

**Quality Assurance Project Plan
for the
Devils Lake Water Quality Monitoring Project**

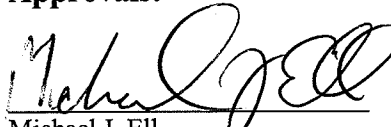
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November 2009

This quality assurance project plan (QAPP) has been prepared to ensure that environmental and related data collected, compiled, and/or generated for this program/project are complete, accurate, and of the type, quantity, and quality required for their intended use. The work conducted will be in conformance with the Quality Management Plan (QMP) for the North Dakota Department of Health Environmental Health Section (NDDoH, August 2008) and with the procedures described in this QAPP. The QMP and this QAPP reflect provisions from the Environmental Protection Agency (EPA) entitled "EPA Requirements for Quality Assurance Project Plans" (March 2001, reissued May 2006).

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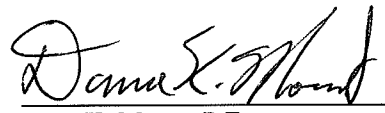
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A. Project Management**A1. Project/Task Organization**

This Quality Assurance Project Plan (QAPP) describes the quality assurance (QA) and quality control (QC) activities/procedures that will be used while collecting samples for the Devils Lake Water Quality Monitoring Project (DLWQMP). The purpose of this document is to present the methods and procedures that will be used to collect chemical, physical, and biological samples and measurements from Devils Lake to ensure quality data through the employment of standardized methods and procedures. The QAPP describes the length, scope, and frequency of monitoring and in general terms how the data will be distributed and preserved. Data will be collected by the North Dakota Department of Health - Environmental Health Section's Division of Water Quality.

Overall organization for the North Dakota Department Health's (NDDoH's) Environmental Health Section (EHS) is detailed in the Quality Management Plan (QMP) for the Environmental Health Section (NDDoH, August 2008)¹. The EHS is one of six sections in the Department. Within the EHS there are five divisions, including the Divisions of Air Quality, Municipal Facilities, Waste Management, Water Quality, and Laboratory Services. Dana K. Mount, P.E. is the Quality Assurance Coordinator (QAC) for the EHS. The QAC is located in the EHS Chief's Office and reports directly to the Chief of the EHS. The EHS Chief's Office through the QAC is responsible for oversight of the EHS's quality system for QA and QC as delineated in the QMP for the EHS, including approving project QAPPs. It is the policy of the EHS that the primary responsibility for QA resides among program staff and Designated Project Managers (DPMs) in each division, therefore each program is responsible for the preparation, implementation, and assessment of its QAPP(s).

Within the EHS, the Division of Water Quality is organized in four programs, the North Dakota Permit Discharge Elimination System (NDPDES) Program, the Groundwater Program, the Surface Water Quality Management Program (SWQMP), and Special Projects (SP). The organizational structure for and Devils Lake Water Quality Monitoring Project is outlined in Figure 1.

¹ This QAPP was prepared according to the EHS's QMP, which has been approved by EPA.

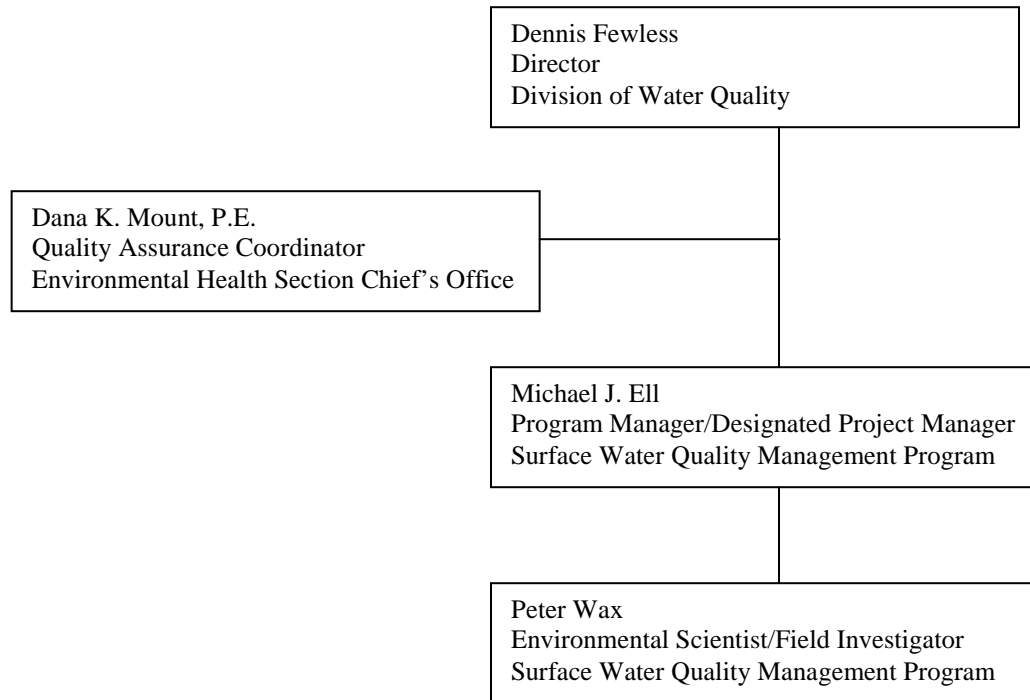


Figure 1. Organizational Diagram for the Devils Lake Water Quality Monitoring Project

Michael J. Ell is Program Manager for the SWQMP. As Program Manager in the SWQMP he has the following responsibilities:

- Review and edit the QAPP;
- Provide oversight for study design, site selection, and adherence to design objectives;
- Review and approve the final project work plan and other materials to support the project (e.g., standard operating procedures);
- Select appropriate project subcontractors, as needed; and
- Coordinate with contractors, reviewers, and US EPA to ensure technical quality and contract adherence.

Mike Ell is the Designated Project Manager for the Monitoring Project. As such, he is responsible for overall project coordination and supervision of data collection. Peter Wax is the primary Field Investigator (FI) for the project. As the FI, Peter Wax is responsible for the field collection of lake data by the NDDoH (Figure 1).

A2. Problem Definition / Background

The Devils Lake Basin is a of 2.4 million acre terminal drainage in northeastern North Dakota (Figure 2). The watershed is located in the Northern Glaciated Plains ecoregion and is a mix of integrated and nonintegrated drainage patterns. Streams within the basin are primarily intermittent. The Devils Lake chain, consisting of several bays and East Devils Lake, is located in southern Ramsey and northern Benson counties of North Dakota.

Two primary drainages within the basin are Channel A and Big Coulee (Mauvais Coulee). Channel A drains the Dry Lake, Edmore, Starkweather and Sweetwater areas, while Big Coulee drains Lake Irving, Lake Alice, Chain of Lakes and Mauvais Coulee (Figure 2). Spring runoff, most of which enters the system through West Bay (naturally) and Six Mile Bay (Channel A), is the major source of water. According to the U.S. Geological Survey (USGS), about 80 percent of the water contributed to Devils Lake enters through these two sources (Greg Wiche, personal communication). Groundwater also contributes to the hydrologic budget. As a result, Devils Lake is susceptible to widely fluctuating lake levels.

