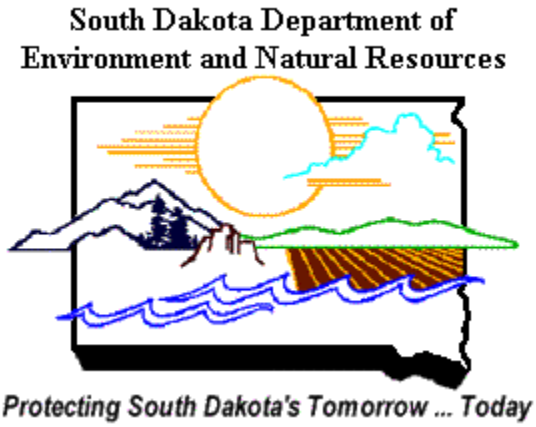
Field Manual for the 2020-2021 Rotating Basin Project



South Dakota Department of the Environment and Natural Resources

Watershed Protection Program

April 2020

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Lake Sampling

Equipment List

Boat/motor or other watercraft
Anchor
Life jackets for all staff
Lake maps and/or GPS with station locations
Multi-meter sonde and handheld with depth sensor and logging capability
Integrated depth sampler
Cooler(s) for holding and shipping samples
Distilled/deionized water
Composite sample container (>3 gallons)
Secchi disk
Sulfuric acid for B bottle
Pipettes for acid
Conductivity calibration standard
pH calibration standard 7
pH calibration standard 10
Bottles (A, B, C, chlorophyll-a)
Nitrile Gloves
Ice (20 lbs)
Fine-tip Sharpie markers or pencils
Labels and datasheets

<u>Supplemental Equipment (only need for special sampling directed by project officer)</u>
Algae bottle
Cyanotoxin sample kit
Dry Ice

Sampling Station Overview

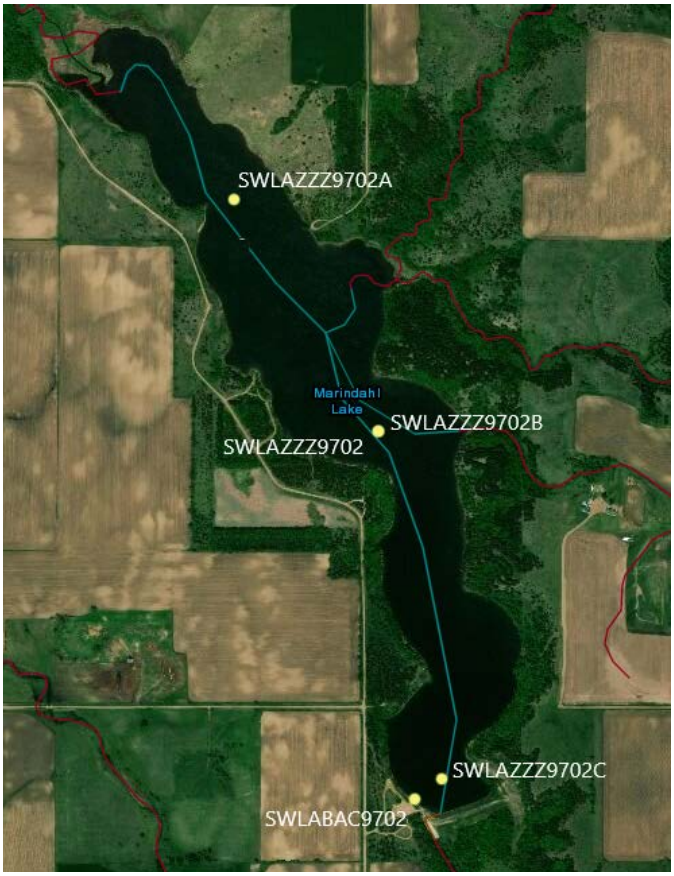

Figure 1. Lake sampling station location map.

All lakes have a total of 5 stations (Figure 1). The primary station on the lake will have a station ID that starts with SWLAZZZ, then includes a 4-digit lake ID. For example, SWLAZZZ9702. Water chemistry results from the composite sample, the average of the Secchi disk results and the average of the surface measurements (0.5 meter depth) from the vertical profile are associated with this station.

Three additional stations have A, B or C at the end of the primary station ID. These are the locations where water is collected for the composite sample. The Secchi disk measurements and vertical profile measurements with the multi-meter are also performed at these stations. Note: the primary lake station and the "B" station share the same location.

Finally, a station along the shoreline where the C bottle (*E. coli*) is collected will have a station ID such as SWLABAC9702, where BAC replaces the ZZZ portion of the station ID to indicate that bacteria samples (*E. coli*) are collected at this location. The bacteria collection stations are located

either on a swimming beach or boat ramp so that the sample is collected where people frequently enter the water.

To accurately locate sampling stations when visiting the lake, enter them in a GPS unit or on a mobile phone or tablet with a mapping application such as Google Maps. Data layers for the Google Maps application containing station locations may be provided by DENR staff upon request. An alternate method for locating the stations is to print satellite images with the station locations indicated. This allows for using local landmarks to navigate to the stations.

Note: Do your best to locate the A, B, and C, stations. It is ok to be not at the exact coordinates of the station when using paper maps to navigate, but you should be in the same water depth and/or distance from shore as the station.

Multi-meter Calibration and Logging Set-up

Tutorial video: Part 1: https://youtu.be/SD-5ievw8zY Part 2: https://youtu.be/4KQzBN9--qE

At the beginning of each day, calibrate specific conductivity in microsiemens (µS), pH, dissolved oxygen (mg/L), and depth (meters). Record the results on the multi-meter calibration sheet (Appendix). Include the pH millivolts, conductivity cell constant, and results of the dissolved oxygen calibration.

Note: If the meter indicates that calibration values are out of range, DO NOT accept the calibration. Start the calibration process over.

Note: Recalibrate dissolved oxygen if the weather changes significantly or if you make a significant change in elevation when travelling from one lake to another.

Set up the multi-meter for logging data by creating files for the A, B, and C data collection stations in the site list. These files will be used to store data when the vertical profile is measured.

AIS Decontamination

The composite sample container should be rinsed on shore with distilled or deionized water before launching the boat. Do not use lake water to rinse the container as this could spread invasive species.

Follow all guidance in this field manual regarding watercraft and equipment decontamination (page 17).

