UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

★ 2002 ★
THE YEAR OF CLEAN WATER
Celebration & Recommitment

Watershed Patch Project

Office of Water
(4501T)
Washington, DC 20460

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A Message from the Administrator

Christine Todd Whitman

I believe water is the biggest environmental issue we face in the 21st Century in terms of both quality and quantity. In the 30 years since its passage, the Clean Water Act has dramatically increased the number of waterways that are once again safe for fishing and swimming. Despite this great progress in reducing water pollution, many of the nation's waters still do not meet water quality goals. I challenge you to join with me to finish the business of restoring and protecting our nation's waters for present and future generations.

Cover: Artwork from the *River of Words* 2001 Art Contest ©**River of Words**

"Down the Drain"
Jasmine U., Age 17, Georgia
Art Finalist
©River of Words Contest

River of Words (ROW) is a nonprofit international art/environmental education organization designed to nurture respect for and understanding of the natural world and to promote literacy in all its forms. ROW is affiliated with the Library of Congress Center for the Book and was cofounded in 1995 by U.S. Poet Laureate (1995–1997) Robert Haas and writer Pamela Michael. Through its workshops, innovative curriculum, publications, and free annual poetry and art contests, ROW fosters responsibility, imagination, and action in young people and publicly acknowledges their creativity and concerns. Deadlines are **February 15 (North America)** and March 1 (international) each year. There is no charge to enter. For information or to order an Educator's guide or other curriculum materials,

River of Words©
P.O. Box 4000-J
Berkeley, CA 94704
Tel: 510-548-POEM (7636)
http://www.riverofwords.org

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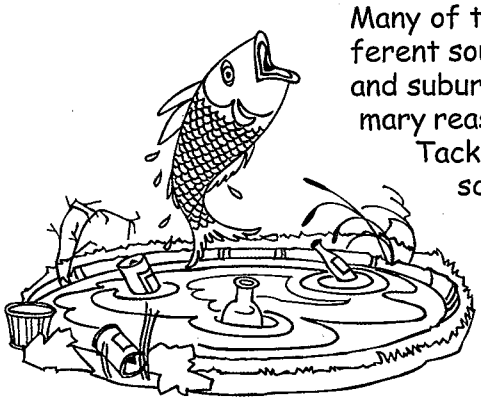
Dear Educator:

Thanks to the passage of the Clean Water Act 30 years ago, America has seen much progress in cleaning up its rivers, lakes, streams, and coastal waters. In 1972 the Potomac River in Washington, DC, was too dirty for human contact; aquatic life in Lake Erie, one of the Great Lakes, was dying because of excessive nutrients; and Ohio's Cuyahoga River was so polluted with floating debris and oil that it caught fire. Many rivers and beaches were little more than open sewers. Conditions in these and thousands of other waterbodies are much better today. Over the past 30 years, the nation has made tremendous progress in addressing pollution from sewage treatment plants and industrial facilities.

Despite these accomplishments, many challenges remain, including threats to human health. Approximately 40 percent of monitored waters, including Georgia's Chattahoochee River and many other major national waterways, still fail to meet state water quality standards, which means that they do not support basic uses like swimming and fishing. Although wetland losses have slowed, the nation continues to lose about 60,000 wetland acres per year. A disturbing number of freshwater fish species are now threatened or endangered.



Many of the remaining pollution problems come from many different sources—not just from a pipe. Polluted runoff from city and suburban streets, construction sites, and farms is the primary reason many of our waters are not fishable or swimmable. Tackling these problems will not be easy. But schools and science clubs can help make a difference by becoming watershed stewards in their communities.

Comments may be directed to Patty Scott, US Environmental Protection Agency, 4501T, 1200 Pennsylvania Avenue, NW, Washington, DC 20460; e-mail: scott.patricia@epa.gov. Please note that mention of any commercial products, services, materials, or publications in this booklet does not constitute endorsement or recommendation for use by EPA.

Please Read!

Any activities on or near the water should be carefully supervised by adults, and safety tips need to be explained to children. Please check with your school and be sure to follow all appropriate safety procedures and policies. All the field activities in this booklet include recommended safety tips. Other important safety guidelines are included on pages 42-44.

