NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WATER MONITORING AND STANDARDS
BUREAU OF FRESHWATER AND BIOLOGICAL MONITORING
P.O. Box 420; Mail Code 35-01 Trenton, New Jersey
Quality Assurance/Quality Control Project Plan
Lake Monitoring Network – Statistical, Reference and Raritan Targeted Lakes
2022-2023

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1.0 Project Name: Lake Monitoring Network 2022-2023

2.0 Requesting Agency: United States Environmental Protection Agency

3.0 Date of Project: Sample collection March 2022 – November 2023

4.0 Project Fiscal Information: Job Number 33340000, Activity Code V4PC

5.0 Project Manager: Johannus Franken – Project Manager, BFBM
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Brian Taylor – Project Data Manager, BFBM

6.0 Special Training Needs/Certification

Assistants to the project will be trained in the operation and use of all sampling equipment. The training will entail calibration methods, deployment techniques and data retrieval from the equipment. The Project Manager or designee will be responsible for any necessary training.

Safety training and safety requirements will comply with the latest version of the Bureau of Freshwater and Biological Monitoring's Field Work Health and Safety Plan (HASP) and any amendments due to COVID-19 safety guidelines.

BFBM is certified by the Office of Quality Assurance (certified lab ID # 11896) for the following parameters during field work for this project: temperature, pH, conductance, dissolved oxygen (DO), turbidity, chlorophyll, and microcystins.

7.0 Project Background

This Network was designed to provide the water quality data necessary to assess the ecological health of the State's lentic water resources and the needs of the watershed management and water quality assessment {305(b)/303(d)} programs. This approach comports with the guidance provided in USEPA's publication, "Elements of a State Water Monitoring and Assessment Program," March 2003, which requires that states develop and implement long-term strategies that include monitoring of all state water body types, including lakes, and the needs of the watershed management and water quality assessment {305(b)/303(d)} programs.

8.0 Project Description

The project will collect ambient water quality information for NJ lakes. The Network consists of three components: a statewide statistical (probabilistic) survey, statewide reference lakes, and targeted regional lakes.

For the Statewide Statistical Survey, 50 lakes, referred to as a Panel, will be sampled over 5 years or 10 lakes per year. A total of 250 lakes were selected for sampling over a 25-year period. Individual Panels of 50 lakes will have sufficient statistical confidence to assess statewide status every five years. It is anticipated that statewide trends will be assessed after a statistically significant number of panels are completed. Lakes were selected using USEPA probabilistic site selection methodology {Generalized Random Tessellation Stratified (GRTS)

survey design for a point resource with reverse hierarchical ordering (RHO), see (Taylor, 2015)[1]}. Potential sites included all lakes (public and private) on DEP Geographic Information System (GIS) Coverage "NJ National Hydrography Dataset," greater than or equal to 5 acres, minimum one meter deep, including potable water supply reservoirs and unnamed lakes.

All potential lakes will be visited by BFBM staff to ascertain that the waterbodies are suitable for sampling per the design criteria (see Appendix A, List of Statewide Statistical Survey Lakes). Actual sampling sites in each lake will be determined during the first on-water site visit and will be selected based on actual morphometry, as determined by this on-site visit. At that time, each in-lake station will be recorded with a handheld Global Navigation Satellite System (GNSS, formerly known as Global Positioning System or GPS) and stored on the DEP GIS system. This will allow printing of aerial photography maps showing actual sample sites. If a lake does not meet design criteria such as inadequate depth, or if access or safety issues exist, the lake will be eliminated. A replacement will be selected, in order, from the list of potential oversample lakes (see Appendix B, List of Potential Oversample Lakes). Digital photographs will also be taken showing overview of the lake, outlet, and drainage pipes.

In addition to the statistical survey sites, statewide reference and targeted regional lakes will be sampled. Eight (8) statewide reference lakes representing 4 of 5 Omernik Level III ecoregions (Northern Piedmont not represented) will be sampled one time annually in the growing season to the demonstrate status established in previous samplings at these lakes. See Appendix C, List of Reference Lakes. Ten (10) targeted regional lakes will be sampled four times annually from 2022-2023. These lakes were chosen by BFBM in consultation with the Bureau of Environmental Analysis, Restoration, and Standards (BEARS) from the Raritan Water Region to align with the current Integrated Report assessment cycle (See Appendix D, List of Raritan Regional Targeted Lakes).

[1] Taylor, Brian. 2015. "*New Jersey Lake Survey Design*". DEP BFBM.

9.0 Project Objectives

Statewide Statistical Survey
Data will be collected to evaluate the trophic state of selected lakes and assess the ecological health of the State's lentic water resources. Fifty lakes (designated as a Panel) are monitored every five years to develop baseline, statewide status, and eventually trend information for New Jersey lakes.

Statewide Reference Lakes
Data will be collected for reference lakes from 4 of 5 Omernik Level III ecoregions (Northern Piedmont not included) within the State. These lakes are intended to be minimally disturbed by human activity and preferably in an area protected from human-induced changes. BFBM and BEARS established the following criteria for selecting Reference lakes:

Manmade or natural lakes:
- ◆ ≥5 acres in surface area and 1-meter depth minimum
- ◆ Surrounding land use <20% Urban + Ag
- ◆ < 2% impervious cover
- ◆ No discharges into lake

♦ No regulated discharges upstream of lake inlet.

Shoreline Characteristics (if available):
♦ Trees/Shrub > 75%
♦ Lawns/grasses < 25%
♦ Bare ground < 5%
♦ Shoreline anthropogenic disturbance (shoreline modifications/development) < 5%

Reference lake data will document baseline information on minimally or non-impacted water quality, ecological integrity, and the trophic state of lakes within each ecoregion. Reference lakes will be monitored every year and can be used to measure variations and trends resulting from climate change and land use. Data may also be compared to disturbed lakes within the same ecoregion to gauge the degree of impairment. Reference data will also serve to inform criteria development, specifically nutrients, to determine criteria that are attainable and appropriate for the ecoregion, and adequate to control nutrient enrichment.

Regional Targeted Lakes
The Department has adopted a Regional Comprehensive Assessment Method for the Integrated Water Quality Monitoring and Assessment Report intended to produce a robust assessment of environmental conditions affecting water quality in a selected water region. This Regional Comprehensive Assessment will incorporate one of five water regions (Atlantic Coastal, Lower Delaware, Northwest, Raritan, and Northeast) during each Integrated Report cycle. The rotating region approach will result in a comprehensive assessment of the entire state every 10 years. This approach will encourage development of measures to restore, maintain and enhance water quality uses that maximize effectiveness and efficiency in achieving positive environmental outcomes that are tailored to the unique circumstances of each region. Lakes monitored for the Regional Comprehensive Assessment will adhere to the sampling frequency requirements as outlined in the 2014 Integrated Water Quality Monitoring and Assessment Methods Document. Targeted regional lakes were selected for the Integrated Report cycle in the Raritan Water Region by BEARS and BFBM.

10.0 Monitoring Network Design

Water quality monitoring will take place at the number of monitoring stations that best represent the limnological aspects of the lake. If the lake is relatively small and uniform in shape, then one or two stations will be centrally positioned and equidistant from the shorelines (if depth allows). If the lake is expected to exhibit relatively uniform water quality characteristics, then one sample station will be located approximately in the center of the lake. Additional monitoring stations, as needed, will be positioned in sections of the lake which may be expected to exhibit differing water quality. In the event an existing lake must be eliminated, water quality monitoring stations at the replacement lake will be selected in the same manner.