Data Collection Activities

Lake data collection stations may be visited in any order so long as resulting data is associated with the appropriate station ID. For example, it is acceptable to start at station C or station B rather than station A. Be sure to save profile to the correct file in the multi-meter handheld and label the Secchi disk results with the correct station in your notes. If you are not able to reach a station due to safety concerns or because you can't reach the location in your boat, skip that station and proceed with data collection at the other stations. Notify the project officer that you were not able to collect water and data at a station.

Note: Anchor the boat at the A, B and C stations so you are able to collect a vertical profile and Secchi disk measurement without significant lateral movement of the boat. This may not be necessary on very calm days, but is always necessary on windy days.

Multi-meter Vertical Profile Measurement

Tutorial video: https://youtu.be/5eI73EQn7fU

1. With the boat stationary at the first station (A, B or C), put the multi-meter sonde in the water and lower it until the depth sensor reads 0.5 meters. Allow readings for specific conductivity (microsiemens), pH, dissolved oxygen (mg/L), and depth (meters) to stabilize. Log one sample at a depth of approximately 0.5 meters.
2. Lower the sonde to log additional samples every 1m from the water surface, allowing the sensors enough time to stabilize, until reaching the bottom. Be careful to not drop the sonde rapidly in such a manner that it sticks in the lake substrate and gets fouled by mud.
3. After locating the bottom, raise the sonde 0.5 m from the bottom and log a sample after the sensors have stabilized.
4. Repeat this process at the remaining two lake sampling stations.

Secchi Disk

Tutorial video: https://youtu.be/m4fd2_MjCFM

1. Confirm that the lowering line is firmly attached to the Secchi disk.
2. Remove sunglasses and hat. Also, do not use view scopes or other visual aids. If wearing prescription sunglasses, temporarily replace them with regular clear lens prescription glasses.
3. Lower the Secchi disk over the shaded side of the boat until it disappears. Lower it one third of a meter and then slowly raise the disk until it just reappears. Move the disk up and down until the exact vanishing point is found.
4. Read the depth indicated on the lowering line or use a tape measure to measure the distance from the water surface to the Secchi disk at the disappearance depth. Record the disappearance depth in a field notebook or enter it in the comments of the SD DENR In-Lake Field Data Collection Sheet (see Appendix).
5. Note any conditions that might affect the accuracy of the measurement in your field notes.
6. Repeat this process at the remaining two lake sampling stations.

Total Depth

Measure the total depth at the in-lake data collection sites A, B, and C using a sonar, push pole, multi-meter depth sensor, or any other reliable measuring device. On the SD DENR Field Data Collection Sheet (see Appendix), record the depth in meters of the deepest station on the lake (A, B or C).

Composite Water Sample Collection

Tutorial video: https://youtu.be/GfO0Q8c_gJ0

In-lake water samples collected for the SD DENR WPP will entail the use of an integrated depth sampler (Figure 2) which composites water from multiple sites within in a lake (A, B and C) into a composite sample container. The integrated depth sampler is a PVC tube that is 2 meters long with an inside diameter of 1.25 inches (3.18 centimeters) fitted with a stopper plug on one end and a ball valve on the other. The device allows collection of water from the upper two meters of the water column (within the euphotic zone).

Figure 2. Composite sample container.

Note: The composite sample container should be rinsed on shore three times with distilled or deionized water before use to prevent the spread of aquatic invasive species.

Figure 3. Photo of integrated depth sampler for lakes.

The composite sample container (Figure 2) is used to hold the composite sample until it is transferred to bottles and preserved. Many types of containers may be used for the composite sample container if they do not contaminate the sample. Typically, food grade plastic carboys and drinking water containers with a spout for filling sample bottles are used for the composite sample container.

1. Calculate the euphotic zone depth by multiplying the Secchi disk disappearance depth from the station you are sampling by 2 (Secchi depth x 2 = euphotic zone). The resulting value determines the depth to which water samples will be collected at this station with an integrated depth sampler. If the euphotic zone is greater than or equal to 2 meters (Secchi depth is greater than or equal to 1 meter), water samples will be taken from the top 2 meters of the water column.
2. Note any conditions that might affect the accuracy of the measurement (waves, sun, excessive algal bloom, etc.) in the notes field at the bottom of the datasheet.
3. Remove the rubber stopper cap and open the ball valve on the bottom end of the sampler. On the opposite side of the boat you plan to collect the sample from, rinse the sampler by submerging the sampler in the lake three times and draining.
4. In a location away from the boat motor, slowly lower the sampler into the lake as vertically as possible. Stop when the upper end is just above the surface if the euphotic zone is $\geq$ 2 m deep. SD DENR WPP protocols are to collect two full (2 m) integrated samplers of surface water at each in-lake sampling site (a total of 4 m of euphotic surface water per sampling site). If the euphotic zone is < 2.0 m deep, the integrated sampler will be vertically lowered into the lake to the depth of the previously calculated euphotic zone for that station; additional samples will be taken to collect the total volume needed to equal a total of 4 m of water.

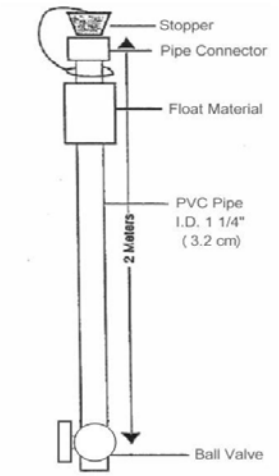

Figure 4. Integrated depth sampler diagram.

5. Cap the upper end with the rubber stopper firmly and slowly raise the sampler while holding it as vertical as possible. When the bottom of the sampler is just below the water surface, reach underneath the surface of the water and close the ball valve on the bottom end of the sampler.
6. Lift the sampler into the boat, keeping it as vertical as possible.
7. Dispense the contents of the sampler into the previously rinsed composite sample container by opening the lower ball value and drain contents of the sampler into an appropriate pre-rinsed composite storage container. When the last sample is transferred to the composite container at each station, cap the sample container, and move it to a shaded area of the boat or cover it to avoid exposing the sample to direct sunlight and/or higher temperatures.
8. Proceed to the next sampling location on the lake and repeat the vertical profile measurement, Secchi disk measurement, total depth measurement, and water sample collection. Repeat these steps for all sample stations on each lake and return to the boat launch location and trailer the boat.

C Bottle Collection Procedure

Tutorial video: https://youtu.be/DNn5ZoYkoDo

Note: The C bottle is either a 100 mL clear bottle or a 250 mL white bottle and should not be rinsed before sample collection.