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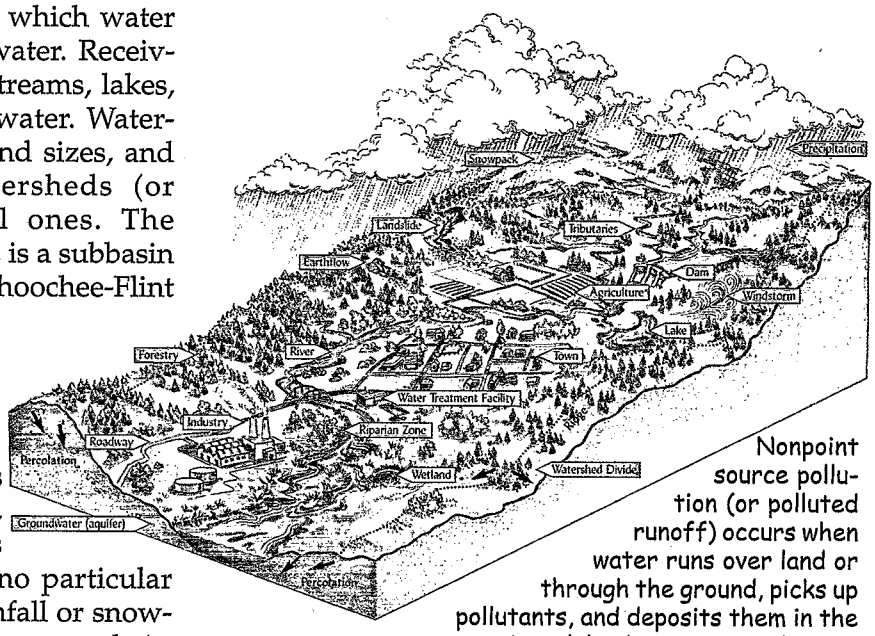
This project is modeled after the successful Water Drop Patch Project, a collaborative effort between EPA and the Girl Scouts of the USA (GSUSA). GSUSA developed its own Patch for Girl Scouts who complete the requisite number of activities. Because of the popularity of that project, EPA has developed this generic version for schools, science clubs, and others interested in watershed protection.

We encourage educators to work with Riverkeepers, state and local water quality officials, and watershed organizations to develop a certificate or awards program. You can contact Patty Scott in EPA's Office of Water at scott.patricia@epa.gov for suggestions or ideas. We strongly advise you to contact state and local experts who can assist you in carrying out the activities and tailoring the projects to your own geographic area.

Background Information

What Is a Watershed?

A watershed is a land area from which water drains into a receiving body of water. Receiving bodies of water can include streams, lakes, wetlands, estuaries, and groundwater. Watersheds come in different shapes and sizes, and local watersheds are subwatersheds (or subbasins) of larger, regional ones. The Chattahoochee River, for example, is a subbasin of the larger Apalachicola-Chattahoochee-Flint (ACF) River Basin.



Nonpoint source pollution (or polluted runoff) occurs when water runs over land or through the ground, picks up pollutants, and deposits them in the river, lake, bay, or groundwater.

What Is Nonpoint Source Pollution?

Unlike pollution from factories and sewage treatment plants, nonpoint source pollution comes from many different areas with no particular place of origin. It is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water. These pollutants include:

- Excess fertilizers, herbicides, and insecticides from farms, cities, and suburban streets
- Oil, grease, and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- Salt from irrigation practices and acid drainage from abandoned mines
- Bacteria and nutrients from livestock, pet waste, and faulty septic systems

Acid rain and changes to stream flow, such as dams and concrete channels, are also sources of nonpoint source pollution. Acid rain, much of which is caused by cars and power plants, is rich in nitrogen, which can overstimulate the growth of aquatic weeds and algae. This in turn can deplete oxygen and kill aquatic life. Structures such as dams and concrete channels change stream flow, reducing the ability of streams to absorb waste and disturbing fish breeding areas.

Acid Rain: A complex chemical and atmospheric phenomenon that occurs when emissions of sulfur and nitrogen compounds and other substances are transformed by chemical processes in the atmosphere, often far from the original sources, and then deposited on earth in either wet or dry form. The wet forms, popularly called "acid rain," can fall to earth as rain, snow, or fog. The dry forms are acidic gases or particulates.

Water Quality Conditions in the United States: "The National Water Quality Inventory"

What is the quality of our waters?

Surface waters are waters that you can see. These waters include rivers and streams, lakes, ponds, reservoirs, wetlands, coastal waters, and estuaries. For the U.S. waterbodies sampled most recently, about 40 percent are rated as impaired.

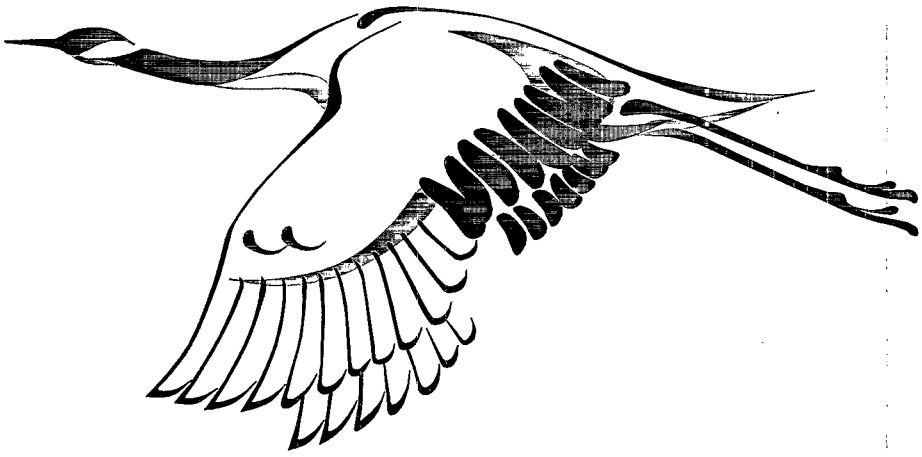
The National Water Quality Inventory

EPA and the states are directed by the Clean Water Act (CWA) to help protect the health of our nation's waters. The CWA gives states the authority and responsibility to establish water quality standards, which set minimum requirements for fish habitat, swimming, and drinking water sources. States, under Section 305(b) of CWA, are required to assess the health of their waters and submit the information to EPA every 2 years. EPA gathers the information from every state and prepares a report called the *National Water Quality Inventory*. To see the latest 305(b) report or other information on the quality of our nation's waters, visit http://www.epa.gov/305b on the Internet.