Statewide Statistical Survey
Every five years, fifty, of the 250 probabilistically selected lakes will be monitored to develop baseline, status, and trend information for New Jersey lakes. Sites are expected to be sampled for one year, four times per year, March through November.

	Begin Year	End Year	Comment
Panel 7	2015	2016	Sampling complete
NLA	2017		Participated in 2017 National Lakes Assessment (NLA) in lieu of Statewide Survey.
Panel 8	2018	2022	Sampling in progress. Lakes were partially sampled in 2018/2019 due to HAB intensive studies, not sampled in 2020 due to COVID-19 Pandemic and resumed modified routine schedule in 2021.
Panel 9	2023	2027	To be sampled
Panel 10	2028	2032	To be sampled
Panel 11	2033	2037	To be sampled

Statewide Reference Lakes

Statewide reference lakes will be monitored to document baseline, status, and trend information on minimally or non-impacted water quality, ecological integrity, and the trophic state of lakes within each ecoregion. Sites will be sampled once during the growing season, between July and August.

In addition, Deer Park, Hands Mill, Mashipacong Ponds and Mount Misery Lake will have continuous monitoring arrays deployed in the water column and along the shoreline for the Lake Regional Monitoring Network (RMN). Water column arrays will have loggers to monitor dissolved oxygen, temperature, and water level while shoreline loggers will record temperature and pressure. This effort is a partnership with United State Environmental Protection Agency (U.S. EPA) and covered under a separate QAPP (approved in April 2021).

Targeted Regional Lakes

Targeted regional lakes will be monitored to produce an assessment of environmental conditions affecting water quality in a selected water region. Sites are expected to be sampled for two years, four times per year, March through November.

See Appendix E, 2022-2023 Lake Sampling Parameters, for a table of the sampling frequency and associated parameters for each sampling type.

11.0 Sampling Procedures

11.1 General Procedures: Statistical Survey will be sampled four times from March 1st through November 30th. Reference lakes will be sampled once during the growing season, between July 24th and August 7th (± one week) timeframe. Targeted regional lake sampling will take place four times from March 1st through November 30th. Sample bottles will be provided by the contracted New Jersey certified laboratory listed in section 16.1. Sample volume and container type will be as described in the respective laboratory's "Quality Manual" and/ or SOP as approved by DEP Office of Quality Assurance (OQA). See 16.1 Laboratory Analysis for sample volumes and container types.

11.2 Cleaning Sample Equipment: Prior to field sampling, all sample collection equipment will be cleaned using the protocol outlined in Appendix F, Submerged Water Sampler Cleaning Method.If two lakes are sampled in one day, a separate, clean

submerged water sampler will be used on the second lake. Sampling crews will carry multiple clean submerged water samplers in their vehicles to avoid cross contamination from previous sample collection.

11.3 In-Lake Sampling Procedures and Parameters: Samples will be collected at multiple in-lake sampling stations. Samples will be collected as per "DEP Field Sampling Procedures Manual," 2005. Samples will be collected using a horizontal submerged sampler, which will be cleaned at the BFBM laboratory prior to use at each lake. An equipment blank of ULTRA-PURE water will be collected from the submerged sampler prior to the first sample for each lake. The equipment blank will be analyzed for Total Phosphorus, Nitrite and Nitrate (NO_2+NO_3), ammonia (NH_3), and Total Kjeldahl Nitrogen (TKN). Reference lakes require collection of an additional equipment blank for ortho phosphorus analysis. The submerged sampler will be field rinsed with "water of interest" three times prior to collecting a sample at each station or depth for the lake. Each individual lake will require one clean submerged sampler.

A top-to-bottom profile will be collected at each in-lake station for optical dissolved oxygen (ODO), pH, chlorophyll a, phycocyanin, specific conductance, and water temperature and depth. Readings for these parameters will be collected as stated below.

All stations require a reading at 0.1 meter below surface and determined sample depth. Stations with total depths ≤ 1.0 meters require readings at half of the total depth. Stations with total depths < 3.0 meters require readings at 0.5-meter intervals. Stations with total depths ≥ 3.0 meters require readings at 1.0-meter intervals. Stations with total depths > 1.0 meters require a reading at 0.5 meters above the bottom.

Readings and sample depths will not necessarily be recorded at whole numbers due to the high accuracy (±0.04m for 30-meter cables and ±0.004m for 10-meter cables) of the depth sensor used.

Total depth and interval/sample depth will be determined using a YSI Pro DSS. The YSI Pro DSS is a multi-parameter water quality system that combines depth, temperature, pH, conductance, ODO, and Total Algae probes into one meter that is submersible to the desired depth in the lake. The YSI Pro DSS Total Algae Sensor measures phycocyanin and chlorophyll a. A sample will be collected from approximately one-meter depth at stations ≥1.5 meters total depth or mid-depth at stations <1.5 meters total depth. The sample will be analyzed for the parameters listed in Appendix E, 2022 Lake Sampling Parameters according to the sampling type. Turbidity will be measured from the sampled depth using a Hach 2100Q Turbidity meter.

11.4 Aquatic vegetation (macrophytes): During the growing season, a gross estimate of total areal coverage of dominant type(s) of macrophytes will be made. This estimate will be made following the procedure outlined in Appendix G, Lake Macrophyte Areal Extent.

In addition, BFBM will coordinate with Bureau of Geographic Information Systems (BGIS) to schedule unmanned aerial vehicle flights (UAV) to photograph lakes during the growing season. Aerial photographs will be used to digitize the total areal coverage of macrophytes covering the lake surface. BGIS will perform flights as time and airspace allow.

11.5 Chlorophyll a: A depth-dependent sample will be collected for chlorophyll a. Sample analysis will be performed by BFBM staff at BFBM Laboratory, 35 Arctic Parkway, Ewing. BFBM staff will use a modified version of EPA Method 445.0 for this analysis. Samples will be collected in reusable brown plastic bottles and stored on ice to 4º C.

11.6 Phycocyanin: BFBM will screen for cyanobacteria in the field using a Turner Designs Fluorosense handheld fluorometer and the YSI Pro DSS Total Algae Sensor. The Fluorosense and Total Algae Sensor will assist with the in-situ detection of phycocyanin, a pigment unique to cyanobacteria, a naturally occurring component of a lake phytoplankton community. Under certain conditions, a cyanobacteria population can rapidly increase in density, forming a bloom which can potentially produce toxins, called cyanotoxins. These cyanobacteria blooms are known as Harmful Algal blooms (HABs). The Fluorosense will be used at the water surface (0.1m) and sample depth (determined by total depth, see 11.3). A vertical profile of chlorophyll a and phycocyanin will also be collected to determine concentrations of these compounds throughout the water column. If phycocyanin levels are approaching HAB conditions, Fluorosense reading of 12 relative fluorescence units (RFU) or higher, a sample will be collected and analyzed for cell identification, enumeration and cyanotoxins. HAB sampling and analysis will follow guidance in the latest version of the NJ Cyanobacterial Harmful Algal Bloom (HABs) Freshwater Recreational Response Strategy

11.7 Physical Habitat (PHab) Characterization: During the growing season, a PHab characterization will be performed at select lakes as time and resources permit. PHab characterization method was utilized by the USEPA as part of the NLA. Procedures are outlined in: *USEPA. 2012 National Lakes Assessment: Field Operations Manual, Version 1.0, May 15, 2012. EPA 841-B-11-003. U.S. Environmental Protection Agency, Office of Water, Washington, DC.*

12.0 Data Quality/Quality Control Requirements

12.1 Testing by BFBM

BFBM is certified by the DEP-OQA (certified lab ID # 11896) for all parameters listed below:

Temperature, pH, Conductance and DO will be measured using a YSI Pro DSS. The YSI Pro DSS is a multi-parameter water quality system that combines temperature, pH, conductance, and ODO probes into one meter that is submersible to the desired /depth of the lake.