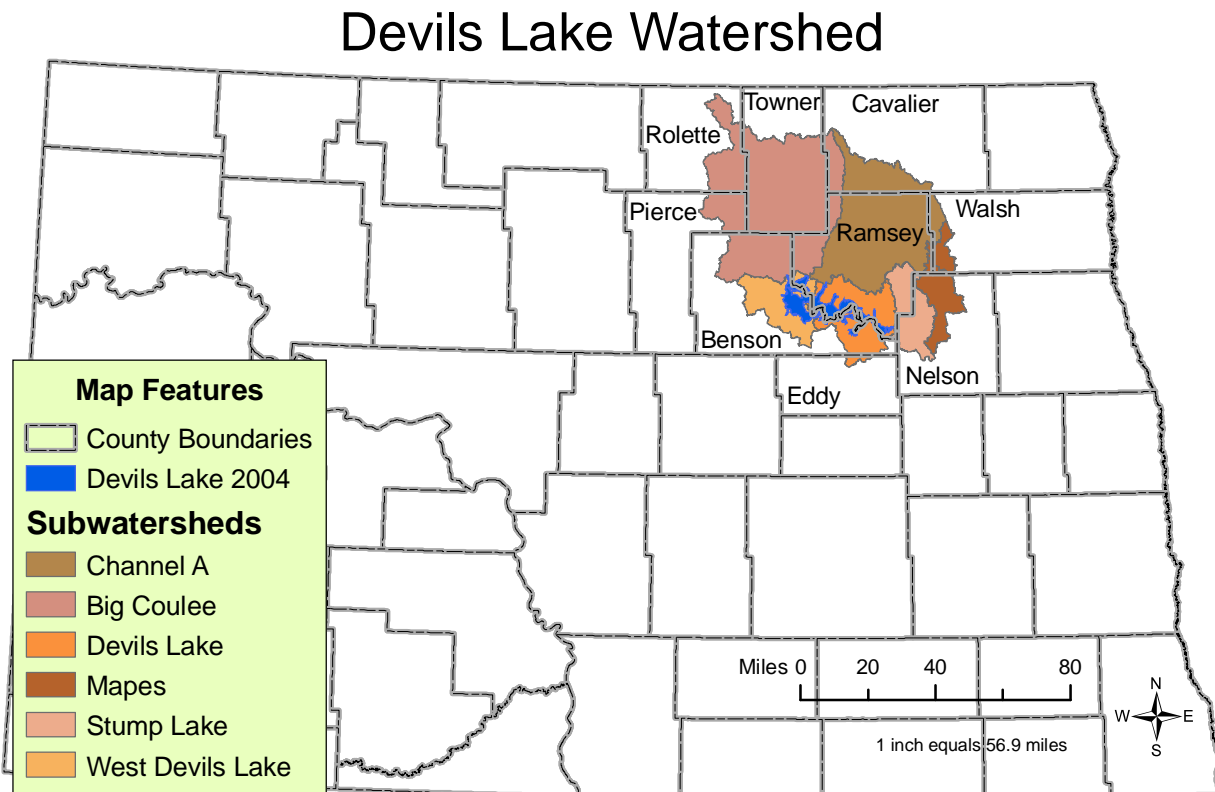


Figure 2. Major Subwatersheds in the Devils Lake Basin

Since 1993 water levels in Devils Lake have risen over 25 feet and increased the lake volume from approximately 43,000 acres to 134,000 acres. Fluctuating water levels are primarily related to the closed-basin nature of the system. The absence of a surface outlet and the fact that annual evaporation frequently exceeds annual precipitation are important factors leading to high concentrations of total dissolved solids (TDS) and fluctuations in nutrient concentrations.

High TDS and changing nutrient concentrations are identified as important variables affecting water quality and the aquatic community structure in Devils Lake. High concentrations of TDS affect fish reproduction, fish growth and algal blooms. Furthermore, high nutrient concentrations result in a lake classification of hypereutrophic (nutrient-rich) evidenced by low-light transparency and frequent, prolific, nuisance algal blooms. These algal blooms are dominated by cyanophyta (blue-green algae) and result in impaired water-based recreation.

A3. Project Monitoring Goals/Objectives/Tasks Description

The goal of the Devils Lake Water Quality Monitoring Plan (DLWQMP) is to monitor the ambient chemical, physical and biological character of Devils Lake by: 1) assessing the current water quality condition and trophic status of the Lake; 2) assessing possible spatial differences in water quality and trophic status among seven (7) regions in the lake; and 3) assessing annual and long term temporal trends in lake water quality and trophic status by comparing water quality from seasonally spaced collection periods and historic water quality data.

Objective 1: Collect chemical, biological and physical data from seven monitoring sites four times annually (Table 1, Figure 3, Appendix A through D). The four sampling periods are: 1) January to March; 2) May; 3) mid-July to mid-August; and 4) October.

Task 1: Collect four times annually from each of the 7 sites a Secchi Disk Transparency measurement and record of field conditions (Appendix A).

Product: Four sets of Secchi Disk Transparency and field condition data collected for the 7 monitoring sites.

Milestone: Annually by October 31

Task 2: Collect four times annually from each of the 7 sites dissolved oxygen, temperature, specific conductance and pH profiles (Appendix B).

Product: Four sets of temperature, oxygen, pH and specific conductance profile data collected for the 7 monitoring sites.

Milestone: Annually by October 31

Task 3: Utilizing a 6-foot integrated column sampler collect and field filter four times annually from each of the 7 sites chlorophyll-a and b samples (Appendix C).

Product: Four sets of chlorophyll-a & b samples for the 7 monitoring sites.

Milestone: Annually by October 31

Task 4: Utilizing a Kemmerer sampler collect, filter and preserve four times annually from the 7 sites discrete depth water chemistry samples (Appendix D, Section B1.3).

Product: Four sets of discrete depth water chemical samples collected from each of the 7 monitoring locations.

Milestone: Annually by October 31

Objective 2: Ensure the data are readily available to natural resource professionals (e.g., fisheries managers, hydrologists, engineers, water quality specialists) and the public.

Task 5: Enter and store all data collected for the Monitoring Project in the SWQMP’s Access 2000 database known as SID (Samples Identification Database). The data will also be stored in EPA’s STORET/WQX database.

Product: Project data entered in SID and STORET/WQX.

Milestone: Annually by the following January

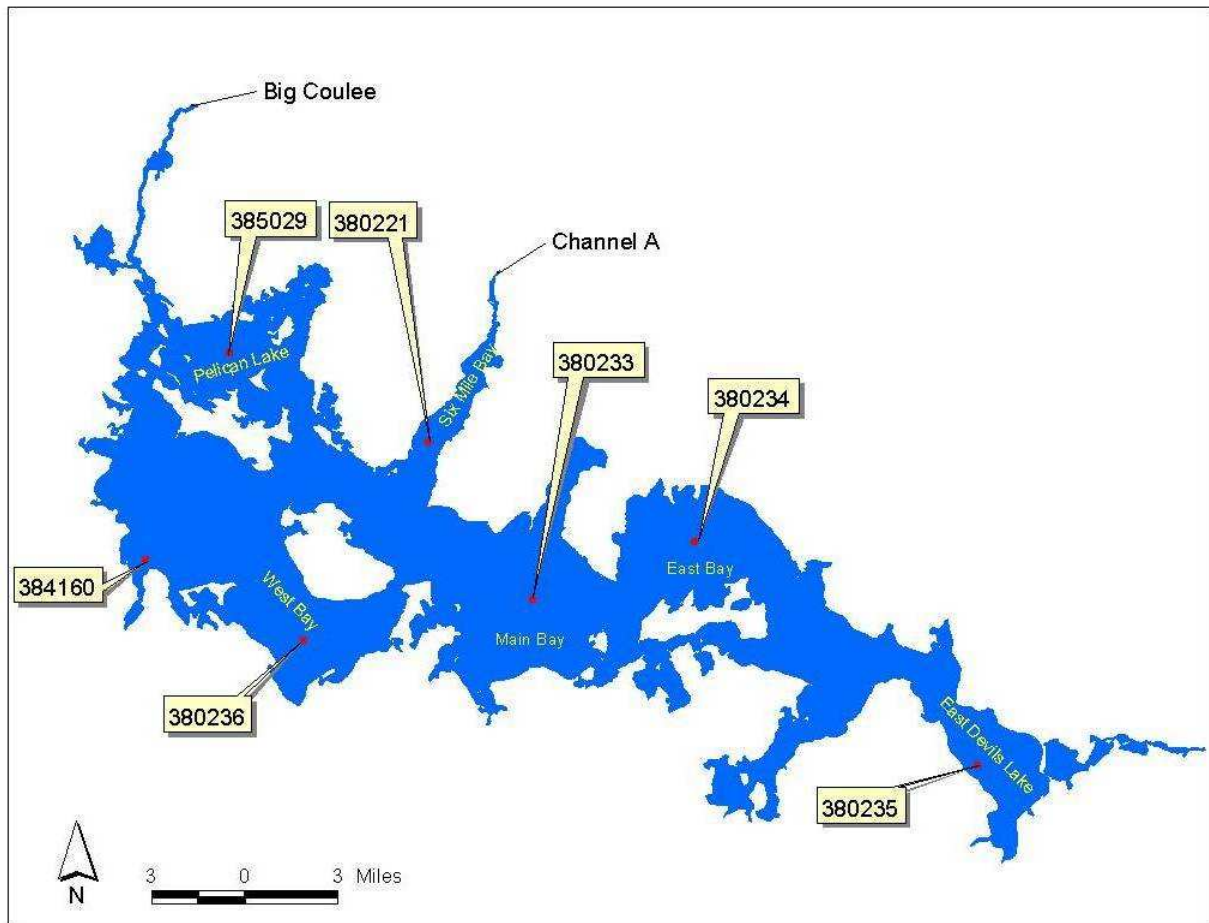


Figure 3. Devils Lake Water Quality Monitoring Sites

Table 1. Devils Lake Water Quality Monitoring Locations.