How is the quality of our waters determined?

Every state adopts goals or standards that need to be met for its waters, based on the intended uses of the waterbodies. Different goals are set for different waterbody uses. For example, if the water is going to be used for cooling machinery in a factory, it doesn't have to be as clean as water used for drinking. Scientists monitor the waters and give them one of the following scores:

- **GOOD**: The waterbody fully supports its intended uses.
- **POLLUTED OR IMPAIRED:** The waterbody does not support one or more of its intended uses.
- **GOOD, but THREATENED:** The waterbody supports its uses, but is considered vulnerable because of threats from existing or potential sources of pollution.



What Is a Wetland?

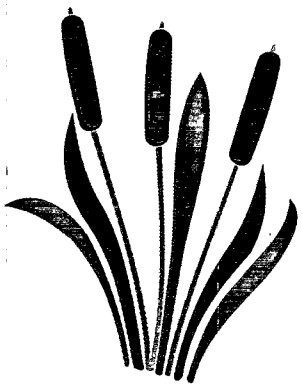
Wetlands are areas of land that are wet at least part of the year. They are populated by plants well adapted to grow in standing water or saturated soils. There are many different types of wetlands, including marshes, bogs, fends, swamps, prairie potholes, and bottomland hardwood forests. Wetlands may not always appear to be wet. Many dry out for extended periods of time. Others may appear dry on the surface but are saturated underneath.

What Are the Basic Characteristics of Wetlands?

Wetlands share three basic characteristics: (1) hydrology (water), (2) hydric soils (soils that form due to the presence of water), and (3) hydrophytic vegetation (plants adapted to living in saturated soils).

Wetland Benefits

These complex ecosystems play an important role in the health of our environment and the quality of our water. Wetlands provide support for:



- Fish and wildlife habitats
- Complex food webs
- Water absorption to reduce storm flooding and damage
- Sediment traps
- Erosion control
- Water quality
- Groundwater replenishment; maintaining flows in streams by releasing water during dry periods
- Open space and recreational opportunities

Did You Know?

Over one-third of all the threatened and endangered species live in wetlands, and nearly half use wetlands at some time in their lives. Other names for wetlands include swamps, bogs, marshes, fens, and pocosins.

Why Are Wetlands Important?

Wetlands as Sponges

Have you ever poured water onto a damp sponge? The sponge will hold a lot of water before it slowly starts to leak. The same happens in a wetland. Because of its low-lying position on the landscape, a wetland traps runoff water that flows into it during a rainstorm and slowly releases the water later. This helps to prevent flooding.

Wetlands as Filters

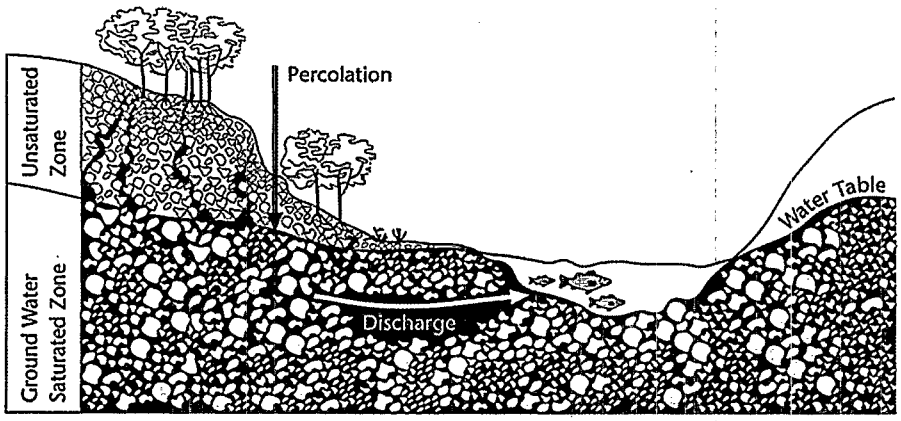
After being trapped by the wetland sponge, polluted runoff moves slowly through a wetland, finding its way around plants and through small spaces in the soil. While it moves, the nutrients are absorbed by the plant roots that poke through the soil spaces. Some spaces are very small and pollutants get trapped. Sometimes the pollutants just stick to the soil. By the time the water leaves the wetland, it is much cleaner than it was when it entered. This is why many people think of wetlands as nature's filter system.

Wetlands as Habitat

Wetlands are home to many types of macroinvertebrates, fish, amphibians, birds, mammals, and reptiles. These animals rely on the plentiful food, water, and shelter that wetlands offer. Although some animals spend their whole lives in a wetland, many use it for only a particular time in their lives, such as for hatching eggs and raising young.

What Is Groundwater?

Beneath the land's surface, water resides in two general zones, the saturated and the unsaturated. The unsaturated zone lies directly beneath the land surface, where air and water fill in the pore spaces between soil and rock particles. Water saturates the zone beneath the unsaturated one.



