bottom sediment and biological tissue samples.
    b. Transmit analytic data to NYS-DEC via agreed upon media/format.
5. Implement internal quality assurance/quality control procedures.

Division of Fish Wildlife & Marine Resources
Bureau of Fisheries
Inland Fisheries Section

VI. Fisheries Water Chemistry Lake Sampling

Jeff Loukmas, Co-Project Leader, 518-402-8897 (*jjloukma@gw.dec.state.ny.us*) and Lisa Holst, Co-Project Leader, 518-402-8887(*lkholst@gw.dec.state.ny.us*)

Responsibilities

1. Coordinate the collection of water chemistry samples, field parameters and aquatic plant samples, by Regional Fisheries Staff, at lakes, selected for comprehensive fish community assessments, following the most recent version of The Collection of Lake Water Quality Samples SOP (#203-12).
2. Submit water chemistry samples and chain of custody forms to the Analytical Laboratory with copies sent to the LCI Program Manager.
3. Provide the LCI Program Manger with copies of field parameter and water chemistry data at the conclusion of each monitoring season.

New York State Office of Parks Recreation and Historical Preservation
Environmental Management Bureau

VII. State Parks Total Phosphorus Lake Sampling

Karen Terbush, Project Manager, 518-474-0409 (*Karen.Terbush@oprhp.state.ny.us*)

Responsibilities

1. Conduct total phosphorus sampling at targeted lakes within New York State Parks and Historical Sites following the most recent version of The Collection of Lake Water Quality Samples SOP (#203-12).
2. Collect aquatic plant samples following prescribed sampling procedures and quality assurance methods
3. Submit samples and chain of custody forms to the LCI Program Manager.

New York State Department of Health

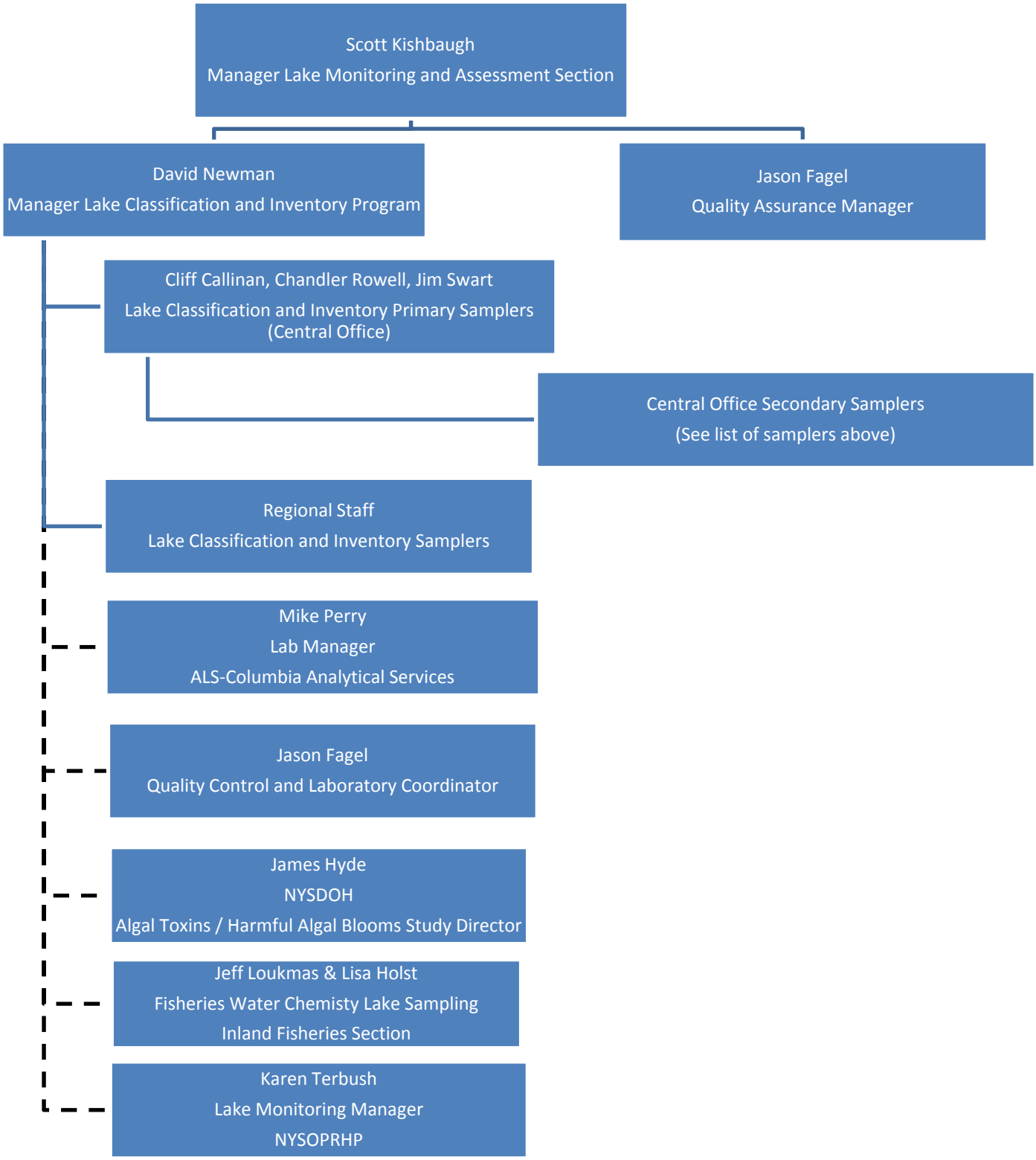
VII. Bureau of Public Water Supply Protection

James Hyde Algal Toxins / Harmful Algal Blooms Study Director, 518-402-7713 (*jbh01@health.state.ny.us*)

Responsibilities

1. Provide sample containers, for Algal toxins project, as needed.
2. Conduct quality control checks for comparison to samples collected by NYSDOH staff.
3. Update DOW staff with progress of the Harmful Algal Blooms Study

Figure 1: Organization Chart



2. Background– Description of Problem

New York State is mandated to conduct a statewide water quality monitoring program. This mandate originated in the mid-1960s and activities to fulfill this mandate have evolved over time. By the early 1980s an ambient lake monitoring program was developed to evaluate baseline water quality conditions in lakes throughout the state, utilizing a rotating monitoring cycle loosely patterned after the stream monitoring programs conducted by the Department. However, due to staff shortages, this ambient lake monitoring program (the LCI) was suspended in 1990. This left the NY Citizens Statewide Lake Assessment Program (CSLAP), a volunteer lake monitoring program overseen by NYSDEC, as the only statewide ambient lake monitoring program conducted by the NYSDEC.

In 1987 the Rotating Integrated Basin Studies (RIBS) Sampling Program was established within the NYSDEC's Division of Water, to bring together a variety of monitoring strategies into one program. In the years since, the program has undergone steady changes and growth, aimed at providing better monitoring and assessment of New York State's water quality. One component of this evolution was the coordination of efforts between the RIBS stream program and the re-establishment of the LCI Monitoring Program in the mid-1990s. By 1998, the rotating schedule developed through the RIBS stream program was adopted by the LCI Monitoring Program, with a further convergence between some site selection and logistics activities associated with each program. The LCI Monitoring Program outlined in this document is an integral component of the New York Statewide Waters Monitoring Program and of the Division of Water's *Comprehensive Water Quality Monitoring Strategy*.

The New York Statewide Waters Monitoring Program represents the foundation of the Division of Water's Comprehensive Water Quality Monitoring Strategy. The primary goals of the LCI Monitoring Program component of the New York Statewide Waters Monitoring Program include:

- water quality screening of as many waters as possible to document "good" waters that support designated uses, and identify waters with possible/potential impairment to uses;
- intensive sampling of selected waters to evaluate impairments, causes and sources and to characterize general water quality conditions

The water quality data and assessments generated by the LCI Monitoring Program are used to support various water quality management functions within the NYSDEC Division of Water. Specifically, lake monitoring information is used to: update the Division's Waterbody Inventory/Priority Waterbody List, a database of water quality conditions and impairments across the state;

- help identify water bodies not meeting their designated uses for inclusion on the New York State Section 303(d) List of Impaired Waters
- prepare the New York State 305(b) Water Quality Report, a biennial report to Congress on the quality of water resources in the state;
- select locations for more intensive water quality surveys and investigation as well as other special water quality monitoring projects;
- support the development of Total Maximum Daily Load (TMDL) plans and water quality based SPDES permit limits;
- support development of nutrient criteria within the state and within selected NYS ecoregions;

- complete USEPA's Index of Watershed Indicators (IWI), the Unified Watershed Assessment (UWA) and other federal water quality initiatives.

3. Program / Task Description

The following tasks will be performed as part of this monitoring program:

A. Collection of monthly samples and field observations during the summer months at intensive network sites, through the LCI Monitoring Program surveys in the **Lower Hudson River**, **Black River** and **Chemung River** drainage basins. Sampling sessions will include water sample collections, assessments of use impairments, visual observations and identification of submergent macrophytes (to genus level for indigenous species, and to species level for exotic species; voucher specimens of exotic species will be collected and bagged for laboratory identification), and observations about weather and sky conditions from a single site at the lake, corresponding to the deepest portion of the lake.

