Volunteer Stream Monitoring Program Level 2 Contact:

For all program, logistics, equipment repair and misc. questions, contact:

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Additional program materials and information can be found at:

http://watermonitoring.uwex.edu/level2/stream.html
Project Background

Wisconsin Department of Natural Resources’ (WDNR) Biologists monitor streams on a regular basis for a variety of parameters including dissolved oxygen, air and water temperature, pH, and transparency. Your participation in the Volunteer Stream Monitoring program’s Level 2 monitoring will provide valuable data to the DNR to supplement monitoring being conducted by WDNR staff at other monitoring sites or in other streams.

What is the importance of Level 2 stream monitoring?

Water quality and habitat assessment are high priority activities that the WDNR undertakes to document and monitor the status and trends of water resources of the state. Accomplishing this objective is an enormous task because of the magnitude of the state’s water resources, limited number of staff number and financial resources. Volunteer monitors can assist this effort by providing not only valuable data about waters of Wisconsin, but also provide an essential role in helping to protect Wisconsin’s natural resources as advocates for streams.

Volunteers use WDNR methods and WDNR equipment to monitor streams around the state. Level 2 stream monitoring began in 2006, and ever since then has provided one significant way for citizens to take an active role in collecting water quality data in partnership with the WDNR. If you carefully follow the methods and quality assurance procedures, your data are considered to be high quality. In fact, as a Level 2 citizen monitor, you are asked to enter your data directly to the WDNR’s database.

During 2010, Level 2 citizen monitors collected data at 216 monitoring sites throughout Wisconsin. Since the program’s inception in 2006, citizens have monitored at 436 sites in the Level 2 program.
Volunteer Monitor Responsibilities

Volunteers who are new participants of the program must:

- Attend a scheduled training session, which will have both field and classroom components.
- Collect dissolved oxygen, air and water temperature, pH and transparency at least monthly from May – September.
- Adhere to a predetermined monitoring schedule.
- Record data results in the WDNR database following each monitoring visit.

Volunteer Qualifications

- Must have one season of monitoring experience (e.g. with Water Action Volunteers).
- No science background is needed, training will be provided to those who are interested and able to meet the defined responsibilities.
- Ability to walk along river banks and enter the water to access a monitoring site.
- Enjoyment of the outdoors.

Sampling Plan

- WDNR liaisons will recommend sites that could be useful to have monitored based on needs to acquire status or trends information, or other types of monitoring that is priority.
- We ask that you monitor at least from May through September. Early morning monitoring is best to assess minimum dissolved oxygen levels at a site.
- We request that you choose primary (P) and secondary (S) sampling dates in advance and note on your data sheets on which of those dates you monitored. Predetermining sampling dates minimizes the chance that monitoring only occurs on lovely, sunny days. We are aiming to have you collect information on days with any type of weather with the following exceptions:
  - The only reasons we ask you not to sample on a primary date is due to safety concerns about being at the stream site (e.g., tornado, lightning, dangerously high flows), or a true family emergency (a Hex hatch doesn’t count!).
  - The goal is to monitor at the same time each month, preferably 30 days apart from the last monitoring visit.
Please enter your data by the end of each month.

The Program Coordinator is responsible for answering questions you have about entering data into the database. WDNR staff liaisons should direct questions they are unable to answer to the Program Coordinator.

All data must be entered into the database by October 1, each monitoring season.

All volunteers must turn in their equipment at the end of each season. (Some equipment is available for further use once data has been downloaded and equipment has received any necessary maintenance. Please inquire with the Program Coordinator.)

Creating a Monitoring Team

Monitoring in “teams” can make tasks easier and more enjoyable. Some things citizen monitors will want to keep in mind when forming a “team” of people to complete monitoring:

- Each member of the team must fill out a Volunteer Liability Waiver and return it to the Program Coordinator. This also helps us track how many volunteers are involved in the program. Not everyone on a team needs to register with SWIMS. One person can be in charge of data entry.
- The larger your team, the more sites you can monitor. Please remember to be realistic about the time commitment.
- Having several people on your team helps ensure that you are able to stick to your scheduled monitoring dates.
- Monitoring with a team can easily turn into a social event. Experienced volunteers have found all sorts of ways to couple monitoring with fishing, brewing beer, paddling, or other such fun.

