Hennepin County

River Watch

Educator Guide

The River Watch educator guide is intended to help teachers and group leaders learn more about the program before bringing their class our group out into the field. The educator guide includes information and tips on preparing to go out in the field, collecting and monitoring at the stream site, identifying in the lab and discussing the results with youth participants.

Hennepin

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Frequently asked questions

What is River Watch?

River Watch is a hands-on biological water quality monitoring program for youth in Hennepin County. Every spring and fall, classes or groups of youth venture into Hennepin County streams with waders securely fastened and dip-nets in hand to collect aquatic macroinvertebrates, or bottom-dwelling, spineless organisms such as mayflies, stoneflies, snails and beetles. Collecting, identifying and quantifying the stream's biological community allows youth to assess the health of the stream because macroinvetebrates are impacted by the physical and chemical properties of water. River Watch is an eye-opening experience for all participants, and the resulting data helps us to understand the water quality of our local streams.

Why biological monitoring?

Biological monitoring measures the effects of many factors that influence the organisms that live in a stream. Macroinvertebrates cannot move to escape poor water quality, and some macroinvertebrates spend years maturing in the stream. Thus, the size and diversity of their population reflect all stream conditions that occur during their life cycles, such as water chemistry, habitat characteristics, pollution concentrations, and changes in water flow or velocity. Certain species are intolerant of pollution and won't be present in streams with degraded water quality or habitat. Biological monitoring adds a significant component to the overall assessment of stream health, and many participants find it more engaging.

Aquatic macroinvertebrates are good indicators of stream quality because:

- They are affected by the physical, chemical, and biological conditions of the stream.
- They can't escape pollution and show the effects of short- and long term pollution events.
- They may show the cumulative impacts of pollution.
- They may show the impacts from habitat loss not detected by traditional water quality assessments.
- They are a critical part of the stream's food web.
- Some are very intolerant of pollution.
- They are relatively easy to sample and identify.

What does Hennepin County provide?

- All equipment
- In-class assistance with preparation
- Busing costs
- In-field assistance with sample collection
- In-classroom assistance with macroinvertebrate identification
- Data analysis
- Annual reporting
- Connection to local government agencies including watershed management organizations.

What streams are currently monitored?

Nearly 20 stream sites are currently being monitored. These sites are along Basset Creek, the Crow River, Elm Creek, Mattson Brook, Minnehaha Creek, Rush Creek and Shingle Creek. See data for the sites currently being monitored on the interactive map at ***www.hennepin.us/riverwatch***.

Who can be involved?

River Watch can accommodate groups of youth through a school classroom, youth group, church or library group. Youth are typically middle school or high school aged.

Kaleidoscope Charter

Why should I be involved and how does this fit into my class?

River Watch provides an invaluable experiential scientific and environmental education activity. It allows youth to be directly involved in professional monitoring assessments of county streams. River Watch provides a hands-on education opportunity for youth and important data about stream health for the county and its partners.

Educators use the hands-on experience provided through River Watch in a variety of classes to meet many different standards. River Watch has been used in biology and chemistry classes, advanced placement classes, and general science classes, writing, and math. River Watch is applicable in many classes because it incorporates concepts in science, math, ecology and human interaction.

Participating in River Watch

River Watch generally involves four segments:

1. Pre-fieldwork prep and watershed study, which typically takes one class period or about one hour.
2. Collection and monitoring in the field, which typically takes two to three hours.
3. Identification and water quality assessment in the lab, which requires one or two class periods or about one to two hours.
4. Analyzing results and discussing environmental impacts, which typically takes a half hour to an hour.

The minimum group size is five to 10 youth. The recommended number of chaperones is one adult per five youth in grades 6 to 8 and one adult per 10 youth in grades 9 to12.

Educators will work with River Watch staff to select an appropriate site that is as close to their school or group location as possible.