Collection of single samples at screening sites through the LCI Monitoring Program surveys in the **Lake Champlain**, **Susquehanna River** and **Atlantic Ocean-Long Island Sound** basins. Sampling sessions will include water sample collections, assessments of use impairments, visual observations and identification of submergent macrophytes (to genus level for indigenous species, and to species level for exotic species; voucher specimens of exotic species will be collected and bagged for laboratory identification), and observations about weather and sky conditions from a single site at the lake, corresponding to the deepest portion of the lake.

The LCI Monitoring Program schedules, and lists of sampling locations, associated with each of these tasks, are outlined in Appendix A and B, respectively. Specific locations (coordinates) can be found at: ftp://ftp.dec.ny.gov/dow/BWAM/LCI/.

4. Quality Objective and Criteria

Data quality requirements including criteria for detection limits, precision, and accuracy for water chemistry parameters are listed in Table 1. The application of the tabulated requirements is described below as well as additional data quality considerations. These data quality requirements are consistent with those used in other water quality monitoring programs conducted by the NYSDEC and other state agencies, and are consistent with requirements provided by USEPA. These also satisfy the data requirements associated with the state water quality standards, 6 NYCRR Part 703.

Sensitivity relates to the lowest detection limit of the method or instruments, for each of the parameters of interest. For the LCI, the methods and instruments/sampling equipment selected for use have detection limits that allow for comparison to both numeric and narrative New York State Surface Water Quality Standards. Comparison to these standards and guidance values (where numeric standards do not exist) are the basis for assessing whether a waterbody is meeting its designated uses.

Precision will be measured by the use of field duplicate samples. Field duplicates will be collected immediately after collection of the environmental sample, using the same sampling equipment and procedures followed for the collection of the environmental sample. Duplicates will be assigned unique sample identification numbers by field staff, which will not be linked within the laboratory to the analytical sample (i.e. blind samples). Duplicate samples will be collected at a frequency of one per 15-20 environmental samples, roughly corresponding to one duplicate sample collected during each week of sampling. Given the sampling schedule outlined in Appendix B, this will correspond to approximately 1 duplicate per sample delivery group (SDG). Since the monitoring program involves many repeat measurements over a relatively short period of time (< 6 months), the Relative Standard Deviation (RSD) of measurements from the repeat sampling sites will be used as a secondary metric of precision. The precision of field measurements will be measured by duplicating one complete vertical profile per every 15 sampling events. A duplicate Secchi Disk reading will also be collected once per 15 lakes.

Accuracy will be measured by collecting certain samples in duplicate (or triplicate) and then designating these additional aliquots to be spiked at the laboratory and carried through the analysis process as a matrix spike. The laboratory will also run a spiked water blank (or LCS, frequency = minimum 1 per SDG) to assess any bias in the analytical system. Multiprobes will be calibrated to the manufacturer's specification at the intervals listed in Table 1. At the end of each sampling week each parameter on the multiprobe will be checked against a known standard to ensure the calibration was held during each sampling week.

Representativeness of samples in defining the sampled waterbodies is addressed by using standard limnological sampling protocols in regards to sample location within the waterbody and water column (for spatial representativeness) and frequency of sampling (for temporal representativeness). These are addressed by complying with the existing lake sampling SOP; described in greater detail in the NYSDEC Lake Sampling SOP; SOP#203-12. These are also discussed in Section II.

Comparability is a measure of how data results can be compared between different sampling events at the same location, how data can be compared between different sampling locations, and how data can be compared to water quality standards. For the LCI, comparability will be achieved by following consistent field sampling protocols (from site to site and year to year), sampling at the same locations, and obtaining analytical data following standardized methods for chemical analyses of water.

Table 1: Analytic Specifications and QA/QC Requirements - in Water Column

Parameter	Analytic Lab	Standard Method	Precision	Accuracy	Resolution	Calibration			Detection Limit/Range	Reporting Limit
						Initial	Ongoing	Blanks		
Field Parameters										
Temperature	In Situ	2550 B	± 1˚C	± 1.5˚C	0.1˚C	Factory Set			-5-45˚C	same
Dissolved Oxygen		4500-0 G	± 1%	± 6%	0.01 mg/l	Daily			0-50 mg/l	same
pH, field		4500-H + B	± 0.05 SU	± 0.2	0.01 pH units	Weekly			0-14 pH units	same
Conductivity, field		2510 B	± 0.001mS/cm	± 1%	1 mS/cm	Monthly			0-100 µmho/cm	same
ORP, field		2580 B	± 1mV	± 20mV	0.1 mV	Monthly			-999- 999 mV	same
Clarity, field		SOP #203-X	± 0.1 m	± 0.1 m	0.1 m	Monthly			0.1 m	same
Nutrients										
Ammonia	ALS-Columbia	EPA 350.1	± 20% RPD	± 20%	± 20%	Daily	Every 10 Samples	Every 10 Samples	0.0100 mg/l	same
TKN		EPA 351.2							0.100 mg/l	same
Nitrate/Nitrite (NOx)		EPA 353.2							0.00200 mg/l	same
Phosphorus, Total		EPA 365.1							0.0030 mg/L	same
Phosphorus, Reactive		EPA 365.1							0.00300 mg/l	same
Sediment Phosphorus, Total		EPA 325.2							5.6 mg/kg	same
Minerals and Metals										
Calcium	ALS-Columbia	EPA 200.7	± 20% RPD	± 20%	± 20%	Daily	Every 10 Samples	Every 10 Samples	1.0 mg/l	same
Chloride		EPA 300.0							0.200 mg/l	same
Sulfate		EPA 300.0							0.200 mg/l	same
Arsenic		EPA 200.8							0.1 ug/l	same
Iron		EPA 200.7							0.1 mg/l	same
Manganese		EPA 200.7							0.01 mg/l	same
Silica		USGS 1-2700-85							0.01 mg/l	same
Other										
Chlorophyll *a*	ALS-Columbia	SM 10200H	± 20% RPD	± 20%	± 20%	Daily	Every 10 Samples	Every 10 Samples	2.0 mg/m3	same
True Color		SM 2120B							1.0 cu	same
pH		EPA 150.1							0.1 pH units	same
Specific Conductance		EPA 120.1							1 µmho/cm	same
Total Alkalinity		SM 2320B							2.00 mg/l	same
Total Organic Carbon		SM20 5310C							1.00 mg/l	same

Completeness is a measure of the number of samples intended to be collected and analyzed compared to the number of samples actually collected and analyzed, expressed as a percentage. Due to the nature of the LCI Monitoring Program as an ambient monitoring program--where water quality sampling is repeated at the same locations--incomplete data would result in a lower level of confidence in, but not necessarily invalidate, conclusions drawn from the data. Generally, eighty-five percent (85%) of LCI samples at a site will be considered to be the minimum acceptable level of completeness.

5. Special Training/Certifications

All Primary Samplers will meet the minimum job qualifications for, or be employed in one of the following New York State Civil Service titles: "Environmental Engineering Technician 1" , "Environmental Program Specialist Trainee 1", "Environmental Analyst 1", "Biologist 1 Trainee", "Fish and Wildlife Technician 1" and/or "Water Quality Program Specialist" before they will be able to be a Primary Sampler (minimum qualifications for some of the above position are available at http://www.dec.ny.gov/about/571.html).

Program specific training is the responsibility of the Program Manager and is required for all field staff involved in the current sampling program to ensure the proper collection of water samples and field data.

In addition all DOW staff, conducting sampling through the LCI Monitoring Program, will participate in health and safety training when these courses are offered by the Department. These courses include:

- US Coast Guard boating safety course offered through the DEC training program
- ECO Training Academy hands-on boating safety class
- Other recommended training provided through the DOW Health and Safety Program

6. Document and Records

Field Data Sheets

Hard copies of the field data sheets (see Figure 2 below) are to be submitted to the LCI Program Manager and/or entered by one of the Primary Samplers into the MS Excel workbook for the appropriate sampling year. Field data will be stored electronically at L:\DOW\Statewide Monitoring\Lakes WQ Data.

Analytical Laboratory Results

Complete data packages are required for the LCI Monitoring Program, in order to provide data validation capability. Data packages will be delivered to the Assistant Quality Assurance Officer, in accordance with the requirements of the NYSDEC Prescribed Analytical Protocols-Volume 5 (2011), and to the LCI Monitoring Program Manager. The LCI Project Manager will review the results and discusses any irregularities with the Assistant Quality Assurance Officer.

Linking Field Data to Analytical Laboratory Data
A sample identification number is used to associate laboratory water chemistry data with data that was collected in the field. These sample identification numbers are created by the LCI Program manager before sampling takes place. The sample identification number will take the form of the following:

YY-ACB-xxx

- YY : corresponds to the two digit year of sampling (13 will be used for all 2013 samples)
- ACB: corresponds to basin the sample was taken in. In 2013, the sampled basins will be the, Chemung River Basin (=CHM), the Black River Basin (=BLK), Lower Hudson River Basin (=LHB), Atlantic Ocean-Long Island Sound Basin (=LIB), Susquehanna River Basin (=SRB), and Lake Champlain Basin (=LCB).
- xxx: is a pre-assigned (by the Program Manager) 3 digit number that is unique for each sample taken in a given basin during a given year.

