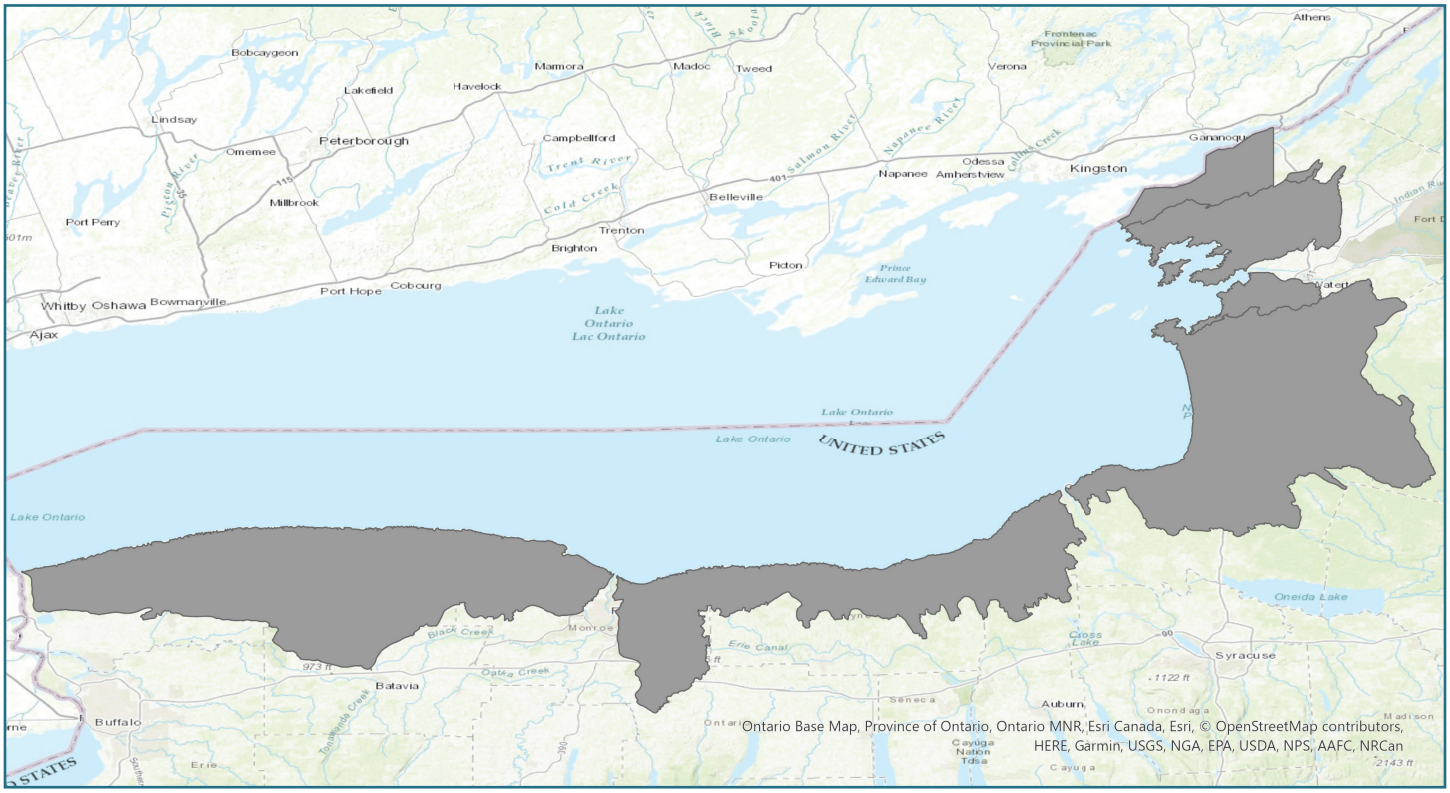
# Teacher Information Packet




*Map displaying the Lake Ontario-St. Lawrence River Watershed (shaded gray) in New York State.*

Welcome to the "Day in the Life of the Lake Ontario and St. Lawrence River Watershed" program!

This packet contains important information about the event and how to prepare, an equipment list, and instructions for the student sampling activities. To ensure the best possible experience for you and your students, please be sure to read this information carefully.

Name:_____

Sampling Location:_____

Watershed:_____

New York State Parks, Recreation and Historic Preservation

Sea Grant NEW YORK

NEW YORK STATE Department of Environmental Conservation

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*Sampling activities and instructions within this packet are adapted from "A Day in the Life of the Hudson River," "A Day in the Life of the Genesee River," "A Day in the Life of the Buffalo River", and "A Day in the Life of the Niagara River/Lake Erie".*

# Program Information

## Introduction to A "Day in the Life"

The goal of the *Day in the Life (DITL) of the Lake Ontario-St. Lawrence River Watershed* program is to promote awareness of Great Lakes environmental issues and stewardship of the Lake Ontario and St. Lawrence River watershed. This program provides a unique opportunity for middle school students throughout the region to engage in both classroom learning and outdoor, hands-on data collection to assess the health of their local watershed.