Choosing Monitoring Sites

You are free to choose stream sites you or your group wishes to monitor. While this situation places no requirements on the location of your monitoring, we ask that you consider any requests made by WDNR biologists, county staff, or other agency staff persons. Sites should be monitored for 3-5 years minimum, as the goal of the Level 2 Program is to collect status and trends data, and thus an extended period of monitoring is required.
Data collected at all locations are important. There are two ways to look at selecting monitoring sites. First, your data may very well be more useful to the WDNR and/or other agencies when taking into account the recommendations of natural resource managers. Second, your monitoring might be more valuable to you if you or your group has a good idea how you would like to use the data.

Where agency staff persons might choose to place you depends on both short-term and long-term monitoring goals. Sometimes, long-term (8-10 years) data collecting at set locations will be most useful to the ongoing work, and in other cases, changing your monitoring locations to complement short-term (1-3 years) studies may be most useful to ongoing work.

For every new monitoring station, you will be asked to provide the geographic information necessary to allow the Data Manager to create a new monitoring station ID in the SWIMS database. To request a monitoring station after the training session, please see the Registering New Sites section on page 29 of this manual.

**Scheduling Monitoring Events**

WDNR methods dictate that status and trends monitoring are completed at consistent intervals. This type of monitoring places an emphasis on consistency, rather than monitoring only when it’s convenient for the volunteer. Therefore, we ask that you monitor on a regular, predetermined schedule. Guidelines for scheduling monitoring events include:

- Monitor at least once monthly from May through September.
- Try to schedule monitoring events in the morning to when stream’s oxygen levels are at their lowest. This provides biologist with a ‘worst case scenario’. If you are unable to monitor in the morning, no problem. Consist time is more important.
- Space monitoring dates apart by roughly 30 days. For instance, plan to monitor on the second Tuesday of each month or on the 22nd of each month.
- Schedule a Primary (P on the data sheet) date and a Safety (S on the data sheet) date for each month. Monitor on your Safety date only if either an electrical storm or flooding keep you from monitoring on your Primary date. Safety dates are also predetermined dates and are typically scheduled a couple of days or one full week after your Primary
date. If you are unable to monitor on your Primary or Safety date, then monitor when possible and record Other (O) on your data sheet.

Data Summary Reports
The WDNR makes data reports available to all Level 2 citizen monitors. You can obtain station and/or regional data summary reports or continuous temperature graphs for a site from the SWIMS database by following directions posted at:
http://watermonitoring.uwex.edu/level2/swims.html

Your Role in Ensuring Quality Data
The data are only as good as the care we all take in collecting and recording the data. We cannot stress enough just how important it is to take the proper steps in monitoring and entering data into the database. What do you need to do to help out with Quality Assurance and Quality Control?

1. Instrument Calibration
   Each month you monitor, please follow the instructions for calibrating the meters, step by step. This includes completely filling out the Calibration Logs each time you calibrate the meters. Good record keeping assures us that the meters are well maintained and functioning properly.

2. Address Abnormal Results
   If a measurement is outside the expected range, please repeat the measurement. If it’s still outside the expected range, please recalibrate and repeat the measurement. If you are finding an abnormally low or high value, then call the program coordinator as soon as possible.

3. Side-by-Side Sampling
   Each year, the program coordinator visits with many citizen monitors in the field. During this visit, the program coordinator will sample using his or her own equipment, side-by-side with the volunteer. We do this to check equipment function and protocol consistency. The program coordinator keeps yearly records on the results of the side-by-side sampling.
4. **Recording your Data**

Be sure to complete all entries on your field data sheet and add any comments that may assist others in understanding your data. Make sure to return all data sheets and calibration logs to the program or local coordinator at the end of the season.

5. **Entering your Data**

Follow the instructions for entering data into the database, and pay close attention to the numbers you are entering and the placement of those decimal points. It’s that simple.

6. **Review your Data**

Check to make sure that you entered the data correctly. To do so, take a look at the instructions for entering data into the database, and follow how to view your entered data.

