# Lower Fox River Basin

# Volunteer Monitoring Program

# Volunteer Manual

# Volunteer Responsibilities:

- Attend the volunteer training
- Read and follow DNR sampling protocol guidelines (based on WisCALM standards)
- Collect transparency, stream flow, and water samples for total phosphorus (TP), total suspended solids (TSS), dissolved reactive phosphorus (DRP), and total nitrogen (TN) once per month (May to October)
- Package and ship water samples to the Wisconsin State Laboratory of Hygiene (WSLH) in Madison
    - Note: all shipping costs will be covered by the WDNR
- After the samples are collected and shipped notify the DNR project coordinator and give them your streamflow and transparency data (if not written on the lab slip)
- Return supplies to the WDNR project coordinator if you don't plan on sampling the next season. Also return streamflow worksheets to coordinator

# Important Reminders:

- If possible, samples should be collected on the same date each month (or as close as possible), preferably earlier in the month in case alternative sampling arrangements need to be made, samples can be collected a minimum of 15 days apart
- Keep in mind the lab is not open on Saturday and Sunday and there is a short hold time on the DRP sample (48 hours), therefore it is best to sample early in the week (Monday to Wednesday)
- Package pickups for overnight delivery at various UPS locations differ, please check the latest pickup time to plan your sampling event
- If samples are sent the day after collection, keep the samples in the refrigerator overnight
- Place yellow acid label on the front of the lab slip, be sure the sticker contains the lot number and expiration date from the vial
- Check that all required fields are filled in on the lab slip before packing into mailer along with samples. These fields include: Name, email address, phone number, and date and time of sample collection. If these fields are not filled in, the lab cannot process the samples and upload the data into SWIMS
- Be sure the lab slip is included in the cooler with the samples in a separate Ziploc bag. If the lab slip is left out, the lab cannot process the samples
- If collecting duplicate samples, place all samples and lab slips in the same cooler. If shipping multiple coolers, make sure the lab slip is in the cooler with the corresponding samples
- Before shipping samples, check that the front index card shows the lab address (WI State Lab of Hygiene, 2601 Agriculture Dr., Madison, WI 53718) and the back of the card is filled in with volunteer address. At the end of the sampling season (October), you can remove the index card so that the cooler is not shipped back
- Contact the DNR project coordinator after samples are collected and shipped
- Coolers should ship back to the volunteer within two weeks. If the cooler does not arrive within two weeks, please let the project coordinator know so a new one can be shipped

# Total Phosphorus, Total Nitrogen, Total Suspended Solids, and Dissolved Reactive Phosphorus Collection

## Equipment:

### *General Water Sampling Supplies*

- Sharpie
- Pen or pencil
- Extension pole (PVC pipe) with rubber band to fasten bottle
- Nitrile or latex gloves
- Safety glasses
- Lab slips (also called "Test Request – Inorganic Surface Water & Microbiology" form)
    - One lab slip for each sampling site per visit
- Waders or shoes that can get wet

### *Total Phosphorus and Total Nitrogen-Specific Supplies*

- 1.0 mL vial of sulfuric acid ($H_2SO_4$)
- 250 mL polyethylene bottle (one per site)

### *Total Suspended Solids-Specific Supplies*

- 1-quart polyethylene bottle (one per site)

### *Dissolved Reactive Phosphorus-Specific Supplies*

- 60 mL polyethylene bottle (one per site)
- 50 ml syringe and capsule filter

# Total Phosphorus and Total Nitrogen Sample Collection

The phosphorus sample and nitrogen sample are taken from the same bottle. A video demonstration of TP sampling can be found here: https://www.youtube.com/watch?v=1eBW3iyoNrU

1. On the 250 ml bottle check the box next to "Nutrients," check the $H_2SO_4$ box, and write the field number and sample location on the bottle (these are listed on your lab slip as "Field Number (Bottle Label ID)" and "Station ID (Storet #)" (Figure 1). It is recommended to write on the bottles with sharpie before collecting the water samples to avoid smearing.

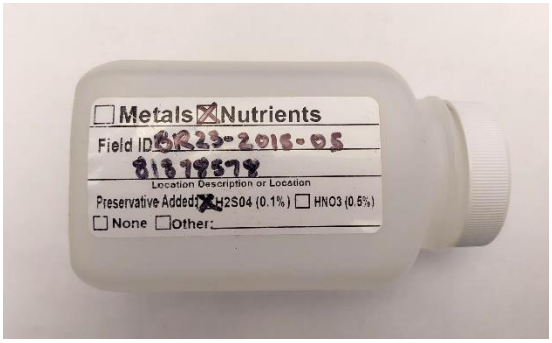



**Figure 1.** 250 mL polyethylene sample bottle.

2. Locate a sampling location that is at least 10 to 20 feet upstream from a bridge crossing, in the middle of the stream channel, and is at least knee deep. **Walk upstream** to the sampling location. This ensures the sample is not contaminated by sediment that has been dislodged from the substrate.
3. Facing upstream, **rinse the 250 mL polyethylene bottle three times with water 3 to 6 inches below the water's surface. The fourth time, fill the bottle to its shoulder and screw on the cap.** Whenever possible, and especially when stream flow is swift or water levels are high, fasten the bottle to an extension pole and use that to collect stream water that is well mixed.
4. Avoid touching or allowing water at the surface / scum on the surface to touch the rim of the bottle or inside of the cap. One way to prevent this is to uncap and recap the bottle underwater. If you uncap the bottle above the water's surface, always place the cap top side down to avoid contamination.

**Figure 2.** Add a vial of sulfuric acid to sample. Be sure to place cap topside down to avoid contamination.

5. Wearing gloves and safety glasses, preserve the sample by **adding a vial of sulfuric acid to the 250 mL bottle** (Figure 2). **Attach acid sticker to the corresponding lab slip.** Be sure the sticker contains the lot number and expiration date and does not cover any of the requested tests. Back at home, triple rinse the empty acid vial with water and dispose in the garbage.
6. **Securely cap the bottle and mix by inverting several times.**
7. Immediately place the sample on ice.