1. Put on a pair of nitrile or latex gloves and proceed to the designated bacteria collection station (usually either a public swimming beach or boat ramp).
2. Do not rinse the C bottle (100 mL or 250 mL bottle).
3. In water approximately 1 meter deep, invert the C bottle so the bottle mouth is facing down, and submerge the bottle in the water approximately halfway to the lake bottom. Avoid collecting surface scum.
4. While holding the bottle underwater, tip upright so the bottle fills. Remove the bottle from the water and screw on the cap.
5. Label the C bottle and place it in a cooler under loose ice.

Composite Sample Processing

Tutorial video: https://youtu.be/dg1ZnTue74Y

Bottle Overview

In most cases, a total of 3 sample bottles will be filled from the composite container at each lake. The A and B bottle are both white 1 liter narrow-mouth Nalgene bottles. Both the A and B bottle should be triple rinsed with lake water before filling. The chlorophyll-α bottle is a brown bottle with a volume of either 500 mL, 1 liter, or 2 liters and should be triple rinsed with lake water before filling. In some cases, an algae ID/enumeration sample and/or an algal toxin sample will be collected. These samples are sent to out-of-state laboratories for analysis and do not follow the same labeling and datasheet convention as the A, B, C and chlorophyll-α bottles. The algae bottle is a 125 mL brown bottle that is pre-preserved with Lugol's solution and should not be rinsed before filling. Information about algal toxin sample bottles is provided in the algal toxin sample kit.

Note: It is good practice to label sample bottles before filling and preserving samples. See the Bottle Labeling and Datasheets for Lake Sampling section below for instructions on bottle labeling.

Sample Processing Procedure

1. Mix the composite jug by shaking the jug and rinse bottles labeled A, B, and chlorophyll-α three times each with a small amount of lake water from the composite jug. Fill bottles A, B, and chlorophyll-α to the shoulder of the bottle from the composite jug. Place the A bottle and the chlorophyll-α bottle in the cooler under loose ice.
2. Using a plastic pipette, add 2 mL of sulfuric acid (H_2SO_4) to the B bottle and place the cap on the bottle. Invert the bottle several times to mix the contents and place the B bottle in the cooler under loose ice.
3. If collecting an algae ID/enumeration sample under special instructions from the project officer: Without rinsing, fill the 125 mL algae bottle to the shoulder. On the bottle label, write the date, your initials, and the lake's primary station ID (SWLAZZZXXXX). Store the algae bottle in an upright position at room temperature and deliver it to the project officer when feasible. Contact Jesse Wilkens (jesse.wilkens@state.sd.us 605 773-4046) for more information about algae ID/enumeration samples.
4. If collecting an algal toxin sample under special instructions from the project officer: Follow the algal toxin sample kit instructions for sample collection, labeling, storage, and shipping. Contact Jesse Wilkens (jesse.wilkens@state.sd.us 605 773-4046) for more information about algal toxin samples.

Bottle Labeling and Datasheets for Lake Sampling

Bottle Labeling Procedure

1. On shore at the vehicle, using waterproof labels and a waterproof pen or pencil (fine tip sharpie recommended), fill out the empty fields on the labels for bottles A, B, C, chlorophyll-α, and where necessary, the algae ID/enumeration bottle and/or algal toxin bottles. If waterproof labels and pens/pencils are not available, apply packing tape over the top of the label to protect it from getting wet. In most cases when using pre-printed labels, most fields other than Station ID, sampler initials, date, and time will be filled out. Other fields that may need to be filled include Project, Source (the waterbody being sampled), Code or Agency Code (your unique billing ID from the SD Health Lab), whether it is a surface, midwater, or bottom sample (usually surface), and the sample bottle type (A, B, C, or Chl A for the chlorophyll-α bottle).
2. For the chlorophyll-α bottle, enter the volume of the composite sample that was put into the chlorophyll-α bottle. Typical volumes for chlorophyll-α samples are 500 mL, 1000 mL, or 2000 mL, depending on the size of the bottle. Place the labels on their corresponding bottles.

Filling Out Datasheets

Two datasheets are provided: one for the composite sample (A, B and chlorophyll-α bottles), and one for the C bottle sample. Separate sheets are provided because the C bottle is a grab sample that is collected at a swimming beach or boat ramp, while the composite sample is collected at the A, B, and C locations on the lake. Additionally, the C bottle must be analyzed by the lab within 24 hours while the

composite sample has a holding time of 48 hours (Table1). It is allowable to collect the C bottle on a separate lake visit than the composite sample to increase flexibility in the timing of sampling and sample shipping.

1. Fill out the empty fields on the sample collection datasheets to match the values entered on the bottle labels for Agency Code, Sample Date, Time, Sampler, Source Water, Station ID, Project, and Project ID.
2. Using a field notebook, iPad, or scratch-paper, calculate the averages from the three lake sampling stations (A, B and C) for specific conductivity, dissolved oxygen, pH, water temperature, and Secchi disk. Enter the resulting averages on the datasheet in the appropriate fields.
3. On the datasheet, review the boxes that are checked for each bottle for the parameters to be analyzed by the lab. Ensure they are correct.
4. Be sure to keep a record of Secchi disk results from the individual A, B, and C stations to provide to the project officer for entry into the DENR water quality database. If notes are kept on an iPad or other electronic device, you may email the notes to the project officer.

Quality Assurance/Quality Control Sample Collection for Lake Sampling

Blank Sample Procedure

Tutorial video: https://youtu.be/N6BLXkPW8vM

1. To submit a blank sample to the lab, triple rinse and fill bottles A, B, and chlorophyll-α with distilled or deionized water. Fill the C bottle with distilled or deionized water without rinsing it.
2. Preserve the B bottle with 2 mL of sulfuric acid (H_2SO_4) as you would with a regular sample.
3. Place the sample bottles in the cooler on ice.
4. On the sample labels, indicate that the sample is a blank sample by checking the box or writing “BLANK” on the label.
5. Fill out a datasheet as you normally would with the date, time, station ID, and sampler. Check the box next to “Blank” to indicate it is a blank sample. You may use any real station ID for a blank sample. Do not make up a fake station ID for the blank sample.
6. Ship the blank sample to the South Dakota State Health Lab using the courier the same as a regular sample would be shipped.