Aquatic Macrophyte Identifications
The scientific name of any aquatic macrophytes that is submitted to Central Office for identification or identified in the field will be added to the corresponding electronic record that contains the field data collected in conjunction with the macrophyte.

Calibration Log Books
A calibration/maintenance log book is kept with each multiprobe unit in accordance with SOP # 211-11, Use Calibration, Maintenance and Storage of multi-probe meters used to measure water quality parameters.

Records Retention
Legally, all records from the LCI Monitoring Program fall under Records Disposition Authorization Number 17099, and are to be retained for at least 3 years as specified by the Department's Records Retention Documents found at http://internal.dec.state.ny.us/home/about/recordsmngmt.html. In practice, records of documentation must be retained until the data are no longer being used.

All results will be summarized in a final report to be prepared by the Project Manager
The final report will include all field and laboratory QA/QC results including any blanks, duplicate analyses, matrix spike and matrix duplicates analyzed during this study. An evaluation of the precision, accuracy, and completeness based upon replicate and spike analysis will be accomplished. A summary section on how QA/QC objectives were or were not met will be included in the final report. The final report will include a summary and discussion of analytical results for those parameters included in Tables 1.

II. DATA GENERATION AND ACQUISITION

1. Rationale of Monitoring Design

Sample Distribution

Based on the objectives of the New York Statewide Waters Monitoring Program (SWMP) and contained in the program's Quality Assurance Management Plan (NYSDEC, 2012), the LCI Monitoring Program uses a rotating strategy in which waterbodies in all major drainage basins in the state are monitored over a five year cycle. In 2013, waterbodies of six of the seventeen major drainage basins in New York State will be sampled. These basins are the Lake Champlain, Susquehanna River, and the Atlantic Ocean/Long Island Sound Basin(Year 1: Screening Sampling) and the Lower Hudson River, Chemung River, and Black River basins (Year 2: Intensive Sampling). In 2013, there will be approximately 25 lakes sampled in the 3 screening basins, with approximately 20 lakes sampled in the 3 intensive basins.

Sampling locations are selected according to criteria that ensure samples collected will meet the monitoring program's objectives (see below for criteria used).

Year One: Planning and Screening

The Year One Screening Network's focus is on the largest waterbodies within each basin that the Division of Water has no water quality data for. In addition LCI Monitoring Program staff will meet with regional staff, other monitoring unit staff, and local parties to discuss water quality issues/problems in the basin, and where specific monitoring efforts may be directed. The primary LCI Monitoring Program sampling activity during Year One will be the Screening Network monitoring, using key eutrophication indicators collected in the critical portion of the summer, to provide a preliminary evaluation of water quality conditions in a large number of lakes, as well as limited biological monitoring. The Screening sampling efforts will provide some qualitative documentation of "good" quality waters and identification of waters with possible impairment, including those waters that may also be candidates for the Intensive Network monitoring to be conducted in Year Two.

Year Two: Intensive

Results of the Year One Screening as well as other sources of information will be used to identify lakes where more intensive chemical and biological monitoring is appropriate. In addition, Intensive sites are identified through review of the existing Waterbody Inventory/Priority Waterbodies. The sampling of these Intensive sites is the primary LCI Monitoring Program activity during Year Two of the study.

A. Selection of Lakes to be Sampled

One of the most important components of planning a monitoring network is site selection. The specific rationale for the selection of the lakes to be sampled varies for each of the three component networks due to the different objectives of each.

Screening Network lakes are identified using the criteria described below

- The focus of the Screening Network is on lakes that the Division of Water does not have previous water quality data for. The limited data collected in the Screening Network may be sufficient to characterize extreme conditions in these lakes (particularly at the extremes in the trophic spectrum), or may be utilized to move a sampled waterbody into Intensive Network Sampling.
- Additionally, a small number of lakes having potential water quality problems that have been brought to the Program Manager's attention by other DEC staff (central and regional office) and/or the public will be included in the Screening Network.

Intensive Network lakes are identified using the criteria described below:

- *Waterbody Inventory/Priority Waterbodies* - Verification of water quality conditions and suspected impairment is the primary function of Intensive Network monitoring. Specifically, Waterbody Inventory/Priority Waterbodies listings with minimal documentation ("possible" or "suspected") and/or use impairments that may result in designation of these waterbodies of the USEPA 303d impaired waters list and therefore be subject to the development of a Total Maximum Daily Limit plan are considered the highest priority candidates for each sampled basin;
- Lakes with potential water quality concerns based on data collected during the screening year.

B. Identification of Sampling Sites

The Screeningand Intensive network sampling sites are located at the "deep hole" of each lake and are chosen through bathymetry or an initial sounding survey using an electronic sounding device. Once the sampling site is chosen GPS coordinates are recorded, these coordinates are used to locate the sampling site in any subsequent sampling sessions at the target waterbody.

C. Accessibility of Sampling Locations

The Screening and Intensive network sampling sites are accessed through public or private boat launches or from gaining permission from local residents (including municipalities) with shoreline access to the lake. The LCI Program Manager with assistance from other Primary Samplers and/ or regional DEC staff will attempt to determine the most suitable access point for all Screening and Intensive network lakes two to six weeks before sampling is begun. Once suitable access sites are determined the LCI Program Manager will contact local residents or lake associations found through tax map information and internet searches, to request permission (written or verbal) to sample those lakes that do not have a public access point. Sampling locations not accessible, due to the inability to secure permission, are deferred until access can be secured.

D. Selection of Monitoring Parameters

Use Perception Surveys

Samplers complete a field perception surveys during each sampling session. These surveys are used to evaluate recreational and water quality perceptions and, when linked with water quality data collected at the same time, can link water quality data to management objectives. This portion of the field sheet (Figure 2) is completed before all other measurements are taken. This eliminates bias based on water quality measurements.

Chemical Monitoring Parameters are selected based on a number of factors (Table 2). Limited analytic budgets dictate that economy and efficiency are considered in parameter selection and sampling frequency. Beyond that, the LCI Monitoring Program chemical sampling is designed to evaluate trophic status and characterize ambient water quality conditions in lakes using trophic or trophic-surrogate indicators.

Table 2: Water Column Parameters

Indicator	Description	Sampling Network
Field Parameters (Air and Water Tempeature, pH, DO, Conductivity, ORP, Clarity)	to provide general characterization of lake	Intensive and Screening Networks
Conventional Parameters (Nutrients & Color)	to indicate cultural eutrophication; determine sediment and nutrient load as impacting phytoplankton or macrophyte growth	Intensive and Screening Networks
Common Minerals, Metals	to determine geologic contribution and evaluate potential human health impacts	Intensive and Screening Networks
Heavy Metals	frequently detected priority toxics (naturally occurring/industrial use)	Intensive and Screening Networks

Biological Monitoring Indicators- a limited number of biological monitoring parameters have also been incorporated into the LCI Monitoring Program (Table 3). Specific biological monitoring activities include collecting integrated samples for chlorophyll *a* analyses, collecting macrophytes for identification and integrated and/or grab samples for investigating cyanotoxins associated with blue-green algal blooms.

- **Biological Sampling**- To address potential swings in the biologic community structure, and to complete the trophic characterization of the lake, chlorophyll *a* samples are collected in conjunction with all surface (versus hypolimnion) water samples. Macrophyte specimens are collected during the first visit to each program lake and during each subsequent monitoring event only if additional species are observed.
- **Algal Toxin/Harmful Algal Bloom Special Study**- To assist the New York State Department of Health in a Algal Toxin/Harmful Algal Bloom (HAB) Study, LCI field teams will collect extra samples at lakes that are visually observed to be undergoing a full lake algal bloom, characterized by an overall green appearance with low water clarity (< 0.5 m), and/or at lakes that are observed to have accumulations of algae at near shore locations, characterized by algal scums and/or mats at the surface of the lake. For lakes undergoing a full lake bloom an additional 1000ml of raw water is collected at the surface of the lake with an integration tube. Grab samples of algal scums and/or mats are collected with bottles provided by DOH. Phycocyanin samples are run on each of these samples in the laboratory.

Table 3: Biological Indicators of Water Quality

Indicator	Description	Sampling Network
Phytoplankton standing crop (chlorophyll *a*)	Used to estimate density of algal communities.	Intensive, and Screening Network
Macrophyte identification	Focuses on collection and identification of nuisance macrophyte species and/or endangered aquatic plant species; the former consists primarily of exotic submergent macrophytes.	Intensive, and Screening Networks
Algal toxin analysis	Used to evaluate susceptibility to potable water or contact recreational exposure to cyanotoxins	Analysis of microcystin measurements from blue-green algal blooms observed in eutrophic and Class A lakes

2. Sampling Methods

Sampling methods utilized in this Monitoring Program have been previously outlined in NYSDEC Division of Water SOPs. Lake open water sampling will be conducted as per SOP # 203-12 (Lake Sampling SOP), sediment coring and sub-littoral macroinvertebrate sampling will be conducted as per the most current revision of SOP #207-12 ("Sediment Sampling SOP") and shoreline lake sampling undertaken as part of these programs will be conducted as per the most current revision of SOP # 208-12 (Stream Biomonitoring SOP). No variances from these SOPs in regards to sampling methodology, sampling equipment, and sample processing are expected for this monitoring program.