## Total Suspended Solids Sample Collection

1. Write the appropriate field number and sample location on the front of the 1-quart polyethylene bottle (these are listed on your lab slip as "Field Number (Bottle Label ID)" and "Station ID (Storet #)". Check the box indicating that no preservative was added (Figure 3).

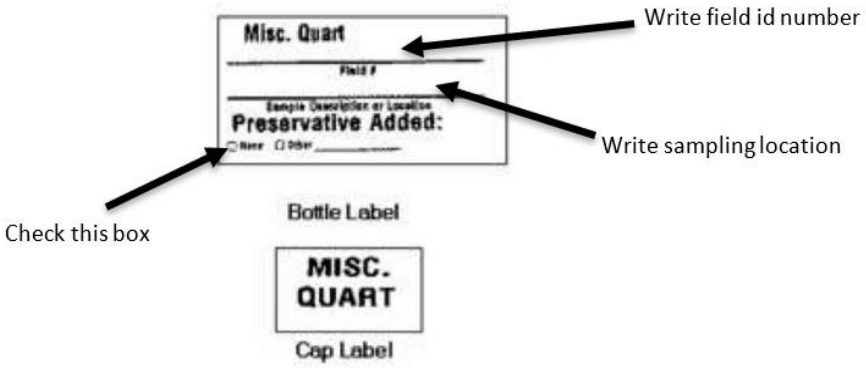



**Figure 3.** 1-quart polyethylene sample bottle label.

2. Repeat steps 1 to 4 from "Total Phosphorus and Total Nitrogen Sample Collection" to collect a sample in a 1-quart polyethylene sample bottle.
3. Securely cap the bottle.
4. Immediately place the sample on ice.

## Dissolved Reactive Phosphorus Sample Collection

1. On the 60 ml bottle write "FF" on the cap to indicate the sample was field filtered. Write the field number and sample location on the bottle (these are listed on your lab slip as "Field Number (Bottle Label ID)" and "Station ID (Storet #)" (Figure 4).
2. Remove plunger from the 50 ml syringe prior to attaching the filter (Figure 5)


**Figure 4.** 60 mL polyethylene sample bottle.

**Figure 5.** Remove plunger from the 50 ml syringe.

**Figure 6.** Screw the filter onto the syringe tip.

3. Attach the filter by screwing it onto the syringe tip. Note that it will only fit one correct way (Figure 6). Triple rinse the syringe before each use by pouring a little bit of water from the 1-quart TSS bottle into the syringe, discard the water.

4. Shake up the 1-quart TSS bottle to ensure sample is properly mixed, pour sample from the TSS bottle into the syringe and fill to the top of the barrel (Figure 7).
5. Re-insert the plunger, slowly push the plunger down and discard about 5 ml of the solution. Triple rinse 60 mL bottle by squirting about 5 mL of water for each rinse from the syringe and filter. Cap and shake after each rinse and discard water.
6. To fill bottle, place the filter over the 60 ml bottle opening and push the plunger down slowly (Figure 8). Fill bottle to its shoulder and screw on the cap. It may seem difficult, but most samples will only require about 30-45 seconds to filter 50 ml. Some sampling locations may require more than one filter per sampling event. **CAUTION: Filter may rupture if too much pressure is applied.** Additional water from 1-quart TSS bottle may be needed to fill 60 mL bottle. Discard the syringe and filter after use.

**Figure 7.** Pour water from 1-quart bottle into syringe.

**Figure 8.** Hold filter over 60 ml bottle and press plunger down slowly.

7. If reusing the syringe, either triple rinse with river water or rinse with tap water and let completely dry between uses.
8. Securely cap the bottle and immediately place on ice.

## Duplicate Sample Collection

If you receive an extra lab slip for one of the collection months with "DUP" in the Field Number section, you will need to collect a duplicate sample. The duplicate sample is collected at the same time as the regular sample and the collection process is the same. The lab slip should be filled out the same way as a regular sample. The duplicate sample bottles should be labeled as duplicates, the Field ID you write on the bottle should match what is on the lab slip. Package the three duplicate sample bottles in a separate Ziploc bag than the regular sample and place the bag in the same cooler as the regular sample.

# Documentation – Lab Slips

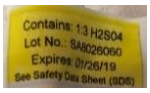
1. **Complete** the lab slip that has been provided to you for the stream site you are collecting a sample at. Lab slips will be provided to you and should ***never*** be photocopied. **Complete a separate lab slip for each sampling site and event.** Most of the required fields on the lab slip are automatically filled out for you, but volunteers still need to fill the following fields:
    a. Time and Date of Sample Collection, including:
        i. Date (mm/dd/yyyy)
        ii. Time (24-hr clock)
    b. Who Collected the Sample, including:
        i. Your name
        ii. Your phone number
        iii. Your email
    c. **IMPORTANT!** Peel the label from the sulfuric acid bottle (Figure 9) and place it on the front of the corresponding lab slip (on the spot indicated below). Make sure the lot number and expiration date transfer.
        i. There may be a separate sticker provided that states the lot number and expiration date, place that sticker on the lab slip instead of using the sticker on the vial

**Figure 9.** Peel acid label sticker from sulfuric acid vial.

2. Put lab slip in the provided gallon Ziploc bag and place in shipping box (on top of cooler lid while still inside shipping box).
3. Transport the samples on ice and prepare them to be shipped to the WSLH (See Sample Packaging and Shipping).

***DO NOT PHOTOCOPY***

Place acid sticker here.