Replicate Sample Procedure

Tutorial video: https://youtu.be/sWRn3_4_7yU

1. To submit a replicate sample, triple rinse and fill bottles A, B, and chlorophyll-α with lake water from the composite jug as you are filling the bottles for the regular sample. Place the A and chlorophyll-α bottle under loose ice in the cooler.
2. Preserve the B bottle with 2 mL of sulfuric acid (H2SO4) you would with a regular sample. Place the B bottle under loose ice in the cooler.
3. Collect the C bottle replicate sample at the same time and place as the regular C bottle sample. Place the replicate C bottle under loose ice in a cooler.
4. On the sample labels, indicate that the samples are replicate samples by checking the box or writing “REPLICATE” on the label.

5. Fill out a datasheet as you normally would with the date, time, station ID, and sampler. Enter the exact same time on the replicate datasheet that you entered on the regular sample datasheet. Do not enter a time that is slightly different from the normal sample time.
6. On the replicate sample datasheet, check the box next to "Replicate" to indicate it is a replicate sample.
7. Ship the replicate sample to the South Dakota State Health Lab using the courier the same as a regular sample would be shipped.

Stream Sampling

Equipment List

Multi-meter sonde and handheld
Cooler(s) for holding and shipping samples
Distilled/deionized Water
Sulfuric acid for B bottle
Pipettes for acid
Conductivity calibration Standard
pH calibration standard 7
pH calibration standard 10
Bottles (A, B, C)
Nitrile Gloves
Ice (20 lbs)
Waders
Labels and datasheets
Fine-tip Sharpie markers or pencils

<u>Supplemental Equipment</u>
Van Dorn Sampler

Pre-sampling Activities

Multi-meter Calibration

Tutorial video: Part 1: https://youtu.be/SD-5ievw8zY Part 2: https://youtu.be/4KQzBN9--qE

Calibrate specific conductivity, pH, and dissolved oxygen. Record the calibration results on the multi-meter calibration sheet (Appendix). Include the pH millivolts, conductivity cell constant, and results of the dissolved oxygen calibration.

Note: If the meter indicates that calibration values are out of range, DO NOT accept the calibration. Start the calibration process over.

Note: If the weather changes significantly, or you make a significant change in elevation when travelling from one lake to another, recalibrate dissolved oxygen.

Data Collection Activities

Multi-meter Measurement Procedure

Tutorial video: https://youtu.be/StijlQf9PsI

1. Place the multi-meter sonde into the water near the center of the stream just below the water surface. Ensure that all sensors are submerged in the water.
2. If the stream has a cobble substrate, the sonde may be rested on it. If the substrate is muddy, hold the sonde above the substrate so that it doesn't become fouled with mud.
3. With the sensors in the water, wait for the results for each parameter to stabilize.
4. Record the results for pH, water temperature in degree Celsius, dissolved oxygen in mg/L, and specific conductivity in microsiemens (µS) on the SD DENR Water Quality Datasheet.

C Bottle Collection Procedure

Tutorial video for A, B and C bottle collection: https://youtu.be/XtrFUBOC7LU

Note: The C bottle should be collected before the A and B bottles to avoid sample contamination.

Note: The C bottle is a sterile bottle and should never be rinsed with distilled or sample site water.

1. Put on nitrile or latex gloves.
2. Remove lid and position the open end of the bottle towards the flow.
3. Plunge the bottle down into the water (0.5 foot – 1 foot) to avoid introducing surface scum.
4. Fill the bottle to the 250 mL or 100 mL mark, whichever is appropriate for the bottle size. Fill the bottle to the shoulder. If too much water enters the bottle, pour out a small amount (~5 mL).
5. Write down the time of collection for the C bottle.
6. Place the C bottle in a cooler with loose ice, making sure most of the sample bottle is in contact with ice.

A Bottle Collection Procedure

1. Rinse bottle with stream water 3 times.
2. Position the open end of the bottle towards the flow.
3. Lower bottle into the stream (0.5 foot – 1 foot) and allow the bottle to fill up to the shoulder.
4. Place the A bottle in a cooler on loose ice, making sure most of the sample bottle is in contact with ice.

B Bottle Collection Procedure

1. Rinse bottle with stream water 3 times.
2. Position the open end of the bottle towards the flow.
3. Lower bottle into the stream (0.5 foot – 1 foot) and allow the bottle to fill up to the shoulder.
4. Using a plastic pipette, add 2 mL of sulfuric acid (H_2SO_4) to the B bottle and place the cap on the bottle.
5. Cap the bottle and invert several times to ensure mixing of the preservative throughout the sample.
6. Place the B bottle in a cooler on loose ice, making sure most of the sample bottle is in contact with ice.

Alternative Stream Sampling Method

Van Dorn Sampler

Tutorial video: https://youtu.be/fQLsJZN633Q

If it is not safe to wade into the water to collect a sample at a stream site or conditions prevent direct physical access to the water, a Van Dorn sampler may be used. The Van Dorn sampler allows a field sampler to collect water by lowering the device into the water, then sending a heavy weight down the rope that closes the ends of the tube, in turn capturing water from the stream.

1. Open the plungers, attach plunger clips to the trip mechanism and lower the Van Dorn into the water and rinse three times.
2. Lower the Van Dorn sampler back into the water and hold just below the surface.

3. Release the messenger down the rope to trip sampler and close the plungers.
4. Pull the Van Dorn sampler back up from the water.
5. Open the drain valve on either end and fill bottles A, B, and C.