The following equipment will be utilized for *in-situ* data collection as part of this sampling program- the use of this equipment is outlined in the aforementioned SOPs:

Lake Water Sampling-

- Water Sample Collection:
  - Amber Wide-Mouth Sampling Bottle (surface monitoring for lakes less than 1.5 meters in depth)
  - Integrated sampling tube (surface monitoring for lakes 1.5 meters or greater in depth)
  - Van Dorn bottle (grab depth samples, primarily for hypolimnetic samples)
  - field filtration (hand pump)

- Field Measurements:
  - Secchi disk
  - electronic multiprobe

- Macrophyte Sampling-
  - Two sided rake with tether line

- Algal Toxin/Harmful Algal Bloom Special Study
  - Integrated sampling tube (surface water sample)
  - Sample bottle provided by DOH (grab sample)

The Screening and Intensive sites are monitored by NYSDEC staff using a NYSDEC sampling vessel. Hand-operated sampling boats- canoes and small john boats with oars and or an electric trolling motor- are used for the sites that are less than 200 hectares (500 acres) in surface area or for sampling site that are less than 1 mile from the boat launching area. For larger Intensive and Screening sites, a 12-15 foot boat outfitted with up to a 15hp outboard motor is used for the sampling.

Split sampling will be conducted for QA purposes. Filtering, compositing, and splitting of samples are discussed in detail in the aforementioned SOPs. Samples are well mixed when the subsamples are drawn. The sample splitting churn, mixing carboy or collapsible container are designed to accomplish this. Sample splitting procedures are performed as described in the NYSDEC Lake Sampling SOP; SOP#203-12.

Lake samples will be filtered for chlorophyll *a* and soluble phosphorus. Filtered samples are prepared after the unfiltered sample (raw water) containers are filled. A known volume of raw water (see Table 4 below for volume guidance) from the surface sample is filtered through 45µm. fiber filter (GF/C) for chlorophyll *a* analysis (due to the lack of light penetration chlorophyll *a* is not analyzed for in hypolimnion samples). The chlorophyll *a* filter is folded in quarters and wrapped in aluminum foil and transferred to a borosilicate vial and submitted for laboratory analysis. For soluble phosphorus, a 45µm Cellulosic filter is used and the filtrate is transferred to the subsample bottle and submitted for laboratory analysis.

Chlorophyll *a* and soluble phosphorus filtrations are performed as described in the NYSDEC Lake Sampling SOP; SOP#203-12.

Sample containers and preservatives used for the analytes measured in this sampling program are listed in Table 1 of the most current version of the NYSDEC SOP "Ambient Surface Water Sampling SOP # 210-11".

Field Sheets

A field sheet provides a record of each sampling event (see Figure 2). A field sheet is used to record: (1) field measurements of basic water quality parameters (water temperature, dissolved oxygen, pH, and conductivity), (2) other notable field observations, including water clarity, weather, aquatic macrophyte species observed or collected, and other information about the actual sample, (3) indicate semi-quantitative (scored) observations of lake perception; and (4) additional comments to evaluate analytical sampling results.

Table 4: Volume of Water to be filtered for Chlorophyll a Analysis

Secchi Disk Depth	Volume of raw water to filter
< 1 meter	250 ml
>1 but < 2 meters	500ml
> 2 meters	1000ml

*This table provides only a guide to a reasonable compromise. If staff can filter more water without seriously increasing the filtering time they should do so. If the filter is noticeably green and staff has not filtered the specified amount, then less water may be filtered. The actual volume of filtered water needs to be recorded on the field sheet and on the laboratory chain of custody. This information is used in the calculation of chlorophyll *a* concentrations.

A copy of the field sheet is sent to the LCI Program Manager. Once received by the project manager, one of the Primary Samplers will use the field sheet to enter the information into the Excel workbook for the appropriate sampling year. Field data will be stored electronically at L:\DOW\Statewide Monitoring\Lakes WQ Data.

All field sheets include spaces for writing lake name and/or site description, sample identification number (linking it to the analytical results), sampling date, weather condition (wind, sky), macrophyte identification listings and qualitative assessment of densities/extent of aerial coverage, water clarity, water color (qualitative), volume of water filtered for chlorophyll *a* and sounding depth.

Field Observations/Lake Perception Survey
Samplers complete the field perception portion of the field sheet (Figure 2) before collecting any samples or performing any field measurements, this is to prevent introducing bias into their perception of the lake. These assessments were developed as part of the Citizens Statewide Lake Assessment Program (CSLAP) and allow comparison of perception data across programmatic lines. These surveys are used to evaluate perception of lake conditions (necessary to evaluate impairments to aesthetic and recreational use impacts that are not otherwise measurable through the LCI monitoring program).

(a) The physical condition of the lake, ranging from:
(1) crystal clear, to (5) severe algae levels with massive floating scum/streaks, fish kills, and/or odor (one choice only);
(b) The aquatic plant populations in areas where people boat and swim in the lake, ranging from:
(1) not visible from the lake surface, to (5) dense growth covering all but the deepest part of the lake (one choice only);
(c) The recreational perception of the lake, ranging from:
(1) beautiful, could not be nicer, to (5) swimming and aesthetic use of the lake impossible (one choice only); and
(d) The conditions that affect recreational perception of the lake, among:
(1) poor water clarity, (2) excessive weed growth, (3) too much algae/odor, (4) lake looks bad, (5) poor weather, or (6) other (multiple choices possible)

Aquatic Macrophytes: Aquatic macrophytes are identified and densities are qualitatively assessed by observation from sampling vessels or through shoreline observations. Plant identifications to genus and, where possible, species level are largely limited to the littoral zone at the boat launch site and transit to and from the sampling areas. When an invasive non-indigenous species or a rare-threatened or

endangered species is found or suspected a single specimen or two of these macrophytes are placed in a plastic sealable bag with a moist paper towel. Sediment, algae, or other debris should be removed, but any flowers, leaves, stems, and other plant parts useful for identification should be included. The bag is labeled with the Lake Name and Date. Specimens are kept cool until they can be brought or shipped to:

Scott Kishbaugh
NYSDEC
625 Broadway, 4th Floor
Albany, NY 12233-3502

When samples are received in central office one or more of the Primary Samplers or other consulting botanist will confirm the identification of the species. After the identification is made the scientific name of the specimen will be entered into the corresponding electronic record that contains the field data collected in conjunction with the specimen. If a rare, threatened, or endangered plant species is found, information regarding the exact location and extent of the population will be submitted Stephen Young at the New York Natural Heritage Program (young@nynhp.org) by the Primary Sampler that observed the plant. If an invasive species is encountered information regarding the exact location and extent of the population will be submitted to New York iMapInvasives at http://www.nyimapinvasives.org/.

Water Clarity: Water clarity measurements are collected with the use of a Secchi disk, a black and white quartered 20cm disk connected to a non-stretch vinyl line with gradations at 0.1 meters. The Secchi disk is lowered over the shady side of the boat. The depths at which the disk disappears and reappears, respectively, from sight are averaged and recorded, to the nearest 0.1 meters, as the Secchi disk transparency. If the Secchi disk is still visible while resting on the lake bottom, the measurement is qualified on the field sheet with a greater than sign (>).

Field Parameter Measurements
Water temperature, dissolved oxygen, pH, ORP, and conductivity are to be recorded in the appropriate places on the field sheets (Figure 2).

Vertical profiles are taken with a YSI Model 556 probe, Hydrolab Surveyor III multiprobe, or Hydrolab MS5 Multi parameter Sonde (hereafter all three will be referred to as “multiprobe(s)”). In-situ data for dissolved oxygen, temperature, water depth, pH, specific conductivity and ORP are collected at one meter intervals from the surface throughout the thermocline and hypolimnion with a multiprobe. Calibration and calibration drift checks are conducted before and after each sampling trip and the multiprobes are standardized in the laboratory prior to the initiation of each sampling run. The multiprobes provide both digital readouts and data logging capabilities, with all parameters displayed simultaneously.

> **Dissolved Oxygen:** D.O. measurements are taken after the equipment has been appropriately calibrated. The manufacturer's directions are followed when calibrating and using the meter. With the multiprobe, D.O. is standardized against barometric pressure (measured in the unit).
>
> **Specific Conductance/Conductivity:** Conductivity measurements are taken after the equipment has been appropriately calibrated. The manufacturer's directions are followed when calibrating and using the multiprobe.

pH: pH measurements are collected after the equipment has been appropriately calibrated using standard buffers that reflect the expected pH of the lake (s). All multiprobes are standardized against pH 7 buffer; when acidic lakes are sampled, the units are also standardized against pH 4 buffer, while pH 10 buffers are used when alkaline lakes are sample. The manufacturer's directions are followed when calibrating and using the multiprobe. Electrodes are rinsed well after each reading. If the readings of electronic meters are suspect, pH indicator strips with an accuracy of 0.3 pH units may be used in place of the electronic meter.