STORET ID	Site Description	Latitude	Longitude
380221	Devils Lake - 6 Mile Bay	48.1053	-99.02549
380233	Devils Lake - Main Bay	48.03265	-98.95333
380234	Devils Lake - East Bay	48.05927	-98.84115
380235	East Devils Lake	47.95486	-98.64633
380236	Devils Lake - West Bay	48.01335	-99.11192
384160	Devils Lake - SW West bay	48.04898	-99.21235
385029	Pelican Lake	48.14634	-99.16399

Table 2. Water Quality Sampling Frequency and Parameters

Sampling Month	Depth	Parameter
January or February, May, July, October	Surface to Bottom	Temperature, Dissolved Oxygen, Specific Conductance, pH Profile
January or February, May, July, and October	Discrete Depths (Section B1.3)	Total Phosphorus, Total Dissolved Phosphorus, Total Nitrogen, TKN, Total Ammonia, Nitrate + Nitrite, Major Cations/Anions, Trace Metals
May, July, and August	Surface	Secchi disk depth
May, July, and August	Integrated Surface to 6-feet of Depth	Chlorophyll -a & b

A4. Data Quality Objectives and Criteria for Measurement Data

A4.1 Data Quality Objectives

It is the policy of the US EPA and the Department’s EHS that data quality objectives (DQOs) be developed for all environmental data collection activities. Data of known quality are essential to the success of any monitoring or sampling project. Data quality objectives are qualitative and quantitative statements that clarify the intended use of the data, define the type of data needed to support the decision, identify the conditions under which the data should be collected, and specify tolerable limits on the probability of making a decision error due to uncertainty in the data. DQOs are developed by data users to specify the data quality needed to support specific decisions. Sources of error or uncertainty include the following:

- Sampling error - the difference between sample values and *in situ* true values from unknown biases due to collection methods and sampling design.
- Measurement error - the difference between sample values and *in situ* true values associated with the measurement process.
- Natural variation - natural spatial heterogeneity and temporal variability in population abundance and distribution.

-
- Error sources or biases associated with compositing, sampling handling, storage, and preservation.

The primary data quality objective of this project is to provide water quality data for Devils Lake of known precision and accuracy and of sufficient temporal and spatial scale that is needed to: 1) assess the current water quality condition and trophic status of the lake; 2) assess possible spatial differences in water quality and trophic status among sites/regions in the Lake; 3) assess temporal trends in lake water quality and trophic status by comparing current Monitoring Project data to historic water quality data available for the lake. Methods and procedures described in this document are intended to reduce the magnitude of the sources of uncertainty (and their frequency of occurrence) by applying the following approaches:

- Use of standardized sample collection, handling, and analysis procedures.
- Use of trained scientists and technicians to perform the sample collection, handling activities, data entry, and review procedures.

A4.2 Measurement Performance Criteria

In order to meet the DQO for the project, the types of data needed for this project and their intended use are described in Table 3. For each of these data, a discussion of the measurement performance criteria or data quality indicators is provided. Data quality indicators include the following:

- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability

This QAPP does not address measurement performance criteria for the laboratory analyses of chemical samples. Measurement performance criteria for all lab analysis are described in the NDDH, Division of Laboratory Services-Chemistry, and Quality Assurance Plan (NDDH 2000).

Measurement Performance Criteria for Laboratory Analytes sampled for this project are provided in Table 4. Measurement performance criteria are provided for all chemical and bacterial analytes sampled and analyzed as part of this project. Measurement performance criteria are provided to ensure that the “achievable laboratory limits” (i.e., method detection and quantification limits) provided by the laboratory performing the analysis are consistent with the project’s quantification limits and/or action limits.

Precision is a measure of mutual agreement among individual measurements or enumerated values of the same property of a sample, usually under demonstrated similar conditions. Precision is best measured in terms of the standard deviation. For purposes of this project, precision of biological samples and chemical analyses will be calculated from replicate samples and expressed as relative percent difference (RPD), if it is calculated from duplicate samples, or as relative standard deviation (RSD), if it is to be calculated from three or more samples. Table 5 provides a summary of the precision requirements for data collected for this project.

Table 3. Project Data Needs and Intended Use

Data Needed	Intended Use
Secchi Disk transparency measurements	To provide an estimate of trophic status through Carlson’s Trophic Status Index for Secchi Disk Transparency measurements.
Temperature and DO profile measurements	To determine the magnitude and extent of thermal stratification in the Lake, the depth of the epilimnion, metalimnion and hypolimnion.
Chemical and biological water quality monitoring data	To characterize the general water quality and trophic condition of the Lake. To assess spatial differences in water quality and trophic status among sites/regions. To assess temporal differences in Lake water quality and trophic condition by comparing project data to historic water quality data.

Accuracy is the degree of agreement between an observed or measured value and the true or expected value of the measured quality. Many kinds of error, including unintentional bias, affect the inherent accuracy of data. While the investigator almost never knows true population values, accuracy of chemical laboratory samples may be obtained from the analysis of spiked matrix samples. Performance evaluation (PE) samples may also be employed to estimate the accuracy of chemical analysis.

This is especially true when working with natural biological communities. Therefore, the best an investigator can do is to avoid bias by assuring consistency of sampling and sample processing and striving for repeatability of measurements. Table 5 provides a summary of the accuracy requirements for data collected for this project.

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter or variation at a sampling point, process condition or an environmental condition. The representativeness of the project relies in part, on the selection of sample sites and the collection of a significant number of samples.

Table 4. Measurement Performance Criteria for Laboratory Analytes.

Analyte	Matrix	Project Action Limit	Project Quantification Limit (QL)	Analytical Method		Achievable Laboratory Limit	
				MDLs ¹	Method	MDLs	QLs
Total N	Water	NA	0.015 mg/L	NL ²	4500-N C ³	0.015 mg/L	0.015 mg/L
TKN	Water	NA	NA	NL ²	Calculated	NA	NA
Nitrate	Water	NA	0.03 mg/L	NL ²	353.24	0.007 mg/L	0.03 mg/L
Ammonia	Water	NA	0.03 mg/L	NL ²	350.14	0.024 mg/L	0.03 mg/L
Total P	Water	NA	0.004 mg/L	NL ²	365.14	0.004 mg/L	0.004 mg/L
Chromium	Water	NA	0.03 ug/L	0.08 µg/L	200.8	0.03 ug/L	1.00 µg/L
Copper	Water	NA	0.005 ug/L	0.02 ug/L	200.8	0.005 ug/L	1.00 ug/L
Zinc	Water	NA	0.1 ug/L	0.1 ug/L	200.8	0.1 ug/L	1.00 ug/L
Arsenic	Water	NA	0.04 ug/L	0.4 ug/L	200.8	0.04 ug/L	1.00 ug/L
Selenium	Water	NA	0.08 u/L	2.1 ug/L	200.8	0.08 u/L	1.00 ug/L
Cadmium	Water	NA	0.02 ug/L	0.03 ug/L	200.8	0.02 ug/L	1.00 ug/L
Barium	Water	NA	0.008 ug/l	0.04 ug/L	200.8	0.008 ug/l	1.00 ug/L
Lead	Water	NA	0.004 ug/l	0.05 ug/L	200.8	0.004 ug/l	1.00 ug/L
Manganese	Water	NA	0.002 mg/L	0.02 ug/L	200.7	0.002 mg/L	0.01 mg/L
Iron	Water	NA	0.009 mg/L	6.2 ug/L ²	200.7	0.009 mg/L	0.05 mg/L
Aluminum	Water	NA	7.7 ug/L	45 ug/L ²	200.7	7.7 ug/L	50 ug/L
Boron	Water	NA	6.7 ug/L	5.7 ug/L ²	200.7	6.7 ug/L	50 ug/L
Antimony	Water	NA	0.004 ug/L	0.04 ug/L	200.8	0.004 ug/L	1.00 ug/L
Beryllium	Water	NA	0.03 ug/L	0.02 ug/L	200.8	0.03 ug/L	1.00 ug/L
Nickel	Water	NA	0.006 ug/L	0.06 ug/L	200.8	0.006 ug/L	1.00 ug/L
Silver	Water	NA	0.005 ug/L	0.005 ug/L	200.8	0.005 ug/L	1.00 ug/L
Thallium	Water	NA	0.009 ug/L	0.02 ug/L	200.8	0.009 ug/L	1.00 ug/L
Cation	Water	NA	NA	NL ²	Calculated	NA	NA
Anion	Water	NA	NA	NL ²	Calculated	NA	NA
TSS	Water	NA	NA	NL ²	SM 2540 D ¹	NA	5 mg/L
pH	Water	NA	NA	NL ²	SM 4500 H+ B ¹	NA	NA
Conductivity	Water	NA	0.24 umhos/cm	NL ²	SM 2510 B ¹	0.24 umhos/cm	4 umhos/cm