Temperature: The probe is calibrated with a NIST-certified thermometer on a quarterly basis. Records of the calibration shall be maintained by the BFBM.

pH: The probe is calibrated daily per OQA recommendations. The probe is also checked each day of use with a buffer which corresponds to the expected range of the values to be measured. After three hours of continuous use, the pH of the certified buffer will be checked. Records of all calibrations and calibration checks shall be maintained in the field logbook which will be kept with each multimeter.

Conductance: The probe is calibrated on a weekly basis per OQA recommendations. The probe is also checked each day of use with a certified standard which corresponds to the expected range of the values to be measured. Records of all calibrations and calibration checks shall be maintained in the field logbook.

DO: A Winkler check is performed on a weekly basis. The meter is also barometrically compensated and checked at each sampling site. Records of all calibrations and calibration checks shall be maintained in the field logbook.

Turbidity: HACH Model 2100Q turbidimeter is calibrated once every three months per OQA recommendations. The meter is then checked with certified standards for accuracy within the calibration range during each day of use. Records of all calibrations and calibration checks shall be maintained in the field logbook.

Chlorophyll a: BFBM will follow the procedures and calibration requirements required by EPA Method 445.0

Bureau of Water Monitoring Certified SOP, for field measurements and calibrations.
Bureau of Water Monitoring Certified SOP for the analysis of chlorophyll a.
DEP Field Sampling Procedures Manual (2005).
NJAC 7:18 - Regulations Governing the Certification of Laboratories and Environmental Measurements.

Other Parameters:

Ambient Air Temperature: Fisher Brand Traceable Flip-Stick Thermometer is calibrated with a NIST-certified thermometer before the sampling run. Air temperature is measured for general information purposes only and not used for project's data objectives.

Barometer: Thommen TX Mechanical Barometer or built-in barometer when using YSI ProDSS Handheld and measured for /ODO meter compensation only. Not used for project's data objectives.

Chlorophyll a/ Phycocyanin (YSI ProDSS Total Algae Sensor): The probe is calibrated using a rhodamine dye solution on a weekly basis per manufacturers recommendation.

Cyanotoxins: BFBM will follow the procedures and calibration requirements required by the Abraxis ELISA methods and EPA Method 546 for microcystins. BFBM is certified for method 546.

Forel-Ule Color: Forel-Ule Color Comparator. Forel-Ule Color is measured for general information purposes and not used for project's data objectives.

Secchi Depth: Universal 20cm secchi disc to measure transparency. All monitoring stations require a secchi depth measurement as stated below.

Stations with secchi depth measurement <1.0 meter, record to the nearest 0.05 meter.
Stations with secchi depth measurement >1.0 meter, record to the nearest 0.1 meter.

12.2 Additional Testing performed by a NJ Certified Laboratory

Samples will be delivered to New Jersey certified laboratories – NJ Department of Health (DOH, certification number 11036) and NJDEP Bureau of Freshwater & Biological Monitoring (BFBM, certification number 11896). Testing will be done by a method for which the laboratory has certification (see section 16.1). Quality control procedures (including required calibrations and quality control procedures required by regulation or by the method) shall be defined in the laboratory's Quality Manual (QM) or Standard Operating Procedures (SOPs). The QM and SOPs must be approved by the DEP-OQA.

13.0 Data Analysis

Data is collected to evaluate the trophic state of selected lakes and assess the ecological health of the State's lentic water resources to develop baseline, and eventually statewide status and trend information for New Jersey lakes using the probabilistic design. Reference lake data will document baseline information on water quality, ecological integrity, and the trophic state of minimally or non-impacted lakes within each ecoregion. Over time this data can be used to measure variations and trends resulting from land use and climate change and will also be used to compare to disturbed lakes within the same ecoregion to gage the degree of impairment. Reference lake data will also serve to inform nutrient criteria development.

Data will be forwarded to staff of BEARS for additional analysis. BEARS staff will evaluate water quality results as they relate to Surface Water Quality Criteria thresholds, historical data, and other sources. However, BFBM will do an evaluation of results of the Statewide Statistical Survey. This analysis will include estimating the status of lake water quality with a known amount of statistical confidence as well as identifying patterns and trends by ecological region. Statistical summaries will be produced based on this assessment. If samples are collected because of an observed suspected HAB, results will be compared to NJDEP Recommended NJ Action Level and Health Advisory Guidelines for Recreational Exposure to Microcystins, Cylindrospermopsin, Saxitoxin and Anatoxin–a. If a HAB is confirmed through laboratory analysis, BFBM will follow response actions as outlined in the NJDEP Cyanobacterial Harmful Algal Bloom (HABs) Freshwater Recreational Response Strategy.

14.0 Sampling Schedule

Initial site selection has been completed. Field reconnaissance of 2022 Statistical Survey sites will be conducted prior to initiation of sampling. Statistical survey lakes will be sampled four times during between March and November. Reference lakes will be sampled once during the growing season between July 24th and August 7th (± one week). Targeted Regional lakes will be sampled four times from March through November. See Appendix E, 2022 Lake Sampling Parameters for a table of the sampling frequency for each component and associated parameter.

15.0 Resource Needs

BFBM will need a minimum of three hourly staff, in addition to the existing full-time staff, to complete this project.

16.0 Quality Assurance

16.1 Laboratory Analysis: The following parameters will be analyzed byNew Jersey certified laboratories – NJDOH and NJDEP BFBM. Single use plastic bottles, of the volume indicated, will be used for each parameter listed. Laboratories used shall be certified by DEP's OQA for the requested parameters. The reporting levels, listed in the table below, are **required** for this project.