The term *groundwater* refers to water in the saturated zone. This water is an important natural resource and is used for many purposes, including drinking water, irrigation, and livestock raising.

Surface water replenishes (or recharges) groundwater when it sinks or percolates through the unsaturated zone. Therefore, the unsaturated zone can act as a pathway for groundwater contamination. Groundwater can move sideways and emerge at openings in the surface, such as springs on hillsides, or seep to streams, lakes, wetlands, and oceans. In this way, polluted groundwater can contaminate surface waters. Conversely, some surface waters, such as wetlands, hold floodwaters and allow them to soak slowly into the groundwater. When wetlands are filled or drained, groundwater may dry up.

Did You Know?

Half the drinking water in the United States comes from groundwater.

What Is the Quality of Your Drinking Water?

The Environmental Protection Agency requires water utilities to write annual drinking water reports called "Consumer Confidence Reports (CCRs)." These reports, issued with utility bills, provide fundamental information, including the source of your local drinking water (lake, river, aquifer, or other source), its susceptibility to contamination,and the level or range of any contaminants found. EPA's Web site, http://www.epa.gov/safewater, includes useful information on how to interpret the reports. For a copy of your CCR, check with your local water utility.

Watershed Patch Requirements

River Rookie (Grades 3–4)—Do any 4 of the first 10 requirements
Conservation Captain (Grades 4–5)—Do any 5 of the first 15 requirements
Aquifer Ace (Grades 5–6)—Do any 6 of the first 18 requirements
Watershed Wizard (Grades 6–8)—Do any 7 of the 20 requirements

1. After answering the questions on the Home and Lawn Care checklist (pages 13–15), plan how you and your family can change three to five "no" answers to "yes" answers. Share your plan with your school and members of your neighborhood. See how many "yes" answers other kids in your group have. Or use *Give Water a Hand Action Guide* to identify changes you can make on your farm, at your school, or in your community (page 15).

2. Wetlands provide many benefits. They help reduce flooding, sustain stream flow, filter polluted waters, provide habitat for wildlife, and support biological diversity. Visit a National Wildlife Refuge (NWR) or a locally protected wetland. Using the list on page 7, see how many wetland characteristics you can identify. Call 1-800-344-WILD or visit http://www.fws.gov for help in finding the nearest NWR. Or call EPA's Wetlands Helpline at 1-800-832-7828.

3. Enter the international "River of Words" Poetry and Art contest. The contest, open to youth between the ages of 5 to 19, invites children to explore and interpret their local watershed through the arts. To obtain an entry form or more information, contact River of Words, P.O. Box 4000-J, Berkeley, CA 94704; Tel: 510-548-POEM or download an entry form at http://www.riverofwords.org

4. Find out what different plants and animals live in your watershed. How many kinds of wildlife can you identify (e.g., crabs, oysters, waterfowl, and fish)?

5. Go on a hike with your school and follow a local creek or stream. Where does the stream ultimately drain? What does it pick up along the way? What happens when it rains? How does the stream change? What insects, birds, plants, or aquatic life do you observe? Use a United States Geological Survey (USGS) map or draw your own to illustrate your local watershed. USGS topographic maps can be obtained by calling 1-888-ASK-USGS (cost is $4) or visiting http://topozone.com/. Share with others what you have learned.

6. Create an attractive wall mural for your school or community with messages about clean water. Some ideas for themes might be "We all live downstream," "What is a watershed?" "Where does my drinking water come from?" or "The Wonders of Wetlands." You might take a look at a poster series developed by the USGS at http://water.usgs.gov/outreach/OutReach.html for some ideas!

7 Visit a local aquarium or a natural history museum to see specimens of aquatic life. Share your experiences with your school and family. Consider visiting one of Coastal America's Coastal Ecosystems Learning Centers if there is one near you. Check out Coastal America on-line at http://www.coastalamerica.gov or call 202-401-9928. Find out how Coastal America, a partnership of 11 federal agencies and the Executive Office of the President, is helping to protect the manatee, the whooping crane, salmon, and the right whale.

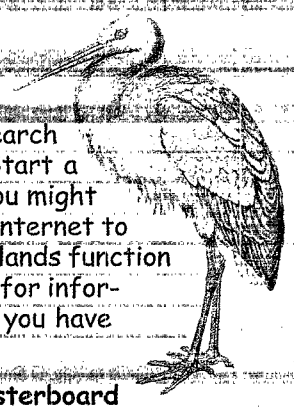
8 Visit a local sewage treatment plant or water filtration plant to see how wastewater is treated or drinking water is purified. Look at the treated water as it is being discharged into your river, stream, or estuary. Is it clear? Does it stink?

9 Participate in a special activity during May to celebrate American Wetlands Month or during the third week of October to celebrate National Wildlife Refuge (NWR) Week. For wetlands ideas, see the list below, visit the Izaak Walton League of America's Web site at http://www.iwla.org/SOS/awm or call 1-800-BUG-IWLA. For NWR Week, contact the Fish and Wildlife Service at 1-800-344-WILD or visit http://www.fws.gov.

10 Identify two people working in water resource protection and invite them to come to speak to your school or club.

11 Work with your school to organize a Storm Drain Stenciling Project in your neighborhood. Produce and distribute a flyer or door hanger for local households to make them aware of your project and to remind them that storm drains dump directly into your local waterbody. Guidelines for the project are on pages 16–17.