The highlight of this program is a one-day Student Summit field trip during the first week of October. Participating teachers, their students, and program assistant staff will travel to a local State or County Park to conduct sampling activities at a streamside or shoreline location and collect data about the water quality at their site. Some of the activities include measuring turbidity, stream discharge, pH, dissolved oxygen, phosphorus, nitrogen, and assessing the aquatic macroinvertebrate community.

## Accessing Additional Digital Resources

Additional program information, as well as final summaries of student-collected data, can be found on the New York State Department of Environmental Conservation's website at https://www.dec.ny.gov/education/125689.html. A shared Box folder has been created online to house downloadable resources and inportant program documents for teachers, including digital copies of this packet and student data packets. This Box folder can be accessed by using the link or QR code listed below.

**Day in the Life Box Folder**

Link: https://cornell.box.com/s/d43tk7yf0n66l28ris0appwplpxijrfq

To use the QR Code to the right, open the camera app on your phone, point camera at QR code, then click on the link that appears.

Trouble accessing? Email Megan Kocher (mk2236@cornell.edu).

## Program History and Funding

A *Day in the Life of the Lake Ontario-St. Lawrence River Watershed*, modeled after other highly successful DITL programs that occur annually throughout New York's watersheds, debuted in the Lake Ontario and St. Lawrence River region in 2022. Last year, the program engaged over 300 middle school students from throughout the watershed! Additional information and resources from year 1 are available on the NYS Department of Environmental Conservation's website at: https://www.dec.ny.gov/education/125689.html.

This DITL program is made possible through a collaboration between New York Sea Grant (NYSG), NYS Department of Environmental Conservation (DEC), NYS Office of Parks, Recreation, and Historic Preservation (OPRHP), and other partner organizations, with funding from the U.S. Environmental Protection Agency in support Great Lakes Restoration Initiative Focus Area 5.

# Student Summit Event Information

## Prior to the Event:

- Reserve the recommended shelter at your field trip site using the guidelines provided (in Box). Any costs associated with making reservations will be ***reimbursed*** through the program.
    1. Once the reservation has been paid, please email Sharon Mullen (slm22@cornell.edu) the receipt and invoice requesting reimbursement to your school.

- You, or your school, should arrange busing transportation to and from your field trip site. Busing transportation will be ***reimbursed*** through the DITL program. Please follow the steps below:
    1. Before the trip, please email Sharon Mullen (slm22@cornell.edu) the busing transportation estimate. This estimate should show the number of buses requested and the estimated total cost. Along with the estimate, please provide the name and contact information for the person at your school who will be issuing the invoice.
    2. After the trip, please email Sharon Mullen (slm22@cornell.edu) the busing transportation invoice requesting reimbursement to your school.

- Following your school's field trip policy, invite chaperones to the event, such as teacher aids, other teachers, or parents.

- Inform Megan Kocher (mk2236@cornell.edu) of any student accessibility needs or other concerns at least 3 weeks prior to the event.

- Make copies of the Student Data Packet (file in Box) or send printing requests to Megan Kocher (mk2236@cornell.edu) at least 3 weeks prior to the event.

- Prepare your students for the Summit event by reviewing the provided equipment, activity instructions, and utilizing any of the lesson plans, activities, or resources mentioned on page 8.

- Review safety information with your students, such as staying with the group, wearing appropriate footware, sunscreen, and bug spray, using caution in and around the water, etc.

- Complete the Predictions Worksheet (file in Box) with your class based on what they've learned and class discussions.

- Gather extra equipment (see "Recommended Equipment" on page 6).

- We recommend a 9:00am start time for the Summit event. If your class plans to arrive at a different time, please let Megan (mk2236@cornell.edu) know at least 1 week prior to the event.

- Review and print a copy of the Quality Assurance Project Plan and NYSDEC-issued sampling permit for the event (files in Box).

- Optional: Send home the Photo Release Form (file in Box) to be signed by each student's parent or guardian. Please notify us of any students that do not have photo release.

# Student Summit Event Information (*continued*)

### Day of the Event:

- Make sure to bring...
    - This Teacher Information Packet
    - Copies of the Student Data Packets for participating students
    - A copy of the Quality Assurance Project Plan
    - A copy of the NYSDEC-issued sampling permit
    - A copy of your park shelter reservation or permit
    - Provided student equipment kit (see "Provided Equipment" on page 6)
    - Any additional supplies (see "Recommended Equipment" on page 6)

- Your class will be accompanied by at least two trained program staff. They will help run the event; however, we look to you, the teacher, to take an active role in running the event. Please review safety information again with your students.

- Student activities are split into 4 stations. Divide your class into 4 groups and start each group at a different activity station. Have the groups rotate in order until everyone has completed all stations. (For example, Group 4 starts with Station 4 and ends with Station 3.) We recommend that students spend 30-45 minutes at each station.