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**Preventing the Spread of Aquatic Invasive Species**

Since Volunteer Stream Monitoring equipment kits are often shared between multiple stream sampling sites it is important to do what we can to prevent spreading of Aquatic Invasive Species from one stream to the next. Besides the well known invasive plant species we are also concerned about spreading Viral Hemorrhagic Septicemia, known more commonly as VHS. VHS has been found in the Lake Winnebago System and Lake Michigan. VHS is a fish disease that is not harmful to people. However, VHS can kill or injure many types of game fish, such as muskies, walleye, trout, bluegill, smallmouth bass, and northern pike. It is unknown how the virus entered Wisconsin’s waters, but moving fish or water from one water body to another can spread the disease.

Ways you can help prevent the spread of AIS:

**Rinse your equipment**

You should already be rinsing your meter probes with DI water after each use. After each sampling site, before moving to the next stream, you should also rinse buckets, transparency tubes, and your boots/waders with clean water (no need for distilled water, tap water is fine). You can also carry separate buckets, bottles for collecting water at each site.

**Dry your equipment**

This method will work for some volunteers who only monitor one site per day. Transparency tubes, buckets, and boots/waders should initially dry and then remain dry for 5 consecutive days.

**Disinfect your equipment**

Alternatively, volunteers who monitor multiple water bodies on the same day can disinfect their transparency tube, buckets, and boots/waders with vinegar or a bleach solution (1 Tablespoon bleach in one gallon of water). The bleach/vinegar must remain on the surface for 10 minutes to be effective. Applying with a misting spray bottle works well. Rinse surfaces after 10 minutes.

**Note: pH and DO probes should NOT be bleach cleaned or dried out.** This will affect the proper function of the probes. Rinsing with DI water thoroughly is fine.
YSI Model 550a Dissolved Oxygen Meter Calibration

Calibrate the meter before you go to the field and leave it on until done for the day.

Do not let sponge inside the probe chamber dry out! Keep sponge moist by re-wetting at least bi-weekly. If the sensor membrane becomes damaged, you will need to replace it and wait 12 hours before calibrating and using the monitor.

1. Turn on the meter and allow 15 minutes of warm up time before calibration.
2. Verify the good condition of the sensor membrane.
   a. Check that the sponge inside the probe chamber is still moist.
   b. Shake or blow off excess water on the sensor.
   c. Check for holes or tears in the membrane.
   d. Check for air bubbles beneath the membrane.
   e. Replace the solution and membrane if air bubbles or damage exist.
   f. If you need to replace the membrane, ensure that membrane housing has been filled with KCl fluid for at least 12 hours before calibration and first use.
3. Insert the sensor into the probe chamber.
4. Record date, time, name of analyst calibrating the monitor, and the altitude (ft) where calibrating.
5. Record the number of minutes of warm up time.
6. Record the stabilized probe temperature (°C).
7. Press the MODE button to change from % saturation to (mg/L).
8. Record the stabilized pre-calibration D.O. (mg/L).
9. Press and release both the UP ARROW and DOWN ARROW keys at the same time to enter the calibration menu. The meter will say CAL on the screen in large letters and CAL in small letters in the lower left corner. The small CAL letters will stay on the screen until the calibration process is done.
10. Press ENTER on the meter. This will show a value for altitude (x100) in feet.
11. Adjust the altitude with the up and down arrow buttons for the elevation where the calibration is taking place and press ENTER. The % saturation value is now showing on the meter display.
12. Allow the % saturation value to stabilize.
13. Press ENTER. The salinity of the water samples is now on the screen.
14. Press ENTER again to accept 0 (the salinity of fresh water). The calibrated % saturation value is now on the screen and the small CAL is no longer visible in the lower left corner.

15. Press the MODE key to switch to (mg/L). (This key is used to toggle between mg/L and % saturation.)

16. Record the post-calibration D.O. (mg/L).

17. Look up the calibration chart D.O. value (mg/L) from the table included with your meter. Find the probe temperature and altitude and record the corresponding D.O. (mg/L) value as the calibration chart D.O. on the calibration log. If the difference between the post-calibration D.O. and the calibration chart D.O. is greater than 0.3 (mg/L), re-calibrate the meter before using in the field.

   Leave meter on until last reading of the day is completed.