How Can I Help Protect Wetlands?



Before you can protect them, you have to understand them...

1. **Be a Wetlands Detective!** Investigate why wetlands are unique. Research what kinds of animals and plants live in the wetlands in your state. Start a journal to record the names of birds, frogs, insects, and plants that you might find in a local wetland. Try to draw them! Go to the library or use the Internet to uncover the mysteries of wetlands. Don't forget to investigate how wetlands function to keep a watershed healthy. Visit http://www.epa.gov/owow/wetlands for information or call EPA's Wetlands Helpline at 1-800-832-7828. Now that you have learned about wetlands, go explore one...
2. **Visit a publically accessible wetland and design a photograph posterboard display.** Form teams of two or three, each team with their own camera (disposable cameras work well). Using a field guide, photograph four or five items, such as insects, birds, plants, or trees. Label/describe the photos and mount them onto posterboard (laminating posters is recommended). Finally, display the poster in a public location such as a library, church, or school!
3. **Volunteer at your local wetland!** Call your county's agricultural extension agent or the local/state natural resource management agency and get a list of ongoing wetland/stream restoration projects.

12 Go on a stream, wetlands, or lake walk and make observations and assessments of waterbody conditions. See pages 18–30 for streamwalk guidelines. As part of your streamwalk, you may want to consider collecting stream insects to evaluate stream health. See pages 31–34 for guidelines.

13 Sponsor a Groundwater Festival or Watershed Festival at your school or in your community to raise awareness about the importance of clean water and watershed protection. See pages 35–36 for guidelines and a list of resources.

14 Do a display or presentation on groundwater and how pollutants threaten its purity. Show where your drinking water comes from. Students can check their family water utility bill or visit EPA's Web page at http://www.epa.gov/ow/states.html. Click on the map and link to information about local drinking water. Make an Aquifer Model (pages 37–38) part of your presentation.

15 Design a "mock-up" of your watershed. Share it with younger groups. Use EPA's Locate Your Watershed (http://www.epa.gov/surf) and Index of Watershed Indicators (http://www.epa.gov/iwi) Web sites or the resources list (pages 47–48) to create it.

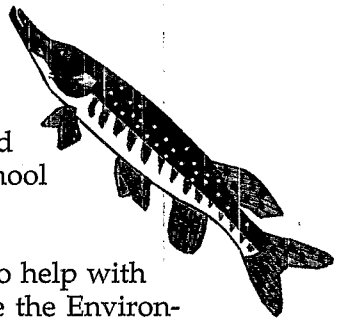
16 Share your knowledge of water pollution with younger children, perhaps a kindergarten or first grade class. Consider doing a presentation about your local watershed. Discuss threats to its health (e.g., pollution or habitat loss). Highlight things that students and their families can do to protect water quality (see checklist on pages 13–15). Visit the Watershed Information Network at http://www.epa.gov/win to obtain information about your watershed.

The Mississippi River

The Mississippi River carries rainfall and snowmelt from 31 states into the Gulf of Mexico. Scientific investigations have documented a zone in the northern Gulf of Mexico with low oxygen levels. This hypoxic zone is the result of an overabundance of nutrients such as nitrogen and phosphorus that get washed off the land and into the Mississippi River and its tributaries. The river then carries these nutrients out to the Gulf where the nutrients cause excessive algal growth. When the algae die, they use up all the oxygen in the water column, killing or weakening aquatic organisms such as fish and crabs.

A significant portion of the nutrients entering the Gulf from the Mississippi River comes from human activities: discharges from sewage treatment and industrial wastewater treatment plants and stormwater runoff from city streets and farms. Nutrients from automobile exhaust and fossil fuel power plants also enter the waterways and the Gulf through air deposition to the vast land area drained by the Mississippi River and its tributaries.

Many organizations within the basin are working together to improve the quality of the resources related to the Mississippi River and its major tributaries. Increasingly, citizens are learning how to live in harmony with the River. For more information on work that agencies and organizations across the country are involved in to protect the Mississippi River and its resources, visit EPA's Web site at http://www.epa.gov/msbasin.



Create a wildlife habitat or another conservation project in your school. Call the Natural Resources Conservation Service at 1-888-LANDCARE for a free backyard conservation booklet that outlines 10 conservation activities. Or consider joining the National Wildlife Federation's Schoolyard Habitat Program and receive a certificate and sign for your school project (see page 39).

Find a watershed group in your community and volunteer to help with a project (e.g., tree planting, habitat restoration project.) Use the Environmental Protection Agency's *Adopt Your Watershed* Internet site (http://www.epa.gov/adopt) to search for an organization active in your watershed. Check out EPA's Five Star Wetlands Restoration Program (http://www.epa.gov/owow/wetlands/restore/5star/index.html), which offers opportunties for youth groups to get involved in wetland restoration projects.

Work with your school and your local government to organize or join in a stream, wetland, or beach cleanup. Consider participating in the annual International Coastal Cleanup sponsored by the Ocean Conservancy held the third Saturday every September. Be sure to read the guidelines on pages 40–41 and safety tips on pages 42–44.