- The program should last around 3-4 hours in total. Remember to break for lunch.

- Help ensure that all equipment is collected. Clean equipment with bleach water and remove any vegetation to prevent the spread of invasive species or diseases to other waterways.

- Ensure the site and its facilities are left in good order before you leave.

### Event Safety:

- Teachers are responsible for student safety and emergencies. Encourage students to stay together and to stay away from hazardous areas. Sunscreen and insect repellant is strongly encouraged.

- Students should be supervised whenever they are near or directly in the water. Shallow wading is permissible; however, no swimming is allowed.

- Ticks are small arachnids which may attach to the skin and transmit diseases. Insect repellant is recommended and everyone should check for ticks after being outside.

### After the Event:

- Complete and submit the Master Datasheet to Emily Fell (emily.fell@dec.ny.gov). See the Master Datasheet (file in Box) for more details.

- Fill in the "Actual Results" column on the Predictions Worksheet and make comparisons. See the Predictions Woksheet (file in Box) for more details.

# Equipment Checklist

Essential equipment for student activities is provided through the program. However, with so many event participants, we cannot provide personal equipment for every student (i.e. waders, nets). Teachers are strongly encouraged to bring their own supplies, such as clipboards, water shoes, towels, first aid kits, etc. See the lists of provided and recommended equipment below:

## Provided Equipment

**Measuring Tools:**
- ☐ compass (1)
- ☐ cup anemometer (1)
- ☐ digital timer/stopwatch (3)
- ☐ field thermometer (2)
- ☐ turbidity tube (1)
- ☐ meauring tape (1)

**Containers:**
- ☐ large equipment bin (1)
- ☐ 5gal bucket (1)
- ☐ 8qt collection tub (2)
- ☐ 1000mL funnel pitcher (1)
- ☐ ice cube trays (2)

**Nets:**
- ☐ 4in aquatic dip net (2)
- ☐ D-frame net (2)

**Identification Tools:**
- ☐ magnifying lens (2)
- ☐ macroinvertebrate ID cards (1 set)
- ☐ plant/animal field guide (1 set)

**Water Chemistry Kits:**
- ☐ dissolved oxygen test kit (1)
- ☐ nitrate test kit (1)
- ☐ pH test kit (1)
- ☐ phosphate test kit (1)

**Safety:**
- ☐ disposable gloves (assorted sizes)
- ☐ keyhole type II life jacket (2)
- ☐ chest waders (2)

**Clean Up:**
- ☐ paper towels (1 roll)
- ☐ garbage bags (4)
- ☐ chemical waste disposal (2 bottles)
- ☐ bleach tablets (1 bottle)
- ☐ 1gal water sprayer (1)

**Other Supplies:**
- ☐ flagging tape (1 roll)
- ☐ laminated site maps (2)
- ☐ laminated instructions (1 per station)
- ☐ plastic spoons (10)

## Recommended Equipment

- ☐ first aid kit (bandaids, antibiotic ointment, insect bite ointment, sunscreen, insect repellant, etc.)
- ☐ student emergency contact list
- ☐ drinking water
- ☐ packed lunch/snacks
- ☐ towels
- ☐ **clean** water shoes/rain boots
- ☐ dry change of clothing/shoes
- ☐ clipboards
- ☐ calculator
- ☐ additional field guides

# A Breif Look at the Lake Ontario - St. Lawrence River Watershed

## Lake Ontario

Lake Ontario is the last in the chain of Great Lakes that straddle the Canada/United States border. Since Lake Ontario is the most downstream Great Lake, it is impacted by human activities occurring throughout the Lake Superior, Michigan, Huron, and Erie basins. The average depth of Lake Ontario is 283 ft, and the retention time of water flowing through the Lake and into the St. Lawrence River is 6 years.


## St. Lawrence River

The St. Lawrence River is one of the largest hydrologic systems in the world, measuring 744 miles long, and is the third largest in North America, next to the Mississippi and Mackenzie Rivers. The river drains the Great Lakes, and 25% of the worlds surface freshwater, to the Atlantic Ocean. The St. Lawrence Seaway serves as a vital shipping corridor.


## Lakewide Action Management Plans

Environmental issues within Lake Ontario and the St. Lawrence River include degradation of the lower food chain, fish consumption restrictions, loss of biodiversity, aquatic invasive species, and nearshore water quality. The Lake Ontario Lakewide Action and Management Plan (LAMP) and the US and Canadian Great Lakes Water Quality Agreement guides the management of Lake Ontario, St. Lawrence River, and surrounding watersheds from impacts of human activities and other environmental degradation. LAMP objectives strive for Lake Ontario to:

- Be a source of safe, high quality drinking water.
- Allow for swimming and recreational uses.
- Allow for consumption of fish and wildlife.
- Be free from pollutants that could harm people and other organisms.
- Support healthy habitats to sustain native species.
- Be free from nutrients that support unhealthy or toxic algae.
- Be free from aquatic and terrestrial invasive species.
- Be free from harmful impacts of contaminated groundwater.
- Free from other substances or conditions negatively affecting lake.

