STANDARD OPERATING PROCEDURES
FOR FIELD SAMPLERS

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1.0 BACKGROUND

The Surface Water Quality Management Program (SWQMP) is one of three major programs within the North Dakota Department of Health (NDDoH), Division of Water Quality (DWQ). In general, the SWQMP is responsible for the assessment and protection of the state's surface water resources (i.e., rivers, streams, lakes, reserves and wetlands). Specifically, the SWQMP is responsible for the development of surface water quality standards, ambient water quality monitoring and assessment, fish tissue surveillance for contaminants, nonpoint source pollution assessment and control, and the investigation of complaints or reports of pollution related incidences.

All of these activities require the collection, management and interpretation of water quality data. These data include samples collected from the water column for physical/chemical analysis, samples collected for fish tissue analyses, sediment samples, biological surveys of vegetation, algae, macroinvertebrate, and fish communities, and habitat assessments of our streams.

To ensure these data and the results, assessments, and decisions made from them are accurate, it is imperative that proper and consistent field and laboratory procedures are followed during sample collection, preparation, and analysis. Standard Operating Procedures (SOPs), which are well documented and rigorously followed, will ensure accurate, precise, and representative, river, stream, lake, reservoir, and wetland data. SOPs also ensure that there is continuity in methodology between projects administered and carried out by the SWQMP.

2.0 QUALITY ASSURANCE/QUALITY CONTROL

2.1 GENERAL

SOPs are one component of an integrated quality assurance/quality control (QA/QC) program. Other components of the SWQMP QA/QC program include the Environmental Health Section's (EHS's) QA Management Plan (QAMP), and QA Project Plans (QAPPs), (NDDoH 2008). The QA Management Plan for the Environmental Health Section (EHS) is an umbrella document which summarizes QA/QC requirements for all divisions, programs, and projects within the NDDoH's EHS. In addition, QA/QC requirements for specific programs and projects within the SWQMP are documented in program and project specific QAPPs. Project specific requirements for monitoring in terms of sampling schedules, sampling sites, sampling media, and parameters which are to be analyzed are outlined in each project, program, or QAPP. Each project QAPP also identifies the SOPs which are to be followed in sample collection. It is the intent of this document to provide a comprehensive list of all SOPs which will be required by projects administered or carried out by the SWQMP.

2.2 QA/QC PROCEDURES

QA begins with initial project planning and continues through sample collection and data analysis. QA in the field requires some basic handling procedures. These can be generalized into four main areas: sample collection, QA/QC sampling, sample custody, and equipment calibration and preventive maintenance.

2.2.a SAMPLE PROCEDURES

To ensure the sample collected is representative, some basic handling procedures must be followed: The procedures are as follows:

1. Sampling equipment (e.g., buckets, Van Dorn or Kemmerer samplers, sediment samplers) should be clean and free from dust, dirt, or other contamination. In the field, equipment should be rinsed with stream, lake, or wetland water prior to sample collection. When not in use, equipment should be properly stored in order to avoid possible contamination.

2. The sample container must be appropriate for the sample parameter(s) requested for analysis. Sample containers should also be cleaned and rinsed properly to avoid possible contamination.

3. Once a sample is collected it should be properly preserved. Table 1 shows the proper sample container, preservative, and holding time by parameter or group of parameters.

4. The sample should be properly labeled and a log of the sample collected maintained by the sampler, project, or program.

2.2.b QA\QC SAMPLING

QA/QC sampling is a part of every project which collects field data. Most QA/QC sampling includes the collection of field replicate and blank samples. Replicate samples should be collected from the same site and time, and field blank samples should be collected at the same time as the sample. Quality control samples include, but are not limited to, any of the following (depending on what is required at the site-specific project):

- Field blanks.
- Replicates.
- Duplicates.
- Equipment blanks.
- Surrogates.
- Matrix spikes.
- Trip blanks.

All equipment used in the field is maintained according to manufacturers' recommendations. Each of the field instruments should be checked out and examined before sampling activity is to begin to ensure that the equipment will work properly when needed. In addition, for some equipment (e.g., dissolved oxygen temperature meters, pH meters) a specific schedule for preventive maintenance and calibration procedures is required. These schedules and frequencies are defined in the appropriate SOPs.

Spare parts such as batteries, probes, O-rings, standard solutions, glassware, etc. are kept on hand within the SWQMP.

Calibration preventive maintenance or repairs should be recorded in a log book kept for each major field instrument.

2.2.c SAMPLE CUSTODY

All field and laboratory generated data are handled in an orderly and consistent manner. This procedure termed "sample custody" is less stringent for monitoring programs such as within the SWQMP than would be for samples collected for enforcement actions.

The following is a brief description of field procedures, forms, and labels used to ensure the orderly and consistent handling of all data collected for the SWQMP. Field procedures, forms, and labels which are unique to a specific SOP or project will be described with the SOP or in the project's QAPP. Sample custody procedures employed by Laboratory Services (LS) are detailed in the January 2009 revision of the ND Department of Health Laboratory Services Division Chemistry Laboratory Quality Assurance Program.