Parameter	Laboratory	Detection Limit (mg/L)	Reporting Level (mg/L)	Holding Time	Preservative	Volume
Nitrite + Nitrate	DOH cert # 11036	0.007	0.012	28 days	See Note 1	500ml
Ammonia (Non-distillation)	DOH cert # 11036	0.005	0.010	28 days	See Notes 1 & 2	
Ammonia (Distillation)	DOH cert # 11036	0.023	0.05	28 days	See Notes 1 & 2	
Total Kjeldahl Nitrogen	DOH cert # 11036	0.04	0.100	28 days	See Note 1	
Total Phosphorus	DOH cert # 11036	0.007	0.010	28 days	See Note 1	
Dissolved Organic Carbon (DOC)	DOH cert # 11036	0.45	1.00	28 days	See Note 3 and 1	500ml
Color Dissolved Organic Matter (True Color, see Note 5)	DOH cert # 11036	2.5 PCU	2.5 PCU	48 hours	See Note 3 Ice to 4ºC	500ml
Dissolved Silica (see Note 5)	DOH cert # 11036	0.17	0.5	180 days	See Note 3 and 4	500ml
Alkalinity	DOH cert # 11036	1	1	14 days	Ice to 4ºC	1000ml
Apparent Color (Qualified True Color method, see Note 5)	DOH cert # 11036	2.5 PCU	2.5 PCU	48 hours	Ice to 4ºC	
Chloride (flow injection)	DOH cert # 11036	1.3	2.5	28 days	Ice to 4ºC	
Total Suspended Solids (see Note 5)	DOH cert # 11036	1	1	7 days	Ice to 4ºC	
Sulfate (flow injection)	DOH cert # 11036	2.8	10	28 days	Ice to 4ºC	

Parameter	Laboratory	Detection Limit (mg/L)	Reporting Level (mg/L)	Holding Time	Preservative	Volume
Ortho Phosphorus (see Note 5)	DOH cert # 11036	0.004	0.005	48 hours	Ice to 4ºC	
Hardness	DOH cert # 11036	0.069	0.662	180 days	See Note 4	
Calcium (see Note 5)	DOH cert # 11036	0.12	0.5	180 days	See Note 4	
Magnesium (see Note 5)	DOH cert # 11036	0.056	0.5	180 days	See Note 4	500ml
Sodium (see Note 5)	DOH cert # 11036	0.045	0.5	180 days	See Note 4	
Potassium (see Note 5)	DOH cert # 11036	0.093	0.5	180 days	See Note 4	
Chlorophyll a	BFBM cert # 11896	0.1 (µg/L)	N/A	21 days	Ice to 4ºC and filter within 24 hours.	500ml
Microcystins	BFBM cert # 11896	0.10 ppb	0.15 ppb	30 days	Ice to 4ºC and freeze within 24 hours.	50ml
Cylindrospermopsin (see Note 6)	BFBM cert # NA	0.040 ppb	0.05 ppb	30 days	Ice to 4ºC and freeze within 24 hours.	50ml
Anatoxin-a (see Note 6)	BFBM cert # NA	0.10 ppb	0.15 ppb	30 days	Ice to 4ºC and freeze within 24 hours.	50ml
Saxitoxin (see Note 6)	BFBM cert # NA	0.015 ppb	0.02 ppb	30 days	Ice to 4ºC and freeze within 24 hours.	50ml

1. Concentrated H_2SO_4 to pH 2; ice to 4°C
2. Samples with turbidity levels >10NTU's must be distilled. The turbidity level determined by the BFBM will be noted on the chain of custody forms and the sample bottle labels relinquished to the NJ certified laboratory for ammonia testing.
3. Filter volume listed for sample using peristaltic pump, dedicated tubing and 0.45µm capsule filter after following procedure in 16.3 Filtration Blanks
4. Conc. HNO_3 to pH of <2; ice to 4°C
5. Reference sites only.
6. Not a NJ certified parameter. Samples can be analyzed by BFBM using a microtiter plate Enzyme-Linked Immuno-Sorbent Assay (ELISA) using the Abraxis kits for Microcystins, Anatoxin and Cylindrospermopsin. This method was utilized by the USEPA as part of the NLA. QA/QC procedures are outlined in: *USEPA. 2009 (Final). Survey of the Nation's Lakes: IntegratedQuality Assurance Project Plan. EPA/841-B-07-003. U.S. Environmental Protection Agency, Office of Water and Office of Research and Development, Washington, DC.*

16.2 **Equipment Blanks:** All lake visits will require an equipment blank for unfiltered parameters. This sample is collected in the field by completely filling a clean submerged sampler (see cleaning protocol in Appendix F, Submerged Water Sampler Cleaning Method) with ULTRA-PURE water. An equipment blank, of a volume necessary for analysis, is then taken from the submerged sampler by filling the bottle(s). The equipment blank is preserved with concentrated H_2SO_4 (when applicable) to pH 2 and iced to 4°C. Analysis includes the same chemical parameters listed above except for alkalinity, chloride, sulfate, hardness, Chlorophyll "a," and Cyanotoxins.

16.3 **Filtration Blanks:** Each 0.45µm capsule filter will be flushed with 3 liters of ULTRA-PURE water prior to sample collection in the field. The filtration blank, of a volume necessary for DOC analysis, will then be collected after passing through the filter. The filtration blank is then preserved, as detailed in the above table, for each parameter. Analysis will include dissolved parameters based on lake type.

16.4 Sample Containers: Analytical sample containers shall be dedicated, single use plastic. Chlorophyll a sample containers shall be brown plastic, resuable plastic. Sample containers shall be provided by the NJ certified laboratory.

16.5 Chain of Custody: Chain of custody procedures are required for all samples forwarded to a NJ certified laboratory for testing (see Appendix H, NJ Department of Health Sample Submittal Form). Information to be recorded includes all information required by N.J.A.C. 7:18-5.6(d) and 8.5(c). For Chl "a" analysis performed by BFBM, chain of custody forms will not be used; details concerning sample collection and analysts will be recorded in field logbook and laboratory records.

17.0 Data Validation

The Project Manager and Data Manager are responsible for all initial and final data validation. If apparent anomalous data is suspected (e.g., dissolved values larger than total values; field blank values larger than ambient values), the Project Manager and/or the Supervisor will review the sampling procedures with the field sampler to make sure the proper collection and preservation procedures were followed. Additionally, for nutrient parameters (particularly Ammonia, TKN, Nitrate + Nitrite and Phosphorus), the field sampler, Project Manager and/or the Supervisor may perform further water quality logic tests on the suspect data, as described in the U.S. Geological Survey Open File Report 02/383; 2003, entitled, *"Methods for Quality Assurance Review of Water Quality Data in New Jersey."*

If the data is still suspect, the NJ certified laboratory will be contacted. An internal review of their laboratory procedures and/or calculations used in the analysis of the suspect sample, with special emphasis on transcription of data to assure that no transposition of figures occurred will be conducted. The NJ certified laboratory will be asked to check on equipment calibration. If no problems are found in the analytical laboratory procedures, the data may then be compared to any historical data that might have been collected at the same site prior to the most recent sampling event to see if similar anomalies might have been found previously. The suspect data may also be compared to literature values or standard analytical treatises to verify whether the results are within the limits of accuracy of the test method.

If no obvious problems are found after these reviews, the complete data set will be reported with the suspect data identified as such. The BFBM will then conduct its own review of the data, as it relates to the objectives(s) and data accuracy required in this project.

18.0 Data Storage

Data will be stored locally in electronic format (MS Access). Water quality data will be entered into USEPA's water quality data system, WQX, by June of the year following receipt of results from the analytical laboratory. All raw data records shall be maintained for a period of no less than five years. See Appendix I for Data Management information.

19.0 Performance System Audits

All NJ certified laboratories are subject to audits and to the requirements of the DEP-OQA's Laboratory Certification Program as well as internal performance evaluations. DEP-OQA will be notified of field monitoring schedules for possible audits.

20.0 Data Reporting

20.1 Preliminary Reporting of Data

Preliminary analytical data will be reported to BFBM, from the laboratory employed for this project, in either hardcopy, electronic format or by verbal communication to the Project Manager or Data Manager, within 21 calendar days from receipt of sample. Samples which yield results considered anomalous by the Project Manager or Data Manager will be validated as specified in section 17.0, Data Validation.