NYSDEC and other partners, including NY Sea Grant, NYS Office of Parks, Recreation and Historic

# A Breif Look at the Lake Ontario - St. Lawrence River Watershed (*continued*)

Preservation, and local communities, help meet these objectives by reducing trash that ends up in our waterways, promoting awareness about pollution and how it can be prevented, restoring habitats by conserving land and planting native vegetation, controlling and preventing the spread of invasive species, improving wastewater treatment systems, and other activities.

### Cooperative Science and Monitoring Initiative

To evaluate conditions and management of Lake Ontario, the US and Canada Cooperative Science and Monitoring Initiative (CSMI) collect data on each lake every 5 years, with Lake Ontario monitoring planned in 2023. CSMI data collected that relates to the Day in the Life of Lake Ontario includes:

- Nearshore nutrient concentrations
- Nutrient loadings from tributaries
- Aquatic food web status

For the Day in the Life student event, students will visit Lake Ontario or the St. Lawrence River, monitor a waterway that drains to the lake or river. Data collected from the tributary will be compared to information available about the open lake from the CSMI, and students will assess if the tributary has any potential impacts to the Lake or River.

## Classroom Resources

This DITL program provides a number of suggested activities, lessons and resources that can be used in a classroom setting with students to prepare them for the Student Summit events. These tools are intended to provide background information watersheds, land use and watershed health, water quality, and methods for environmental monitoring. These resouces can be found on the NYSDEC's Day in the Life website or in the shared Box folder (see page 3).

## Student Summit Activity Instructions

The following pages contain the step-by-step instructions for the Student Summit monitoring activities. These instructions are similar to the instruction sheets the students will see, which are provided within the equipment bins. However, additional sections are provided in this version, including background information and important vocabulary terms, to assist teachers and site partners with guiding students through the activities. Fillable tables and charts for data collection will be found in the Student Data Packet (file in Box).

# Station 1: Land Assessment

## Section #1: Date, Location, Weather, and Wind

**Objective:** Students record initial information about their sampling site.
**Recommended Time:** 15 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ watershed map
- ☐ thermometer
- ☐ compass
- ☐ flagging tape
- ☐ timer
- ☐ anemometer

### Vocabulary

*dissolved oxygen (DO)* - The amount of oxygen gas in the water.
*runoff* - The flow of water from rain, snow melt, or other sources over land.
*watershed* - An area of land that separates flowing water into different waterways.

### Background

When collecting data, the date and location of your collection are some of the most important pieces of information to include in your notes. When sampling at a stream site, the name of the stream and it's watershed are also important to note. A watershed, or basin, is an area of land that separates flowing water into different waterways. All the water within one watershed will flow into the same body of water.

Weather and wind tell us about the physical conditions around the river. Weather includes what the weather is today and what the weather was like during the past few days. Weather conditions can affect water quality. Heavy rains might flush pollutants into the river through runoff. High winds can mix extra oxygen from the air into the water and increase dissolved oxygen levels.

### Student Instructions

**Date and Location Procedure:**

1. Record the following information on your data sheet:
   - Today's date
   - Name of the park you are sampling at
   - Name of the stream or body of water you are sampling in
   - Name of the watershed your sampling location is in

# Station 1: Land Assessment

## Section #1: Date, Location, Weather, and Wind (*continued*)

**Weather Procedure:**

1. To measure air temperature, hold the thermometer upright and out of direct sunlight. Allow several minutes for the thermometer to give an accurate reading. Record air temperature on your data sheet.
2. Observe today's weather conditions. Record any precipitation and percentage of cloud cover on your data sheet.

**Wind Procedure:**

1. For wind direction, attach a piece of flagging tape (about 12 inches in length) to a wooden stick.
2. Hold up the wooden stick with flagging tape and use the compass to determine wind direction based on how the flagging is flying.
   **Tip:** Remember, winds are named for the direction the wind is coming from, so record the direction opposite to the direction of the blowing flagging.
3. Record the wind direction on your data sheet.
4. For wind speed, place the cup anemometer on a flat spot in an open area. Assign one person as the "Counter" and one person as the "Timer".
5. When the "Timer" starts the timer, the "Counter" counts how many times the colored cup passes them until time is up. Do this for 1 minute.
6. Record wind speed on your data sheet.

# Station 1: Land Assessment

## Section #2: General Environmental Assessment

**Objective:** Students observe and record information about the land around their sampling site.
**Recommended Time:** 15 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ satellite map

### Vocabulary

***bulkhead*** - A barrier of wood timber, concrete, or metal, holding the shore in place along the water's edge.
***ecosystem*** - A community of organisms together with their physical environment, viewed as a system of interacting and interdependent relationships.
***habitat*** - The area or natural environment in which an organism or population normally lives. A habitat is made up of factors such as soil, temperature, light, availability of food, and the presence of predators.
***marsh*** - An area of shallow water with many plants growing through the water's surface.
***riprap*** - Large rocks that are piled up along a shoreline to protect it from strong waves and erosion.

