



ACTIVITY 4

Testing Local Water

FIELD TRIP

4 : TESTING LOCAL WATER

GUIDING QUESTION

How can technology improve people's ability to collect information about the natural world?

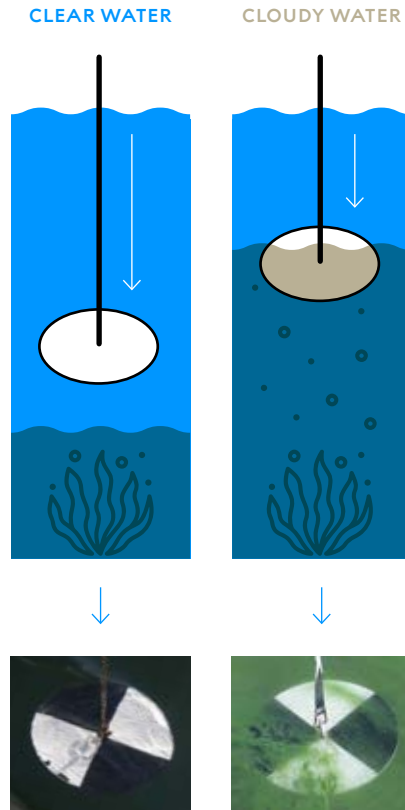
INTRODUCTION

Skipton's residents who had concerns about their water quality observed some cloudiness in their water. However, they could not gather information about the cause of the turbidity based on their senses alone. People cannot directly observe many phenomena—such as chemicals or microscopic parasites—without the use of scientific tools. Technology can enhance the collection and analysis of such observations. Today, data on many water contaminants can be measured in micrograms per liter, or how many 0.000001 grams of the contaminant are in a liter of water. Some water contaminants may not be harmful at such low levels, while others are dangerous even in these tiny amounts. That's why different water contaminants have varying legal limits. In this activity, you will investigate the water quality of a local water body, using your senses and scientific tools, such as the Secchi disk shown in Figure 4.1.

CONCEPTUAL
TOOLS



FIGURE 4.1
Secchi Disk



A Secchi disk is one way to gather data on the turbidity of a large body of water. It is a white disk attached to a rope with centimeter (or inch) intervals marked along its length. It is lowered into the water until it can no longer be seen from the surface. The depth at which the disk disappears provides a measurement of the water's turbidity. Secchi disc measurements can vary from 53 meters at the Mediterranean Sea to 1–2 cm at Spirit Lake, Washington, after the 1980 Mount St. Helens volcanic eruption.

MATERIALS LIST

FOR THE CLASS

ACCESS TO
A LOCAL WATER BODY
(such as a lake)

FOR EACH GROUP OF FOUR STUDENTS

18% GRAY-SCALE CARD
DISTILLED WATER SAMPLE
(in clear container)

FOR EACH PAIR OF STUDENTS

pH PAPER WITH pH SCALE
SMARTPHONE WITH
HYDROCOLOR
(or similar) APP

PROCEDURE

- 1 In your science notebook, make a table like Table 4.1, "Testing Local Water."

TABLE 4.1
TESTING LOCAL WATER

WATER SAMPLE	OBSERVATION OF ODOR AND APPEARANCE	INITIAL WATER QUALITY ASSESSMENT AND REASONING	pH	TURBIDITY	FINAL WATER QUALITY ASSESSMENT AND REASONING
DISTILLED WATER (CONTROL)				<0.1 NTUs	
LOCAL WATER BODY					

- 2 You will be investigating water quality at a local water body, such as a lake.
 - a After you arrive at the site, take a few minutes to listen and observe. Note plant and animal life, soil type, presence of rocks, and anything else in the area.
 - b Share your observations with a partner and discuss whether any of your observations could be relevant to water quality.
- 3 Examine the control and the water in your local water body. Then in Table 4.1, record your observations of the odor and appearance of both water samples.
- 4 Based on your initial observations, discuss with your group what you can conclude about the water quality of your control and your local water body.
- 5 Test the pH of each water sample and record your results in your table.



Researcher and Hydrocolor app developer Thomas Leeuw calibrating his app by taking a photo of the sky.

- 6 Use the HydroColor app to measure the turbidity of your local water body. Turbidity is measured in nephelometric turbidity units (NTUs). A low NTU reading indicates clearer water, while a high NTU reading indicates water with more suspended particles.

The U.S. Environmental Protection Agency (EPA) requires drinking water to have a turbidity measuring no higher than 0.3 NTUs. The HydroColor app measures on a scale of 0–80 NTUs and also provides a concentration of suspended particulate matter in grams per cubic meter.