State of Wisconsin
Department of Natural Resources
and Laboratory of Hygiene

# Test Request – Inorganic Surface Water & Microbiology

Form 4800-024 (R 05/22) Page 1 of 2

**Billing and Reporting**

| Account Number | Field Number (Bottle Lable ID) | Report to A |
|---|---|---|
| | SR57-2023- | |
| DNR User ID | Report To Name | City |
| WENDOKRW | WENDORF, KATHERINE | |
| Date Results Needed (mm/dd/yyyy) | | Report to Email (Non-DNR only) |

**Write the "Field Number (Bottle Label ID)" and "Station ID (Storet #)" on the sample bottles.**

**Date and Time of Sample Collection**

| Date (mm/dd/yyyy) | Time (24-hr clock) | End Date (mm/dd/yyyy) | End Time |
|---|---|---|---|
| | | | |

**Fill in "Date and Time of Sample Collection" and "Who collected the sample" boxes.**

◯ Storm Water ◯ EF Effluent (Treated Wastewater) ◯ IF Influent (Untreated Wastewater)
◯ Monitoring Well ◯ PO Private Well ◯ SE Sediment
◯ Soil ◯ OW Other Waste ◯

**Who collected the sample**

| Collected By (First and Last Name) | Telephone | Email |
|---|---|---|
| ~~KATHERINE WENDORF~~ | | |

**Where the sample was collected**

| Station ID (STORET #) | Sample Address or Location Description |
|---|---|
| 10021359 | SHEBOYGAN RIVER - US OF STATE HIGHWAY 57 |

| County | Waterbody ID (WBIC) | Point / Outfall (or SWIMS Fieldwork Seq No) |
|---|---|---|
| 60-Sheboygan | 50700 | 344487060 |

**Sample Details**

Sample Description / Device Description

| Enforcement? ◯ Yes ◯ No<br>If yes, include chain of custody form. | If Field QC Sample (select one):<br>◯ Duplicate ◯ Blank ◯ | Depth of Sample: _____ ◯ ft ◯ m ◯ in ◯ cm |
|---|---|---|
| Is Sample Disinfected? ◯ Yes ◯ No<br>If yes, how? | Grant or Project Number<br>East_01_CMP23 | Or Top and Bottom of Sample Interval<br>_____ - _____ ◯ ft ◯ m ◯ in ◯ cm |

**Analyses Requested**

If field filtered, indicate by checking the box on this sheet and noting on the lid of the sample bottle.

**Plastic Quart Bottle** (No chemical Preservation)

☐ Sample field filtered? (Check box if yes)

- ☐ Alkalinity, pH, Conductivity
- ☐ $BOD_5$ Dissolved
- ☐ $BOD_5$ Total (900 ml needed)
- ☐ $CBOD_5$ Total (carbonaceous)
- ☐ Chloride
- ☐ Chlorophyl A (if Field Filtered, give ml _____ filtered)
- ☐ Color
- ☐ Fluoride
- ☐ MBAs Screening
- ☐ pH only (non compliance)
- ☐ Sulfate
- ☐ Turbidity
- ☐ _____

**Solids**

- ☐ Suspended Sediment
- ☐ Total Dissolved Solids
- ☐ Total Solids
- ☐ Total Volatile Solids (includes total solids)
- ☐ % Sand, Silt, Clay
- ☒ Total Suspended Solids (500 ml needed)
- ☐ Total Vol. Susp. Solids (includes Total Susp. Solids)

**60 ml Bottle** (No chemical Preservation)

☒ Sample field filtered? (Check box if yes)

- ☒ Orthophosphate
- ☐ Silica
- ☐ $NO_2$+$NO_3$ as Nitrogen (drinking water)
- ☐ Nitrite ($NO_2$) as Nitrogen

**250 ml Glass Amber**

- ☐ TOC (acidified w/Sulfuric Acid)
- ☐ DOC (field filtered and acidified w/Sulfuric Acid)
- ☐ DOC (not field filtered nor acidified)

**250 ml Metals Bottle (Acidify w/ Nitric Acid)**

☐ Sample field filtered (Check box if yes)
☐ Low Level Metals. Note: Clean sampling with special bottles
☐ TCLP (Toxicity Characteristic Leaching Procedure - use mason jar)
Total recoverable metals will be run unless otherwise instructed.

| | | |
|---|---|---|
| ☐ Aluminum | ☐ Copper | ☐ Selenium |
| ☐ Antimony | ☐ Hardness-as $CaCO_3$ | ☐ Silver |
| ☐ Arsenic | ☐ Iron | ☐ Sodium |
| ☐ Barium | ☐ Lead | ☐ Strontium |
| ☐ Beryllium | ☐ Magnesium | ☐ Thallium |
| ☐ Boron | ☐ Manganese | ☐ Titanium |
| ☐ Cadmium | ☐ Mercury | ☐ Vanadium |
| ☐ Calcium | ☐ Molybdenum | ☐ Zinc |
| ☐ Chromium, Total | ☐ Nickel | ☐ _____ |
| ☐ Cobalt | ☐ Potassium | ☐ _____ |

**250 ml Nutrients Bottle (Acidify w/ Sulfuric Acid)**

☐ Sample field filtered (Check box if yes)

- ☒ Tot.-Phosphorus
- ☐ Ammonia-N
- ☐ $NO_2$+$NO_3$ as Nitrogen
- ☐ COD
- ☐ Total Kjeldahl-N
- ☒ Total Nitrogen
- ☐ Tot. Dis. Phosphorus (filter, then acid preserve in 60 ml bottle)
- ☐ Low Level Total Phosphorus (special bottles needed)

**250 ml Round Bacteria Bottle**

- ☐ E. coli by MPN, non-potable
- ☐ Enterococci by MPN, non-potable

For lab use:
Sample Temp _____ °C
☐ Iced

Please enclose this form in the mailer along with the sample and send to the State Lab of Hygiene.