18. Press the green button to turn the meter off at the end of the day.

Note: If you notice your meter is not calibrating properly, check for bubbles or tears in the membrane and replace if necessary. If replacing the membrane does not work, try cleaning the probe by following instructions in the instrument’s manual (located in the pocket of your meter case) or contact the program coordinator for directions.
## Dissolved Oxygen Saturation (mg/L) Based on Elevation or Ambient Barometric Pressure (Station Pressure)

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<thead>
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<th>Temp.</th>
<th>Elevation Feet Above Sea Level</th>
<th>Elevation Barometric Pressure (in mm Hg)</th>
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<tr>
<td></td>
<td>0</td>
<td>1000</td>
</tr>
<tr>
<td>C</td>
<td>F</td>
<td>Press: 706.5</td>
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<tr>
<td>0</td>
<td>-200</td>
<td>709.1</td>
</tr>
<tr>
<td>1</td>
<td>32.0</td>
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**Dissolved Oxygen Saturation (mg/L) Based on Elevation or Ambient Barometric Pressure (Station Pressure)**

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<tr>
<th>Temp.</th>
<th>Elevation Feet Above Sea Level / Equivalent Un-corrected Barometric Pressure mm Hg</th>
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<td>Press: 706.5 709.1 711.8 714.5 717.1 719.8 722.5 725.1 727.8 730.5 733.1 735.8 738.5 741.1 743.8 746.5 749.1 751.8 754.5 757.1 760 765.1</td>
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<td>35</td>
<td>95.0</td>
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</tbody>
</table>

* Dissolved oxygen saturation at 760 mm Hg derived from the tables of Benson & Kaus (1980), from C.M. Mortimer 1991. The oxygen content of air-saturated fresh waters over ranges of temperature and atmospheric pressure of limnological interest. Mitt. Int. Ver. Limnol. No. 22. Stuttgart, Germany

1 Dissolved oxygen saturation values based on elevation due not account for true station pressure. For more accurate dissolved oxygen saturation values use un-corrected pressure measurements.

Uncorrected barometric pressure values = National Weather Service Barometric Pressure in mm Hg x (Equivalent elevation pressure / 760)

Source: J. Sullivan, WDNR-La Crosse, March 2006
YSI Model 550a Dissolved Oxygen Meter Measurement

To Measure Dissolved Oxygen in the Stream:

1. Enter the stream, approaching the site you will monitor from downstream.
2. Insert the probe into the water to be measured.
3. Continuously stir or move the probe through the water (especially when monitoring in very still water).
4. Allow the temperature and dissolved oxygen readings to stabilize (about 2-3 minutes).
5. Observe and record temperature and dissolved oxygen values on the monitoring data sheet.
6. Press MODE and observe and record the % saturation on the monitoring data sheet.
7. Rinse the probe with distilled water after each use, and replace in the probe chamber.
8. Be sure to always keep the probe sponge moist by soaking with distilled water.
Oakton Acorn pH Meter Calibration Procedure

1. Connect pH and temperature probes to the meter and ensure the pH probe connector snaps into place.
2. Turn the meter on.
3. Use provided pH 7 and pH 10 buffer solutions to calibrate the meter.
4. Record the date, time, person doing calibration, and the pH 7 buffer standard value on the log sheet.
5. Remove electrode from container with storage solution.
6. Rinse electrode with distilled water and shake excess water off electrode.
7. Press CAL button on the meter to start the calibration process.
8. Place electrode and temperature sensor into the lower pH buffer solution and submerge the glass bulb completely.
9. Wait for reading to stabilize and record the Stabilized pH on the calibration log sheet.
10. Press the ENTER key once and record the Calibrated pH value.
11. Check that the Calibrated Value is within 0.2 of the pH buffer standard. If the value is more than 0.2 higher or lower than its pH buffer value, recalibrate the meter. Record new results on the next line of the Calibration Log.
12. Remove electrode from pH 7 buffer solution, rinse with distilled water and shake off excess water.
13. Repeat steps 7 through 12 for the pH 10 buffer solution.
14. Replace pH probe in storage solution, turn meter off, and head out to the field.