- Keep track of the kinds of trash collected. If it comes primarily from fast food restaurants, consider working with local restaurant owners to put up signs encouraging people not to litter in their community.
- If possible, separate the trash for recycling. Have different colored bags for paper, plastic, glass, and aluminum
- Take "before and after" photos of your efforts. Send them to a local paper to publicize your efforts.

Become a volunteer water quality monitor. Help collect quality data and build stewardship for your local waterbody. Attend a training workshop to learn proper monitoring techniques and safety rules (see page 34).

Safety First!

Any activities on or near the water should be carefully supervised by adults, and safety tips need to be explained to children. Please check with your school and be sure to follow all appropriate safety procedures and policies. All the field activities in this booklet include recommended safety tips. Other important safety guidelines are included on pages 42-44.

Projects and Activities

Home and Lawn Care Checklist: "Personal Pollution"

When rain falls or snow melts, the seemingly small amounts of chemicals and other pollutants in your driveway, on your lawn, and on your street are washed into storm drains. In many older cities, the storm water runoff is not treated and runoff flows directly into rivers, streams, bays, and lakes. Pollutants in this runoff can poison fish and other aquatic animals and make water unsafe for drinking and swimming.

What can you do to help protect surface waters and groundwaters? Start at home. Take a close look at practices around your house that might contribute to polluted runoff. The following is a checklist to help you and your family become part of the solution instead of part of the problem!

Do-It-Yourself Home Cleaning Products

General, multipurpose cleaner (for ceramic tiles, linoleum, porcelain, etc.): Measure 1/4 cup baking soda, 1/2 cup white vinegar, and 1 cup ammonia into a container. Add to a gallon of warm water and stir until baking soda dissolves.

Window Cleaner: 3 tablespoons of ammonia, 1 tablespoon of white vinegar and 3/4 cup of water. Put into a spray bottle.

Visit http://www.epa.gov/grtlakes/seahome/housewaste/src/recipes.htm for more ideas on nontoxic alternatives!

Household Products

1. **Do you properly dispose of household hazardous waste such as leftover oil-based paint, excess pesticides, nail polish remover, and varnish by taking them to your city's or county's hazardous waste disposal site or by putting them out on hazardous waste collection days?** Labels such as **WARNING, CAUTION, and DANGER** indicate the item contains ingredients that are hazardous if improperly used or disposed of.

   ☐ Yes ☐ No

2. **Do you use less toxic alternatives or nontoxic substitutes?** Baking soda, distilled white vinegar, and ammonia are safe alternatives to caustic chemicals. And they save you money.

   ☐ Yes ☐ No

3. **Do you limit the amount of chemicals, fertilizers, and pesticides you use and apply them only as directed on the label?**

   ☐ Yes ☐ No

4. **Do you recycle used oil, antifreeze, and car batteries by taking them to service stations and other recycling centers?**

   ☐ Yes ☐ No

Landscaping and Gardening

5. **Do you select plants with low requirements for water, fertilizers, and pesticides? (e.g., native plants)**

   ☐ Yes ☐ No

6. **Do you preserve existing trees and plant trees and shrubs to help prevent erosion and promote infiltration of water into the soil?**

☐ Yes ☐ No

7. **Do you leave lawn clippings on your lawn so that the nutrients in the clippings are recycled, less fertilizer is needed, and less yard waste goes to landfills?** If your community does not compost lawn trimmings, they usually go to landfills.

☐ Yes ☐ No

8. **Do you prevent trash, lawn clippings, leaves, and automobile fluids from entering storm drains?** Most storm drains are directly connected to our streams, lakes, and bays.

☐ Yes ☐ No

9. **If your family uses a professional lawn care service, do you select a company that employs trained technicians and minimizes the use of fertilizers and pesticides?**

☐ Yes ☐ No

10. **Do you have a compost bin or pile? Do you use compost and mulch (such as grass clippings or leaves) to reduce your need for fertilizers and pesticides?** Compost is a valuable soil conditioner that gradually releases nutrients to your lawn and garden. In addition, compost retains moisture in the soil and thus helps conserve water and prevent erosion and runoff. Information about composting is available from your county extension agent (see the blue pages in your phone book).

☐ Yes ☐ No

11. **Do you test your soil before fertilizing your lawn or garden?** Overfertilization is a common problem, and the excess can leach into groundwater and contaminate rivers or lakes.

☐ Yes ☐ No

12. **Do you avoid applying pesticides or fertilizers before or during rain?** If they run off into the water, they will kill fish and other aquatic organisms.

☐ Yes ☐ No

Did You Know?

One quart of oil can contaminate up to 2 million gallons of drinking water!

Water Conservation

Homeowners can significantly reduce the volume of wastewater discharged to home septic systems and sewage treatment plants by conserving water. If you have a septic system, you can help prevent your system from overloading and polluting ground and surface waters by ensuring that it is functioning properly and decreasing your water usage. For other ideas on what you can do to conserve water, check out a new Web site, http://www.h2ouse, developed in partnership with the California Urban Water Conservation Council.