- a Find a location where you can look down into the water at depth. Open the app and select Collect Data.
- b Select Gray Card to take a photo of the 18% gray scale.
- c Select Sky to take a photo of the sky.
- d Select Water to take a photo of the water. (Avoid shadows, bubbles, and debris.)
- e Select Analyze Images. Name your file to save your data.
- f Find your turbidity reading in the table and record this value in Table 4.1.

- 7 a Compare your pH and turbidity values with
- the pH ranges described in the Science Review of pH in Activity 2.
 - the turbidity limits shown in Table 4.2, “Regional Turbidity Limits.”
- b As a group, discuss what your pH and turbidity values indicate about the water quality of your local water body.

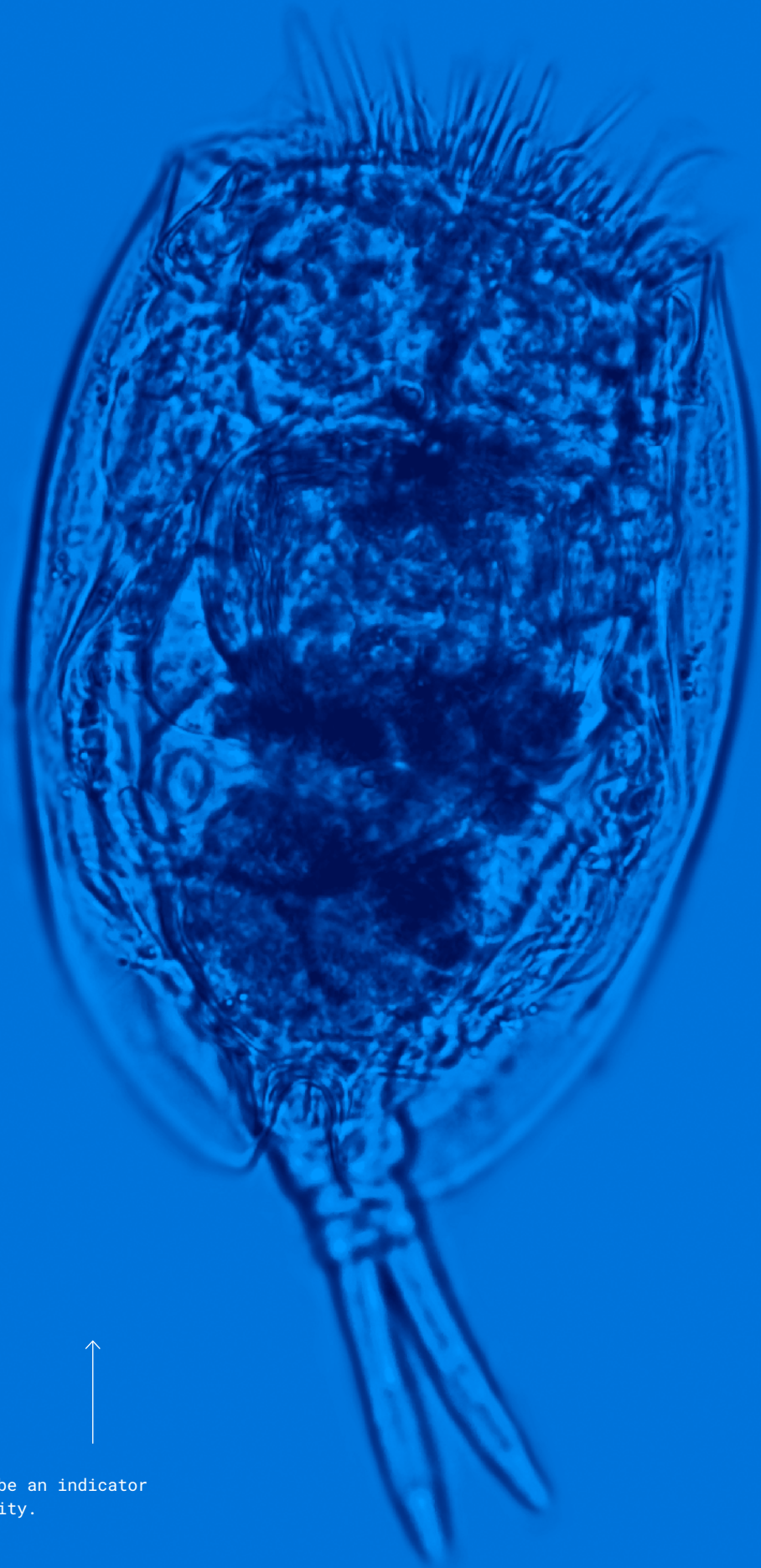
TABLE 4.2
REGIONAL TURBIDITY LIMITS

PURPOSE / LOCATION OF WATER	TURBIDITY (MAXIMUM LIMIT IN NTUs)	LIMITS SET BY
DRINKING WATER	< 0.3 NTUs	U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
RECREATION	5 NTUs	AMERICAN WATER WORKS ASSOCIATION
TROUT WATERS	10 NTUs	STATE OF NORTH CAROLINA
NON-TROUT STREAMS	25 NTUs	STATE OF NORTH CAROLINA
NON-TROUT LAKES	50 NTUs	STATE OF NORTH CAROLINA

- 8 Work with your group to use data from both your senses and your measurements to evaluate the water quality of each sample. Record your final water quality assessment in Table 4.1.

EXTENSION

Interested in gathering more evidence about your local water body? Combine data from your senses with the use of a scientific tool by examining water samples under a microscope. Bioindicators are organisms used to monitor the health of an aquatic ecosystem. Certain species of algae and microorganisms are typically found in cleaner water, while other organisms, such as the bacteria *E. coli*, can indicate the presence of fecal matter in an aquatic system. Use your microscope observations to further evaluate your local water quality.



Rotifers can be an indicator of water quality.



BUILD UNDERSTANDING

- ① What was the difference between the information you were able to discover with your senses alone compared to the information you were able to discover with the pH and turbidity tests?