When project personnel collect a sample for analysis, all associated field data and descriptive information is recorded on the field report form. This report form includes information on project name, station or site identification, sample site description, observer(s), date and time of sample collection, and ambient weather information such as temperature, wind speed and direction, and percent cloud cover. Snow cover and ice thickness are also recorded during the winter. Field measurements such as temperature and dissolved oxygen concentrations are also recorded on this form.

For each set of samples, including replicate and blank samples, submitted to the laboratory for analysis, the sampler must fill out and submit a sample identification/custody record (Figure 1). This form contains information on the project, the site ID and description, date and time collected, and the analysis requested. Upon receipt of the sample(s) the LS checks the sample(s) submitted against those requested on the form. If there are any discrepancies, the LS contacts the sampler or the Designated Project Manager (DPM). The LS then assigns laboratory log numbers to the set of samples and returns a copy of the form to the DPM. The original copy is kept by the LS for their records.

After sample collection and preservation, project personnel attach a label to the sample container. The sample label contains information about the sample station (including site ID), project name, station description (location), analyte group (e.g., nutrients and trace metals), the date and time of sample collection, sample container size, sample preservation method, and the field sampling personnel collecting the sample (sampler).

In addition to the field report form, project personnel are responsible for filling out the sample log form for each water chemistry sample. The sample log allows the sampler(s) to track the samples collected for each project and is a way to determine and document when duplicate and blank samples should be collected.

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 □	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, 4th 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 DI* DWI** 0-2 meter column	**Depth:**	**Units:**	**Discharge:**	**Stage:**
Conductivity:	**pH:**	**Temp:**	**Dissolved O_2**	**Turbidity:**
Comment:				

Analysis Requested

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

Figure 1. Sample Identification/Custody form. * Depth Integrated ** Depth/Width Integrated

3.0 SAMPLE CONTAINERS, PRESERVATION AND HOLDING TIMES

Only a few parameters will be measured or analyzed in the field. These include pH, dissolved oxygen, temperature, specific conductance, and Secchi disk transparency. The majority of other chemical constituents will be analyzed by the NDDoH, Division of Laboratory Services (LS) or other approved laboratory. In most cases it may require one to three days to transport the samples to the LS therefore it is imperative that samples are collected in the proper containers, and are properly preserved, cooled to 4 degrees Celsius and transported. All water samples should be preserved immediately and packed in ice or frozen jell packs in non-breakable coolers. A list of laboratory schedules and sampling requirements for water samples is presented in Table 1. Parameters analyzed within each group are presented in Table 2. A list of pesticides and their detection limits are available in Table 3.

Table 1. Laboratory Schedules and Sampling Requirements.

Laboratory Schedule	Container	Preservative	Filtered (yes/no)	Cooled to 4°C (yes/no)	Holding Time
General Chemistry/ Major anions	500 mL HDPE[1]	None	No	Yes	14 days
Trace Metals	250 mL Nalgene	Nitric acid	No	Yes	6 months
Total nutrients	500 mL HDPE[1]	Sulfuric acid	No	Yes	28 days
Dissolved nutrients	500 mL HDPE[1]	Sulfuric acid	Yes	Yes	28 days
Total Organic Carbon	125 mL amber glass	Sulfuric acid	No	Yes	28 days
Dissolved Organic Carbon	125 mL amber glass	Sulfuric acid	Yes	Yes	28 days
Total Suspended Solids	200 mL HDPE[1]	None	No	Yes	7 days
Bacteria	200 mL HDPE[1]	None	No	Yes	48 hours
Pesticides	2- 1 L amber glass	None	No	Yes	72 hours
Fish	Qorpak 8 oz. glass jar with teflon lined lid	None	No	Yes	48 hours
Sediment	Qorpak 16 oz. glass jar with teflon lined lid	None	No	Yes	14 days

[1]High Density Polyethylene

Table 2. Parameters Analyzed.

Field Measurements	Laboratory Analysis			
	General Chemistry	**Trace Elements[1]**	**Nutrients**	**Biological**
Temperature	Sodium	Aluminum	Ammonia (Total)	Fecal coliform
pH	Magnesium	Antimony	Nitrate-nitrite (Total)	E. coli
Dissolved Oxygen	Potassium	Arsenic	Total Kjeldahl Nitrogen	
Specific Conductance	Calcium	Barium	Total Nitrogen	
	Manganese	Beryllium	Total Phosphorus	
	Iron	Boron	Total Organic Carbon	
	Chloride	Cadmium	Ammonia (Dissolved)	
	Sulfate	Chromium	Nitrate-nitrite (Dissolved)	
	Carbonate	Copper	Total Kjeldahl Nitrogen (Dissolved)	
	Bicarbonate	Lead	Total Nitrogen (Dissolved)	
	Hydroxide	Nickel	Total Phosphorus (Dissolved)	
	Alkalinity	Silver	Dissolved Organic Carbon	
	Hardness	Selenium		
	Total Dissolved Solids	Thallium		
	Total Suspended Solids	Zinc		

[1]Analyzed as total recoverable metals

Table 3. North Dakota Department of Health Pesticide Variables Analyzed.