To participate:

- Schedule assistance from River Watch staff for both monitoring in the field and identification in the lab by completing the River Watch registration form at ***www.hennepin.us/riverwatch***.
- Have all participants complete and submit the Hennepin County waiver (available at ***www.hennepin.us/riverwatch***) before heading to the stream site. For individuals under 18, a parent or legal guardian must approve and sign the form. A waiver must be signed regardless of the level of participation.
- Request funding for bus transportation if needed. Hennepin County has funding available to cover the costs of bus transportation to the field site for River Watch. Complete the bus reservation form available at ***www.hennepin.us/riverwatch*** to take advantage of this service.
- See the equipment checklist at ***www.hennepin.us/riverwatch*** to ensure you have all the equipment needed for both in-field monitoring and in-lab identification and assessment. Work with River Watch staff to determine what equipment is provided by Hennepin County and what equipment you need to provide.

West Lutheran High School

Step 1: Pre-fieldwork prep and watershed study

Preparing students is the most important step to take before you go to the stream site. Once you're in the field, time will fly! If students understand their role and the fieldwork goals, things will move efficiently and groups will be effective.

When you're in the field, some participants will be in the stream collecting macroinvertebrates while others will be on the banks sorting through the sample. Additional activities, including habitat assessment and flow assessment, can be conducted depending on your group size. Find data sheet for these activities at ***www.hennepin.us/riverwatch***.

Before going into the field, discuss the following with your class or group:

- What is a watershed: A watershed is an area of land that catches rain, snow, and any other form of precipitation and flows to a common lake, stream, wetland or groundwater source. Watersheds come in all different shapes and sizes. Smaller watersheds drain into larger watersheds, much like a creek drains into a river. Some watersheds cross county, state, and even international borders. The rain water that falls on your house, lawn or driveway runs into a nearby lake, river or stream. This water, like all the surface water in Hennepin County, will eventually flow into the Mississippi River and the Gulf of Mexico. Actions taken to protect or pollute water will impact the quality of lakes, rivers or wetlands downstream.
- The location of your monitoring site, including what watershed it is located in and how your stream connects to larger rivers and other bodies of water. Use the River Watch interactive map (available at ***www.hennepin.us/riverwatch***) to see the location of your monitoring site and historical data collected at that site.
- How monitoring and collection works, including why we do biological monitoring, what youth will be looking for, how to collect macro-invertebrates, what equipment will be used and how to monitor safely.
- How our actions impact water quality and what we can do to protect water. See the *Ten Things You Can Do to Protect Minnesota's Lakes, Rivers and Streams* for ideas and discussion points.

Park Center High School

Step 2: Collection and monitoring in the field

How to monitor

Youth will use nets to collect macroinvetebrates in the stream. Youth should begin downstream and sample walking upstream. They should keep their nets facing upstream so they don't lose their samples as the stream flows through the net.

Youth walking upstream to collect samples.

Macroinvertebrates like to attach to any substrate available. This includes in-stream vegetation, logs, sticks, undercut banks and rocks. Look for all of these habitats within the stream, and use the following tips for sampling in different habitat types.

- Sample vegetated banks by jabbing vigorously with an upward motion, brushing the net against vegetation and roots along the bank. The entire jab motion should occur underwater.
- Sample snags and logs by holding the net with one hand under the section of submerged wood. With the other hand (which should be gloved), rub about 1 square foot of area on the snag or log. Scoop organisms, bark, twigs, or other organic matter into the net.
- Sample aquatic vegetation beds by jabbing vigorously with an upward motion against or through the plant bed. Jabbing vigorously will loosen the vegetation beds.
- Sample a silt/sand/gravel substrate by placing the net with one edge against the stream bottom and pushing it forward about a foot in an upstream direction to dislodge the first few inches of silt, sand, gravel or rocks. To avoid gathering a netful of mud, periodically sweep the mesh bottom of the net back and forth in the water, making sure that water does not run over the top of the net. This will allow fine silt to rinse out of the net.

Have youth empty the contents of their nets into the trays or buckets provided. Once youth have collected enough organisms in the trays or buckets, they will be ready to preserve the sample.