Note: If you notice your meter is not calibrating properly, try cleaning the probe by following instructions in the instrument’s manual (located in the pocket of your meter case) or contact the program coordinator for directions.
Oakton Acorn pH Meter Sampling Procedure

1. Wade into stream mid-width.
2. Face upstream and dip plastic sample bottle into stream with the mouth facing downward.
3. Submerge the bottle 12 inches or halfway between the surface and stream bottom.
4. Fill bottle by turning bottle (while underwater) so that its mouth faces up.
5. Rinse and dump water from sample bottle downstream.
6. Repeat steps 2-4.
7. Transport sample bottle back to shore or vehicle.
8. Connect any electrodes to pH meter and turn meter on.
9. Remove electrode from container with storage solution.
10. Rinse electrode with distilled water and shake off excess water.
11. Place pH and temperature probes into sample bottle and gently stir the probes.
12. Wait 2-3 minutes for pH reading to stabilize.
13. Record the pH reading on the log sheet. Do not record the temperature reading from the pH meter since it is not the actual stream temperature.
14. Rinse electrode with distilled water and shake off excess water.
15. Place electrode back in container with storage solution.
16. Disconnect electrodes and turn the meter off to store.

Note: Store pH probe in pH storage solution only. Never use distilled water. If you are out of solution, contact the program coordinator.
Transparency Monitoring Procedure

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. Never wear sunglasses when you take this reading.

In Stream
- Walk into the water downstream from the sampling location. Be careful not to stir up the bottom sediment upstream of your sampling location.
- Face upstream (into the current) in the middle of the stream or in a well-mixed area offshore.
- Collect your water sample by plunging your bucket or tube 8-12 inches beneath the surface or halfway down from the surface. Scoop away from your body and into the current.
- 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.

Reading the Transparency Tube
1. Remove large objects from the water sample. (Filter through nylon stocking if necessary.)
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 1).
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 (e.g., 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 2). Have them stop letting water out immediately when you can just see the contrast between black and white on the disc.
6. Read the level of water in the tube in cm using the measuring tape on the side of the tube.
7. Record the measurement on your data sheet in cm.
8. Dump contents of tube on ground.
9. Collect a new sample then repeat steps 1 through 8.
10. Record the second measurement in cm on your data sheet.

Figure 1: Transparency tube shaded by observer.

Figure 2: Slowly releasing water until the disk is just visible.
Stream Water Level Assessment

Tips for assessing if water level is high, normal or low

This is something that you will feel more comfortable with assessing the more you visit your stream site. Some things to look for when you first visit your site to help you make the assessment are:

- Look to see if terrestrial vegetation along banks is submerged. The terrestrial vegetation will end at the normal high water mark.
- Look for water stains on rocks or bridge abutments. Water will stain rocks if it flows over or by them for an extended period of time. If you see stains above the level of water in the stream during you visit, the level is likely low.

This diagram shows a cross section of a typical streambank, demarcating the upper and lower banks.
Continuous Temperature Monitoring Procedure
(Revised for VSM from Wisconsin DNR Apr 2010 Standard Operating Procedures)

Temperature has an important influence on pH, density, specific conductance, the rate of chemical reactions, and solubility of constituents in water. Also, the biological activity and species composition of a water body is largely determined by water temperature.

Thermistors (continuous temperature monitoring devices) will be deployed in May and collected in September at a minimum. Thermistors will be launched by the program coordinator and distributed to volunteer monitors to be placed in streams. The thermistors will be set to record temperature at one hour intervals to assess thermal extremes and to determine if a stream should be classified as cold, cool, or warm. Volunteers should check thermistors at least monthly to ensure they are in place and submerged. At the end of the monitoring season, volunteers will retrieve the thermistors and return them to the program coordinator for data retrieval. One thermistor is available for each Level 2 sampling site. If your group is interested in placing thermistors at additional locations contact the program coordinator to see if extra thermistors are available. Collecting continuous water temperature data on all sizes and types of streams – small, medium, and large; warm, cool and cold; and across the range of stream classifications - is useful.

Thermistor Logs
Once launched, the thermistors constantly log data. When the data are downloaded we need to delete all readings when the thermistor was not in the water (pre and post deployment, as well as any low water events that left the thermistor suspended above the water). The Thermistor Logs are extraordinarily helpful for determining what data to cut out. Thank you for taking the time to fill them out throughout the season!

Attempt to place the thermistor in an area that will be submerged, well-mixed, and free of sedimentation during the period of deployment. If the thermistor gets buried by sediment or vegetation it will not be exposed to the true water temperature, and may not sense changes in temperature as quickly. A riffle or run is preferred to a pool. Seek shade so as to minimize any radiant heat from the sun. A deep run or riffle in the sun would be acceptable. Be sure to
consider the safety of others using the stream and try your best to pound rebar stakes in where it is unlikely people will run into them.