Pesticide	Detection Limit (µg/L)	Pesticide	Detection Limit (µg/L)	Pesticide	Detection Limit (µg/L)
Heptachlor	0.040	Methoxychlor	0.100	Dichlorprop	0.150
Fenvalerate	0.500	DDT	0.025	Carbaryl	0.500
Parathion Methyl	0.500	Heptachlor Epoxide	0.020	Bentazon	0.250
Parathion Ethyl	0.500	Endosulfan I	0.025	3-Hydroxycarbofuran	0.500
Malathion	0.100	Endosulfan II	0.025	Dicamba	0.050
Diazinon	0.100	Endosulfan Sulfate	0.025	Ethalfluralin	0.025
Chlorpyrifos	1.000	Endrin	0.010	Atrazine	0.100
Alachlor	0.200	Endrin Aldehyde	0.020	Prowl	0.025
Endrin Ketone	0.025	Simazine	0.070	Metribuzine	0.020
trans-Nonachlor	0.025	DDE	0.025	Aldicarb	0.500
Chlordane (alpha)	0.050	Bromoxynil	0.025	2,4-D	0.100
Chlordane (gamma)	0.050	Far-Go (Triallate)	0.025	Treflan (Trifluralin)	0.025
Toxaphene	1.000	Aldicarb-sulfoxide	0.500	Dinoseb	0.100
Hoelon	0.250	Aldicarb-sulfone	0.500	MCPA	12.00
Aldrin	0.050	Oxamyl	0.500	Tordon	0.050
Dieldrin	0.025	Carbofuran	0.500	2,4,5-T	0.050
BHC (Alpha)	0.025	3,5 Dichlorobenzoic Acid	0.125	Silvex (2,4,5-TP)	0.050
BHC (Beta)	0.025	Methomyl	0.500	Pentachlorophenol	0.020
BHC (Delta)	0.020	Acifluorfen	0.100	Metolachlor	0.070
Lindane	0.020	Chlorothalonil	0.050		
DDD	0.025	Propiconazole	2.500		

4.0 SAMPLING AND PROCESSING EQUIPMENT CLEANUP AND PREPARATION

Dirty or soiled sampling equipment can adversely affect the representativeness of a sample by contaminating the sample. Following each sample trip, or at a minimum frequency of at least once per week, equipment should be cleaned thoroughly. This is accomplished by first breaking the equipment down into the smallest possible components. The components should be washed with a strong, non-phosphate-type detergent, followed by a thorough rinse with tap water, then rinsed again using de-ionized water and allowed to air dry thoroughly. Tubes used in the filtering process must be soaked in 10% hydrochloric acid before being rinsed thoroughly with de-ionized water.

All equipment used for the collection or processing of samples which will be analyzed for organic parameters (e.g., PCBs, pesticides, VOCs) should be rinsed again with laboratory grade hexane and again allowed to air dry thoroughly. After drying, reassemble all components properly and place the cleaned equipment into sealed plastic bags until needed (Note: latex gloves should be worn during all phases of equipment clean up).

When not in use, sampling and processing equipment should be kept in sealed plastic bags at all times. If multiple samples at multiple sites are collected with a piece of sampling equipment during a particular sampling trip, the equipment should also be rinsed at each site immediately prior to the collection of the first sample. This is accomplished by rinsing with water from the same source as the water being collected for the sample.

Decontamination of field monitoring equipment (e.g., pH, probes) should be done with deionized water prior to and after each measurement.

5.0 LABORATORY ANALYTICAL METHOD

Analytical methods used by the NDDoH, Division of Laboratory Services (LS) or other approved laboratories are those approved by the U.S. Environmental Protection Agency (EPA). Analytical procedures used in the analysis of samples submitted by the SWQMP are described in the January 2009 revision of the ND Department of Health Laboratory Services Division Chemistry Laboratory Quality Assurance Program.

6.0 EQUIPMENT MAINTENANCE LOG BOOK PROCEDURES

An equipment maintenance log should be established and maintained for each meter (e.g., dissolved oxygen, pH, conductivity, flow). The log, in the form of a hardcopy book or a computer database, should contain the make, model, serial number, and department identification number. The log provides a record of all preventive maintenance, repair, and calibration procedures which are conducted during the equipments life span.

Each entry in the log should contain the date and time of the procedure. The person(s) making the entry should also initial or sign each entry.

Entries regarding maintenance procedures should be made as a comment or remark. For calibration entries, the following procedures and entries should be made:

1. Known concentration, temperature, pH, conductivity, or other measured value. For dissolved oxygen, the known value is based on the Modified-Winkler titration method.

2. Measured value(s) based on field calibration methods.

3. Calculate and enter the difference between the known and measured value.

All instrument problems should be reported to the SWQMP Program Manager immediately. Logs should be inspected regularly by the Program Manager.

7.0 SAMPLING PROCEDURES

The following is a description of the standard operating procedures (SOPs) employed by specific programs and projects administered and/or conducted by the SWQMP.