20.2 Final Reporting of Data

Final analytical data will be reported to BFBM, from the laboratory employed for this project, in the agreed upon format within 40 calendar days from receipt of sample. All data shall be reported in a complete and concise fashion and shall meet the reporting requirements of NJAC 7:18. Routine quality control results must be retained on file for review by the BFBM and the OQA.

Data will be summarized and evaluated by the Data Manager to assess the water quality and health of the lakes sampled using the analytical data, field measurements, and observations collected during this study. Data will evaluate the trophic state of selected lakes and assess the ecological health of the State's lentic water resources in order to develop baseline, statewide status and eventually trend information for New Jersey lakes using the probabilistic study design. Final data reporting will also include the evaluation of water quality results as they relate to Surface Water Quality Criteria thresholds, historical data, and other sources.

Final data will be accessible through the National Water Monitoring Council's Water Quality Portal (waterqualitydata.us) and used by the NJDEP Bureau of Environmental Analyses, Restoration and Standards in the generation of the biennial New Jersey Integrated Water Quality and Assessment Report [305(b) and 303(d)].

21.0 Assessment, Oversight, and Response

The Project Manager will be responsible for the oversight of all activities relating to this project. The Project Manager will assess field collection functions and make corrections when necessary to maintain the data accuracy as defined in this plan. If any changes or modifications are made to this plan regarding data collection, as it relates to the objectives(s) and data accuracy required in this project, all original signees of the QAPP will be notified.

Appendix A
List of Statewide Statistical Survey Lakes

SiteID	GNIS Name	County	Municipality
NJLM-1001	"Cutt Bros"	Burlington	Tabernacle Twp
NJLM-1309	"Lee Bros"	Burlington	Woodland Twp
NJW04459-413	Lake Kemah	Sussex	Hampton Twp
NJLM-1088		Cumberland	Downe Twp
NJLM-1261	Curlis Lake	Mercer	Hopewell Twp
NJW04459-084	Timber Lake	Burlington	Medford Twp
NJLM-1079	"Hanover Lake"	Ocean	Plumsted Twp
NJW04459-265	Skyline Lakes	Passaic	Ringwood Boro
NJLM-0360	Round Valley Reservoir	Hunterdon	Clinton Twp
NJLM-0092	Meadow Lakes	Mercer	East Windsor Twp
NJW04459-255	Lake Tranquility	Sussex	Green Twp
NJLM-1172		Morris	Rockaway Twp
NJLM-0774		Camden	Winslow Twp
NJW04459-123	Stephen Lake	Atlantic	Estell Manor City
NJW04459-087	Delaware Lake	Warren	Knowlton Twp
NJLM-0214	E. Brunswick Comm. Park Lake	Middlesex	East Brunswick Twp
NJLM-0275		Burlington	Medford Twp
NJLM-0259		Ocean	Dover Twp
NJW04459-383	Woodland Township Lake	Morris	Pequannock Twp
NJLM-1124		Monmouth	Wall Twp

Appendix B
List of Potential Statewide Statistical Oversample Lakes

SiteID	GNIS Name	County	Municipality
NJLM-1311	"Pine Island"	Burlington	Washington Twp
NJLM-0123	Lake Ocquittunk	Sussex	Sandyston Twp
NJLM-0416		Morris	Hanover Twp
NJLM-0640		Salem	Lower Alloways Creek Twp
NJLM-1072		Cumberland	Downe Twp
NJW04459-425	Lawrence Lake	Sussex	Andover Twp
NJLM-1171		Morris	Rockaway Twp
NJLM-1176	Lake My-An-Ho	Camden	Winslow Twp
NJLM-0706	Cloverleaf Lake	Atlantic	Hamilton Twp
NJLM-0957		Sussex	Sparta Twp
NJW04459-097	Great Gorge Lake	Sussex	Vernon Twp
NJLM-1271	Dun-rite Pond	Camden	Gloucester Twp
NJLM-0342		Burlington	Pemberton Twp
NJLM-0455	Spring Lake	Mercer	Hamilton Twp
NJLM-1197	Echo Lake	Monmouth	Howell Twp
NJLM-0280		Burlington	Medford Twp
NJLM-1083		Ocean	Plumsted Twp
NJLM-0265	Hemlock Lake	Sussex	Walpack Twp
NJW04459-362	Darlington Lake	Bergen	Mahwah Twp
NJLM-1327	Silver Lake	Morris	Harding Twp
NJLM-1091		Cumberland	Downe Twp
NJLM-0363		Hunterdon	Franklin Twp

Appendix C
List of Statewide Reference Lakes

Site ID	GNIS Name	County	Municipality
NJW04459-058	Mount Misery Lake	Burlington	Pemberton Twp
NJW04459-352	Hands Mill Pond	Cumberland	Maurice River Twp
NJLM-0028	Green Turtle Lake	Passaic	West Milford Twp
NJW04459-134	Silver Lake	Sussex	Hardyston Twp
NJW04459-097	Great Gorge	Sussex	Vernon Twp
NJW00459-233	Watchu Pond	Sussex	Byram Twp
NJW04459-339	Mashipacong Pond	Sussex	Montague Twp
NJW04459-009	Deer Park Pond	Warren	Allamuchy Twp

Appendix D
List of Raritan Regional Targeted Lakes

Site ID	GNIS Name	County	Municipality
NJLM-0135	Cushetunk Lake	Hunterdon	Readington Twp
NJLM-0091	Etra Lake	Mercer	East Windsor Twp
NJW04459-294	Carnegie Lake	Mercer	Princeton Twp
NJLM-0867	Baldwin Lake	Mercer	Hopewell Twp
NJLM-1119	Duhernal Lake	Middlesex	Spotswood Boro
NJW04459-374	New Market Pond	Middlesex	Piscataway Twp
NJLM-0253	Lake Topanemus	Monmouth	Freehold Twp
NJLM-0004	Budd Lake	Morris	Mount Olive Twp
NJLM-0888	Middlesex Reservoir	Union	Clark Twp
NJLM-0678	Echo Lake	Union	Westfield Town

Appendix E
2022-2023 Lake Sampling Parameters

Indicator Type	Indicator	Statistical Lakes	Statewide Reference (by Ecoregion)	Targeted Regional (Water Region)
Trophic Indicators	Vertical profile measurements (DO, Temperature, pH)	x	x	x
	Secchi Disk transparency	x	x	x
	Water chemistry	Chloride Conductivity Turbidity Alkalinity Hardness Sulfate	Chloride, Conductivity, Turbidity, Alkalinity Hardness, Calcium, Magnesium, Sodium, Potassium, Sulfate, True Color, Apparent Color, Total Suspended Solids	Chloride Conductivity Turbidity Alkalinity Hardness Sulfate
	Nutrients	TP, NH3, TKN, NO2-NO3, DOC	TP, Ortho P, NH3, TKN, NO2-NO3, DOC	TP, NH3, TKN, NO2-NO3, DOC
	Chlorophyll-a	x	x	x
Ecological Integrity	Physical habitat characterization	x	x	x
	Visual Assessment	x	x	x
Human Use	Phytoplankton (cyanobacteria)	Checked during each visit with handheld fluorometer		
	Algal toxins (cyanotoxins) per section 11.6	x	x	x

Number of Lakes	Total Number of lakes sampled/ category	250; 5 panels of 50 lakes sampled over 25 years	8	10
Duration	Time period to sample all lakes	5 years/ 50 lake statewide panel	2 year/statewide	2 years/ region
Frequency	samples /year	10 lakes per year, 4X Mar-Nov	1X July 24-Aug 7 (± one week)	4X March-Nov
Sites/lake	in-lake stations	As needed	As needed	As needed

Appendix F
Submerged Water Sampler Cleaning Method

1. Fill small, graduated cup with 1oz. of concentrated Liqui-Nox soap. Add this soap into a one-gallon plastic container. Fill container with ULTRA-PURE water and mix well. This makes an approximate 1% "Liqui-Nox solution".