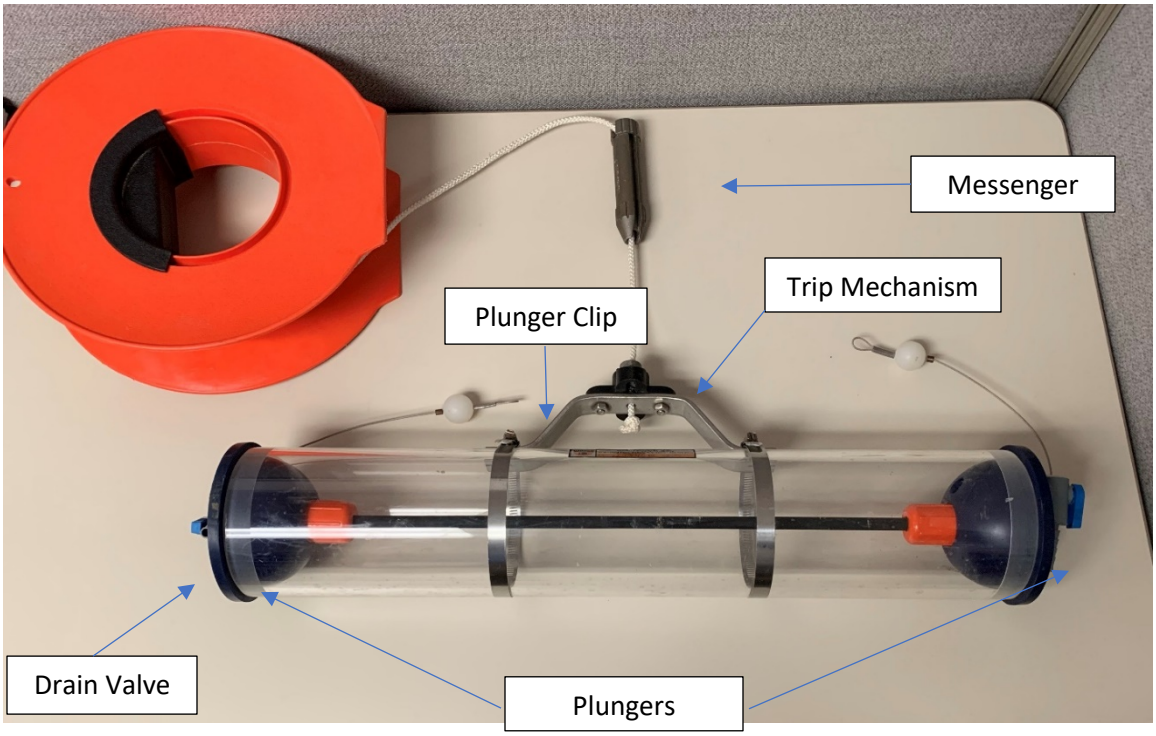

Figure 5. Van Dorn sampler.

Bottle Labeling and Datasheets for Stream Sampling

Bottle Labeling Procedure

At the vehicle, using a waterproof pen (fine tip Sharpie only) or pencil, fill out the empty fields on the labels for bottle A, B, and C. If waterproof labels and pens/pencils are not available, apply packing tape over the top of the label to protect it from getting wet. In most cases when using pre-printed labels, most fields other than Station ID, sampler initials, date, and time will be filled out. Other fields that may need to be filled out include Project, Source (the waterbody being sampled), Code or Agency Code (your unique billing ID from the SD Health Lab), whether it is a surface, midwater, or bottom sample (usually surface), and the sample bottle type (A, B, or C). All samples will be marked as "Grab" samples.

Filling Out Datasheets

1. Fill out empty fields on the SD DENR Water Quality Datasheet to match the values entered on the bottle labels for Agency Code, Sample Date, Time, Sampler, Source Water, Station ID, Project, and Project ID.
2. Review the boxes that are checked for each bottle for the parameters to be analyzed by the lab to ensure that they are correct.

Quality Assurance/Quality Control Sample Collection for Stream Sampling

Blank Sample Collection Procedure

Tutorial video: https://youtu.be/BAhUF1wNx_A

1. To submit a blank sample to the lab, triple rinse and fill bottles A and B with distilled or deionized water.
2. Preserve the B bottle with 2 mL of sulfuric acid (H_2SO_4) like you would with a regular sample.
3. Without rinsing, fill the C bottle with distilled or deionized water.
4. Place the sample bottles in the cooler under loose ice.
5. On the sample labels, indicate that the samples are blank samples by checking the box to indicate a blank sample or writing “BLANK” on the label.
6. Fill out a datasheet as you normally would with the date, time, Station ID, and sampler. Check the box next to “Blank” to indicate it is a blank sample.
7. Ship the blank sample the same as a regular sample would be shipped.

Replicate Sample Collection Procedure Tutorial

video: https://youtu.be/P9VVYgSygh0

1. Without rinsing the bottle, fill the replicate C bottle at the same time while using the same technique as the C bottle for the regular sample.
2. Triple rinse and fill replicate bottles A and B with water from the stream at the same time you are filling the A and B bottles for the regular sample.
3. Preserve the replicate B bottle with 2 mL of sulfuric acid ($H_2SO_{4)}$ like you would with a regular sample.
4. On the sample labels, indicate that the samples are replicate samples by checking the box or writing “REPLICATE” on the label.
5. Place the replicate sample bottles in a cooler under loose ice.
6. Fill out a datasheet as you normally would with the date, time, Station ID, and sampler. Enter the exact same time on the replicate sample datasheet that you entered on the regular sample datasheet.
7. On the replicate sample datasheet, check the box next to “Replicate” to indicate it is a replicate sample.
8. Ship the replicate sample along with the regular sample.

Sample Care, Shipping, and Packaging

Sample Shipping

Tutorial video: https://youtu.be/KlS_9eUpCBI

Sample shipping will be conducted using the South Dakota Health Laboratory courier system, which is conducted by Sameday Express. The courier has scheduled pick-up locations and times throughout eastern South Dakota. Scheduled pick-up locations and times are shown below.

Courier service scheduled pickup times and locations

Webster – 5pm – Game, Fish, and Parks office
Watertown – 4pm – Health Dept. on Hwy 212 on west side of town
Aberdeen – 3:30pm – St. Luke's Hospital
Huron – 5pm – Huron Regional Hospital
Brookings – 4pm – Brookings Hospital
Mitchell – 8-9pm – Queen of Peace Hospital
Yankton – 3:30pm Sacred Heart

If you are not able to reach a scheduled pick-up location, or if it isn't sensible to use one of the scheduled pick-up locations, you can call Sameday Express to schedule a pick-up nearly anywhere in South Dakota by calling **605-366-3299**. Be sure to call early in the morning to schedule your pick-up to allow the courier ample time to coordinate.

Sample Care and Packaging

All samples should be held and shipped in a hard-sided cooler with enough loose ice to cover all sample bottles. Samples must be kept at a temperature of <4° C. Datasheets should be sealed in a 1 gallon zip-seal bag and taped to the inside of the cooler lid. Take precautions to ensure the datasheets do not get wet.

Note: Ice in the sample cooler should be removed from the bag it came in and spread over the top of the sample bottles. If ice is left in the bag, the sample bottles will not reach a temperature of <4° C.

The cooler should be taped shut with packing tape. Make sure the cooler drain plug is closed. A shipping label with the South Dakota State Health Laboratory's address should be taped on the lid of the cooler in such a manner that it will not come off during shipping. The address for the health lab is below.