**Field Parameters - Optional** **Only fill out if directed by your project coordinator.**

| | | | | | |
|---|---|---|---|---|---|
| Temperature - Sample (°C) | | __ __ . __ | Gage Height (ft) | | __ __ __ __ . __ |
| Temperature - Ambient Air (°C) | | __ __ . __ | Flow (cfs) | | __ __ __ __ __ __ . __ |
| DO (mg/l) | | __ __ . __ | Flow (MGD) | | __ __ __ __ __ __ |
| % Saturation | | __ __ __ . __ | Depth to Groundwater | ____ ft or m | __ __ __ __ __ . __ __ |
| pH (su) | | __ __ . __ | Turbidity (NTU) | | __ __ __ . __ __ |
| Secchi Depth (feet or meters) | ____ ft or m | __ __ __ . __ | Transparency Tube (cm) | | __ __ __ __ . __ __ |
| Secchi Depth Hit Bottom? | | ☐ Yes ☐ No | Nitrates (mg/l) | | __ __ __ __ __ __ |
| Cloud Cover (%) | | __ __ __ | | | |
| Cond (µS/CM@25°) | | __ __ __ __ __ | | | |

# Sample Packaging and Shipping

## Background

Prior to the start of the season, volunteers will be issued a cooler(s), the sampling equipment and documentation needed for each sampling period, and prepaid UPS shipping labels. The shipping labels enable you to send your samples to the WSLH as soon as possible after collection (see instructions below). Each month, after submission to the WSLH, these coolers will be shipped back to you from the WSLH. Please contact the project coordinator if you have not received your cooler within two weeks of your previous sample.

## Considerations/ Precautions

Samples should be shipped the day of sample collection. DRP samples must be analyzed within 48 hours of collection. Do not mail samples on Thursday, Friday, or Saturday because lab staff is not present on the weekends. If the ice melts completely or DRP samples are received after the 48-hour hold time, sample data will be flagged (it will still be usable). If the weather is extremely warm, if you collect a sample from more than one site, and/or you collect duplicate samples in addition to your regular sample you should add extra ice or use multiple shipping coolers to submit your samples to the lab. Refrigerate the samples or keep them on ice until they are shipped. If you refrigerate the samples overnight, they should not be on ice while inside the refrigerator.

## Packing and Shipping Instructions

A video demonstration of packing and shipping can be found here:
https://www.youtube.com/watch?v=SrKVifeTHhM

1. Place all three sample bottles in one gallon Ziploc bag. If taking samples from multiple locations keep the samples in separate Ziploc bags and coolers. Place samples in cooler.
2. Fill one gallon Ziploc bag with ice cubes (generally you want at least equal parts of ice and water sample in the cooler, more if it's very warm outside). Do not use ice packs.
3. Insert one Ziploc bag of ice on top of/next to the samples.
    a. If it is very warm outside, extra ice can be placed in the bag with the sample bottles. Never place ice in the cooler without being inside a Ziploc bag.
4. Double check the lab slip(s) is filled out, then place the lab slip(s) in a gallon Ziploc bag and put on top of the cooler lid but within the shipping box. Be cautious not to tape the Ziploc bag if the box isn't fully closed when you add the packaging tape.
5. Close the box lid and wrap with reinforced shipping tape completely around the box.
6. Remove the mailing label card from the plastic envelope on the front of the cooler and flip over so the WSLH address is exposed and reinsert into envelope.
7. Ship the samples to the WSLH using UPS.

# Transparency Monitoring

## Background

The transparency tube is a tool used for measuring the water clarity in a stream. The transparency tube is 120 cm long x 4 cm wide, made of clear plastic, and has a valve at the bottom (some transparency tubes may be 60 cm long x 4 cm wide). A rubber stopper inserted at one end of the tube is painted black and white. When you look down into the tube a distinct "Secchi" symbol is visible at the bottom (Figure 10). To measure water clarity, the tube is filled with water that has been collected from a stream or river. While looking down into the tube, water is released through the valve until the black and white Secchi symbol just becomes visible. The depth of the water when the symbol becomes visible is recorded in centimeters (marked on the side of the tube). If the Secchi symbol is visible when the tube is full, the transparency reading is ">120 centimeters." A higher transparency reading in centimeters reflects higher water clarity.

**Figure 10.** Secchi symbol at the bottom of the transparency tube.

Transparency can be affected by several factors. Both *dissolved* and *suspended* materials can influence water transparency. The amount of suspended solids in the water is the most important factor: the more suspended materials, the lower the water transparency. In most streams and rivers, soil particles (for example, silts and clays) contribute to lower transparency readings. Algae may also make up a portion of the suspended solids in some slow-moving streams and larger rivers. Dissolved material may also affect transparency. A good example of this is the tea color of bog-influenced lakes and streams common in the northern part of the state. This "tea color" is caused by dissolved organic material.

In general, a low transparency reading most often reflects that a large amount of soil particles are being carried by the stream. These soil particles may be deposited as sediment on stream bottoms. The suspended sediment can also reduce light penetration needed for the growth of aquatic plants. When sediment is deposited on stream bottoms it can reduce habitat space needed for diverse macroinvertebrate populations or cover fish eggs, keeping them from getting the oxygen needed to survive. Sediments may also have phosphorus attached to it. High levels of phosphorus can trigger excess algae and weed growth.

## Transparency Monitoring Methods

A video demonstration of transparency monitoring can be found here:
https://www.youtube.com/watch?v=f7yGbsMli3s

- Note: record the transparency measurement on the lab slip in cm

### *Sample Collection*

Collect the sample away from the stream bank in the main flow (well-mixed) area. Be careful not to disturb the stream bottom when you collect the water sample. If you get sediment from bottom disturbances, dump out the sample, move upstream (away from the disturbed area) and try again. For the observer, consistency is the key. If you initially wear your eyeglasses when you take the reading, then always wear your eyeglasses to take this measurement. However, you should never wear sunglasses when you take this reading.