### Background

Each sample site is unique, ranging from old industrial sites to rural nature preserves. Some sites may show heavy human involvement, such as industries or houses near the river. Other sites will have many ecosystems, such as forests and marshes.

### Student Instructions

1. Explore and observe the area around your sample site. The area along a stream is referred to as the riparian area.
2. Record percent land composition of the surrounding area using the table provided on your data sheet. Make sure that your percentages total up to 100%.
3. Record any notable shoreline features for your site in the table provided on your data sheet.
4. Describe three ways in which the environment at your sample site can impact water quality either positively or negatively and record your answer on your data sheet.

# Station 1: Land Assessment

## Section #3: Plant and Animal Observations

**Objective:** Students observe, identify, and describe the organisms present at their sampling site.
**Recommended Time:** 15 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ field guides

### Vocabulary

***biodiversity*** - The variety of species found in an area.
***invasive species*** - A non-native species that causes harm to native species, human health, and/or the economy.
***native species*** - A species that occurs within its natural distribution.

### Background

Based on the students' observations in Section 2, they should have an idea of whether there is a variety of habitat types present at their site. An area with more diverse habitats usually has a greater biodiversity. Biodiversity is important to an ecosystem because it helps to keep everything in balance. When a non-native species is introduced into a new area, there is potential for this balance to become disrupted. When a non-native species causes harm to other native species, human health, or the economy, the non-native species can be considered invasive.

### Student Instructions

1. Explore and observe the organisms around your sampling site.
2. Use the provided field guides to identify some of the species you have found.
3. Record the species you identify on your data sheet, include a short description of the organism, and note whether the organism is a native or non-native species.

# Station 2: Water Assessment

## Section #1: Site Characteristics

**Objective:** Students observe characteristics of the water, substrate, and vegetation at their sampling site.
**Recommended Time:** 20-25 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet

### Vocabulary

***pool*** - Section of a stream that is deeper with slow-flowing water, often occurring on the outside of bends in the stream channel.
***riffle*** - Section of a stream with smooth unbroken flow, connecting pools and riffles.
***run*** - Section of a stream that has fast, shallow flow over boulders and cobbles that break the water surface.
***substrate*** - The sediment found along the stream bottom (mud, sand, gravel, cobble, boulders, etc.).

### Background

The substrate within a stream, or the kind of sediment that makes up the stream bottom, plays an important role for the aquatic organisms that live there. The sand, rocks, etc. provide hiding places from predators and can also allow for vegetative growth, providing food. Diverse habitats can exist within one stream, from differences in substrate to differences in the flow of the water. Unique combinations of these stream characteristics provide habitat for many different species.

### Student Instructions:

1. Observe the overall shape of the water channel. If at a stream, record how many pools, runs, and riffles, you can identify at your site using the graphic provided on your data sheet.
2. Observe the substrate along the bottom of the stream or waterbody. Record the most abundant kind of substrate in the table provided on your data sheet.
3. Observe how much of the stream bottom and the stream surface is covered in vegetation. Record your percentage in the table provided on your data sheet.
4. Spend the next 5-10 minutes drawing a detailed sketch of your sampling site. Be sure to include notible features such as large rocks, trees, log jams, bridges, pipes, etc. If at a stream, lable the riffles, runs, pools, and direction the water is flowing. Include a North arrow.

# Station 2: Water Assessment

## Section #2: Temperature and Turbidity

**Objective:** Students measure and calculate the flow rate at their sampling site.
**Recommended Time:** 20-25 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ thermometer
- ☐ measuring tape
- ☐ turbidity tube
- ☐ funnel pitcher

### Vocabulary

**Water Temperature:**

***dissolved oxygen*** - The amount of oxygen gas in the water.
***saturation*** - The point at which a solution of a substance cannot dissolve anymore of that substance.
***thermal pollution*** - Discharge of heated water into a water source that can cause a dangerous rise in temperature.

**Water Turbidity:**

***Secchi disk*** - A black and white disk that is lowered into water to the depth at which it vanishes from sight to measure turbidity.
***turbidity*** - The cloudiness of water or how much suspended solids are in the water.

### Background

**Water Temperature:**

Water temperature can determine which animals survive in the river. It affects their feeding habits and other bodily functions. Water temperature also determines how much oxygen the water has in it. Oxygen that is mixed into water is called dissolved oxygen. Warm water holds less oxygen than cold water, which means there is less oxygen for fish and other animals to breathe.

One factor that can change water temperature in a river is thermal pollution. Thermal pollution occurs when heated water flows into a waterway. Industries and power plants may draw in cold river water to cool machines, and then return warmer water to the river. Buildings and sidewalks can trap heat and warm up rainwater, which then runs off into the river.