13. **Do you use low-flow faucets and shower heads, and reduced-flow toilet flushing equipment?**

☐ Yes ☐ No

14. **When washing your family's car, do you use a bucket instead of a hose to save water?**

☐ Yes ☐ No

15. **Do you use dishwashers and clothes washers only when fully loaded?**

☐ Yes ☐ No

Give Water A Hand

What is your city, town, or school doing to prevent polluted runoff? GIVE WATER A HAND ACTION GUIDE contains checklists for schools, communities, and farms. This guide can help you and your school identify potential problems in your community and take action.

You can download a free copy of ***Give Water A Hand Action Guide and Leader Guidebook*** at http://www.uwex.edu/erc/gwah. Or to order printed copies call:

University of Wisconsin-Extension
608-262-3346
Items 4-H450 & 4-H855
Leader Guidebook ($4.92)
Action Guide ($6.96)
Price includes shipping.

16. **Do you take short showers instead of baths and avoid letting faucets run unnecessarily (e.g., when brushing teeth)?**

☐ Yes ☐ No

17. **Do you promptly repair leaking faucets, toilets, and pumps to conserve water?**

☐ Yes ☐ No

18. **Do you conserve the amount of water you use on your lawn and water only in the morning and evening to reduce evaporation?** Overwatering may increase leaching of fertilizers to groundwater.

☐ Yes ☐ No

19. **Do you use slow watering techniques such as trickle irrigation or soaker hoses?** These devices reduce runoff and are 20 percent more efficient than sprinklers.

☐ Yes ☐ No

In Your Community

20. **Do you always pick up after your pet (e.g., Rover's poop)? Be sure to put it in the trash, flush it down the toilet, or bury it at least 5 inches deep.** Pet waste contains viruses and bacteria that can contaminate surface and groundwater.

☐ Yes ☐ No

21. **Have you helped stencil stormdrains to alert people that they drain directly to your local waterbody?** If not, get involved with a local conservation group or organize your own stenciling project.

☐ Yes ☐ No

22. **Do you ride or drive only when necessary?** Try to walk instead. Cars and trucks emit tremendous amounts of airborne pollutants, which increase acid rain. They also deposit toxic metals and petroleum by-products.

☐ Yes ☐ No

23. **Do you participate in local planning and zoning decisions in your community?** If not, get involved! These decisions shape the course of development and the future quality of your watershed.

☐ Yes ☐ No

Storm Drain Stenciling Project Guidelines

A storm drain stenciling project consists of stenciling a message next to the street drain reminding people to **"Dump No Waste—Drains to River"** with the image of a fish. (Stencils are also available for lake, stream, bay, groundwater, ocean, or simply **"Protect Your Water"** with the image of a glass and faucet.) Steps to consider when conducting a stenciling project:

First, call for permission. For public streets, call the city or county Public Works Department (storm water or road maintenance division). In some cases, the State Highway Administration has jurisdiction. Public Works will probably issue a permit or letter of approval. They might even help by providing storm drain maps, traffic safety cones, flags, and vests. Check to see if they prefer that you stencil on the sidewalk or on the street next to the drain. For some drains on private property (e.g., business or apartment parking lots), obtain the permission of the property owner.

Consider safety. Especially when stenciling with children, seriously consider traffic safety issues when you select your site. Neighborhoods are usually safer than downtown city streets (and many nonpoint sources go down storm drains in residential neighborhoods). Place traffic safety cones, and assign at least **one adult with a traffic flag to watch traffic at all times.**

Prepare materials. Before using stencils for the first time, "weed" remaining letters from the die cuts. This prevents small plastic or oilboard pieces from washing into drains while you are stenciling. "Stencil weeding" is a good activity for a short training meeting before going out to paint. For painting, an aerosol can or traffic-zone latex paint (without chlorofluorocarbons (CFCs) that harm the ozone) is a good option. Some stencilers use a small roller or stencil brush with recycled latex-based paints. Be careful that younger stencilers do not apply the paint too thickly because it will run under the stencil or smear the letters.

Call the media. Notifying the media of a stenciling event can get your watershed protection message out to the whole community. Young people in the project enhance media photo opportunities. Remember to take your own pictures, too.

Avoid a mess. Remind stencilers to wear old clothes. Rubber gloves and protective eye gear are helpful, as are plastic bags worn over shoes. Bring rags to clean up unexpected paint on your arms or fingers. Also include big litter bags to bring back used gloves and rags as well as any garbage you pick up that otherwise could go down the storm drain. Paint spray can drift onto nearby parked cars, so bring a large box opened flat to use as a shield around the stencil as you spray.

Help for Storm Drain Stenciling Projects

Many local watershed groups and county governments offer help with stenciling projects. You can often borrow stenciling kits from these organizations.

The *Ocean Conservancy* sponsors a "Million Points of Blight" national storm drain stenciling campaign. Call Ron Ohrel at 757-496-0920 to request stencils on loan and project guidelines. Ocean Conservancy's address: 1432 North Great Neck Road, Suite 103, Virginia Beach, VA 23454.

Earthwater Stencils produces stencils and other watershed education materials. Write to: 4425 140th Avenue, SW, Dept. V, Rochester, WA 98579-9703. Phone: 360-956-3774. On the Web at http://www.earthwater-stencils.com.