ORP: OPR measurements are taken after the equipment has been appropriately calibrated. The manufacturer's directions are followed when calibrating and using the multiprobe.

Water Temperature: Water temperature measurements are collected with a multiprobe. The temperature is factory calibrated on all multiprobes used for LCI monitoring.

Air Temperature: Air temperature measurements are collected with either a multiprobe or an ASTM approved non-mercury glass bulb or dial thermometer. Air temperature measurements are taken in a shaded area that is protected from strong winds but open to air circulation. The calibration cup on multiprobe units are replaced with the sensor guard before air temperature readings are taken.

Sample Information
Water depth (depth range for integrated sample) and text descriptions of color, odor, and comments specific to the sample/the collection of the sample are recorded on the Field Sheet

Notes and Remarks
Any conditions/observations that the sampling team deems pertinent to making an informed assessment of the water quality status and/or designated uses is noted on the field sheet.

Sampling Equipment Cleaning
Cleaning and decontamination of sampling equipment will be handled as per the SOP#103-11.

Figure 2: LCI Field Data Sheet

LAKE CLASSIFICATION AND INVENTORY SURVEY (LCI) FIELD SHEET

LAKE NAME_____ DATE_____ TIME_____

SITE DESCRIPTION_____
(location of sampling site in the lake)

GPS CORDINATES_____ _____
(Set GPS to WGS84 with WAAS enabled | record coordinates in decimal degrees)

WEATHER_____ _____
(current) (past 48 hours)

MACROPHYTES_____

_____

PERCEPTION: (circle 1 per line)						
	QA (**Water clarity**)	1 (Crystal Clear)	2 (Not quite **CC**)	3 (Algal Greenness)	4 (High **AG**)	5 (Severe **AG**)
	QB (**Weed coverage**)	1 (None visible)	2 (Below surface)	3 (At surface)	4 (Dense at surface)	5 (Cover surface)
	QC (**Recreation**)	1 (Could not be nicer)	2 (Excellent)	3 (Slightly Impaired)	4 (Greatly Impaired)	5 (Not usable)

Reasons for recreational impact_____
Evidence of current uses_____
Comments_____

		Integrated Sample	Hypo Sample
ZSecchi_____m	SAMPLE#	11_____	11_____
Water Color_____	DEPTH	_____	_____
ZSounding_____ft or m	COLOR	_____	_____
Air Temp_____°C	ODOR	_____	_____
Chlorophyll *a* volume _____ ml	COMMENTS	_____	_____

DEPTH PROFLIES

Depth (m)	Temp (°C)	DO (mg/l)	pH	SpCond (µS/cm)	ORP
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
0					

Field Crew

3. Sampling Handling and Custody

The collection method, sample container, preservative method, and holding time for all of the analytes are provided in Table 5. Samples are either shipped overnight or hand-delivered to the laboratory.

Table 5: Sampling Specification

Water Column					
Parameter	Medium	Collection Method	Sample Container	Preservation Method	Holding Time
Alkalinity	Lake	Depth Integrated or Grab	120 ml plastic	Chill-4^0 C	14 days
Major Anions (Cl, SO4)	Lake	Depth Integrated or Grab	250 ml plastic	Chill-4^0 C	28 days
Total Phosphorus (TP), NO_3+NO_2	Lake	Depth Integrated or Grab	250 ml plastic	Chill-4^0 C	28 days
NH3, TKN	Lake	Depth Integrated or Grab	250 ml plastic	Chill-4^0 C	28 days
Major Cations (Ca, Fe, Mn)	Lake	Depth Integrated or Grab	500 ml plastic	HNO_3 Chill-4^0 C	28 days
Other Metals (As)	Lake	Depth Integrated or Grab	500 ml plastic	HNO_3 Chill-4^0 C	28 days
Silica (Si02)	Lake	Depth Integrated or Grab	500 ml plastic	HNO_3 Chill-4^0 C	28 days
Total Organic Carbon (TOC)	Lake	Depth Integrated or Grab	250 ml plastic	Chill-4^0 C	14 days
True Color	Lake	Depth Integrated or Grab	150 ml plastic	Chill- 4° C	2 days[#]
Chlorophyll *a*	Lake	Filtered Depth Integrated	Filter (volume to be filtered see table #4)	Chill-4° C	24 days
Algal Toxins/HAB Special Study	Lake	Depth Integrated and/or Grab	125ml plastic	Chill-4° C	7 days

[#] The 2 day holding time for True Color is recognized and every effort is made to have samples at the lab within the holding time although this may not always be possible. Results from samples analyzed past their holding time will be given a qualifier which will be maintained within the division's database.

Chain of Custody
All sample handling, transport, and custody procedures are detailed in NYSDEC-DOW SOP 101-11, Sample Handling, Transport, and Chain of Custody. Individual sample containers are labeled with pre-printed water proof labels to identify the four digit project year and drainage basin, sample ID number, lake name, collection date, and location within the water column (Figure 3).

Figure 3: Sample Container Label Examples

YYY LCI-*Basin* Sample No. *YY*BB*XXX* Lake Name: X Lake Date: ___*X*___/ __*X*___ / *YY* Sample Depth = *Surface or Bottom*	2012 LCI-Upper Hudson Sample No. 12UH051 Lake Name: Indian Lake Date: _____/ _____ / 12 Sample Depth = Surface Waters

A *Chain of Custody Record/Form* will be completed by sampling personnel and submitted to analytic laboratories with the samples (see Figure 4 for an example chain of custody form).

ALS-Columbia's Chain of Custody form also serves as a request for analysis (Figure 4). All sections of the Chain of Custody/Laboratory Analysis Request must be fully completed, including project name (LCI), project contact (LCI Project Manager), samplers name and signature, sample ID, date and time of sampling, sample matrix (water), the number of containers per sample (7 for hypolimnion, 8 for epilimnion, or more if a field duplicate and/or spike is collected being sent to the lab), analysis requested, lake name with location within the water column, and sample relinquished by.

The State Health Department has their own Chain of Custody/Request for Analysis Form for algal bloom samples (Figure 5). All sections of this chain of custody form must also be fully completed, including sample date, sampler's name, name of the lake, what county the samples was taken in, sample ID number (the same ID number from the integrated surface sample taken at the lake), sampler's remarks and comments, and the date the sample was shipped.

Transport and Shipping Procedures
All LCI water chemistry samples, except for parameters collected in the field and algal bloom samples are submitted to ALS-Columbia (address below). Algal bloom samples are shipped to the Biggs Laboratory of the Wadsworth Center/New York State Department of Health (address below). All LCI samples are shipped in large plastic coolers, with all samples submitted at the end of each sampling run. To safely ship chilled samples, the following guidelines are followed:

1. The cooler is carefully inspected. Broken and/or leaking coolers are replaced. Drain spouts are sealed.
2. All shipping coolers are lined with a plastic bag if using fresh ice.
3. All bottle caps are tightened.
4. To prevent breakage when samples are sent in coolers, all glass containers are placed in a foam sleeve, or its equivalent.
5. Generally, reusable ice packs are used to keep the sample chilled during shipping. Ice, if used, is placed in a plastic bag or otherwise contained.

6. During the summer, the coolers are pre-chilled. Then the samples are packed with fresh ice or ice packs.
7. The laboratory chain of custody sheets are placed in a plastic bag and fastened to the underside of the cooler's lid with tape.
8. All containers from the same site are grouped together in a plastic bag
9. The plastic liner bag is carefully sealed and the cooler taped shut.
10. All samples from a site are mailed in the same cooler

Table 6: Analytical Laboratories

LABORATORY NAME	LOCATION	LABORATORY SPECIALTY
ALS-Columbia (Former Columbia Analytical Services)	Rochester, NY	Dilute water systems
NYS Department of Health	Albany, NY	Toxic Substance Assessment

Mailing addresses for LCI Monitoring Program analytical laboratories are:

ALS-Columbia (Water column samples)

- ALS-Columbia, ATTN: Mike Perry
  1565 Jefferson Road
  Building 300, Suite 360
  Rochester, NY 14623
  Telephone: (585) 288-5380

New York State Department of Health (HAB samples)

- Biggs Laboratory
  Wadsworth Center
  NYS Department of Health
  Dock J-P1 Level
  Empire State Plaza
  Albany, NY 12237

All samples are either hand deliver to the laboratory or shipped overnight by UPS.