¹ Method Detection Limit

² Not Listed in the Method.

³ From Standard Methods, 20th Edition

⁴ US EPA Clean Water Act Method Approved for Use at 40 CFR 136

Completeness is defined as the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system. To optimize completeness, every effort is made to avoid sample and/or data loss. Accidents during sample transport or lab activities that cause the loss of the original samples will result in irreparable loss of data, which will reduce the ability to perform analyses, integrate results and prepare reports. In order to maximize completeness, all samples will be stored and transported in unbreakable (plastic) containers.

Percent completeness (%C) for measurement parameters and samples is defined as:

$$\%C = v/T \times 100$$

Where v = the number of measurements or samples judged valid; and

T = the total number of measurements of samples collected.

In order to fulfill statistical criteria, samples will be collected at 100% of the sites unless unanticipated conditions (e.g., bad weather) prevent sampling. Table 3 provides a summary of the completeness requirements for data collected for this project.

Table 5. Summary of Precision, Accuracy, and Completeness Requirements

Measurement Parameter	Precision	Accuracy	Percent Completeness
Chlorophyll- <i>a</i>	20 %	NA	100 %
Secchi Disk Transparency	0.05 meter	0.1 meter	100 %
Water Chemistry (e.g., major cations and anions, nutrients)	20 %	NA	100 %
Field Profile Measurements			
Dissolved Oxygen	0.1 mg/L	0.3 mg/L	95 %
Temperature	0.1 °C	0.2 °C	95 %
pH	0.1 units	0.2 units	95 %
Specific Conductance	1 µmohs	10 µmohs	95 %

Comparability is a measure of the confidence with which one data set can be compared to another. Comparability is dependent on the proper design of the sampling program and on strict adherence to accepted sampling techniques, standard operating procedures, and quality assurance guidelines. For this project, comparability of data will be accomplished by standardizing the sampling season, the geographic extent of the project, the field sampling methods and the field training as follows:

- All samples will be collected from specific sites located within Devils Lake Chain (Figure 3, Table 1). The estimated project sampling period will be January-February, May, July-August, and October.
- Standard sampling and analytical methods, as well as standard units of reporting for all parameters sampled will be used (Appendices A-D).
- All field personnel involved with sampling will have adequate training and experience.

A5. Special Training/Certification

The DPM and/or the FI(s) will be responsible for all field data collection. The lake sampling crew is required to have the necessary knowledge and experience to perform all field activities. Training in the proper methods for sample collection, preservation and the transfer of water chemistry will be provided by Peter Wax, the FI, and/or the DPM.

A6. Documents and Records

Thorough documentation of all field sampling and handling activities is necessary for proper processing in the laboratory, data reduction and, ultimately, for the interpretation of study results. Field sample collection and handling will be documented in writing and the following forms and labels will be used:

- A set of Sample Identification/Custody Record forms that accompanies all water quality samples submitted to the Division of Laboratory Services for analysis (Appendix C and D).
- A Sample Identification Label that accompanies and identifies all water samples (Appendix C and D).
- All field measurements (i.e., weather conditions, Secchi disk transparency, temperature, DO, pH and specific conductance measurements) will be recorded on the Lake and Lake Field Data Form (Appendix A).

Each sample collected will be uniquely identified on the sample label and field custody forms by specifying the site ID and location, sample depth, and sample date and time, and name of the person collecting the sample.

B. Data Generation and Acquisition**B1. Sampling Process Design (Experimental Design)****B1.1 Monitoring Goals**

The goals of the Devils Lake Water Quality Monitoring Plan is to monitor the ambient chemical, physical and biological character of Devils Lake by: 1) assessing the current water quality condition and trophic status of the Lake; 2) assessing possible spatial differences in water quality and trophic status among seven (7) regions in the lake; and 3) assessing annual and long term temporal trends in lake water quality and trophic status by comparing water quality from seasonally spaced collection periods and historic water quality data.

B1.2 Sample Locations and Depths

Seven water quality monitoring sites have been selected for the Monitoring Project (Figure 3, Table 1).

At each sample site the number of discrete depth intervals to be sampled will be determined based on the sites depth and measurement of the temperature and dissolved oxygen profile. Based on those two criteria the following sampling rules for the individual sampling sites will apply:

- Southwest West Bay – A single water quality sample will be collected at the mid-point of the water column. During ice-cover the water column depth will be measured from the surface of the sediments to the bottom of the ice.
- Peilcan Lake – Samples will be collected at either one or two depth intervals depending on the presence or absence of thermal stratification. If, upon reviewing the temperature/dissolved oxygen profile, the site is not thermally stratified, then a single 1-meter depth sample will be collected. If thermal stratification is present, two depth intervals will be sampled, one at the 1- meter depth interval and one located at 1- meter off the bottom.
- Six-Mile Bay, West Bay, Main Bay, East Bay and East Devils Lake – Samples will be collected at either two to three depth intervals depending on the presence or absence of thermal stratification. If, upon reviewing the temperature/dissolved oxygen profile the site is not thermally stratified two sample intervals will be sampled, one at the 1-meter of depth and one located 1- meter off the bottom. If thermal stratification is present, three samples will be collected. One at the 1-meter depth interval, one immediately below the thermocline, and one located 1-meter off the bottom.

B1.3 Sampling Frequency

The seven Devils Lake monitoring sites will be monitored in the following months: January-March (under ice cover), May, July, and October.

B1.4 Sampling Parameters

Sampling parameters will vary slightly between season and sampling procedures. On each sampling visit regardless of the season the current weather conditions will be collected, and a temperature, dissolved oxygen, specific conductance, and pH profile will be collected as well as depth associated chemical grab samples. Additionally, during the open water season secchi disk transparency will be measured and a chlorophyll-a & b sample will be collected. During the winter all of the previous data will be collected with the exclusion of measuring secchi disk depth, and collecting a chlorophyll a & b Sample. Parameters and associated dates are listed in Table 6.

B2. Sampling Methods

Table 6 provides a summary of project sampling methods. Detailed descriptions of all field-sampling methods are described in Appendices A-D.

Table 6. Sampling Methods.

Matrix/ Substrate	Parameter	Sampling Equipment	Sampling Method	Max Holding Time	Sample Container	Sample Preservation and Care
Transparency	Secchi Disk Transparency	1	1	NA	NA	NA
Water column	Temperature, pH, DO, and Specific Conductance	2	2	NA	NA	NA
Water column	Chlorophyll- <i>a</i> & <i>b</i>	4	4	4	4	4
Water column	Chemistry	3	3	3	3	3

- 1 - Appendix A
- 2 - Appendix B
- 3 - Appendix C
- 4 - Appendix D

B3. Sample Handling and Custody Requirements

Following sample collection in the field all the chemistry and chlorophyll-a water samples will be hand delivered to the Division of Laboratory Services Chemistry laboratory in Bismarck, North Dakota.