### *In Stream*

1. Walk into the water at an access point downstream from the sampling location. Be careful not to stir up the bottom sediment upstream of your sampling location.
2. Face upstream (into the current) in the middle of the stream or in a well-mixed area offshore.
3. Collect your water sample by plunging your bucket or transparency tube 3-6 inches beneath the surface or halfway down from the surface. If using a bucket, scoop away from your body and into the current.
4. Return to shore with the sample.

### *From Shore*

To collect a sample while standing on the shore, use a bucket or sample bottle attached to a pole so that you can reach offshore. Scoop from below the surface in the upstream direction. Be careful not to stir up the sediment upstream of your sample.

**Figure 11.** Transparency tube shaded by observer.

### *Reading the Transparency Tube*

1. Remove large objects from the water sample. If necessary, filter through a nylon stocking.
2. If the sample has settled, use a stirring stick to stir the sample, or pour the sample into a clean bucket and back into the transparency tube to suspend all materials.
3. Stand out of direct sunlight. If you cannot get to a shady place, use your body to cast a shadow on the tube (Figure 11).
4. If you are wearing sunglasses, remove them. Then look for the target (black and white) disc on the bottom of tube. If disc is visible, record the length of the tube (>120 cm) on the data sheet.
5. If target disc is not visible, have your partner let water out a little at a time using the valve at the bottom until disc is just visible (Figure 12). Have them stop letting water out immediately when you can just see the contrast between black and white on the disc at the bottom of the tube.
6. Read the level of water in the tube in cm using the measuring tape on the side of the tube.

**Figure 12.** Slowly releasing water until the disc is just visible.

7. Record the measurement on the backside of your lab slip next to "Transparency Tube" in cm.
8. Dump contents of tube on ground.
9. Note: Some transparency tubes will have a secchi disk on a string rather than having one attached to the bottom of the tube. In this case follow the "Sample Collection" steps above and follow steps 1-3 in "Reading the Transparency Tube". To get the reading slowly lower the secchi disk in the tube until you are unable to make out the black and white on the disc, record the point you can no longer see the disc. Lower the disc to the bottom of the tube and slowly bring it back up, record the point you can see the black and white disc. Add the two readings together and divide by two to get the average, record this final calculation on the lab slip. If you are able to lower the secchi disk to the bottom of the tube and can still make out the black and white, record the reading as ">120 cm"

# Streamflow Monitoring

## Background

Streamflow, or *discharge*, is the volume of water moving past a cross-section of a stream over a set time period, it is usually measured in cubic feet per second (cfs). Streamflow is affected by the amount of water within a *watershed*, increasing with rainstorms or snowmelt, and decreasing during dry periods. Flow is also important because it defines the shape, size, and course of the stream. It is integral not only to water quality, but also to habitat. Food sources, spawning areas and migration paths of fish and other wildlife are all affected and defined by stream flow and velocity. Velocity and flow together determine the kinds of organisms that can live in the stream (some need fast-flowing areas; others need quiet, low-velocity pools). Different kinds of vegetation require different flows and velocities, too.

Streamflow is affected by both forces of nature and by humans. In undeveloped watersheds, soil type, vegetation, and slope all play a role in how fast and how much water reaches a stream. In watersheds with high human impacts, water flow might be depleted by withdrawals for irrigation, domestic or industrial purposes. Dams used for electric power generation may affect flow, particularly during periods of peak need when streamflow is held back and later released in a surge. Drastically altering landscapes in a watershed, such as with development, can also change *flow regimes*, causing faster runoff with storm events and higher peak flows due to increased areas of *impervious surface.* These altered flows can negatively affect an entire ecosystem by upsetting habitats and organisms dependent on natural flow rates.

Tracking streamflow measurements overtime can give us baseline information about the stream's natural flow rate.

## Definition of Terms

- *Discharge:* Another term for streamflow, or the volume of water moving past a designated point over a set time period.
- *Flow Regime:* The pattern of stream flow over time, including increases with stormwater runoff inputs and decreases to a base-flow level during dry periods.
- *Impervious Surface:* A surface that does not allow water (e.g., rain) to pass through (infiltrate).
- *Rating Curve:* A graphical representation of the relationship between the *stage height* and the discharge (flow).
- *Run:* An area of a stream that has swift water flow and is slightly deeper than a riffle (a run will be about knee/thigh deep).
- *Stage Height:* Height of the water in a stream above a baseline.
- *Watershed:* An area of land that drains to a main water body.

## Streamflow Monitoring Methods

The method you are going to use in determining streamflow is known as a velocity-area approach. The task is to find out the volume of water in a 20-foot (at least) section of stream by determining both the stream's velocity and the area of the stream section. You will first measure the width of the stream, and then measure water depth at a number of locations across the width to find the average depth at your monitoring site.