Figure 4: ALS-Columbia Chain of Custody Form

CHAIN OF CUSTODY

Page ____ of ____

New York State Department of Environmental Conservation – Division of Water

Project Name: LCI	**Project Number:** LCI2012	**NYSDEC SDG:**
X Report to Project Manager	**Sampler Collector:** David Newman	
Project Manager: David Newman	**Sampler Signature:** *David J Newman*	☐ **Bill to Project Manager** **Bill to:** Jason Fagel
Address: 625 Broadway, 4th Floor Albany, NY 12233-3502	**Address:** 625 Broadway, 4th Floor Albany, NY 12233-3502	**Address:** 625 Broadway, 4th Floor Albany, NY 12233-3502
Phone: 518-402-8201	**Phone:** 518-402-8201	**Phone:** 518-402-8156
Email: djnewman@gw.dec.state.ny.us	**Email:** djnewman@gw.dec.state.ny.us	**Email:** jrfagel@gw.dec.state.ny.us

Matrix Codes:
WW – Wastewater
GW – Groundwater
AW – Ambient Water
SE – Sediment
SL – Sludge
T – Tissue
O – Other _____

Preservative Codes:
(Please include in ( ) on "Analyses Ordered" line):
0 – Cool to < 6°C
1 – HCL
2 – HNO_3
3 – H_2SO_4
4 – NaOH
5 – Zn. Acetate
6 – MeOH
7 – NaHSO4
8 – Other

NYSDEC LCI Sample ID	Collection Date	Collection Time	Matrix Code	No. of Containers	Analyses Ordered (list)									Location Info/ NYSDEC Notes	Lab Sample ID/ Lab Notes
					2	3	3	0	0	0	0	0			
					Metals (Mg, Ca, Fe, Mn)	TP, NOx, NH4, TKN	TSP	TOC	True Color	Alkalinity	Cl, S04, Si	Chlorophyll a	Chl a Vol. (ml)		
12ALG101	6/15/12	10:00	AW	8	1	1	1	1	1	1	1	1	250	Bear Lake – epi	
12ALG102	6/15/12	10:05	AW	7	1	1	1	1	1	1	1			Bear Lake - hypo	
12ALG103	6/16/12	13:00	AW	8	1	1	1	1	1	1	1	1	500	Case Lake – epi	
12ALG104	6/16/12	13:05	AW	7	1	1	1	1	1	1	1			Case Lake – hypo	

Special Analysis Instructions:

Relinquished by Sampler:	Date:	Time:	Received by:	Date:	Time:
David J Newman	6/16/12	15:00			
Relinquished by:	**Date:**	**Time:**	**Received by:**	**Date:**	**Time:**
Relinquished by:	**Date:**	**Time:**	**Received by Laboratory:**	**Date:**	**Time:**

Laboratory Receipt Notes:

Sample Temp.: _____°C
Properly Preserved: Y / N
Samples Intact: Y / N

Figure 5. Chain of Custody Form for Algal Toxin/Harmful Algal Bloom Water Samples

Chain of Custody/Request for Analysis Form
DOH HABs

Ship to:
Biggs Laboratory
Wadsworth Center
NYS Department of Health
Dock J-P1 Level
Empire State Plaza
Albany, NY 12237

Sampling Date:

1. Sampled by (print and signature):_____

_____

Lake Name

2. County: _____

Sample Number for the 1.5 m sample:

Special bloom sample descriptions:
B1:
B2:
B3:
B4:

Sampler's
Remarks:

Shipping date:
Sample Received by: (print and signature):

Sample Identification
Samples will be identified by a unique identification number assigned to each sample. See the Documents and Records section above for details on how Sample Identification numbers are assigned.

3. Analytical Methods

Analytical methods used in this sampling program are provided in the Table 1. Samples will be analyzed as per the NYSDEC Prescribed Analytical Protocol-Volume 5 (2011).

5. Quality Control

I. Quality Control Sampling

The objective of the LCI Monitoring Program quality control methodology is to establish and maintain standards that will ensure the validity of the data. An integral part of sample quality is collection of representative samples. The usefulness of the data obtained from any monitoring program depends upon how accurately that data actually describes the characteristics of the waterbody being studied. The samples that are collected for analyses must accurately represent the studied waterbody and be unaffected by collection procedures, sample preservation and sample handling.

In order to monitor the integrity of this sampling effort, the LCI Monitoring Program quality control effort uses Matrix Duplicate, Matrix Spike, Field Blank, and Laboratory Control Samples.

> **Matrix Duplicate Samples** involve the independent analysis of two aliquots of a homogeneous sample by one laboratory. This sampling is used to determine the precision of the overall sampling process, from the collection of the sample through the analysis for a given matrix.
>
> Matrix duplicate samples are collected at one site during each week of sampling. This frequency corresponds to between five percent (5%) and ten percent (10%) of the samples collected. Matrix duplicates are analyzed for each of the sample analytes.
>
> **Matrix Spike Samples** are collected along with regular water quality samples and spiked in the analytic laboratory with a known concentration of analyte. The samples are then analyzed to determine the accuracy (percent recovery) of the analytic results for a given matrix.
>
> Matrix spike samples are collected at one site during each week of sampling. This frequency corresponds to between five percent (5%) and ten percent (10%) of the samples collected. Matrix spikes are analyzed for each of the sampled analytes.

Field Blank Samples are collected after sampling equipment has been cleaned using standard operating procedures by running deionized/distilled water through the sample collection equipment, and preserving the sample. The sample is then analyzed to help identify possible contamination from the sampling procedure (equipment, sample containers, preservatives and handling) and to document the decontamination of sampling equipment.

Field blank samples are collected at one site during each week of sampling. This frequency corresponds to between five percent (5%) and ten percent (10%) of the collect samples. Field Black Samples are analyzed for each of the sampled analytes.

Laboratory Control Samples are used to help identify the accuracy of analytic methods. Control samples verify calibration standards of known concentrations, to determine if the analytic instruments and overall laboratory performance (or field instruments/procedures) are within expected specifications.

Analysis of internal analytic laboratory quality control samples is conducted for each week that samples are to be analyzed or per SDG or per group of 15-20 samples. Each analytic laboratory is responsible for maintaining internal quality control as a part of their quality assurance plan. Each laboratory provides LCI Monitoring Program personnel with an evaluation of the internal quality control of the lab each year.

II. Quality Control Evaluation

The quality control results are evaluated using an evaluation criterion that is appropriate for the type of sample collected and the objective for collecting it. These various calculations used to determine the precision, accuracy, and overall quality of the water quality data results are outlined below.

Field Blank Samples are collected in order to determine the amount of contamination that occurs in the sample collection and analysis. The ideal field blank would have analytic results consisting entirely of less than minimum reporting level values. However, given the exceptionally low levels of analytic detection and the pervasiveness of many water quality parameters in the environment, that is not a realistic criterion. The evaluation criteria for acceptable field blank results, is any value that is equal to or less than two (2) times the minimum reporting level (i.e., 200% of the minimum reporting level).

Field Parameter Calibration Check is performed at the end of each sampling week by checking the field parameters (those measured with a multiprobe) against known standards.

Matrix Duplicate Samples, as well as duplicate measures of field parameters and measurements are collected in order to determine the precision (i.e., reproducibility) of the water quality data results. Due to natural variation and the limits of the analytic

instruments, it is unlikely that the results will be identical. However, for matrix duplicate samples a two-part evaluation criteria is used to determine acceptable results. For low level results--where the value is equal to or less than five (5) times the minimum reporting level--acceptable duplicate results must be within one reporting level of the reported value. For high level results--those where the value is greater than five (5) times the minimum reporting level--the relative percent difference (*RPD*) between the two values should be less than twenty percent (20%).

$$RPD = \frac{x_1 - x_2}{x_1 + x_2 / 2}$$

NOTE: For the purpose of calculating the *RPD*, values for results reported as less than a specific value are assumed to be seventy percent (70%) of that specific value.

Matrix Spike Samples are collected in order to determine the accuracy (i.e., percent recovery) of an analyte injected into a sample. Because the LCI samples are spiked in the laboratory, this quality control sample will measure only those effects associated with the laboratory preparation and analysis.

Matrix spike results will be evaluated by calculating the average percent recovery and determining the statistical accuracy for the parameters for which the samples were analyzed. The average percent recovery (P_{avg}) is, simply, the average of the percent recovery for all of the spikes for each parameter.

$$P_{avg} = \frac{P_i \bullet\bullet\bullet P_n}{n}$$

The accuracy of the spike results is expressed as a percentage of bias, bias being the difference between the true value and the measured value, resulting from the normal skew of the laboratory equipment.

$$\%Bias = \left| P_{avg} - 100 \right|$$

When assessing the matrix spike results, it is also useful to calculate the standard deviation (*s*) of the percent recovery of the spike data set.

$$s = \frac{\sqrt{\sum_{i-1}^{n} (P_i - P_{avg})^2}}{n-1}$$

The range defined by the average percent recovery plus or minus two (2) standard deviations indicates statistically where the percent recovery will fall ninety-five percent (95%) of the time.

When QC samples fail to comply with the criteria established above, the LCI Monitoring Program Manager will initiate an investigation of the laboratory with the NYSDEC Division of Water Quality Control Coordinator and the corresponding laboratory manager to conduct procedures necessary to correct the problems contributing to violating these criteria. If these procedure prove inadequate to solve the problems, the Program Manager and Quality Control Coordinator will determine if this laboratory needs to be replaced by an alternative laboratory that has successfully completed these QC checks as part of a recent monitoring program.

6. Equipment Testing, Maintenance and Calibration Procedures

Field instruments and equipment testing, inspection and maintenance will be performed in this sampling program as per the most recent version of the NYSDEC SOP #103-11, "Equipment Cleaning" and per the manufacturer's instructions.