South Dakota State Health Laboratory
615 E. 4th Street
Pierre, SD 57501

The cooler should also be labeled with the cooler owner's organization name, phone number, and address so the cooler can be returned to the owner. Write this information on the cooler with a Sharpie or attach a label with this information to the cooler.

Note: The health lab will ship your coolers back to you with empty sample bottles.

Sample Holding Times

Table 1. Sample holding times and bottle type information.

Bottle	Size & Material	Preservative	Parameters	Holding Time
A	1,000 mL HDPE	Cool to 6°C	Alkalinity, total solids, TSS, volatile solids, TDS, BOD, CBOD, CO_3, Hardness, K, lab pH, lab conductivity, nitrate, chloride, fluoride, HCO_3, SO_4	48 hours
B	1,000 mL HDPE	2 mL H_2SO_4	Ammonia, Nitrate+Nitrate, TKN, Total P, COD	28 days
		pH <2		
		Cool to 6°C		
C	250 mL sterilized HDPE	Na_2SO_3 if chlorinated	Fecal coliform, *E. coli*, total coliform, enterococci, fecal PFG	24 hours
		Cool to 6°C		
Chlorophyll-a	1,000 mL brown HDPE	Cool to 6°C	Chlorophyll-a	48 hours (unfiltered)
				28 days (filtered)
Algae	125 mL brown HDPE	1 year at room temperature	Identification/Enumeration	1 year at room temperature

Aquatic Invasive Species

The following decontamination protocols were designed to prevent field workers from spreading Aquatic Invasive Species (AIS) while performing their duties on water bodies in South Dakota. A two-tiered approach was developed to ensure that adequate preventative measures are taken while minimizing impacts to time-sensitive field work.

Level 1 Decontamination (Undetected/Negative Waters)

The Level 1 Decontamination protocol is to be utilized when watercraft, equipment or clothing have been used in waters designated as undetected or negative for AIS. This is the **minimum** decontamination standard and, where time permits, Level 2 Decontamination protocol should be followed to ensure the highest level of AIS prevention.

Watercraft

1. Perform a watercraft inspection. Upon removing the watercraft from the water, begin inspecting the boat from bow to stern on one side. Pay special attention to through-hull fittings and trailer cross members, bunks, and rollers. Repeat the process on the opposite side of the watercraft as well as the interior of the vessel.
2. Collect all plant fragments and other debris found during the inspection, seal them in a plastic bag (trash bag or Ziplocs), and dispose of the bag in a trash receptacle.
3. Rinse dirt, mud, and debris from the watercraft. Rinsing can be done by power washing the watercraft at a GFP office or SDBASS/GFP boat wash location. If the watercraft is to be used in multiple water bodies in the same day or if a power wash location is unavailable, the debris may be removed by rinsing the watercraft with water from the water body (i.e. a 5-gallon bucket filled prior to trailering the watercraft).
4. Remove all drain plugs prior to leaving the boat launch area.
5. Trim the motor down to allow the water to drain prior to leaving the boat launch area. Remember to secure the motor in the correct position prior to travel.
6. If time permits, allow the watercraft to completely dry prior to subsequent use. If the vessel will be used on multiple waters in the same day, towel-dry all standing water prior to subsequent use

Equipment & Clothing

1. Inspect all equipment (nets, tools, waders, boots etc.) for plants, mud or other attached debris.
2. Rinse dirt, mud and debris from the equipment or clothing to the extent possible. Nets and equipment that have substantial algal growth or mud should be power washed. Felt or porous soled boots and waders may not be used at any time in the field.
3. If time permits allow the equipment or clothing to completely dry or freeze prior to subsequent use.

Level 2 Decontamination (Inconclusive, Suspect, Positive, or Infested Waters)

The Level 2 Decontamination protocol must be followed when watercraft, equipment or clothing have been used in a waters designated as inconclusive, suspect, positive or infested for AIS. This protocol is the **minimum** requirement and may be supplemented with additional measures when applicable.

Watercraft

1. Perform a watercraft inspection. Upon removing the watercraft from the water, begin inspecting the boat from bow to stern on one side. Pay special attention to through-hull fittings

and trailer cross members, bunks, and rollers. Repeat the process on the opposite side of the watercraft as well as the interior of the vessel.

2. Collect all plant fragments and other debris found during the inspection, seal them in a plastic bag (trash bag or Ziploc), and dispose of the bag in a trash receptacle.
3. Remove all dirt, mud, and debris from the watercraft.

   Waters containing AIS plants or fish—The watercraft and trailer must be power washed to remove any plant fragments or mud on the vessel. No plant fragments or mud may remain on the vessel after the decontamination

   Waters containing AIS invertebrates—The watercraft and trailer must be power washed with water heated to no less than 140°F. Furthermore, all interior compartments with standing water must be flushed with 140°F water for no less than three minutes. No plant fragments or mud may remain on the vessel after the decontamination
4. Remove all drain plugs prior to leaving the boat launch area.
5. Trim the motor down to allow the water to drain prior to leaving the boat launch area. Waters containing AIS invertebrates—Engine "muffs" must be used in conjunction with a hot water pressure washer until water exiting the motor is 140°F. Remember to secure the motor in the correct position prior to travel.
6. Allow the watercraft to completely dry prior to subsequent use. If the vessel will be used on multiple waters in the same day, towel-dry all standing water prior to subsequent use

Equipment & Clothing

1. Inspect all equipment (nets, tools, waders, boots etc.) for plants, mud or other attached debris.
2. Remove dirt, mud and debris from the equipment or clothing.

   Waters containing AIS plants or fishnets and equipment that have algal growth or any mud or debris attached must be power washed and, if possible, be allowed to completely dry prior to subsequent use.

   Waters containing AIS invertebrates-Nets and equipment that became wet or that have algal growth, mud or debris attached must be power washed with water heated to no less than 140°F and must be allowed to completely dry prior to subsequent use. Items that cannot be power washed must decontaminated with hot water (140°F for no less than three minutes), soaked in hot water (>113° for no less than 40 minutes), or frozen.

   Didymo infested waters— All clothing and equipment must be soaked in a 5% dish detergent solution for no less than 30 minutes, hot water (>113°F) for no less than 40 minutes or put in a freezer until frozen solid.

   Boots/Waders—Any mud or debris on boots and waders must be removed. If possible, boots and waders should be soaked in 140°F water for no less than three minutes or in hot water (>113°F) for no less than 40 minutes. Felt or porous soled boots and waders may not be used at any time in the field.