- ② *Cryptosporidium* is a microscopic parasite that can cause gastrointestinal illness in humans and animals. At one stage of its life cycle, it can become part of the solids suspended in the water column. Which water quality test—pH or turbidity—would be a more valid test for the presence of this organism in drinking water? Explain.
- ③ Do you have enough evidence to determine if your local water body could meet drinking water quality standards, such as the ones listed in Table 4.3? Why or why not? Address strengths and/or limitations in the evidence in your response.

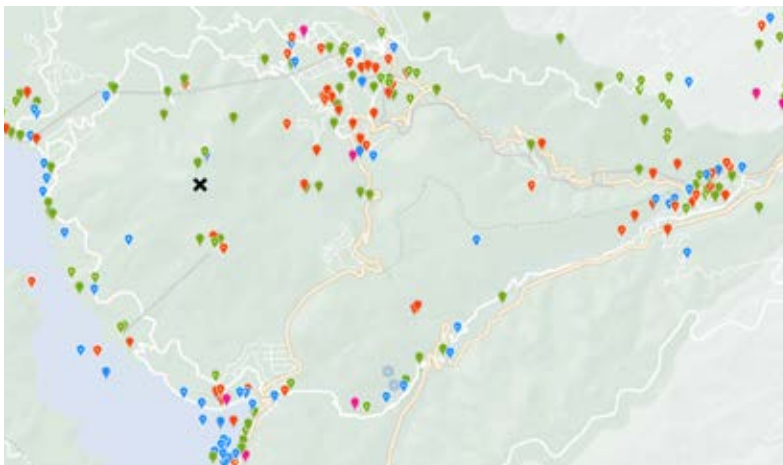
TABLE 4.3
SOME DRINKING WATER QUALITY STANDARDS

WATER QUALITY TEST	MAXIMUM ALLOWABLE LIMIT
CRYPTOSPORIDIUM PARASITE	0
E. COLI BACTERIA	0
LEAD	0
NITRATES	10 mg/L
pH	6.5–9
TURBIDITY	< 0.3 NTUs

CONNECTIONS TO EVERYDAY LIFE

- ④ Technology is being used to collect scientific data in many ways. In the iNaturalist app, users contribute observations of plants and animals, which can then be identified through photos. The app generates maps that show where different species were observed. Biologists can use the app to track biodiversity and animal ranges.

The following map is an example of an iNaturalist map from Fuji Hakone Izu National Park in Japan. It is a mountainous area with many hiking trails. Look carefully at the map and notice the pattern of data. Would it be valid to use this data to determine the habitats of local plants and animals? Why or why not?



iNaturalist map

- plants
- vertebrates
- invertebrates
- fungus and lichens

- ⑤ Today there are an increasing number of apps that provide opportunities for citizens to contribute data or access information about the natural world. One such app is the U.S. Environmental Protection Agency's Bloomwatch app. It educates users about algal blooms—the rapid growth of algae that results in a layer of greenish scum on the surface of a body of water. Users can upload photos and provide additional information about observed blooms. Do you think information from such apps should be used to make government policy? Why or why not?