# Station 2: Water Assessment

## Section #2: Temperature and Turbidity (*continued*)

**Water Turbidity:**

Turbidity is the cloudiness of water. Turbidity is caused by things suspended in the water, like small plants, animals, sand, mud, and pollutants. High turbidity levels can decrease how much oxygen fish can use from the water. Turbidity can also stop light from reaching plants beneath the surface. A Secchi disk is that black and white disk inside the turbidity tube that used to measure turbidity.

### Student Instructions:

**Water Temperature Procedure:**

1. Choose a location in the water and measure the water depth with the retractable measuring tape.
2. Record the water depth on your data sheet.
3. Submerge the water thermometer for 2 minutes at your chosen location.
4. Record the water temperature as "Reading 1" on your data sheet.
5. Repeat step 4 to obtain "Reading 2" and record it on your data sheet.
6. Average the two readings to get your final water temperature measurement and record it on your data sheet.

**Water Turbidity Procedure:**

1. Go to the edge of the water. Don't kick up too much mud, as this will throw off your results.
2. Use the measuring cup to fill the turbidity tube to the top with water.
3. Place the turbidity tube near the edge of the water with the bottom valve facing the water (this way, when you spill the water out, it doesn't get the whole site wet). As one student looks through the top of the turbidity tube, another slowly lets water out of the tube through the valve at the bottom.
4. The student looking through the top says "Stop" as soon as they can see the black and white circle (Secchi disk). The other student closes the water valve as soon as they hear "Stop."
5. Record the height of the remaining water in the tube as "Reading 1" on your data sheet.
6. Repeat steps 1-4 to obtain "Reading 2" and record it on your data sheet.
7. Take the average of your two readings to get your turbidity measurement and record this number on your data sheet.

# Station 3: Chemical Water Quality Assessment

## Section #1: Nitrate and Phosphate

**Objective:** Students measure the amount of nitrate and phosphate in the water at their sampling site.
**Recommended Time:** 20-25 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ timer
- ☐ disposable gloves
- ☐ nitrate test kit
- ☐ phosphate test kit
- ☐ chemical waste container

### Vocabulary

***eutrophication*** - Enrichment of soils and water resulting from fertilization, sewage, effluent, or other waters that carry a high plant-nutrient component.
***nitrate*** **($NO_2$)** - A naturally occurring form of nitrogen found in soil and fertilizers.
***phosphate*** **($PO_4$)** - A naturally occurring form of phosphorus found in rock, soil and fertilizers.

### Background

Nitrogen is a common element in the air we breathe. It is also used by organisms to build protein. Nitrogen occurs in streams in several forms. The easiest form to measure is nitrates ($NO_2$).

Phosphorus is a nutrient that acts as a fertilizer for aquatic plants. Phosphorus occurs in natural waters in the form of phosphates ($PO_4$).

Nitrogen and phosphorus are often added to fertilizer to help crops grow. High measurements of these elements may be caused by fertilizer runoff, manure runoff, leaky septic systems, sewage treatment plants, car exhausts, or industrial waste. The use of phosphorus detergents also contributes to high phosphate levels.

Nitrates and phosphates are necessary for organisms in small quantities. However, high amounts can cause rapid plant growth that can become a nuisance.

An increase in plant growth in the water, such as an algal bloom, can cause water temperature to increase and dissolved oxygen to decrease. When these plants die, bacteria causing the plants to decompose use large amounts of dissolved oxygen. Low amounts of dissolved oxygen and higher temperatures can be stressful and deadly to fish and other aquatic organisms. This process is called eutrophication.

# Station 3: Chemical Water Quality Assessment

## Section #1: Nitrate and Phosphate (*continued*)

### Student Instructions

**Nitrate Procedure:**

1. Put on a pair of disposable gloves.
2. Fill the test tube (0106) to the 5mL line with water from your sampling site.
3. Add one Nitrate #1 TesTab (2799A).
4. Cap the tube and mix until the tablet has disintegrated.
5. Add one Nitrate #2 CTA TesTab (NN-3703A). Immediately slide the test tube into the Protective Sleeve (0106-FP).
6. Cap the tube and mix for two minutes to disintegrate the tablet.
7. Wait 5 minutes, then remove the tube from the Protective Sleeve.
8. Compare the color of the sample to the Nitrate color chart (5891-CC).
9. Record the result as ppm Nitrate on your data sheet.
10. Carefully transfer any chemical waste from the test tube into the waste container provided in your equipment kit.

**Phosphate Procedure:**

1. Put on a pair of disposable gloves.
2. Fill the test tube (0106) to the 5mL line with water from your sampling site.
3. Add one Phosphorus TesTab (5422A).
4. Cap the tube and mix until the tablet has disintegrated.
5. Wait 5 minutes.
6. Compare the color of the sample the Phosphate color chart (5892-CC).
7. Record the result as ppm Phosphate on your data sheet.
8. Carefully transfer any chemical waste from the test tube into the waste container provided in your equipment kit.