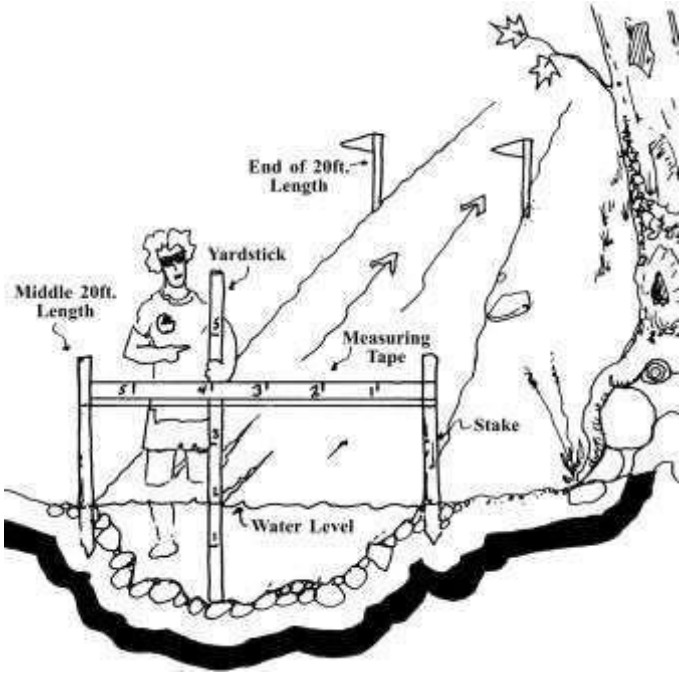
Streamflow can be calculated by multiplying the average depth by the width to determine the average cross-sectional area ($ft^2$) of the stream. Water velocity (ft/sec) is determined by measuring the number of seconds it takes a tennis ball float to travel along the length of stream you are studying. Since water velocity varies at different depths, (surface water moves more quickly than subsurface water because water moving against rough bottom surfaces is slowed down by friction) velocity must be corrected slightly using a correction factor to adjust your measurement to account for the effect of friction. The actual equation used to determine flow is this:

Flow=Area x Corrected Velocity

### *Measuring Streamflow*

A video demonstration of stream flow monitoring can be found here:
https://www.youtube.com/watch?v=uXvkeHjE_0g

1. At your monitoring site, locate a straight section of stream that is at least 20 feet in length and has a uniform width. The water should be at least 6 inches deep and have some movement. Unobstructed *runs* or riffles are ideal sites to choose.




2. Measure 20 feet along the length of your chosen stream segment with your measuring tape and mark both the up and downstream ends of the section with flagging.
3. Working with a partner, measure stream width (wetted edge to wetted edge) by extending a measuring tape across the stream at the midway point of your marked stream segment. Record the width in feet on your recording form. (A tape measure graduated in tenths of feet will make calculations easier.)
4. Secure the measuring tape to both shores so that the tape is taut and above the surface of the water. You might choose to attach the tape or a length of string to two stakes secured on opposite banks to create a transect line across the stream if it is impractical to secure the tape using shoreline vegetation.
5. Using your yardstick or pre-marked (in tenths of feet) D-frame net pole, measure the water depth (ft) at one-foot intervals across the stream where you measured width (and secured the measuring tape). Be sure to measure depth in tenths of feet, not in inches (See conversion chart from inches to tenths of feet on data recording form). Record depth measurements (ft) on the recording form. If your stream is greater than 20 feet wide, measure depth in 20 equal intervals across the stream.
6. Velocity will be measured by tracking the time it takes a floating object to move the marked 20-foot length of stream. You will time the floating object (in seconds) a total of four times, at different locations across the stream. Repeating your measurements across the stream, in both slower and faster areas, will help to ensure the closest approximation to the stream's true velocity. This in turn will make your flow calculations more accurate. However, be sure your float travels freely downstream (during every float trial) without catching in slack water areas of the

stream. For narrower streams (less than 10 feet), you can conduct only three float trials to assess velocity.

7. Position the person who will release the float upstream from the upper flag. Position the timekeeper on the stream bank (or out of the main flow path) at the downstream flag with the stopwatch. Position the person who will catch the float downstream from the timekeeper (Note: unless velocity is very fast, the timekeeper should be able to catch the float with a net after they have finished timing its run down the stream).
8. The float-releaser will gently drop the float into the stream a few feet upstream from the upper flag and will alert the timekeeper to begin timing as the float passes the upstream flag (the float should have time to get up to speed by the time it passes the upper flag into the marked length of stream). If the float gets stuck on a log, rock or other obstruction, it should be released from the starting point again.
9. The timekeeper should stop the stopwatch as the float passes the downstream flag and retrieve the float using the net.
10. Record the float time for the first trial on the recording form.
11. Repeat steps 7-9 for each of the remaining float time trials in different sections of the stream.
12. Record the float time (seconds) for each trial on the recording form.
13. Select a correction factor for the site. For rough, loose rocks, course gravel or weeds use 0.8. For smooth mud, sand, or bedrock use 0.9.
14. Complete the calculations following the streamflow worksheet.
15. Record the final streamflow calculation in cfs on the back of the lab slip next to “Flow (cfs)”.

Name_____ Date_____ Time_____

Stream Sampled_____ Location_____
(County, Road, Site # if known, Township, Range, Section)

Water Action Volunteers

## 1. SITE LOCATION

Length Assessed: _____ ft.

## 2. STREAM WIDTH & DEPTH

Stream Width: _____ ft.

If stream ≤ 20 ft. wide, measure depth every foot across the width. If stream is > 20 ft. wide, measure depth at 20 equal intervals across the entire width.

| Interval | Depth (ft./in.) | Depth ($10^{ths}$ ft.) | Interval | Depth (ft./in.) | Depth ($10^{ths}$ ft.) |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 11 | | |
| 2 | | | 12 | | |
| 3 | | | 13 | | |
| 4 | | | 14 | | |
| 5 | | | 15 | | |
| 6 | | | 16 | | |
| 7 | | | 17 | | |
| 8 | | | 18 | | |
| 9 | | | 19 | | |
| 10 | | | 20 | | |
| | sum _____ ft. | | | | sum _____ ft. |

Add together

Total Sum of depths: _____ ft.