B4. Analytical Methods Requirements

All water samples will be analyzed according to methods and procedures described in the NDDoH Division of Laboratory Services-Chemistry Laboratory 2009 Quality Assurance Plan (Table 4).

B5. Quality Control

For this project, a single person from each agency will be responsible for taking field measurements and collecting water quality samples. Equipment used for field measurements will be calibrated according to manufacturer specifications immediately before and after each sampling trip. Furthermore, every tenth field sample will be duplicated for chemical analysis.

B6. Equipment Testing, Inspection and Maintenance

All field equipment will be inspected prior to sampling activities to ensure that the equipment is in proper working order (e.g., water samplers are without defects, temperature and DO meter functioning properly). The inspection of field equipment will occur in advance of field activities to allow time for replacement or repair of defective equipment. The FI should gather and inspect all equipment prior to each sampling trip. All field equipment will be maintained according to manufacture’s specifications.

B7. Instrument Calibration Frequency

All field equipment will be inspected prior to sampling activities to ensure that proper use requirements are met (e.g., water samplers are without defects). Inspection of field equipment will occur in advance of field activities to allow time for replacement or repair of defective equipment. The FI should gather and inspect all equipment prior to each sampling trip.

As part of instrument and equipment maintenance, the temperature, pH, conductivity, and DO meter(s) will be calibrated according to the manufacturer's specifications.

B8. Inspection/Acceptance of Supplies and Consumables

Careful and thorough planning is necessary to ensure the efficient completion of the field sample collection tasks. A general checklist of field equipment and supplies is provided in the description of the SOPs (Appendices A - D). It is the responsibility of the FI to gather and inspect the necessary sampling gear prior to each sampling trip.

B9. Data Acquisition Requirements (Non-direct Measurements)

Non-direct measurements will include identification and/or verification of each sample location by Global Positioning System (GPS) technology. The latitude and longitude coordinates, in decimal degrees, will be recorded. A hard copy table with coordinates for each sampling site and a map depicting each location will be provided by the DPM to the FIs. Repeat visits to the sampling sites should be confirmed with a GPS to within ± 0.0001 degrees (approximately 40-60 feet).

B10. Data Management

Samples will be documented and tracked through sample identification labels, field and laboratory recording forms and sample identification/custody forms. Water samples collected for chemical analysis will be transported or sent to the Division of Laboratory Services laboratory in Bismarck, ND by the DPM/FI(s).

Results of the chemical analysis of water samples are transmitted from the Division of Laboratory Services to the SWQMP program manager via hard copy report and electronically as an ASCII text file. Results transmitted electronically are stored by the Division of Water Quality's SWQMP in an Access 2003 database termed SID (Sample Identification Database). Field measurement data (e.g., Secchi Disk depth, temperature, DO concentration, pH and specific conductance) are directly entered into SID by SWQMP staff. After review by the SWQMP program manager, sample results will be retained by the DPM for data reduction and analysis. All results are also entered into EPA's STorage and RETreival (STORET) database management system.

C. Assessment and Oversight**C1. Assessment and Response Actions**

Assessment activities and corrective actions have been identified to ensure that (1) sample collection activities are conducted as prescribed and (2) measurement and data quality objectives established by this QAPP are met. The QA program under which this project will operate includes performance and system audits with independent checks of the data obtained from sampling activities. Either type of audit could indicate the need for corrective action. The essential steps in the program are as follows:

- Identify and define the problem.
- Assign responsibility for investigating the problem.
- Assign and accept responsibility for implementing appropriate corrective action.
- Investigate and determine the cause of the problem.
- Establish effectiveness of and implement the corrective action.
- Verify that the corrective action has eliminated the problem.

Immediate corrective actions are: (1) part of normal operating procedures, (2) noted on project field and laboratory recording forms, and (3) the responsibility of the DPM and/or the FI. Problems not solved this way may require more formalized long-term corrective action. In the event that quality problems requiring attention are identified, the DPM will determine whether attainment of acceptable data quality requires either short- or long-term actions. Failures in the chemical analysis system (e.g., performance requirements are not met) and corrective actions for those failures are beyond the scope of this QAPP.

Communication and oversight will proceed from the FI to the DPM. The DPM will be available throughout the entire sampling period to address questions and receive communications of sampling status from the FI. The FI will communicate the status of the sampling activities to the DPM before and after each monitoring period. During this time the FI will communicate any sampling difficulties encountered during the sampling and the corrective actions taken in the field. In most cases, the FI will initiate corrective actions when a problem is immediately identified and note the problem and corrective action in the sampling logbook. In the event the problem cannot be corrected immediately, the FI will contact the DPM to determine the best way to rectify the problem. When corrective actions have been taken and a sufficient time period has elapsed that allows a response, that response will be compared with project goals by the DPM. The DPM will verify that the corrective action has been appropriately addressed to eliminate the problem. The DPM has the authority to stop work on the project if problems affecting data quality will require extensive effort to resolve.

When the FI contacts the DPM with a problem, the FI will make a record of the problem and the corrective action taken.

Performance audits are qualitative checks on different segments of project activities, and are most appropriate for field sampling and laboratory analysis activities. An audit of field sampling activities will be conducted at least once during the project. This audit will be conducted early during the project field season so any problems identified may be corrected quickly to minimize the possibility of compromising data. Field audit techniques include checks on sampling equipment and the review of sampling methods.

System audits are qualitative reviews to check that (1) overall project quality is maintained and (2) that the appropriate QC measures identified in the QAPP are being implemented. The DPM will conduct annual internal system audits during the project and report all deficiencies to the SWQMP program manager during annual reporting.

C2. Reports to Management

Problems and corrective actions identified by the FI will be reported to the DPM each sampling event. Significant problems identified by the field personnel as well as problems and corrective actions identified by the DPM during the field audit will be reported to the Division of Water Quality Director and the EHS QAC.

D. Data Validation and Usability

D1. Data Review, Validation and Verification Requirements

Data review, validation, and verification requirements provide a method for determining the usability and limitations of data, as well as a standardized data quality assessment. All field and laboratory report forms will be reviewed by the FI and the DPM, while all sample custody forms for chemical analysis will be reviewed by the DPM for completeness and correctness. The FI will be responsible for reviewing all data entries and transmittals for completeness and adherence to QA requirements. Data quality will be assessed by comparing entered data to original data or by comparing results with the measurement performance criteria summarized in Section A4.2 to determine whether to accept, reject, or qualify the data. Results of the review and validation processes will be reported to the DPM.

D2. Verification and Validation Methods

The FI will review all field and laboratory record forms. The DPM will review a minimum of 5 percent of field and laboratory record forms and all of the sample custody forms for chemical analysis. Any discrepancies in the records will be reconciled with the field personnel and recorded in the logbook. Analytical validation and verification methods are outside the scope of the QAPP.

The submission of samples to the Division of Laboratory Services-Chemistry laboratory will include a Sample Identification/Custody Record sheet documenting (1) the site location, (2) sample depth, (3) sampling date and time and (4) name of the person collecting the sample. This information will be checked by the Division of Laboratory Services-Chemistry laboratory to ensure that holding times have not been exceeded. Violations of holding times will be reported to the DPM. The DPM, in consultation with Division of Laboratory Services personnel, will determine whether or not to proceed with the analysis of that sample and/or analyte.

D3. Reconciliation with Data Quality Objectives

As soon as possible after each sampling event or the analyses of each sample, calculations and determinations for precision, completeness and accuracy will be made by the FI and compared to the criteria discussed in Section A4. This will represent the final determination of whether the data collected are of the correct type, quantity and quality to support their intended use for this project. Any problems in meeting the performance criteria (or uncertainties and limitations in the use of the data) will be discussed with the FI(s) and the DPM, and will be reconciled, if possible.

Literature Cited

NDDoH. August 2009. Quality Management Plan for the Environmental Health Section. Environmental Health Section, North Dakota Department of Health, Bismarck, ND.

NDDoH. January 2009. North Dakota State Department of Health Laboratory Services Division Chemistry Laboratory Quality Assurance Program. North Dakota Department of Health, Division of Laboratory Services, Bismarck, ND.

EPA. 2001 (reissued May 2006). EPA Requirements for Quality Assurance Project Plans. U.S. Environmental Protection Agency, Quality Assurance Division, Washington, D.C. EPA/QA/R-5.

