Water Quality Lab
Warner Park Nature Center
Teacher Guide

Objectives for Water Quality Lab

- Make a visual assessment of the Little Harpeth River
- Examine the results of chemical tests on water collected from the river
- Observe and identify macro-invertebrates collected in the stream
- Draw conclusions on the water quality of the Little Harpeth River based on these tests & observations
- Read a watershed map and compare your data to the information on the map

Terminology

Macroinvertebrates	Watershed	Dissolved Oxygen
pH	Phosphates	Nitrates
Turbidity	Riparian	Non-point source pollution

Video length: 21min Total approximate time to complete lab: 60min

Introduction

- Students meet the naturalists and the Little Harpeth River.
- Students are asked to observe the physical conditions of the river while viewing videos of the stream.
- Students fill out the physical survey to the best of their ability.

Data Collection

- Naturalists measure the temperature, ph, phosphate, nitrate, dissolved oxygen, and turbidity of the stream.
- Students record this data on their chemical monitoring data form.
- Students are introduced to the importance of macro-invertebrate surveys and learn to classify the organisms based on their pollution tolerance.
- Naturalists demonstrate how to use kick-nets and paintbrushes to collect organisms from under rocks.
- Close-ups of organisms are shown, both in the river and in containers.
- Students use macro-invertebrate keys to identify the collected organisms. *(Macro-invertebrates shown include damselfly nymph, water penny larva, crayfish, fishfly larva, caddisfly larva, gill-breathing snail, aquatic worm, mayfly nymph, clam. This gives a water quality rating of 21, or good.)*
- Students fill out the macro-invertebrate survey form and conclude the water quality based on the sampling.
- Students are asked to draw conclusions based on the physical, chemical and biological surveys and to answer questions provided. (See questions with information in italics below).
- A naturalist explains how to use a watershed map.
- Students are asked to find the Little Harpeth River and its tributaries on the same map online. https://www.tn.gov/environment/program-areas/wr-water-resources/watershed-stewardship/watersheds-by-basin/cumberland-river-basin---barren-river-watershed/harpeth-river-watershed.html
- Students are asked to determine stream status on the map and reasons for this status. (Note: After students share their findings, you may want to inform them that recent studies performed by TDEC show that E coli is currently impacting the Little Harpeth. TDEC's water quality director suggested it was due to a leaky pump station above the park as well as possible dog poop getting into the stream.)
- Students are asked to compare their results with that of TDEC and explain any differences found.
- Students are asked to find their watershed and think of ways they can contribute to water quality in their local waters.

Data Review

Students are given questions to answer based on the data they have collected, observations they have made, and prior knowledge/experience:

1. How does the riparian zone impact the health of this stream? What negative impacts did you observe? What positive impacts? *An ideal riparian zone provides trees and plants with roots that hold the soil and prevent erosion. Trees also provide shade, which cools the water – cooler water has more dissolved oxygen than warm water. Students will notice the leaves in the river – there are macro-invertebrate specialists that feed on these leaves. We observed the queen snake, which is perfectly colored for this streambed, moving beneath roots, leaves and rocks. Riparian vegetation also filters contaminants, capturing surface runoff before it hits the stream. Soil microbes that thrive in moist riparian zones break down chemical pollutants such as hydrocarbons. A healthy riparian zone also decreased the velocity of floodwaters. Negative impacts would be the opposite: no roots to hold the soil, no canopy to provide cover, etc. Students could observe trees and herbaceous plants along the bank, but also areas where erosion has exposed the roots. The river has a lot of micro-habitats – rocks and leaf piles for macro-organisms to thrive. Students could observe riffles which increases the dissolved oxygen of the stream as well as areas shaded by large trees.*
2. Did you see any evidence of non-point source or point source pollution? Explain your evidence if you did. *The videos did not reveal any sources of point source pollution. Students might ascertain that there is non-source pollution if any of their data concluded water quality was poor or fair. Brown sediments covering algae (shown during the river scenes) reveal there is some sediment in the water.*
3. What effects would a drought or heavy rain have on the chemical results? *A drought would magnify the effect of chemicals in the water, increasing pollution. A heavy rain could wash any negative chemicals downstream quickly. Both situations could impact the survivability of macro-invertebrates – either by increased pollution or getting swept away.*
4. What pollutant does turbidity test for? How do you think this pollutant impacts the health of the stream? *Turbidity measures water clarity, or the presence of sediments in the water. Sediments in water affect the amount of light that aquatic plants receive, which in turn Impacts the animals that depend on those plants. It also interferes with the ability of macroinvertebrates to filter-feed and breathe and can smother fish eggs laid in gravel beds. Sediments are the #1 pollutant in Tennessee streams.*
5. Based on the data collected today, what water quality rating would you give this portion of the Little Harpeth River? *Chemical tests should be mixed. Depending on macro-invertebrate identification abilities of students, their results could fall into either good or excellent.*
6. If your conclusions differed from those of the Harpeth River watershed map, how might you explain the difference? *Since we are testing one specific site of the river, we might not find the same conditions as TDEC, who tests repeatedly in a number of locations. In addition, the park is a protected area with a fairly good riparian zone which provides improved habitat for macro-invertebrates.*
   Consider these questions when answering: How and why might the water quality change as the river moves through our watershed? What are some of the drawbacks of a one-time survey of the river? *The water quality of the river at any given moment will be impacted by its riparian zone and the distance from any point-source pollution. As chemicals move down the stream, they disperse and become less concentrated. A one-time survey has limitations because it cannot take into account the average occurrence of chemical pollutants this section experiences. The macro-invertebrate survey is limited by the ability to find all the organisms present in the stream and then identify them accurately. Repeated surveys would give a better picture.*

Discussion and Conclusion

7. Find the watershed *you* live in using the watershed map. What actions can you personally take to ensure the water quality of your watershed is excellent?

After the students provide answers, you may want to share the ideas below provided to you as a separate document.

- Become familiar with your watershed – its name, its tributaries, its destination. Think in terms of having a watershed address and explain to others why you care about water quality.
- Participate in a creek or river clean-up. Check with Cumberland River Compact for opportunities or initiate a clean-up of your own!
- Bag your dog's poop and put in the trash. People often question this -"no one cleans up coyote or raccoon poop!" - but remind them that dogs are not wild animals – they are pets found in way higher numbers than the environment can sustain.
- If you notice a true water pollution event happening like a spill, illegal dumping, point source issue, etc., contact TDEC at 1-888-891-TDEC (8332).