# Station 3: Chemical Water Quality Assessment

## Section #2: Dissolved Oxygen and pH

**Objective:** Students measure the amount of dissolved oxygen and the pH of the water.
**Recommended Time:** 20-25 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ timer
- ☐ disposable gloves
- ☐ dissolved oxygen test kit
- ☐ pH test kit
- ☐ chemical waste container

### Vocabulary

***acid rain*** - Precipitation that is unusually acidic due to atmospheric pollution and harmful to the environment.
***concentration*** - The amount of an ingredient in a given volume of liquid or other sub-stance.
***decomposition*** - The process of breaking down organic material, such as dead plant or ani-mal tissue, into smaller molecules that are available for use by organisms.
***dissolved oxygen*** **(DO)** - The amount of oxygen gas in water.
***pH*** - A number used to express acidity or alkalinity on a scale with values from 0 (acidic) to 14 (alkaline).
***photosynthesis*** - The process by which plants that contain chlorophyll make carbohydrates from water and from carbon dioxide in the air in the presence of light.
***saturation*** - The point at which a solution of a substance cannot dissolve anymore of that substance.

### Background

Oxygen that is mixed into water is called "dissolved oxygen" (DO). It is a measure of how much oxygen is in the water for fish and other organisms to use. It is measured in parts per million (ppm). One ppm is like one cent in $10,000.

DO increases when wind mixes up the water or when river plants make oxygen during photosynthesis. DO decreases when it is used by river animals to breathe, when photosynthesis stops during the night, or when the water is polluted. A healthy stream DO range is 5 – 11 ppm.

The pH scale measures how acidic or basic (alkaline) a solution is on a scale of 0 to 14. It is a measure of hydrogen ion concentration. A pH of 7.0 is neutral. A pH less than 7.0 is acidic, and a pH greater than 7.0 is basic. Most organisms are very sensitive to pH changes and may die if the pH falls outside of the healthy range. A healthy stream pH range is 6.5 – 8.2.

# Station 3: Chemical Water Quality Assessment

## Section #2: Dissolved Oxygen and pH (*continued*)

Normal precipitation is slightly acidic, with a pH range of 5.0-6.3. Acid rain has a pH below 5.0 and is caused by car and industrial emissions. Acid rain can lower the pH of lakes and rivers and kill off resident plants and animals.

### Student Instructions

**Dissolved Oxygen Procedure:**

1. Put on a pair of disposable gloves.
2. Fill the small test tube (0125) until it overflows with water from your sampling site.
3. Add two Dissolved Oxygen TesTabs (3976A) to the test tube.
4. Cap the tube. Be sure there are no air bubbles in the sample.
5. Mix by inverting the test tube upside down and right side up until the tablets have disintegrated. This should take about 4 minutes.
6. After mixing, wait 5 minutes.
7. Compare the color of the sample to the Dissolved Oxygen color chart (6663).
8. Record the result as ppm Dissolved Oxygen on your data sheet.
9. Carefully transfer any chemical waste from your test tube into the waste container provided in your equipment kit.
10. For percent saturation, pair up the measured ppm of DO with the water temperature (°C). Draw a straight line between the two values. The percent saturation is the value where your drawn line intercepts the angled saturation scale. Record percent saturation on your data sheet.

**pH Procedure:**

1. Put on a pair of disposable gloves.
2. Fill the test tube (0106) to the 10mL line with water from your sampling site.
3. Add 10 drops of Wide Range pH Indicator (2218) to the test tube.
4. Cap the tube and mix.
5. Insert the test tube into the Octa-Slide 2 Viewer (1101) and match the color of your sample to the color standard.
6. Record the result as pH on your data sheet.
7. Carefully transfer any chemical waste from your test tube into the waste container provided in your equipment kit.

# Station 4: Biological Water Quality Assessment

## Section #1: Macroinvertebrate Sampling

**Objective:** Students sample the macroinvertebrate community at their site and identify which species are present.
**Recommended Time:** 30 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ life jackets
- ☐ waders
- ☐ D-frame net
- ☐ dip nets
- ☐ 4qt collection tubs
- ☐ tweezers
- ☐ plastic spoons
- ☐ ice cube trays
- ☐ macroinvertebrate cards

### Vocabulary

***adaptation*** - A feature that allows an organism to adjust to differing environmental conditions.
***aquatic*** - Living in fresh water, as opposed to marine (salt water).
***biodiversity*** - The variety of species found in an area.
***ecosystem*** - A community of organisms together with their physical environment, viewed as a system of interacting and interdependent relationships.
***invertebrate*** - An animal without a backbone.
***macroinvertebrate*** - An animal without a backbone that is visible without a microscope.
***metamorphosis*** - A change in the form of a living thing as it matures.  presence of light.
***vertebrate*** - An animal with a backbone. Includes fish, reptiles, amphibians, birds, and mammals.