APPENDIX A

STANDARD OPERATING PROCEDURES FOR MEASURING SECCHI DISK TRANSPARENCY

STANDARD OPERATING PROCEDURES FOR MEASURING SECCHI DISK TRANSPARENCY

Summary

Secchi disk transparency can be a useful and inexpensive method to assess water quality, particularly algae and suspended sediment. Secchi disk transparency as an indication of algae abundance can also be a good measure of lake trophic status.

Interferences

Since Secchi disk transparency is a measure of light penetration, any interference which can modify visibility of the Secchi disk to the human eye should be minimized. The time of the day, the position of the sun and the amount of glare are critical.

Ropes must be made of a nonstretchable material and periodically checked with a measuring tape. (**Note:** After several wet-dry cycles the rope attached to the Secchi disk may shrink and thus affect the accuracy of the depth measurement).

Equipment and Supplies

- Secchi Disk with 5 meters 10 feet of rope marked off in 0.1 meter depth intervals
- Field reporting form (Figure A1)

Procedure

Secchi disk readings are obtained with a 20 cm diameter disk. Observations are made during mid day, without sunglasses and from the shady side of the boat. The observer makes the reading by looking as close as possible to the water to minimize glare.

1. Drop the Secchi disk down until it is no longer visible
2. Bring the Secchi disk up until you can just barely see it.
3. Record the depth at which the Secchi disk is again visible.
4. Repeat the above procedure and average the two readings for the final Secchi disk depth.

APPENDIX B

STANDARD OPERATING PROCEDURES FOR TAKING FIELD MEASUREMENTS IN STREAMS, RIVERS, LAKES AND WETLANDS USING HAND HELD METER(S)

**STANDARD OPERATING PROCEDURES
FOR TAKING FIELD MEASUREMENTS
IN STREAMS, RIVERS, LAKES AND WETLANDS
USING HAND HELD METER(S)**

Summary

The following is summarized from the Field Guide for Collecting and Processing Stream Water Samples for the National Water Quality Assessment Program (Sheldon L. R. 1994, U.S. Geological Survey Open-File Report 94-455).

Measurements of pH can provide some of the most important limnological information pertaining to a water-body. The pH of a solution is a measure of the effective hydrogen-ion concentration. pH is expressed in logarithmic units using a scale of 1 to 14. Water bodies with a pH of less than 7 are considered acidic; water bodies with a pH greater than 7 are considered basic or alkaline.

Dissolved gases such as carbon dioxide, hydrogen sulfide and ammonia appreciably affect pH. Due to this effect, pH must be taken in the field, as a significant change can occur within several hours or even minutes after sample collection.

Specific Conductance is the reciprocal of resistance in ohms and is a measure of the capacity of water or another substance to conduct an electrical current. Specific conductance is reported in microsiemens per centimeter at 25 degrees Celsius. The specific conductance of water is determined by the types and quantities of dissolved substances in the water. Thus specific conductance indicates the concentrations of dissolved solids in water.

The specific conductance of water may change significantly with time because of pollution, precipitation, absorption, ion exchange, oxidation, or reduction. Therefore, specific conductance should be measured in the field.

Temperature and dissolved oxygen measurements may also provide some of the most important limnological characteristics of a water body. Temperature and dissolved oxygen measurements provide valuable information about the biological and biochemical reactions occurring within a water body.

Temperature and dissolved oxygen measurements can be reflections of the reactions taking place in the water body. Therefore, water temperature and dissolved oxygen should be measured in the field.

Interferences

The membrane of a dissolved oxygen electrode is permeable to other gases other than oxygen, such as hydrogen sulfide (H₂S). Caution should be taken when using the membrane electrode in low dissolved oxygen waters since the presence of H₂S may lower the cell sensitivity. This interference can be reduced by frequently changing the membrane and calibrating the electrode.

Equipment and Supplies

- Hand held meter(s).
- Maintenance kit (Potassium chloride/KCl solution, spare membranes, batteries, battery charger).
- Project area map depicting monitoring stations.
- Field report form.
- Pen.
- pH 7 and pH 10 calibrating buffer.

- D.I. water and squirt bottle
- Specific conductance calibration solution (Solution with known specific conductance.)
- Power ice auger (winter sampling).
- Ice skimmer (winter sampling).
- Meter stick (winter sampling).
- Sled (winter sampling).
- Personal Flotation Device.

Streams and Rivers

1. Calibrate the meter using a solution with known specific conductance, pH buffer solutions of 7.0 and 10.0, and calibrate dissolved oxygen accordingly with the atmospheric pressure following owner's manual.
2. Record calibration information in the instrument log and field notes.
3. Locate the main current of the stream or river. Note: When drilling a hole through the ice, be sure not to disturb the water column with undue agitation.
4. Place the guard over the exposed probes and lower the probe to that depth which is approximately 60% the total water depth below the surface. For example, if the stream is five feet deep, take the measurement three feet below the surface.
5. Read temperature, dissolved oxygen, pH, and specific conductance if using a multi-probe meter and record. If using a single probe meter like the YSI 51b switch the display to read temperature, wait for the temperature reading to stabilize (30 seconds minimum), record the temperature reading on the field report form, switch the display to read dissolved oxygen, allow the dissolved oxygen reading to stabilize and record the dissolved oxygen concentration on the field report form. NOTE: To achieve an accurate reading some units require a stirring unit or for the sampler to gently move the probe up and down two to three inches to circulate water across the membrane.

Lakes and Wetlands

1. Locate the desired sampling location and anchor boat or drill a hole through ice. Note: When drilling a hole through the ice do not disturb the water column with undue agitation.
2. Fill in the station identification information on the field report form. Also, measure and record ice thickness and snow depth in the comments section (winter sampling) (Figure B2).
3. Calibrate the meter following the manufacturer's recommended procedures for field calibration.
4. Remove the storage cup and replace with a protective guard, lower the probe to 0.5 meters depth, or just below the ice.
5. Read temperature and the dissolved oxygen concentration and record (Figure B2). If using a single probe meter like the YSI 51b, switch the display to read temperature, wait for the temperature reading to stabilize (30 seconds minimum), record the temperature reading on the field report form, switch the display to read dissolved oxygen, allow the dissolved oxygen reading to stabilize and record the dissolved oxygen concentration on the field report form. NOTE: To achieve an accurate reading some units require a stirring unit or for the sampler to gently move the probe up and down two to three inches to circulate water across the membrane.

6. Lower the probe to the next depth interval and repeat step 5. Readings should be taken at a maximum of one-meter depth intervals.
7. Repeat step 6 until the bottom is reached.
8. Retrieve probe from bottom of water body, rinse thoroughly and replace the storage cup. Check meter calibration following profile measurements to ensure the precision and accuracy of the measurements. If the meter does not resume its initial air calibration reading, re-calibrate the meter and measure the profile again repeating steps 4 through 8.

APPENDIX C

STANDARD OPERATING PROCEDURES FOR THE COLLECTION OF SAMPLES FOR PHYTOPLANKTON AND CHLOROPHYLL ANALYSIS IN LAKES

**STANDARD OPERATING PROCEDURES
FOR THE COLLECTION OF SAMPLES
FOR PHYTOPLANKTON AND CHLOROPHYLL ANALYSIS IN LAKES**

Summary

Phytoplankton and chlorophyll-a samples are two of the most important biological parameters measured in a lake. Chlorophyll is important because of its close relationship to phytoplankton biomass and it is a key indicator of trophic status. Phytoplankton community assemblages can be excellent indicators of water quality.

In general, a six-foot depth integrated sample is collected over the deepest area of the lake. A known volume of sample is filtered through a membrane for chlorophyll analysis. A second known volume of the sample is preserved for phytoplankton identification and enumeration.

Equipment and Supplies

- Six-foot tube style water collector with a two-inch inside diameter
- Two-gallon plastic bucket
- Sample containers
 - One 40-ml glass amber vile for each phytoplankton sample
 - One 50-ml plastic vial for each chlorophyll filtration
- Aluminum foil
- 0.65 μm glass fiber filters (Pall Corp. Glass Fiber Filters No. 61631, 0.47mm or equivalent)
- Filter apparatus with vacuum pump
- 500 ml graduated cylinder
- Stainless steel forceps
- Deionized water for decontamination
- M3 solution
- Sample ID/Custody Report forms
- Field report forms
- Sample log forms
- Sample labels
- Pen
- Cooler(s) with ice or frozen gel packs.