2. Don a set of disposable gloves and rinse them thoroughly with ULTRA-PURE water.

3. With one end sealed and spout(s) in the closed position, fill dirty submerged sampler approximately halfway with Liqui-Nox solution.

4. Scrub the submerged sampler thoroughly, inside and out, using the dedicated submerged sampler cleaning brush. This includes scrubbing of both stoppers.

5. Close the open stopper and vigorously shake the submerged sampler with Liqui-Nox solution inside for approximately 10 seconds.

6. Open spout(s) and allow equal amounts of the contained solution to flow through each spout until the bottle is empty.

7. Put on a new set of disposable gloves and rinse them thoroughly with ULTRA-PURE water.

8. Open both stoppers and rinse bottle with ULTRA-PURE water a minimum of three times.

9. Re-seal one end of the bottle and fill sampler to capacity with ULTRA-PURE water. Close the other end and shake vigorously. Open spout(s) and allow rinsate to flow through spout(s) until empty.

10. Repeat step 9 two more times.

11. Place a new polyethylene bag into the submerged sampler carrying case. Place cleaned submerged sampler into bag and seal case with painters tape. Write "CLEAN, Date of cleaning, and INITIALS of cleaning person" on tape.

12. Rinse cleaning brush three times with ULTRA-PURE water, replace in bag and store in lakes cabinet.

If a trace nutrient problem arises upon analysis while using the above method, a final step will be added. This step will add an acid rinse, followed by several rinses with ULTRA-PURE water to ensure that all trace nutrients are eliminated from the submerged sampler.

Appendix G
Lake Macrophyte Areal Extent

Lake macrophyte areal extent is determined by visual observations while boating on the lake. An aerial photograph map of each lake will be prepared prior to a growing season sampling date. This is done using the latest version of aerial photography available and using GIS shapefiles for lake identification. The map should include the entire area of the lake so that it can be used for navigation and orientation while on the lake.

During the lake visit, all macrophytes observed should be marked on the aerial photograph map. This is done using a combination of landmarks (such as houses, bridges, etc.), lake shoreline features and estimated distances to these features. Areal extent should be marked as accurately as possible so it can be transcribed to GIS maps for use in coverage calculations. Submerged aquatic vegetation (SAV) density should be noted but not drawn.

Upon return to the office, the modified aerial photograph map can be digitized with the polygon(s) that best represent the areal extent of the macrophytes present in each lake. The polygon(s) will then be used, along with the lake surface area, to calculate the percent coverage for macrophytes.

Appendix H
NJ Department of Health Sample Submittal Form

Field ID Number	New Jersey Department of Health Environmental and Chemical Laboratory Services PO Box 361, Trenton, NJ 08625-0361 Phone: 609-530-2820 ORGANIC AND INORGANIC CHEMISTRY SAMPLE SUBMITTAL *(See Instructions)*	Lab Sample Number (For Lab Use Only)

AGENCY INFORMATION

Submitting Agency NJDEP-BFBM	Send Results To Johannus Franken	Agency No. 207	Project Name Lakes
Street Address 35 Arctic Parkway	Final Report Option ☐ Tier 1 ☐ Tier 2 Electronic Report Option ☐ EDD ☐ E-2	Would you like copies of the internal chain of custody forms sent with your report? ☐ Yes ■ No	Project Code V4PC Memo Number
City, State, Zip Code Trenton, NJ 08625	Phone 609-292-0427	Fax 609-633-1095	Email johannus.franken@dep.nj.gov

SAMPLE INFORMATION

Sample Point/Station ID Number/Water Facility ID	Collection Date (YY/MM/DD) __ __ / __ __ / __ __	Sample Type
Sampling Site/Facility/Supply/Location/Sampling Point	Coll. Time (24h) Start ____ Coll. Time (24h) End ____	**Non-Potable:** ■ Stream/Surface ☐ Tissue ☐ Ground Water ☐ Sewage: ☐ Private Well ☐ Raw ☐ Effluent ☐ Septic ☐ Industrial: ☐ Ocean/Saline ☐ Raw ☐ Effluent ☐ Sediment
Waterbody Name	Sample Retention Retain? ■ No ☐ Yes Duration _____	
Municipality/County	Type of Sampling Event ■ Regular ☐ Compliance ☐ Repeat ☐ Non-Regulatory ☐ Other	**Potable:** ☐ Groundwater Rule ☐ At Source ☐ Source ☐ Flushed
Sampling Point Street Address	If Repeat or GWR, List Original Lab Sample No.	☐ Confirmation ☐ 1st Draw ☐ Raw ☐ Lead Source Line ☐ Finished ☐ Surface H$_2$O Intake
	Sample Collector	☐ Private Well ☐ Distribution System **Fraction:** ■ Total ☐ Dissolved
PWSID	Trip #	**Other:** ☐ **Priority:** ☐ Routine ☐ Priority ☐ Emergency

FIELD INFORMATION

Air Temp °C	Water Temp °C	Stream Flow-CFS
Weather Conditions	Sample pH (Field)	Gage Height-Ft.
Preserved in: ■ Field ☐ Lab Date: __ __ / __ __ / __ __ Time: __ __ __ __	DO (mg/l) DO% Sat	Spec.Cond. (µS/CM) Salinity (ppm)
Chlorine Residual	Sample Depth (meters)	Tide Stage
Comments/Field Checks P	Barometric Pressure (mmHg)	Turbidity (NTU)

ANALYSIS REQUESTS

Metals

☐ Ag .... Silver	☐ Mg ..... Magnesium
☐ Al ....Aluminum	☐ Mn ..... Manganese
☐ As .... Arsenic	☐ Mo..... Molybdenum
☐ B ....Boron	☐ Na ....Sodium
☐ Ba ....Barium	☐ Ni .... Nickel
☐ Be ....Beryllium	☐ Pb ....Lead
☐ Ca........... Calcium	☐ Sb ....Antimony
☐ Cd.......... Cadmium	☐ Se ....Selenium
☐ Co...........Cobalt	☐ Si .... Silica
☐ CR-T...Chromium	☐ Tl............Thallium
☐ Cu...........Copper	☐ U ....Uranium
☐ Fe .... Iron	☐ V ....Vanadium
☐ K.........Potassium	☐ Zn.................Zinc

Preferred Methodology
☐ EPA 200.7 / 200.9 ☐ EPA 200.8

Residues
☐ Total Suspended Solids (TSS)
☐ Total Solids (TS)
☐ Total Dissolved Solids (TDS)
☐ Settleable Solids (SS)
☐ Total Volatile Solids (TVS)