Contact lab instrumentation will be operated per the instructions in the NYSDEC Prescribed Analytical Protocol-Volume 5 (2011). The instrumentation/equipment associated with the New York State Health Department's Algal Toxin/Harmful Algal Bloom Special Study is inspected, maintained and calibrated as per their own standard operating procedures and quality assurance documents

Storage
All sampling bottles and equipment related to sampling will be stored and maintained by LCI Monitoring Program sampling staff so that the results obtained from their use will not be questioned. Prior to use, all equipment will be checked to ensure good operating conditions and cleanliness. After sampling has been completed, the equipment will be cleaned (as described below) and kept ready for use. Manufacturer's specifications will be followed in carrying out routine maintenance.

Cleaning
All sampling equipment (buckets, churn, sampler, etc.) will be well cleaned with a distilled (de-ionized) water wash before and after each days use. At each sampling station, field equipment will be rinsed with ambient water before a sample is collected and lab equipment is rinsed with distilled water after sampling is completed so equipment will be ready for use at the next monitoring location. Whenever possible, samples are collected from the least contaminated to the most contaminated site. The equipment may be washed every two weeks using a phosphate free detergent and water scrub followed by a distilled water rinse as needed. Whenever equipment is cleaned with a phosphate free detergent a notation is made in the equipment's log book.

Calibration
When calibrating a multiprobe fresh reference buffers are used and the origins of each buffer are noted in the log book for the multiprobe.

Multiprobes are calibrated before each sampling run, and recalibrated if the type of waterbodies (acidic versus alkaline) change over the course of the sampling run. Specific instructions regarding the calibration of multiprobes are provided in the Operation Manuals for each instrument.

Multiprobe calibration procedures are described in the NYSDEC Lake Sampling SOP; SOP#203-12.

Back-up Equipment and Spare Parts
Duplicates of most of the sampling equipment are kept in the field vehicle. In addition a complete set of all sampling equipment is kept in the prep laboratory on the 6th Floor of 625 Broadway, for instance where multiple field teams may be deployed. Spare parts for the multiprobes are kept either with the probes (for the case of dissolved oxygen membranes) and or in the prep laboratory.

7. Supplies and Consumables

Inspection of supplies and consumables must be made upon arrival of new materials and immediately before their use in the field or laboratory. For newly arrived supplies and consumables all materials must be in their original packaging and free of noticeable damages. For materials already obtained and about to be used no noticeable defects will be allowed. The Primary Samplers are responsible for assuring the quality of all supplies and consumables for each of their sampling trips.

8. Data Management

Sample collection information (station, collection date, time) and field parameter measurements (temperature, dissolved oxygen, pH, conductivity, OPR, water clarity, water depth) will be entered from the sampling field sheets into an electronic data deliverable (EDD) by NYSDEC staff. These EDDs will be loaded into an Earthsoft EQuIS database. Analytic results from contract laboratories will be reported to NYSDEC in a complete data document (Sample Delivery Group, or SDG, package) that includes summaries of data validation conducted by the analytic lab and an EDD containing the analytical results. The EDD containing the analytical results is then loaded into the EQuIS database. Any inconsistencies in the data files are flagged for review and correction by the LCI Project Coordinator. Once the sample collection information (station, date, time, parameter) has been verified, the water quality result values are reviewed. Values are compared against assessment criteria, including established parameter-specific limits. If reported values exceed the established limit, the result is flagged for further investigation.

Investigation of laboratory values may result in confirmation of the results by the analytical laboratory, comparison of the value against other results from the same site, inserting an appropriate data qualifier, and/or accepting the value without qualification. Data qualifiers have been established for laboratory values that are known to be suspicious, less than the reported value, or affected by QA/QC field blank contamination.

III. ASSESSMENT AND OVERSIGHT

Program assessments will be conducted to evaluate the validity of the field data collection and analytical activities conducted as part of this monitoring program. All field staff will be provided training by the one of the Primary Samplers at the onset of the monitoring program, likely during the initial sampling run at one of the program lakes. Random field audits of field staff may be conducted by the Program Manager and/or the Lakes Monitoring and Assessment Section Chief and will be used to assess the performance of the sampling operations. Laboratory audits are conducted routinely by the laboratory QA staff. These may include evaluation of proficiency standards. Results for these assessments will be reported to the Program Manager, who will provide recommendations for any necessary corrective actions (from retraining and modifying procedures to replacing staff associated with the sampling team to modifying the choice of contract laboratories) to the Directors of the Bureau of Water Assessment and Management and the Director of the Division of Water. The responsibility for ultimately approving these corrective actions lies with these Directors.

1. Performance and System Audits

NYSDEC contract laboratories are audited on an annual basis by the NYSDEC Audit Team to determine the laboratory's compliance with the requirements of the Prescribed Analytical Protocol (PAP) for all DEC programs submitting samples. EPA will be notified when these audits are done. Performance evaluation sample results are available. According to NYS Public Health Law 502, the laboratory contractors also must be certified by the New York State Department of Health. This program involves semi-annual performance evaluation samples and annual on-site audits. NYSDEC audits subcontractor laboratories on an as-needed basis. The NYSDEC QA officer will conduct project specific field audits and report the results of these audits to the Project Manager.

2. Corrective Actions

Revisions to the Quality Assurance Project Plan are to be approved by the Program Manager who will post the revised version at ftp://ftp.dec.ny.gov/dow/BWAM/LCI/ and notify those on the distribution list of the revision.

Major sources of errors may include analytical and equipment problems and those resulting from the deviation from intended plans and procedures. If these problems occur in the field, corrective actions should be taken as described in SOP #203-10, Collection of Lake Water Quality Sample as part of the Statewide Ambient Water Quality Monitoring Program. For contract laboratories, Exhibits E of the PAP contain the procedures the laboratory is to follow when problems are encountered in the chemical analysis of samples.

Deviation from intended plans and procedures should be noted by the person observing the deviation and reported to project staff responsible for the operation or analysis in question. The appropriate project personnel shall (1) develop a corrective action plan to ensure that future sampling, analyses, etc. are conducted in accordance with the QA procedures presented in this QAPP; (2) rerun procedures in the appropriate manner and re-analyze samples, if sufficient

sample material is available and holding times are not exceeded; and (3) report all problems and deviations to the LCI Program Manager, who will also be consulted during the development of any proposed corrective action plans. All deviations from intended plans and procedures are to be recorded in the appropriate field or laboratory notebooks.

3. Reports to Management

The Quality, Standards & Analytical Management Section will perform a full data validation review on a minimum of 5% of all SDG packages from the LCI program. Additional SDG data validation reviews will be performed as identified by LCI staff in their initial review of the data. This evaluation together with the analysis of the completeness, precision, and accuracy of the LCI program will provide a level of confidence to the data set and to the interpretations and conclusions drawn from the data.

The complete data packages provided to the Project Manager and the Assistant Quality Control Officer by the analytical laboratory will report on analytical methods, sample holding times and laboratory preparation techniques that have deviated from the methods contained in this QAPP.

As soon as possible after receipt of data packages from the analytical laboratories, data are reviewed, compiled, and assessed using the established criteria and other procedures defined in the Consolidated Assessment and Listing Methodology (CALM) (NYSDEC 2009) and individual data reports.

4. Project Fiscal Information

The budget for the LCI project is maintained as part of the overall spending plan of the NYSDEC Division of Water Statewide Waters Monitoring Program.

5. Data Validation and Usability

Water Chemistry Parameters

Water Chemistry data results, generated by the analytical laboratory, for the LCI Monitoring Program, are reviewed at three separate stages. First, analytic laboratory staff will follow specific laboratory protocols to ensure the quality and validity of the data. For additional information, see NYSDEC Prescribed Analytical Protocols (2011). Second, the LCI Program Manager reviews data results during the input and processing of data files. As previously discussed, this review includes confirmation of suspect values and the possible qualification of data results. And third, the Program Managers evaluate quality control data results for the LCI Monitoring Program as a whole to quantify the precision, accuracy, completeness and overall validity of the LCI sampling data.

Field Parameters

Field results generated by the LCI Monitoring Program are at two separate stages. First, the LCI Program Manager reviews field data results during the input of the data into an electronic format. As previously discussed, this review includes confirmation of suspect values and the possible qualification of data results. Second, Program Managers evaluate quality control data results for

the LCI Monitoring Program as a whole to quantify the precision, accuracy, completeness and overall validity of the LCI field sampling data.

6. Verification and Validation Methods

Data in this monitoring program will be verified and validated by the Program Manager. Data for each of the parameters will be compared with the detection limits and precision/accuracy data provided in Section I; the analytical laboratory performs these comparisons on results that they generate. In general, data verification and validation methods were discussed in the Data Management section (above). Appendix C discusses the evaluation of water quality data. Running ranges will be computed for each of the parameters and compared against established upper and lower limits for this project - these are listed in Appendix C. Data generated by the analytical laboratory that falls outside the running ranges will be verified through inspection of the laboratory SDG package provided with each data transmittal by the project analytical laboratory. Individual analyte data will also be cross-compared against other analytes within the same sample bottle and sampling session to determine if outliers exhibit consistencies. Particular attention will be given to well-correlated or dependent indicators to determine if outliers are mutually dependent. Field data that fall outside the running ranges will be verified through the inspection of the equipment calibration/maintenance log books and/or environmental observations recorded on the field data sheet.