Figure 1a: Collection sample before debris has been removed..

Preserving the sample

1. Look through the material in the bucket and immediately return any fish, amphibians or reptiles to the stream. Then, carefully remove large pieces of debris (leaves, twigs and rocks) from the sample ***(see figure 1a)***.
2. Next, use the forceps, spray bottle and your hands to pick, rub and rinse the leaves, twigs and rocks to remove any attached organisms. Once that the material is clean, discard it back into the stream.
3. Drain the water from the tray or bucket and transfer the organisms to a jar. Pour the contents for the tray or bucket into a net or sieve to drain the water and capture the organisms ***(see figure 1b)***.
4. Fill the jar with alcohol so that all material is submerged. The plastic sample bottle should contain 80 percent alcohol and 20 percent water. Put the lid tightly back onto the jar and gently turn the jar upside down two or three times to distribute the alcohol and remove air bubbles.

Figure 1b: Transferring material from the bucket to the jar.

5. Complete the sampling station ID tag. Be sure to use a pencil, not a pen, because the ink will run in the alcohol. The tag should include the stream name, location (e.g., upstream from a road crossing), date, time, and the names of the members of the collecting crew. Place the ID tag into the sample container, writing side facing out, so that identification can be seen clearly.

FIELD SAFTEY REMINDERS

In order to remain safe while in the stream or at the stream site, keep in mind these important safety reminders:

- Never go in barefoot! Always cover your feet with some type of footwear. Some students have been known to venture into the water without waders. There may be hidden dangers in the streambed that may injure unprotected feet and hands.
- Never go into deep water over the knee. Even apparently slow-moving streams can have a fast, strong undercurrent. Never go into water deeper than what is covered by your waders.
- Wearing life vests is strongly encouraged. In slippery conditions a life vest will help in case of a fall.
- Never monitor alone. Always go in teams of at least two. Two people can keep an eye on each other, keeping them both safe.
- Always watch the weather and never go out into the stream if lightning is nearby.
- If you get stuck in the muck, point your toe into the stream bed and slowly pull your heel out.
- Have a cell phone with you at all times.
- Have a First Aid kit with you at all times.
- Never drink stream water for any reason. There are organisms that thrive in surface water that can make you sick.
- Thoroughly wash your hands after being in the stream.

Step 3: Identification in the lab

After you have collected organisms in the field, youth will work to identify what they collected in order to draw conclusions about the stream's health.

The first step is to count the number of organisms collected. Use the gridded trays provided. One tray will be needed for each work station ***(see figure 1c)***.

1. Rinse your sample by pouring your sample from the jar into a sieve. Rinse well with water.
2. Pour the rinsed sample onto the tray and supplement with ¼ inch of water so the material is floating and not in clumps.
3. Disperse the sample as evenly as possible throughout the tray.
4. Randomly select a numbered square on the tray. Pick that square clean of all invertebrates recording total number of organisms collected from that square. Your goal is to reach 100 organisms for the entire site sample. Each group will contribute to that total.
5. Organize organisms by "sameness" (those that look alike) to help with identification in the next step ***(see figure 1d)***.

Figure 1c: Collected organisms in gridded tray.

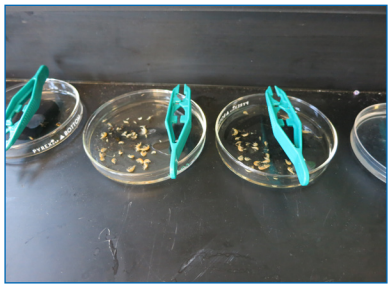


Figure 1d: Organisms separated by "sameness" in petri dishes.