Other
☐ _____ ☐ _____ ☐ _____

General

☐ Alkalinity	☐ Fluoride by IC
☐ Bromide by IC	☐ Hardness
☐ Chloride	☐ MBAS
☐ Chloride by IC	☐ Odor
☐ Chromium, Hexavalent	☐ pH
☐ Chromium, Hexavalent by IC	☐ Phenols (PW)
☐ Color	☐ Phenols (NPW)
☐ Conductance	☐ Sulfate by IC
☐ Cyanide	☐ Sulfate Lachat
☐ Dissolved Oxygen	☐ Turbidity
☐ Fluoride	

Mercury
☐ Mercury by EPA 245.1
☐ Low Level Mercury EPA 1631E

Nutrients

☐ Nitrite	☐ Nitrite + Nitrate
☐ Total Phosphorus	☐ Ortho Phosphorus
☐ Ammonia	☐ Total Kjeldahl
☐ Nitrate (Calculated)	Nitrogen (TKN)
☐ Nitrogen, Total (Calculated)	

Organics (Drinking Water)
☐ EPA 504.1 - EDB, DBCP,123TCP
☐ EPA 505 - Chlordane
☐ EPA 505 - Toxaphene
☐ EPA 507 - N and P containing Pesticides
☐ EPA 515.3 - Chlorinated Acid Herbicides
☐ EPA 524.2 - Purgeables
☐ EPA 525.2 - Liquid-Solid Extractables
☐ EPA 531.1 - N-Methylcarbamoyloximes and N-Methylcarbamates

Organics (Non-Potable Water)
☐ EPA 624 – Purgeables
☐ EPA 625 - Base/Neutral and Acid Extractables

Demands
☐ Total Organic Carbon (TOC)
☐ Dissolved Organic Carbon (DOC)
☐ Chemical Oxygen Demand (COD)

Suggested Dilutions

☐ BOD5 ☐ BOD20 ___ ___ ___
☐ CBOD5 ☐ CBOD20 ___ ___ ___

Relinquished By:	Affiliation:	Received By:	Affiliation:	Date/Time	Reason for Custody Change
Name (Print): _____		Name (Print): _____			
Signature: _____	_____	Signature: _____			
Name (Print): _____		Name (Print): _____			
Signature: _____		Signature: _____			

CHEM-44
FEB 16

Appendix I
Data Management Tables

For Data Management purposes, Water Chemistry is defined as parameters analyzed by a lab;
Field measurements are defined as analyze immediately parameters.

Inventory

Geographic Regions	Statewide
Counties	All
Dates	March 1, 2022 through November 30, 2023
Status	Future/Planned
Sample Frequency	Periodic
Seasons Sampled	Winter, Spring, Summer, Fall
Waterbody Type	Lakes, Reservoirs
Salinity Category	Fresh
Tidal Influence	Non-tidal
Project Description	Statewide Statistical lakes will be monitored to evaluate the trophic state of lakes and assess the ecological health of the State's lentic water resources. Statewide reference lakes will be monitored to document baseline, status, and trend information on minimally or non-impacted water quality, ecological integrity and the trophic state of lakes within each ecoregion. Targeted regional lakes will be monitored to produce a robust assessment of environmental conditions affecting water quality in a selected water region according to the Integrated Water Quality Monitoring and Assessment Report cycle.
Parameters analyzed type	Biological - Algae; Chemical/physical: Nutrients

Data Management Supplement

QAPP network path file location?	V:\LUM\BFBM\Bfbm\Quality Assurance Plans\Calendar Year 2022 QAPPs
Where will data be recorded in field (media)	Field data sheet, YSI Pro DSS, Field Notebook
If on tablet or phone, will download occur at office or wirelessly?	N/A
If on tablets or phones, who will do the download?	N/A
If data collected electronically, where will it be stored?	V:\LUM\BFBM\Lakes and Fishibi\Lakes Monitoring\Databases
Format to be received from Lab	DOH Text File
Method of receipt from lab/s	Citrix
Personnel receiving outside lab data	Leigh Lager
Is data expected to go to WQDE/STORET?	Yes
Data manager - (Bureau and Name)	BFBM Leigh Lager

Table 1. Sample locations

Station ID (WQDE compliant & referenced)	Waterbody/ Location	Latitude-dd	Longitude-dd	County	Site exists in WQDE?	Location Type
NJW04459-058-1	Mt. Misery Lake	39.925783	-74.526095	Burlington	Yes	Reference Lake
NJW04459-058-2	Mt. Misery Lake	39.924246	-74.523682	Burlington	Yes	Reference Lake
NJW04459-352-1	Hands Mill Pond	39.243287	-74.901574	Cumberland	Yes	Reference Lake
NJW04459-352-2	Hands Mill Pond	39.245199	-74.904330	Cumberland	Yes	Reference Lake
NJLM-0028-1	Green Turtle Lake	41.143351	-74.329651	Passaic	Yes	Reference Lake
NJLM-0028-2	Green Turtle Lake	41.148516	-74.329033	Passaic	Yes	Reference Lake
NJW04459-233-1	Watchu Pond	40.928053	-74.770434	Sussex	Yes	Reference Lake
NJW04459-233-2	Watchu Pond	40.930143	-74.769398	Sussex	Yes	Reference Lake
NJW04459-233-3	Watchu Pond	40.931352	-74.767907	Sussex	Yes	Reference Lake
NJW04459-134-1	Silver Lake	41.121719	-74.532404	Sussex	Yes	Reference Lake
NJW04459-097-1	Great Gorge Lake	41.161202	-74.523444	Sussex	Yes	Reference Lake
NJW04459-097-2	Great Gorge Lake	41.161322	-74.518986	Sussex	Yes	Reference Lake
NJW04459-339-1	Mashipacong Pond	41.269306	-74.726483	Sussex	Yes	Reference Lake
NJW04459-339-2	Mashipacong Pond	41.265440	-74.729664	Sussex	Yes	Reference Lake
NJW04459-009-1	Deer Park Pond	40.903843	-74.796497	Warren	Yes	Reference Lake
NJW04459-009-2	Deer Park Pond	40.906200	-74.794777	Warren	Yes	Reference Lake

Statistical and Targeted lakes will be added once Stations are established

Table 2. Sample types

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection	Habitat	Metrics	Indices
NJW04459-058-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-058-2	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-352-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-352-2	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJLM-0028-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJLM-0028-2	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-233-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-233-2	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-233-3	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-134-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-097-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-097-2	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-339-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-339-2	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-009-1	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO
NJW04459-009-2	YES	NO	YES	NO	NO	NO	NO	YES	NO	NO

Statistical and Targeted lakes will be added once Stations are established

Table 3. Partners

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection
NJW04459-058-1	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-058-2	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-352-1	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-352-2	DEP	NO	DEP	NO	NO	NO	NO
NJLM-0028-1	DEP	NO	DEP	NO	NO	NO	NO
NJLM-0028-2	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-233-1	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-233-2	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-233-3	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-134-1	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-097-1	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-097-2	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-339-1	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-339-2	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-009-1	DEP	NO	DEP	NO	NO	NO	NO
NJW04459-009-2	DEP	NO	DEP	NO	NO	NO	NO