**Deploying your Thermistor in the Stream**

When deploying your thermistor remember the two main goals are to 1) keep the thermistor submerged for the whole season and 2) to avoid the thermistor from getting buried by sediment or debris. A very important third goal though is to secure it well so that the thermistor is not lost (keep in mind the flow of your stream can increase drastically after heavy rain events). Connect the thermistor to the rebar or railroad plate with zip ties. We recommend using two zip ties, or one zip tie and some wire, in case one of the zip ties fails. A zip tie around the rebar above the thermistor can also help the thermistor from sliding off the end of the rebar. Alternatively you can weld something to the top of the rebar or bend the top of the rebar 90 degrees. Pound the rebar into the stream bed with a sledge type hammer. Angling the rebar with the flow of the water may help keep it clear of debris. Make sure the thermistor is a few inches above the stream bottom. If you are using a railroad plate simply wedge the plate into the stream bottom. To avoid someone pulling up your thermistor keep the rebar below water level. Undercut banks work great to keep the rebar out of the way of stream users and protect it from getting washed away. The stream type and size may determine which deployment method is most likely to keep the thermistor submerged and free of sediment during the deployment period. Many people have developed their own solution for their particular stream. Ask other volunteers in your area for advice. Every year we do loose some, but thermistors cost over $100 so please try to do what you can to make sure they do not get lost.
Check to see if the light is blinking (you may need to shield the device to see it if the light is faint). If your device is not blinking it may not be logging data. Contact program coordinator before deploying if this is the case.

Take an accurate GPS reading or make detailed notes about where you place the thermistor in the stream (so you can find it again). Record this information, along with the device serial number, date, and time you placed the thermistor in the stream on your Thermistor Log.

**During the Season**

Check the thermistors each month and note the dates of your checks on the Thermistor Log. Check thermistor is not covered by sediment or vegetation and that it is still under the water. If you can see the device without pulling up the rebar check if it is still blinking. If you can’t see well enough to determine this that is ok. If possible, check that thermistors are secure before anticipated high water events.

**Retrieving your Thermistor in the Fall**

At the end of the monitoring season, pull up the rebar or railroad plate to which the thermistor is attached. Note the date and time that the thermistor came out of the water on your Thermistor Log. This is important since the thermistor will continue to log data even after it is out of the stream, however we don’t want the temperature of your car and house to be included in the final data set that is uploaded to SWIMS. You can clean the thermistor with an old soft toothbrush or cloth, being careful not to damage the optics. Program owned thermistors should be returned to the program coordinator for data downloading. The program coordinator will also upload the processed data into SWIMS. Groups that own their own thermistors and software can download the data themselves and send the raw files via email to the program coordinator.

Rebar and railroad plates do not need to be returned each winter. If able, please store them for next year. If you will not be placing thermistors next year contact the program coordinator to see if someone else in your area can use them.
Viewing your Thermistor Data

Once uploaded, you can view your thermistor data in SWIMS. Visit this website to find step by step instructions for how to do this:

http://watermonitoring.uwex.edu/level2/swims.html

Your continuous temperature data can be used for the following:

☑️ Document baseline water temperatures.
☑️ Determine a stream's temperature category - cold, cool, or warm water.
☑️ Aid in documenting and determining the effects of thermal discharges on aquatic biota.
☑️ Aid in location of groundwater influence to streams.
☑️ Document point source and nonpoint source storm-water effects on streams.
☑️ Document thermal impacts of structural dams and beaver dams to cold water streams.
☑️ Distinguish brown trout streams from potential native brook trout streams.
☑️ Document changes in stream temperatures after installation of agricultural and urban best management practices.
☑️ Aid in development of a model using landscape factors to predict stream temperatures.

Temperature ranges for cold, cool and warm water streams as per John Lyons, WDNR research scientist:

Cold = maximum summer daily mean temperature <22 C (<72 F)
Cool = maximum summer daily mean temperature 22 to 25 C (72 to 77 F)
Warm = maximum summer daily mean temperature >25 C (>77 F)