If data validity cannot be verified, these data will be qualified in the database. An indication as to why qualified data did not meet the minimum QA criteria will be provided. Typical data qualifiers are presented in Table 6. This information will be noted in the final QAQC report.

Table 6: Data Validation Qualifiers for Water Chemistry Results

Data Qualifier	Reason
U	Not Detected
J	Estimated Value
B	Analyte Found In Blank As Well As Sample
E	Compounds With Concentrations Exceeding The Calibration Range Of The Instrumentation
K	Maximum Estimated Analyte Concentration
D	Sample Diluted
I	Label Standards Diluted Out And Internal Calibration Standards Applied
X	Other Or Combination Of Specified Flags
V	Metals Data Blank Corrected
M	Duplicate Injection Precision Not Met
N	Spiked Sample Recovery Not Within Control Limits
*	Duplicate Analysis Not Within Control Limits
+	Correlation Coefficient For The MSA Is Less Than 0.995

7. Reconciliation with use Requirements

As noted in Section III, uncertainty in the data allowed for use in the monitoring programs end product will be limited to that found acceptable in the data verification and validation process.

8. Reporting

After the above QC calculations and examinations have been performed for all media, the results will be summarized in a final report. The QA/QC section of the final report will include a discussion and summary of the accuracy, precision, completeness, comparability, and representativeness observed during the study.

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APPENDICIES

Appendix A: Candidate Sampling Sites in 2013

(The sites that are actually sampled are chosen based on resource availability)

1. Intensive Sites (monthly sampling June-September)

Lower Hudson River Basin

Lake Name	County
Basic Creek Reservoir	Albany
Browns Pond	Orange
Congers Lake	Rockland
Copake Lake	Columbia
Glenmere Lake	Orange
Hampton Manor Lake	Rensselaer
Lake Carmel	Putnam
Nassau Lake	Rensselaer
Palmer Lake	Putnam
Sturgeon Pool	Ulster
Tomahawk Lake	Orange
Wappingers Lake	Dutchess
White Lake	Putnam

Chemung River Basin

Lake Name	County
Brick/Weyer Pond	Chemung
Eldridge Lake	Chemung
Lamoka Lake	Schuyler
Waneta Lake	Schuyler

Black River Basin

Lake Name	County
Fourth Lake- Fulton Chain	Herkimer
Limekiln Lake	Herkimer
Nicks Lake	Herkimer
Sixth Lake- Fulton Chain	Herkimer
Stillwater Reservoir	Herkimer

2. Screening Sites (single sampling events)

Lake Champlain Basin

Lake Name	County
Butternut Pond	Essex
Browns Pond	Orange
Chazy Lake	Clinton
Fern Lake	Clinton
Lake Alice	Clinton
Little Ampersand Pond	Franklin
Marsh Pond	Essex
Mead Reservoir	Clinton
Middle Saranac Lake	Franklin
Oseetah Lake	Franklin
Patterson Reservoir	Clinton
Penfield Pond	Essex
Slang Pond	Franklin
Union Falls Pond	Clinton
Woodruff Pond	Essex

Susquehanna River Basin

Lake Name	County
Balsam Pond	Chenango
Long Pond	Chenango
Mill Brook Reservoir	Chenango
Nathaniel Cole Park Pond	Broome
Nanticoke Lake	Broome
Beaver Pond	Broome
(Moe Pond) Unnamed Pond P 404A	Otsego

Atlantic Ocean-Long Island Sound Basin

Lake Name	County
Agawam Lake	Suffolk
Argyle Lake	Suffolk
Deep Pond	Suffolk
Kissena Lake	Queens
Knapps Lake	Suffolk
Long Pond (Greenbelt)	Suffolk
New Mill Pond (Blydenburgh Park Pond)	Suffolk
Prospect Park Lake	Kings
Upper Yaphank Lake	Suffolk
West Lake	Suffolk
Grassy Sprain Reservoir	Westchester

Appendix B: LCI Monitoring Program Schedule

June 2013

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
						1
2	3	4	5	6	7	8
9 **Black**	10	11	12	13	14	15
16 **Lower Hudson**	17	18	19	20	21	22
23 **Chemung**	24	25	26	27	28	29
30	1	2	3	4	5	6

July 2013

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1	2	3	4	5	6
7 **Black**	8	9	10	11	12	13
14 **Lower Hudson**	15	16	17	18	19	20
21 **Chemung**	22	23	24	25	26	27
28 **Susquehanna**	29	30	31	1	1	3

August 2013

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
28 **Susquehanna**	29	30	31	1	2	3
4 **Lake Champlain**	5	6	7	8	9	10
11 **Black**	12	13	14	15	16	17
18 **Lower Hudson**	19	20	21	22	23	24
25 **Chemung**	26	27	28	29	30	31

September 2013

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1 **Long Island**	2	3	4	5	6	7
8 **Black**	9	10	11	12	13	14
15 **Lower Hudson**	16	17	18	19	20	21
22 **Chemung**	23	24	25	26	27	28
29	30	1	2	3	4	5

- This schedule is subject to change, an updated version of the schedule can be found at L:\DOW\Statewide Monitoring\2013 sampling\ LCI2013Schedule.docx

Appendix C: LCI Monitoring Program Parameter-Specific Review Criteria

WATER QUALITY DATA EVALUATION

Water quality data results generated by the LCI Monitoring Program are reviewed by Lake Management Staff prior to release to the public. This review includes the comparison of results with historic and/or expected values, the possible qualification (remarking) of data values (where appropriate), and the evaluation of Quality Control samples taken in conjunction with the water quality samples.

Review Criteria Range Evaluation

Each data result is compared with a range of expected values for each parameter. The review criteria range for each parameter has been calculated to reflect a range of values within existing water quality standards or appropriate guidance values or criteria for New York State. Where no such values exist, professional judgment has been used to define the appropriate ranges. The review criteria range for the LCI Monitoring Program sampling parameters are outlined below.

Any data value that falls outside the review criteria range is to be confirmed by review staff before being stored as final. In most cases, data values can be confirmed as reasonable based either upon historic, site-specific data or due to particular field conditions at the time of sample collection as noted on the field sheet. If neither historic data nor field conditions provide an explanation for an unusually high or low value, then the LCI Program Manager confirms the data value against quality control data results and/or with the analytic lab directly.

Data Qualifiers/Remark Codes

In addition to the numeric value, a data result may also include an alphabetic remark code that qualifies the result is some manner. The most frequently used qualifiers are those series of remark codes that indicate that the actual value is less than the reported value (i.e., less than). For numeric fields, particularly when values are necessary to conduct statistical analyses, values less than the detection limit are reported as one-half of the detection limit. Other qualifiers are used to indicate calculated values, estimated values, presence of a parameter that was not qualified, and so on.

"Suspicious" Values

Perhaps the most significant aspect of the water quality data review involves the decision whether or not to qualify as suspicious those results for which circumstances lead us to have less confidence. Ideally, it would be best if one could qualify data values along a scale indicating varying degrees of confidence and suspicion. However, due to the limited number of remark codes, there are (for the most part) only two choices - to qualify the value as "suspicious" or to not qualify it at all.

For the LCI Monitoring Program data, values remarked as "suspicious" should be interpreted by the user to mean that there is some specific aspect or circumstance regarding the sample collection,

preservation, transportation, analysis and/or reporting that offers an explanation, beyond the value's relationship to the historical record, as to why a data value may be incorrect. Examples of circumstances that warrant qualifying results include samples for which the holding time has been exceeded, volatile samples containing air bubbles, subsequently discovering that the sampling method used may have contaminated the sample and so on.

REVIEW CRITERIA RANGE
Field/Conventional Parameters in the Water Column

Parameter	Review Criteria Range
Nutrients	
Ammonia Nitrogen, Total, as N	0.005 - 1.000 mg/l
Kjeldahl Nitrogen, Total, as N	0.040 - 1.500
Nitrate (+NO_2) Nitrogen, Total, as N	0.020 - 2.000
Phosphorus series	0.002 - 0.020
D.O./Oxygen Demand	
Dissolved Oxygen (at the surface)	5.00 - 15.00 mg/l
Physical	
Specific Conductance, Field	20 - 900 µmhos/cm
pH, Field	6.50 - 8.50 SU
Temperature	0.00 - 30.00 DegC
Water Clarity (Secchi disk transparency)	0.5 - 10 meters
Water Color (True Color)	1 - 30 ptu
ORP	0 - 400 mV
Other	
Chlorophyll *a*	0.01 - 8 µg/l
Calcium	8.0 - 200 mg/l
Other metals	0.1 - 10 mg/l
Alkalinity	20.0 - 1000 mg/L $CaCO_3$
Total Organic Carbon	0.1 - 10 mg/l
Fecal Coliform (Class A or higher waters)	0 - 1 colony/100 mL
Fecal Coliform (Class B or lower waters)	0 - 200 colonies/100 mL

A reported value that differs significantly from either historical data or expected results lends support to the possibility that the reported value is in error and does not accurately reflect the character of the stream. However, the possibility that the unexpected value is accurate and does correctly reflects a change in the character of the stream must also be fully considered. Therefore, significant deviation from historic or expected values alone will not be sufficient evidence to qualify a value as suspicious.