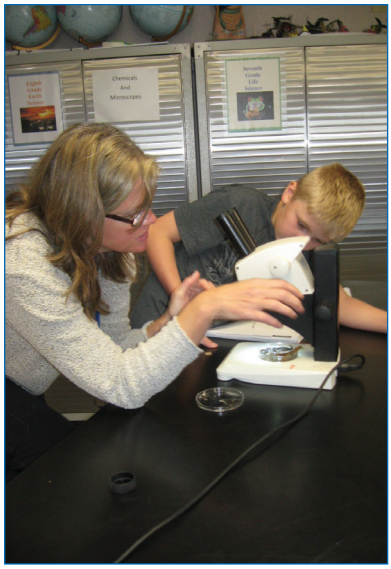
Next, groups will identify the organisms collected.

- Have groups of youth identify the macroinvertebrates that were collected from the stream. Youth should use the University of Minnesota's Volunteer Stream Monitoring Interactive Verification Program, available at ***http://midge.cfans.umn.edu/vsmivp***. Data sheets are available at ***www.hennepin.us/riverwatch***.
- Combine the data from the entire class into the master spreadsheet, available at ***www.hennepin.us/riverwatch***.

Finally, analyze the data you collected to draw conclusions about the stream's water quality.

Student identifying microinvertebrates.

Data analysis



The grading scale used in River Watch is based on the Hilsenhoff Family Biotic Index, which is one of the most common metrics used for data analysis in volunteer monitoring programs. The Hilsenhoff Family Biotic Index measure the overall community of macroinvetebrates and their tolerance to pollution levels.

The index is determined by assigning a pollution tolerance value for each family of macroinvetebrates. The average tolerance for the sample is calculated in the master spreadsheet using the following formula.

Formula:

In this formula:

- n = the number of individuals in each family
- a = the tolerance value of each family
- N = the total number of organisms in the sample

$$\frac{\sum = (n)(a)}{N}$$

Tolerance to pollution is represented on a scale of 0 to 10. Lower values indicate high sensitivity to pollution. We can assume the water quality is good in a stream that can sustain a family of macroinvetebrates that are sensitive to pollution.

Stream grading scale

Family Biotic Index	Water quality
0.00 – 3.75	Excellent
3.76 – 4.25	Very good
4.26 – 5.00	Good
5.01 – 5.75	Fair
5.76 – 6.50	Fairly poor
6.51 – 7.25	Poor
7.26 – 10.00	Very poor

Additional metrics that can be used in biological monitoring include:

- EPT, which stands for Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). These three families include organisms that are the most sensitive to pollution, so higher populations indicate better water quality.
- Number of families, which measures the overall abundance of families or total diversity of family units. The higher the number indicates better ecosystem quality.

Step 4: Discuss results and environmental impact

After you've determined the letter grade for the data collected, compare the grade to past years on the River Watch interactive map, available at ***www.hennepin.us/riverwatch***. Your class or group can also discuss the potential impacts of land use by looking at the land cover section of the map.

Discuss the following questions with youth:

- What do we know about the water quality of our stream site based on the organisms we collected?
- What does the land use map tell us about the area around the stream? What does it tell us about the site?
- What do you think influences the water quality of our stream?
- What actions can we take to protect or improve water quality in our stream? Find ideas for taking action in the "commit to taking action" section below.
- What are the benefits of monitoring the biological communities in surface water?
- Why is it important to know the health of our water?

Commit to taking action

Have your class or group commit to taking action to protect the environment. Ideas for making a commitment include writing down actions and sharing them with parents or peers, creating a piece of art that illustrates the commitments, or developing an action plan that says what action you will take and when.

One action youth could take to protect and improve water quality is keeping grass clippings and leaves out of the street by leaving them on the lawn or bagging them up for compost. Grass clippings and leaves contain phosphorus and other nutrients that feed algae and other aquatic plants. This can cause excess algae growth that can negatively impact other plants and wildlife and can be unsafe for pets. School classes or youth groups could also adopt a neighborhood storm drain and keep it free of leaves, grass clippings and litter. See the *Ten Things You Can Do to Protect Minnesota's Lake, Rivers and Streams* brochure, available at ***www.hennepin.us/residents/environment/protecting-land-water***, for additional ideas.

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