_____ ft. (sum of depths) ÷ _____ (# of intervals) = _____ ft. (Average Depth)

Compute Ave. Cross-Sectional Area:

_____ ft. (average depth) x _____ ft. (width) = _____ $ft^2$ (Cross-Sectional Area)

## 3. VELOCITY MEASUREMENT

| Float Trials | Time (seconds) |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| sum | |

sum ÷ _____ (# of trials) = _____ sec. (Average Float Time)

_____ ft. (length assessed) ÷ _____ sec. (ave. float time) = _____ ft./sec. (Ave. Surface Velocity)

## 4. CALCULATING STREAM FLOW

Correction value for rough, loose, coarse, weedy bottom: 0.8
Correction value for smooth bottom: 0.9

_____ (correction value) x _____ ft./sec. (ave. surface velocity) = _____ ft./sec. (Corrected Surface Velocity)

_____ $ft^2$ (cross-sectional area) x _____ ft./sec. (corrected surface velocity) = **STREAM FLOW:** _____ cubic feet per sec. (round to the nearest tenth)

## Depth Conversion Chart

| Depth Conversion Chart | | | |
|---|---|---|---|
| Ft/in | $10^{ths}$ Ft | Ft/in | $10^{ths}$ Ft |
| ⅜-⅞ | 0.05 | 6⅜-6⅞ | 0.55 |
| 1-1½ | 0.1 | 7-7⅞ | 0.6 |
| 1⅜-2 | 0.15 | 7½-8 | 0.65 |
| 2⅛-2⅝ | 0.2 | 8⅛-8⅝ | 0.7 |
| 2¾-3¼ | 0.25 | 8¾-9¼ | 0.75 |
| 3⅜-3⅞ | 0.3 | 9⅜-9⅞ | 0.8 |
| 4-4⅜ | 0.35 | 10-10⅜ | 0.85 |
| 4½-5 | 0.4 | 10½-11 | 0.9 |
| 5⅛-5⅝ | 0.45 | 11⅛-11⅝ | 0.95 |
| 5¾-6¼ | 0.5 | 11¾-12 | 1.0 |

# Considerations/ Precautions

To avoid bias, monitoring should be conducted at a sampling location as follows:

- Conduct all monitoring at designated sample sites/locations (see enclosed maps).
- For all water sample collections, avoid disturbing the stream water to be collected. If you will collect the sample by wading in the stream, walk upstream to the sample location and take the sample facing upstream.
- Surface samples tend to have debris and other contaminants in them and should be avoided. To avoid contamination, collect water samples 3 to 6 inches below surface. Always rinse sample bottles three times and fill to its neck the fourth time.
- Avoid touching the rim of the bottle or inside of the cap.
- Collect samples in a portion of the stream with the strongest flow. Straight stretches of the stream are preferred sample locations. If sampling on a curve, collect the sample in the portion with greatest flow at the outside of the bend. Slow flow areas along the banks, in eddies or immediately downstream of islands should be avoided.
- Do not trespass on private lands to collect sample. Use the designated access points or seek permission from the landowner or operator to cross their land for the purpose of collecting the samples. Contact the DNR project coordinator with questions.
- If you are sampling with an extension pole, reaching out from shore to an area of flow with some movement (not necessarily the strongest flow) is acceptable. Your safety is important!
- Do not collect the water sample immediately downstream of a wastewater or storm sewer outfall pipe.
- Ensure the water sample is representative of the upstream conditions. Stream reaches with major springs or major sediment deposits, such as former millpond beds, may create much localized conditions that aren't reflective of the upstream conditions and should be avoided. Also avoid reaches immediately downstream of where cattle are in the stream.
- Ensure the water sample is collected in an area with thorough mixing of stream water. Stream reaches immediately downstream from tributaries or major springs may not have complete mixing and should be avoided.