Phytoplankton sample collection

1. Rinse the tube collector, bucket, and sample containers with deionized water.
2. Collect a depth integrated water column sample by immersing the collecting tube to a depth of six feet. Cap the end of the tube and invert the tube.
3. Pour the contents of the tube into the two-gallon bucket. Note: If the sample was collected properly, the sample volume should be approximately 1 gallon.
4. Completely mix the sample and decant a 40 ml aliquot of the sample off into one glass amber vile for phytoplankton analysis.
5. Preserve the phytoplankton sample immediately with approximately 1 mL M3 solution to a final concentration of 1 percent.
6. Place a label on the sample container (Figure C3).
7. Place the sample in the cooler containing ice or frozen gel packs.

8. Fill out the field reporting form (Figure C1) and the sample custody form (Figure C2). If the sample log indicates the collection of a duplicate sample, follow the steps below for the collection of a chlorophyll sample, then collect the duplicate sample following the above procedures. Note: Field duplicate samples should be identified with STORET number 389999. Be sure to indicate on the label the waterbody name and site number of the sample being duplicated.

Chlorophyll Sample Collection and Filtration

1. Completely mix the remaining sample and collect two liters of sample in a cubitainer and place the sample in a cooler on ice immediately.
2. Filter the sample immediately.
3. Remove the filter apparatus from the plastic bag and assemble.
4. Rinse the filter apparatus three times with approximately 250 ml of deionized water each time.
5. Load a glass fiber filter in the apparatus and connect the vacuum pump.
6. Using the graduated cylinder, measure out and filter a known amount of sample.
Note: Filter enough sample so that the filter is distinctly coated with algae, a minimum of 500 ml should be filtered.
7. Remove the filter from the filter assembly, fold once, and place in a 50 mL vial.
8. Place a label on the vial (Figure C3).
Note: On the label, include the volume of sample run through the filter.
9. Wrap the vial in aluminum foil to exclude light.
10. Place the sample in the cooler on ice.
11. Fill out the field reporting form (Figure C1) and the sample custody form (Figure C2). If the sample log indicates the collection of a duplicate sample, repeat the above procedures for the collection and filtration of a chlorophyll sample. Note: Field duplicate samples should be identified with STORET number 389999. Be sure to indicate on the label the waterbody name, site number and volume filtered for the sample being duplicated.



North Dakota Department of Health
Sample Identification Record
Division of Laboratory Services—Chemistry
Telephone: 701.328.6140
Fax: 701.328.6280

For Laboratory Use Only	
Lab ID:	
Preservation: Yes <input type="checkbox"/>	Temperature:
Initials:	

Surface Water Sample Identification Code R (Water samples)
 Samples received without this sheet or without all necessary sections fully completed will be rejected and not analyzed.

Sample Collection/Billing Information			
Account #	Project Code:	Project Description:	
Customer (Name, Address, Phone): SWQMP, Division of Water Quality, Gold Seal Center, 4 th Floor			
Date Collected:	Time Collected:	Matrix: Water	Site ID:
Site Description:			
Alternate ID:		Collected By:	
County Number:	County Name:		
Comment:			
Comment:			

Field Information/Measurements						
Sample Collection Method (Circle One): Grab <input type="checkbox"/> DI* <input type="checkbox"/> DWI** <input type="checkbox"/> 0-2 meter column <input type="checkbox"/>			Depth:	Units:	Discharge:	Stage:
Conductivity:	pH:	Temp:	Dissolved O ₂	Turbidity:		
Comment:						

Analysis Requested			
<input type="checkbox"/> 5) SW-Major Cations/Anions	<input type="checkbox"/> 74) SW-PAHs	<input type="checkbox"/> 33120) SW-E. coli	
<input type="checkbox"/> 7) SW-Trace Metals	<input type="checkbox"/> 84) SW-PCBs	<input type="checkbox"/> SW-TOC	
<input type="checkbox"/> 21) SW-Carbamates	<input type="checkbox"/> 105) SW-Chlorophyll-a & b Filtered: _____ mL	Volume <input type="checkbox"/> SW-DOC	
<input type="checkbox"/> 23) SW-Acid Herbicides	<input type="checkbox"/> 118) SW-TSS	<input type="checkbox"/> SW-C-BOD-5day	
<input type="checkbox"/> 25) SW-Base/Neut. Pest	<input type="checkbox"/> 144) SW-Trace Metals-dissolved	Other:	
<input type="checkbox"/> 30) SW-Nutrients, Complete	<input type="checkbox"/> 160) SW-Nutrients, Complete-dis		
<input type="checkbox"/> 50) SW-Nutrients, Total P-dis.	<input type="checkbox"/> 33080) SW-Fecal coliform bacteria		

Figure C2 Sample Identification/Custody form. * Depth Integrated ** Depth/Width Integrated

Project Code	Project Description
Sample ID	Site Description
Analysis: (DC Code)	SW-Analyte Group
Container:	Preservative:
Date: _/_/_	Time: :_ Depth:
Sampler	

Project Code	Project Description
389990	Sample Blank
Analysis: (DC Code)	SW-Analyte Group
Container:	Preservative:
Date: _/_/_	Time: :_ Depth:
Sampler	

Project Code	Project Description
389999	Sample Duplicate
Analysis: (DC Code)	SW-Analyte Group
Container:	Preservative:
Date: _/_/_	Time: :_ Depth:
Sampler	

Figure C3. SWQMP Water Chemistry Label, Water Chemistry Blank Label, and Water Chemistry Duplicate Label.

APPENDIX D

**STANDARD OPERATING PROCEDURES
FOR THE COLLECTION AND PRESERVATION
OF LAKE OR NON-WADABLE WETLAND WATER COLUMN
SAMPLES
FOR CHEMICAL ANALYSIS**

**STANDARD OPERATING PROCEDURES
FOR THE COLLECTION AND PRESERVATION
OF LAKE OR NON-WADABLE WETLAND WATER COLUMN SAMPLES
FOR CHEMICAL ANALYSIS**

Summary

Water column samples should be reflective of the whole lake. To be representative of the lake, samples must be carefully collected, properly preserved, and appropriately analyzed. In general, two to four samples at various depths are collected from the deepest area of the lake.

Equipment and Supplies

- Non-metallic Kemmerer or Van Dorn sampler, with rope marked at 1-meter depth intervals and a messenger.
- Sample containers.
- Acid for sample preservation.
- Sample labels.
- Cooler with ice or frozen gel packs.
- Deionized water for sample blanks and decontamination.
- Filter apparatus.
- For vacuum method.
 - Vacuum filter holder.
 - Vacuum pump.
 - 0.45 μm membrane filters (Millipore HAWP 047 00 or equivalent).
 - Pre-filters (Millipore AP40 0047 05 or equivalent).
 - Plastic forceps.
- For peristaltic method.
 - Power Drive (Compact Cat No. P-07533-50 or equivalent)
 - Peristaltic head (Easy Load II Cat No. P-77200-62 or equivalent).
 - Inline 0.45 μm cartridge filters (Geotech dispos-a-filter or equivalent).
 - Inline 5.0 μm cartridge pre-filters (Geotech dispos-a-filter or equivalent).
 - Tubing (Masterflex silicone Cat No. P-96400-24 or equivalent).
 - Churn Splitter.
- Field report form (Figure D1).
- Sample ID/Custody Record (Figure D2).
- Field sample log forms (Figure D3).
- Sample labels (Figure D4)
- Ballpoint pen "Black" or pencil.
- Power ice auger (winter sampling).
- Ice skimmer (winter sampling).
- Sled (winter sampling).

Water Quality Sample Collection Procedure

1. Following collection of the temperature/dissolved oxygen profile, determine sample collection depths by following these general rules:
2. For lakes or wetlands four meters deep or less collect two samples, one sample at the one meter depth interval and the other sample approximately one meter off the bottom.
3. On lakes that are greater than four meters deep determine if and at what depth it is thermally stratified.