### Background

Macroinvertebrates ("macro" = big, "invertebrates" = animals without backbones) are animals visible to the naked eye, such as insects, worms, and spiders. Some macroinvertebrates spend their entire life in the water. Others, such as dragonflies and damselflies, begin life in the water and take to the air as adults. Just like frogs, macroinvertebrates go through metamorphosis, where their bodies change from egg, to juvenile, to adult. They also have special adaptations that help them survive in the water, such as oar-shaped legs, snorkel-like breathing tubes, and hairs that trap air like a scuba tank.

# Station 4: Biological Water Quality Assessment

## Section #1: Macroinvertebrate Sampling (*continued*)

### Student Instructions

1. Put on waders and life jackets. Do not go into water deeper than your knees when sampling.
2. Set up a couple of containers on the shore in preparation for your sample. Add enough water to cover the bottom of the container.
3. Use one of the following methods to collect your sample:

   **Kick Netting:** Best for shallow, rocky areas with fast flow.
   1. Grab a D-Frame Net and carefully walk out to a shallow riffle in the water.
   2. Stand with the D-Frame Net in front of you, facing downstream. Water should be flowing into the net.
   3. Make sure you are balanced and then start to gently twist and kick your feet around to stir up debris and sediment in front of the net opening. Macroinvertebrates will be dislodged from the sediment into the flowing water and travel right into your net. Do this for about 2 minutes.
   4. Transfer everything that entered your net into your sample container on shore.

   **Vegetation Sampling:** Best for highly vegetated areas.
   1. Carefully walk into the stream with your D-Frame Net and locate a patch of vegetation near the shore.
   2. Keeping your D-Frame Net partially in the water, sweep along the bottom edge of the vegetation. It's best to do this in a jabbing motion to shake the bottom of the vegetation and stir up the macroinvertebrates.
   3. Transfer everything from your net into your sample container on shore.

   **Rock Picking:** Best for rocky areas.
   1. Grab a pair of tweezers and carefully walk out into the stream.
   2. Pick up a rock along the bottom of the stream. Check all sides of the rock for macroinvertebrates.
   3. If you see a macroinvertebrate on the rock, use the tweezers to pick it up and transfer it directly into your water-filled sample container.
   4. Repeat this process until you have a good collection of different macroinvertebrates to identify.

# Station 4: Biological Water Quality Assessment

## Section #1: Macroinvertebrate Sampling (*continued*)

5. After you have collected samples using one or more of the methods above, bring your sample containers over to a table or flat surface.
6. Use the small dip nets and plastic spoons to transfer the macroinvertebrates from your sample into different slots in the ice cube trays. Separating them into the ice cube slots will make it easier to see and count them.

   **Tip:** Keep your sample container very still and you'll be able to spot them swimming and moving around. You may need to search slowly and carefully through the aqutic vegetation and substrate within your sample to find them. Remember, these aquatic critters are small and delicate so be sure to handle them very gently!
7. Use the macroinvertebrate identification cards provided in your equipment kit to identify the macroinvertebrate species you have collected.

   **Tip:** Use the magnifying lens provided in your equipment kit to see some of the smaller body features of the macroinvertebrates. This can help you to identify what kind of macroinvertebrate you are looking at.
8. Record the common name for each kind of macroinvertebrate you collected and write this in the table provided on your data sheet. Next to the common names of each macroinvertebrate, record how many individuals you collected.

# Station 4: Biological Water Quality Assessment

## Section #2: Pollution Tolerance Index

**Objective:** Students calculate a pollution tolerance index to see how healthy the stream is.
**Recommended Time:** 15 minutes

**Equipment:**

- ☐ pencil
- ☐ data sheet
- ☐ data sheet

### Vocabulary

*bioassessment* - A survey of living systems that measures presence, condition, and number of organisms to evaluate the overall health of aquatic ecosystems.

### Background

A bioassessment ("bio" = life, "assessment" = study) looks at the health of an ecosystem, like a river. It uses living things in the ecosystem, like macroinvertebrates, as clues to its health. Species that can live in polluted waters are "tolerant." Species that can't handle pollution are "intolerant." If you find pollution-intolerant animals, it means you have good water quality!

### Student Instructions

1. Tally up the number of macroinvertebrate species you collected for each "Order" (plecoptera, ephemeroptera, megaloptera, etc.) using the table on your data sheet for help.
2. Record the total collected in Column A of the table on your data sheet.
3. Multiply Column A (total collected) by Column B (tolerance value) to calculate Column C.
4. Sum Column A (total collected) and record the sum at the bottom of the column.
5. Sum Column C (total) and record the sum at the bottom of the column.
6. Calculate the pollution tolerance index by dividing the sum of Column C by the sum of Column A and record this in the table on your data sheet.
7. Use the pollution tolerance index value you calculated to determine the water quality of your site.