Considerations

For items or situations not specifically addressed in this document there are general protocols that should be applied. Anything used in/on a negative or undetected water must be free of mud and plants and should be cleaned with water (from the water body or a power washer). Anything used in/on an

inconclusive, suspect, positive or infested water must be free of mud and plants and decontaminated with hot water (140°F for no less than three minutes), soaked in hot water (>113°F for no less than 40 minutes), or frozen.

Reusable sample containers (carboys where lake water is composited) will not be rinsed in the lake, 2 rinses of ~200 mL of DI water at the completion of sampling efforts at a given waterbody is sufficient to provide clean blank samples from the jugs.

B.A.S.S./GFP Cooperative Boat and Trailer Wash Program

To help STOP the spread of these species and fish diseases, wash your boat, disinfect your live well and remove all mud and aquatic plants and animals from all gear.

The South Dakota Department of Game, Fish and Parks is teaming with the South Dakota B.A.S.S. Federation in an effort to prevent the further spread of aquatic nuisance species such as zebra mussels and Eurasian watermilfoil. The program encourages boaters (including those with personal watercraft) to wash their boats (including livewells and anyplace that may hold water) and trailers before launching them into South Dakota waters.

Who should wash their boat and trailer?

Everyone, but especially boaters who have had their boat/personal watercraft in waters outside of South Dakota or in South Dakota waters known to contain aquatic nuisance species. The following list of B.A.S.S./GFP cooperating boat wash stations all provide the necessary space and high-pressure hot wash necessary for you to rid your boat and trailer of any unwanted "hitchhikers."

Who should disinfect their live well?

Anyone who has had their boat in waters that are known to contain VHS in the Great Lakes region. Clean and disinfect live wells with a 10% household bleach solution (i.e, 1 1/2 cup household bleach to gallon of water). Since chlorine is toxic to fish, rinse live well to remove residual chlorine and drain it away from fish-bearing waters.

Table 2. AIS decontamination boat wash list.

City	Business	Address
DeSmet	Mr. Bill's Car Wash	109 4th Street SW
Estelline	Dale's Sinclair	402 State Avenue
Fort Pierre	Shur Shine Car Wash	Deadwood Avenue
Hartford	Sunnyside Car Wash	201 East Highway 38
Madison	Super Wash	304 2nd Street NE
Milbank	Eastside Car Wash	East Highway 12
Milbank	Westside Truck and Car Wash	504 24th Avenue
Mitchell	Mega Wash	1905 North Main Street
Mitchell	Mega Wash	800 East Kay Avenue
Mitchell	Sportsman's Car Wash	601 East Spruce Street
Pierre	Super Car Wash	1100 North Garfield Avenue
Pierre	Truck-n-Car Wash	1513 East Wells Avenue
Rapid City	Arnie's Pressure Wash	3100 South Highway 79
Rapid City	Parkway Car Wash	206 East Blvd North
Rapid City	Zaug Wash	612 Timmons Blvd
Redfield	Appel Oil Company	833 West 3rd Street
Sioux Falls	Clean Finish Car Wash	515 South Sycamore Avenue
Sioux Falls	Shop'n Cart Car Wash	4309 East 12th Street
Sioux Falls	Superwash - 12th Street	2000 West 12th Street
Sioux Falls	Superwash - Mariod Road	801 South Marion Road
Sioux Falls	Wash World Car Wash	321 North Cliff Avenue NE
Vermillion	Henderson's Ultimate	821 Princeton Street
Vermillion	Royal Car Wash	801 Stanford Street
Watertown	Cenex C Store	East Highway 212
Watertown	Super Wash	501 14th Avenue NE
Watertown	Westside Car Wash	715 3rd Avenue NW
White River	Gillen's Station	North 1st Street, Highway 83
Yankton	Classic Car Wash	600 West 23rd Street

Table 3. AIS contaminated waters list.

	FISH							PLANTS							INVERTEBRATES					
	Bighead Carp	Silver Carp	Grass Carp	Black Carp	Europeon Rudd	Snakehead	Western Mosquitofish	Brittle Naiad	Curly Pondweed	Didymo	Eurasion Water-milfoil	Purple Loosetriffe	Phragmites	Flowering Rush	New Zealand Mudsnail	Rusty Crayfish	Zebra Mussel	Quagga Mussel	Asian Clam	Red Rimmed Melania
Missouri River																				
Lake Oahe					X				X		X									
Lake Sharpe					X				X		X	X					X			
Lake Francis Case					X				X		X						X		X	
Lewis & Clark Lake					X			X	X		X		X			X	X		X	
James River	X	X	X																	
Big Sioux River	X	X	X																	
Below Falls Park	X	X	X																	
Vermillion River	X	X	X																	
Below E. Vermillion SRA	X	X																		
Fall River																				
Hot Springs City Limits																				X
Cascade Creek																				
Cascade Springs																				X
Castle Creek																				
Below Deerfield Reservoir										X										
Rapid Creek									X	X		X								

Table 4. AIS contaminated water list continued.

	FISH							PLANTS							INVERTEBRATES					
	Bighead Carp	Silver Carp	Grass Carp	Black Carp	Europeon Rudd	Snakehead	Western Mosquitofish	Brittle Naiad	Curly Pondweed	Didymo	Eurasion Water-milfoil	Purple Loosetriffe	Phragmites	Flowering Rush	New Zealand Mudsnail	Rusty Crayfish	Zebra Mussel	Quagga Mussel	Asian Clam	Red Rimmed Melania
Angostura Reservoir									X									?	X	
Big Stone Lake									X											
Canyon Lake									X											
Interstate Lakes (Brookings)					X															
Lake Alice					X				X											
Lake Byron	X	X																		
Lake Faulkton														X						
Lake Louise														X						
Lake Madison					X															
Lake Mitchell									X											
McCook Lake								X	X								X			
Mina Lake					X															
Newell Reservoir					X															
Pactola Reservoir					X															
Roy Lake									X											
Sheridan Lake					X				X											
Stockade Lake									X											

Appendix

Multi-meter Calibration Worksheet

Date: _____ Sonde SN: _____ Technician: _____

Pre/Post-Calibration Values

Before **After**

Conductivity: _____ _____ Cell Constant: _____

pH 7: _____ _____ pH MV: _____

(pH 7 MV range: 0 MV ± 50 MV)

pH 10: _____ _____ pH MV: _____

(pH 10 MV range: -180 MV ± 50 MV. Millivolt span between pH 7 and 10 should be ≈165 to 180 mv)

Optical DO: Was the wiper replaced? Y N Does the wiper park 180° from sensor? Y N

The **ACCEPT/REJECT** criteria as follows:

The DO output in % must start at a positive number and decrease during the warm up. Should the output display a negative number or start at a low number and climb up to the cal point, the probe is rejected and must not be deployed.