4. If the lake is not thermally stratified collect three samples; one at the one-meter depth interval, one at mid-depth, and the last sample one meter off the bottom
5. If the lake is thermally stratified, collect three samples; one at the one-meter depth interval (epilimnion), one located one meter below the thermocline (metalimnion), and the last sample one meter off the bottom (bottom of hypolimnion). In some cases, an additional sample can be collected just above the thermocline (bottom of epilimnion).
6. Collect the samples beginning with the one-meter depth interval and progressing down the water column. Triple rinse each sample bottle using lake water from the sample depth interval. Fill each sample bottle. Preserve the nutrient samples to a pH of 2 with 2 ml 1/5th sulfuric acid. Preserve the ICP metals or ICP and trace metals samples to a pH of less than 2 with 2 ml concentrated nitric acid. Note: Do not preserve the total dissolved phosphorus sample until after filtration.
7. Place a label on each sample container (Figure D4). Each sample container should be labeled accordingly with the appropriate analyte group as indicated in Table 3.1.
8. Place the samples in a cooler on ice.
9. Fill out the field report form (Figure D1), Sample ID/Custody Record (Figure 7.04.2), and the water column chemistry sample log (Figure D3).

Field Bottle Blank Sample Collection

1. Field blanks are collected with the first and every tenth sample (i.e., 1, 10, 20....).
2. Triple rinse each bottle with deionized water.
3. Fill each bottle with deionized water.
4. Preserve each sample appropriately. Note: Do not preserve the total dissolved phosphorus sample until after filtering.
5. Place a label on each sample container (Figure 7.04.4). Note: Field bottle blanks samples are identified with STORET number 389990. Be sure to indicate on the label the lake name, associated site identification number and the depth of the sample being duplicated.
6. Place the sample in a cooler on ice.

Field Duplicate Sample Collection

1. Field duplicate samples are collected on the first sample and every tenth sample (i.e., 1, 10, 20....). When the sample log indicates a duplicate sample is to be collected, follow the steps below.
2. Collect the sample by following steps 2 through 9 in the procedure for Field Sample Collection above.
3. Place a label on each sample container (Figure D4). Note: Field duplicate samples should be identified with STORET number 389999. Be sure to indicate on the label the lake name, associated site identification number and the depth of the sample being duplicated.

4. Place the samples in a cooler on ice.

Field Sample Filtration Vacuum Method

1. Unpreserved total dissolved phosphorus samples should be filtered immediately.
2. Remove filter holder from the plastic bag and assemble.
3. Put on new latex gloves.
4. Rinse the filter apparatus three times with approximately 250 ml of deionized water each time.
5. Load a pre-filter in the filter apparatus and connect the vacuum pump.
6. Leach the filter twice with approximately 250 ml of deionized water each time.
7. Filter the sample through the pre-filter. Place the sample back into the sample container.
8. Remove the pre-filter from the filter apparatus and repeat Step 3.
9. Load a 0.45 μm filter into the filter apparatus and connect the vacuum pump.
10. Repeat Step (5).
11. Filter the sample through the 0.45 μm filter.
12. Triple rinse the sample container with deionized water.
13. Transfer the filtered sample back into the sample container.
14. Preserve the sample with 2 ml 1/5 sulfuric acid or 0.2 ml concentrated sulfuric acid.
15. Place the preserved sample in the cooler on ice.
16. If additional samples require filtration, repeat Steps (3) through (15).

Field Sample Filtration Peristaltic Method

1. Peristaltic filtration method is used to collect dissolved nutrient(s), dissolved mineral(s) and dissolved metal(s). The dissolved nutrient and/or dissolved mineral and metal samples should be filtered and preserved immediately as each depth is sampled right in the boat.
 1. Rinse a churn splitter three times with water from the sampling depth.
 3. Place the entire contents of two Kemmerer grabs or two six-foot water column sampler volumes in to the triple rinsed churn splitter.
 4. Assemble and attach pump head to power drive.
 5. Plug in power drive.
 6. Put on new latex surgical gloves.

7. Remove acid rinsed tubing from plastic bag, taking care to prevent contamination and place in head draping the long end into the churn splitter and dangling the short end out of contact with boat or boat seats.
8. Turn on pump and begin rinsing tubing with a minimum of 250 ml of sample water from churn splitter.
9. As tubing rinses remove cartridge filter from plastic bag and insert cartridge while pump is still running to the tube's dangling end. Care should be taken to ensure filter cartridge is inserted in the correct direction.
10. Run 250 ml of sample water through cartridge filter.
11. Place labels on bottles.
12. Triple rinse the sample bottles and lids with sample water coming out of the filter cartridge.
13. Fill sample bottles.
14. Preserve nutrient sample with 2 ml 1/5 sulfuric acid or 0.2 ml concentrated sulfuric acid, and ICP Metals or Trace metals with 5 ml concentrated nitric acid lowering the pH to 2 or less.
15. Place samples in the cooler on ice.
16. If cartridge becomes plugged repeat Steps (6) through (15) with an in-line 2.0 um pre-filter placed in-line prior to 0.45 μm filter.



North Dakota Department of Health
Sample Identification Record
Division of Laboratory Services—Chemistry
Telephone: 701.328.6140
Fax: 701.328.6280

For Laboratory Use Only	
Lab ID:	
Preservation: Yes <input type="checkbox"/>	Temperature:
Initials:	

Surface Water Sample Identification Code R (Water samples)
 Samples received without this sheet or without all necessary sections fully completed will be rejected and not analyzed.

Sample Collection/Billing Information				
Account #	Project Code:	Project Description:		
Customer (Name, Address, Phone): SWQMP, Division of Water Quality, Gold Seal Center, 4 th Floor				
Date Collected:	Time Collected:	Matrix: Water	Site ID:	
Site Description:				
Alternate ID:		Collected By:		
County Number:	County Name:			
Comment:				
Comment:				

Field Information/Measurements					
Sample Collection Method (Circle One): Grab <input type="checkbox"/> DI* <input type="checkbox"/> DWI** <input type="checkbox"/> 0-2 meter column <input type="checkbox"/>		Depth:	Units:	Discharge:	Stage:
Conductivity:	pH:	Temp:	Dissolved O ₂	Turbidity:	
Comment:					

Analysis Requested			
<input type="checkbox"/> 5) SW-Major Cations/Anions	<input type="checkbox"/> 74) SW-PAHs	<input type="checkbox"/> 33120) SW-E. coli	
<input type="checkbox"/> 7) SW-Trace Metals	<input type="checkbox"/> 84) SW-PCBs	<input type="checkbox"/> SW-TOC	
<input type="checkbox"/> 21) SW-Carbamates	<input type="checkbox"/> 105) SW-Chlorophyll-a & b Filtered: _____ mL	Volume <input type="checkbox"/> SW-DOC	
<input type="checkbox"/> 23) SW-Acid Herbicides	<input type="checkbox"/> 118) SW-TSS	<input type="checkbox"/> SW-C-BOD-5day	
<input type="checkbox"/> 25) SW-Base/Neut. Pest	<input type="checkbox"/> 144) SW-Trace Metals-dissolved	Other:	
<input type="checkbox"/> 30) SW-Nutrients, Complete	<input type="checkbox"/> 160) SW-Nutrients, Complete-dissolved		
<input type="checkbox"/> 50) SW-Nutrients, Total P-dis.	<input type="checkbox"/> 33080) SW-Fecal coliform bacteria		

Figure D2 Sample Identification/Custody form. * Depth Integrated ** Depth/Width Integrated

Project Code	Project Description
Sample ID	Site Description
Analysis: (DC Code) SW-Analyte Group	
Container:	Preservative:
Date: _/_/_	Time: :_ Depth:
Sampler	

Project Code	Project Description
389990	Field Bottle Blank
Analysis: (DC Code) SW-Analyte Group	
Container:	Preservative:
Date: _/_/_	Time: :_ Depth:
Sampler	

Project Code	Project Description
389999	Duplicate Sample
Analysis: (DC Code) SW-Analyte Group	
Container:	Preservative:
Date: _/_/_	Time: :_ Depth:
Sampler	

Figure D4 SWQMP Water Chemistry Label, Water Chemistry Blank Label, and Water Chemistry Duplicate Label.