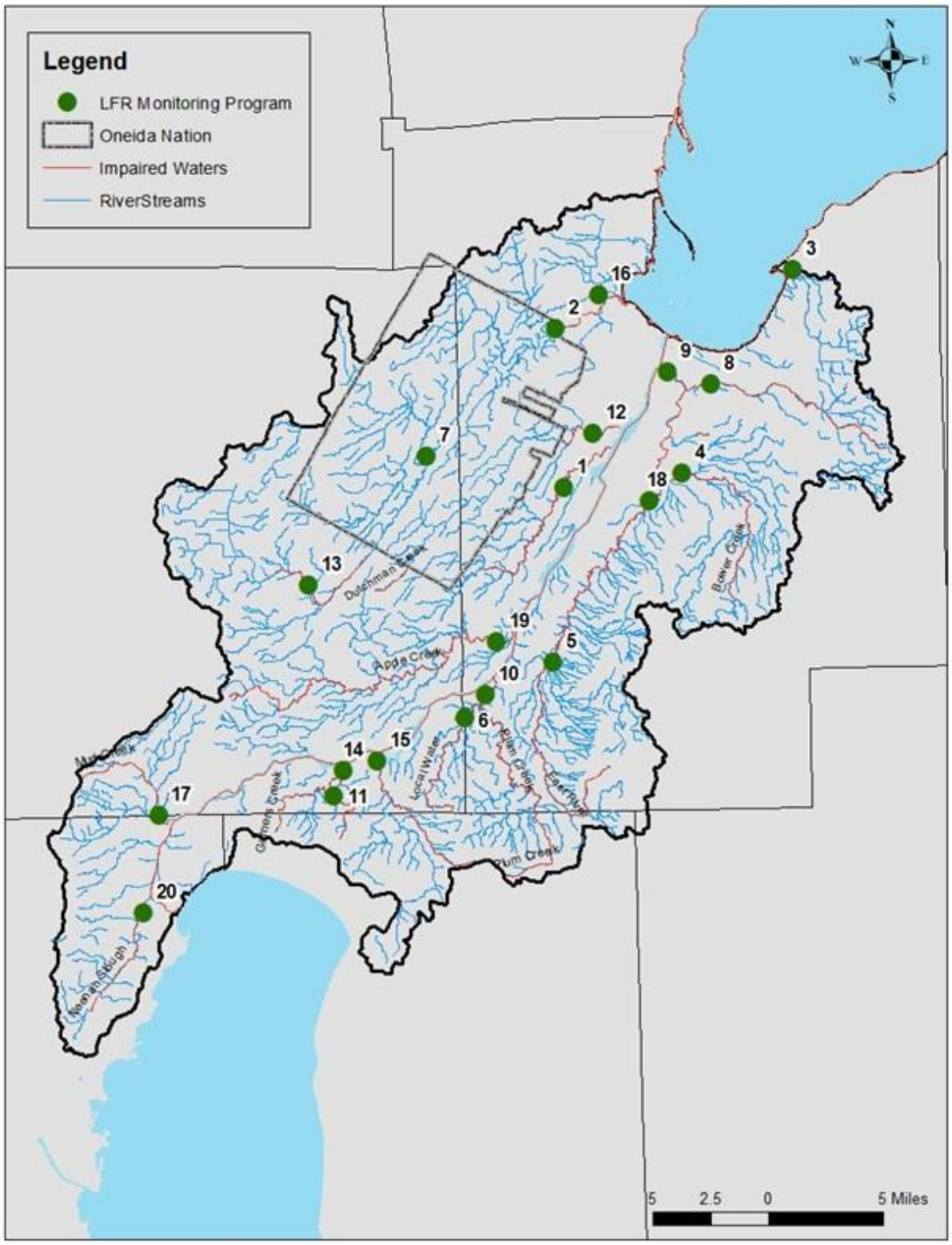
# Safety

Safety precautions of a general nature should be recognized. Sampling should be done from shore whenever possible using an extension pole sampler to aid in water collection. Collecting samples in extremely hot and humid weather carries the risk of dehydration and heat stroke. Never sample during electrical storms or high wind events. Preserving nutrient samples requires the use of small amounts of acid, caution should be used to avoid contact with skin or eyes when acidifying the sample; always wear protective gloves and eye protection. A first aid kit should always be carried for general safety considerations.

When monitoring streamflow, you will need to enter the stream channel to make width and depth measurements and to calculate velocity. Be aware of stream velocity, water depth, and bottom conditions at your stream-monitoring site. Do not attempt to measure streamflow if water velocity appears to be fast enough to knock you down when you are working in the stream. If you are unsure of water depth across the width of the stream, be sure to proceed with caution as you move across the stream, or choose an alternate point from which to measure streamflow. If you are not comfortable with the stream conditions do not measure the flow. **Your safety is important!**

# Acronyms

- DRP – Dissolved Reactive Phosphorus
- QA/QC – Quality Assurance/Quality Control
- SWIMS – Surface Water Integrated Monitoring System
- TMDL – Total Maximum Daily Load
- TN- Total Nitrogen
- TP – Total Phosphorus
- TSS – Total Suspended Solids
- WAV – Water Action Volunteers
- WDNR – Wisconsin Department of Natural Resources
- WisCALM – Wisconsin Consolidated Assessment and Listing Methodology
- WSLH- Wisconsin State Laboratory of Hygiene


Legend
LFR Monitoring Program
Oneida Nation
Impaired Waters
RiverStreams
N
W
E
S
3
16
2
9
8
12
7
4
1
18
13
19
5
10
6
14
15
11
17
20
Dutchman Creek
Apple Creek
Bower Creek
Plum Creek
East Plum
Local Water
Duck Creek
Newman Slough
5
2.5
0
5 Miles

| | Stream Name | SWIMS Station Name | SWIMS ID | Latitude | Longitude |
|---|---|---|---|---|---|
| **1** | Ashwaubenon Creek | Ashwaubenon Creek at Grant Street | 10016502 | 44.44508 | -88.09875 |
| **2** | Lower Duck Creek | Duck Creek at Pamperin Park | 10038644 | 44.54773 | -88.10285 |
| **3** | Wequiock Creek | Wequiock Creek at Nicolet Rd/CTH A | 10010769 | 44.57651 | -87.89083 |
| **4** | Bower Creek | Bower Creek (1) 50m Upstream of CTH GV | 10009445 | 44.45179 | -87.99543 |
| **5** | Upper East River | East River at Mallard Rd | 53508 | 44.33542 | -88.11198 |
| **6** | West Plum Creek | West Plum Creek Downstream of County Line Rd | 10016494 | 44.30296 | -88.18901 |
| **7** | Mid Duck Creek | Duck Creek at Seminary Rd | 453255 | 44.46608 | -88.21892 |
| **8** | Baird Creek | Baird Creek at Preble WI | 53683 | 44.50741 | -87.96754 |
| **9** | East River | East River at Harold Lewis Trail off Main Street | 10043279 | 44.51633 | -88.00587 |
| **10** | Plum Creek | Plum Creek at VandeHey Farm Crossing | 10046999 | 44.31540 | -88.17154 |
| **11** | Tributary to Garner's Creek | Trib. to Garner's Creek at CTH CE | 10047157 | 44.25392 | -88.30658 |
| **12** | Dutchman Creek | Dutchman Creek at Oneida Street | 10015851 | 44.47859 | -88.0723 |
| **13** | Upper Duck Creek | Duck Creek at CTH S | 10029975 | 44.38665 | -88.32509 |
| **14** | Garner's Creek | Garner's Creek Downstream of CTH Z | 10043028 | 44.2701 | -88.29816 |
| **15** | Kankapot Creek | Kankapot Creek at CTH Z Dodge St 100 Ft upstream of Bridge | 453261 | 44.27504 | -88.26778 |
| **16** | Lancaster Creek | Unnamed Trib. (410000) at Lakeview Dr | 10034510 | 44.56583 | -88.06471 |
| **17** | Mud Creek | Mud Creek at CTH BB | 453258 | 44.24417 | -88.46037 |
| **18** | East River | East River at CTH G | 53675 | 44.43550 | -88.02457 |
| **19** | Apple Creek | Apple Creek at Rosin Rd | 53684 | 44.34861 | -88.16119 |
| **20** | Neenah Slough | Neenah Slough #2 (100ft S of Adams St) | 10032175 | 44.18274 | -88.47481 |