_____ **ACCEPT** _____ **REJECT**

ODO Gain: _____ Barometric Pressure:_____

DO% Calculated – (BARO mmHg divided by 7.6) = % saturation Example: 760 ÷ 7.6 = 100.0%

DO% Calculated: _____ DO% Before: _____ DO% After: _____

Depth: If zero was entered, record barometric pressure at time of calibration

If offset depth was entered, record value _____ meters/feet and pressure

Notes:

SD DENR Water Quality Data

Rev 06/19

Agency Code

Sample Date | Time | Samplers Print/Sign

Source Water | Station ID

Site Location

Project | Project ID

Type of Sample ☐ Replicate ☐ Grab ☐ Integrated Vertical ☐ Blank ☐ Composite ☐ Integrated Flow

Medium ☐ Water / Other

Relative Depth ☐ Surface ☐ Bottom ☐ Midwater

H2O Temp		C	Sample Depth		Ft
SPC		µmho/cm	Total Depth		Ft
DO		mg/L	Width		Ft
pH		SU	Gage Stage		Ft
Secchi		Meters	Discharge		CFS

Field Comments

All Samples must be packed in ice and chilled to 6 C

A - 1 Liter
- ☐ Alkalinity
- ☐ TSOL
- ☐ TSSOL
- ☐ VTSS
- ☐ TDSOL
- ☐ BOD
- ☐ CBOD
- ☐ CO3
- ☐ Hardness
- ☐ K
- ☐ Lab Cond
- ☐ Cl
- ☐ Fluoride
- ☐ HCO3
- ☐ SO4

B - 1 Liter
pH<2 ~2 mL H2SO4
- ☐ Ammonia
- ☐ NO3+NO2-N
- ☐ TKN
- ☐ Total P
- ☐ COD

D - 100 mL
Filtered + pH<2 0.25 mL H2SO4
☐ TDP ☐ DIN

R - 4L Cube
☐ Ra 226 ☐ Ra 228

CN - 150 mL
pH >10 ~0.4 mL NAOH
☐ CN ☐ WADCN

H - Liter Glass Amber
pH<2 ~2 mL HCL
☐ TPH Diesel

OG - Liter Glass Amber
pH<2 ~2 mL HCL
☐ Oil Grease

Dissolved Metals - 100 mL
Filtered + pH<2 ~0.5 mL HNO3
☐ Ca ☐ Na ☐ Mg ☐ Mn ☐ K ☐ Fe

Recoverable Metals - 100 mL
pH<2 ~0.5 mL HNO3
☐ Ca ☐ Na ☐ Mg ☐ Mn ☐ Fe

E - 1 Liter *Filtered*
☐ HCO3 ☐ Cl ☐ SO4 ☐ Fluoride

C - 100 mL Idex *Na2SO3 if source is Chlorinated*

Note: Use 250 mL bottle if requesting multiple tests

☐ Fecal Coliform* ☐ Total Coliform ☐ Fecal PFGE ☐ E Coli* ☐ Entercocci*

V-40mL	V1-40 mL	V2-120 mL	V3-120 mL
3 - 40 mL Amber Vials 0.5 mL HCL Zero Head Space	*2 - 40 mL Amber Vials 0.5 mL HCL Zero Head Space*	*120 mL Amber Bottle 1.5 mL HCL*	*120 mL Amber Bottle Filtered 1.5 mL HCL*
☐ TPH Gas	☐ VOC	☐ TOC	☐ DOC

Lab Comments

Dissolved Metals - 250 mL
Filtered + pH<2 ~1.5 mL HNO3
- ☐ Al
- ☐ Sb
- ☐ As
- ☐ Ba
- ☐ Be
- ☐ B
- ☐ Cd
- ☐ Cr
- ☐ Cu
- ☐ Hg
- ☐ Pb
- ☐ Ni
- ☐ Se
- ☐ Ag
- ☐ Ti
- ☐ U
- ☐ V
- ☐ Zn
- ☐ Mo
- ☐ Silica

Recoverable Metals - 250 mL
pH<2 ~1.5 mL HNO3
- ☐ Al
- ☐ Sb
- ☐ As
- ☐ Ba
- ☐ Be
- ☐ B
- ☐ Cd
- ☐ Cr
- ☐ Cu
- ☐ Hg
- ☐ Pb
- ☐ Ni
- ☐ Se
- ☐ Ag
- ☐ Ti
- ☐ U
- ☐ V
- ☐ Zn
- ☐ Mo

Relinquished By: _____ Date/Time _____

Received By: _____ Date/Time _____

Relinquished By: _____ Date/Time _____

Received By: _____ Date/Time _____

Relinquished By: _____ Date/Time _____

Received By: _____ Date/Time _____

Sample Temp (C) **Date / Time Received** **Lab #**

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

A - 1 Liter HDPE

Preservative: None

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

B - 1 Liter HDPE

Preservative: pH < 2.0 (~2 mL H2SO4)

Project: 7
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

A - 1 Liter HDPE

Preservative: None

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

B - 1 Liter HDPE

Preservative: pH < 2.0 (~2 mL H2SO4)

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

A - 1 Liter HDPE

Preservative: None

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

B - 1 Liter HDPE

Preservative: pH < 2.0 (~2 mL H2SO4)

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

A - 1 Liter HDPE

Preservative: None

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

B - 1 Liter HDPE

Preservative: pH < 2.0 (~2 mL H2SO4)

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

A - 1 Liter HDPE

Preservative: None

Project:
Source:
Code:
Station:

Initials

Date Time

☑ Surface ☐ Bottom ☐ Midwater

B - 1 Liter HDPE

Preservative: pH < 2.0 (~2 mL H2SO4)

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area

Project:			Date
Source:			Time
Station:			Initials
Program: WP			
☑ Surface	☐ Bottom	☐ Midwater	Comp mL
☐ Algae	☐ Composite	☐ Periphyton	
☐ MacroInv	☐ Grab	☐ Zooplank	Filtered mL
☐ AFD	☐ Replicate	☐ Art Sub	
☑ Chl A	☐ Blank	☐ Nat Sub	Surface Area