Statistical and Targeted lakes will be added once Stations are established

Table 4. Field measures

Field Name	WQX Name	Media	Units
Barometric Pressure	Barometric pressure	Air (Weather)	mmHg
Air Temp	Temperature, air	Air (Weather)	deg C
Total Depth	Depth, bottom	Water	m
Secchi Depth	Depth, Secchi disk depth	Water	m
Forel Ule	*	Water	*
Dissolved oxygen	Dissolved oxygen (DO)	Water	mg/l
Dissolved oxygen saturation	Dissolved oxygen saturation	Water	%
pH	pH	Water	None
Specific Conductivity	Specific conductance	Water	µS/cm
Water Temp	Temperature, water	Water	deg C
Turbidity	Turbidity	Water	NTU
Chlorophyll a*	Chlorophyll a	Water	mg/l, RFU
Phycocyanin*	Phycocyanin (probe, probe relative fluoresence)	Water	mg/l, RFU

To be determined

Table 5. Chemistry

Analysis (lab name)	EPA Characteristic Name	Method Speciation Name	Result Sample Fraction	Result Measure Unit	Result Value Type	Sample Collection Type	Sample Collection Equipment
Nitrite + Nitrate as N	Inorganic nitrogen (nitrate and nitrite)	as N	Total	mg/l	Actual	Grab	Water Sampler (Other)
Total Kjeldahl Nitrogen	Kjeldahl nitrogen	as N	Total	mg/l	Actual	Grab	Water Sampler (Other)
Ammonia as N	Ammonia-nitrogen	as N	Total	mg/l	Actual	Grab	Water Sampler (Other)
Phosphorus, Total	Phosphate-phosphorus	as P	Total	mg/l	Actual	Grab	Water Sampler (Other)
Orthophosphate as P	Orthophosphate	as P	Total	mg/l	Actual	Grab	Water Sampler (Other)
Dissolved Organic Carbon	Organic Carbon		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
Dissolved Silica	*		Dissolved	mg/l	Actual	Grab	Water Sampler (Other)
Color Dissolved Organic Matter (True Color)	*		Dissolved	*	Actual	Grab	Water Sampler (Other)
Apparent Color	*		Total	*	Estimated	Grab	Water Sampler (Other)
Total Alkalinity	Alkalinity, total		Total	mg/l	Actual	Grab	Water Sampler (Other)
Chloride			Total	mg/l	Actual	Grab	Water Sampler (Other)
Total Suspended Solids	Total Suspended Solids		Total	mg/l	Actual	Grab	Water Sampler (Other)
Sulfate			Total	mg/l	Actual	Grab	Water Sampler (Other)
Hardness, Total	Hardness, carbonate	as CaCO3	Total	mg/l	Calculated	Grab	Water Sampler (Other)

Analysis (lab name)	EPA Characteristic Name	Method Speciation Name	Result Sample Fraction	Result Measure Unit	Result Value Type	Sample Collection Type	Sample Collection Equipment
Calcium			Total	mg/l	Actual	Grab	Water Sampler (Other)
Magnesium			Total	mg/l	Actual	Grab	Water Sampler (Other)
Sodium			Total	mg/l	Actual	Grab	Water Sampler (Other)
Potassium			Total	mg/l	Actual	Grab	Water Sampler (Other)
Chlorophyll a	Chlorophyll a		Total	ug/l	Actual	Grab	Water Sampler (Other)

To be determined

Table 6. Laboratory

Parameter	Laboratory	Lab Number	Method	Method ID Context	Lower Reporting Limit	units	Method Detection Limit	units	Upper Reporting Limit (MPN/100 ml)	units	Holding Time	Preservative
Nitrite + Nitrate, as N	NJ DEPARTMENT OF HEALTH - 11036	11036	4500-NO3(F)	APHA	0.012	mg/l	0.007	mg/l			28 days	pH<2, Ice to 4ºC
Total Kjeldahl Nitrogen	NJ DEPARTMENT OF HEALTH - 11036	11036	351.2	USEPA	0.1	mg/l	0.04	mg/l			28 days	pH<2, Ice to 4ºC
Ammonia as N	NJ DEPARTMENT OF HEALTH - 11036	11036	4500-NH3(H)	APHA	0.010	mg/l	0.005	mg/l			28 days	pH<2, Ice to 4ºC
Phosphorus, Total	NJ DEPARTMENT OF HEALTH - 11036	11036	365.1	USEPA	0.010	mg/l	0.007	mg/l			28 days	pH<2, Ice to 4ºC
Orthophosphate as P	NJ DEPARTMENT OF HEALTH - 11036	11036	365.1	USEPA	0.005	mg/l	0.004	mg/l			48 hours	Ice to <4 ºC
Dissolved Organic Carbon	NJ DEPARTMENT OF HEALTH - 11036	11036	5310-C	APHA	1	mg/l	0.45	mg/l			28 days	pH<2, Ice to 4ºC
Color Dissolved Organic Matter (True Color)	NJ DEPARTMENT OF HEALTH - 11036	11036	SM 2120B	*	2.5	PCU	2.5	PCU			48 hours	Ice to <4 ºC
Apparent Color	NJ DEPARTMENT OF HEALTH - 11036	11036	SM 2120B	*	2.5	PCU	2.5	PCU			48 hours	Ice to <4 ºC
Dissolved Silica	NJ DEPARTMENT OF HEALTH - 11036	11036	200.7(W)	USEPA	0.5	mg/l	0.017	mg/l			180 days	pH<2, Ice to 4ºC
Total Alkalinity	NJ DEPARTMENT OF HEALTH - 11036	11036	2320-B	APHA	1	mg/l	1	mg/l			14 days	Ice to <4 ºC
Chloride	NJ DEPARTMENT OF HEALTH - 11036	11036	4500-CL(E)	USEPA	2.5	mg/l	1.3	mg/l			28 days	Ice to <4 ºC
Total Suspended Solids	NJ DEPARTMENT OF HEALTH - 11036	11036	2540-D	APHA	1	mg/l	1	mg/l			7 days	Ice to <4 ºC
Sulfate	NJ DEPARTMENT OF HEALTH - 11036	11036	375.2	USEPA	10	mg/l	2.8	mg/l			28 days	Ice to <4 ºC
Hardness, Total	NJ DEPARTMENT OF HEALTH - 11036	11036	200.7(W)	USEPA	0.662	mg/l	0.069	mg/l			180 days	pH<2, Ice to <4 ºC

Parameter	Laboratory	Lab Number	Method	Method ID Context	Lower Reporting Limit	units	Method Detection Limit	units	Upper Reporting Limit (MPN/100 ml)	units	Holding Time	Preservative
Calcium	NJ DEPARTMENT OF HEALTH - 11036	11036	200.7(W)	USEPA	0.5	mg/l	0.12	mg/l			180 days	pH<2, Ice to <4 ºC
Magnesium	NJ DEPARTMENT OF HEALTH - 11036	11036	200.7(W)	USEPA	0.5	mg/l	0.056	mg/l			180 days	pH<2, Ice to <4 ºC
Sodium	NJ DEPARTMENT OF HEALTH - 11036	11036	200.7(W)	USEPA	0.5	mg/l	0.045	mg/l			180 days	pH<2, Ice to <4 ºC
Potassium	NJ DEPARTMENT OF HEALTH - 11036	11036	200.7(W)	USEPA	0.5	mg/l	0.093	mg/l			181 days	pH<2, Ice to <4 ºC
Chlorophyll a	NJDEP - ENVIRONMENTAL MONITORING LABORATORY - 11896	11896	445	USEPA	N/A	ug/l	0.1	ug/l			24 hours	Ice to <4 ºC

To be determined