Work in teams of four to six accompanied by an adult. One team **accompanied by an adult** may go together door-to-door passing out flyers or doorhangers (see below). Explain the watershed drainage, your monitoring findings, local river fish and wildlife, and actions neighbors can take to avoid pollution. Rotate jobs for maximum enjoyment and experience.

Tips for applying stencils. Scrub the area briskly with a wire brush and dust it off with a whisk broom. Lay the mylar stencil on the sidewalk or street next to the storm drain. If using spray paint, shake the can and hold it about 6 to 8 inches from the stencil. Use a series of short back and forth motions to spray one line at a time until the letters are uniformly covered. Do not use too much paint because it will run underneath and blur the letters. When finished, carefully lift the stencil up off the street. It may take a little experience in the beginning to adjust the amount of paint. After finishing all the stenciling for the day, lay the stencils out flat to dry in a warm place. When the paint is completely dry, gently roll the stencils to chip off the paint. This works best if the paint is not allowed to build up a thick layer between cleanings.

Prepare a flyer or doorhanger. After stenciling a message that tells neighborhood people what not to do (Dump No Waste), students can hand out and discuss a flyer or doorhanger explaining:

- Recycle used oil at nearby listed locations
- Use fewer chemicals on lawns and gardens
- Save household hazardous chemicals for collection days (give dates and location)
- Pick up waste that would otherwise wash down storm drains
- Other stewardship opportunities

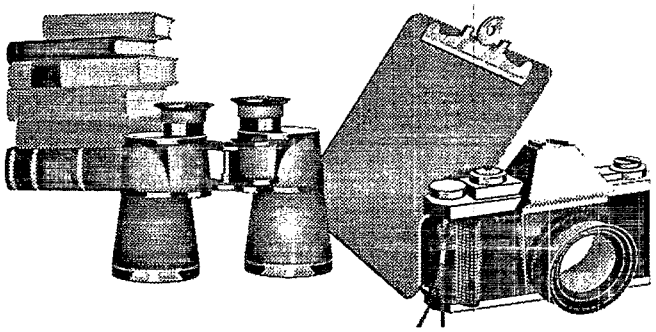
Add local information for a sense of place:

- Where do neighborhood drains go—into what river, bay, lake, or aquifer?
- If drains connect to combined sewer overflows (CSOs), how do they work? What happens with overflows during storm water events? (They go straight to the river.)
- Who lives near or in the river? (Names of local species of fish, birds, and other critters.)
- What restoration projects are under way to clean up or replant streamsides, build and install bird or bat boxes, or maintain local trails?
- How can community members help?

These guidelines were adapted and reprinted with permission from Rhonda Hunter, the founder of Earthwater Stencils, 4425 140th Avenue, SW, Dept. V, Rochester, WA 98579-9703. Phone: 360-956-3774. On the Web at http://www.earthwater-stencils.com. These guidelines were adapted from a story that appeared in The Volunteer Monitor newsletter, Volume 7, No. 2, Fall 1995.

Streamwalk

The Streamwalk is an easy-to-use tool designed to assess the health of a stream corridor. If you observe water quality problems at your site (e.g., dead fish, oil spills, leaking barrels, bulk trash), you should report these findings to your city or county environmental department right away. Explain the nature and location of the problem.



Before the Streamwalk

1. We encourage you to contact local groups involved in environmental issues in your area. This serves two purposes: one, these groups may be able to provide you with information and background on your Streamwalk site; and two, you may be able to piggyback on an existing program. Visit EPA's Adopt Your Watershed Web page at http://www.epa.gov/adopt to see if there is a group in your watershed you can team up with.

2. Choose the general area for your Streamwalk. **Educators should carefully read the Streamwalk tips on page 24 and safety guidelines on pages 42–44 before beginning this activity. Also, it is strongly recommended that you visit the Streamwalk site in advance to take into account any potential hazards (e.g., broken glass, traffic, steep slopes, holes, rocks, poisonous plants, and insect nests).** You may wish to collect data along a familiar stream, one that is close to your school or on school grounds, or one that does not cascade down a steep mountain side. You may decide to do a series of streams in a watershed to collect baseline data or concentrate your efforts in areas suspected of being polluted. It is recommended that Streamwalks be done four times a year (once each season) at your site.

3. Find a U.S. Geological Survey (USGS) topographic map of your area. These "topo" maps show such things as elevations, waterways, and roads, and they help you see the connections between your stream and its watershed. Topo maps identify the latitude and longitude of your site. Help in defining longitude and latitude is provided on pages 28 and 29. We recommend 7½-minute quad maps (1:24,000 scale, where 11 inches = 4 miles), which are available at outdoor supply stores stores or on-line at http://topozone.com. You may also find one to photocopy at your local library, or you can order directly from USGS. For assistance, call 1-888-ASK-USGS.

4. Now, find your specific Streamwalk site on the topo map. For purposes of Streamwalks, you will characterize 100 feet (or about 65 meters) in either direction from your site. You may do as many sites on the stream as you wish. Just be sure that sites are at least 200 feet apart.

5. Finally, make a copy of the Streamwalk survey data form (pages 25–27). **It is very important that you go through the instructions, the Streamwalk Tips, and safety guidelines on pages 42–44 before you begin your walk.** You will use your map and one survey data sheet per Streamwalk site.

Note: Several citizen groups and agency representatives worked with EPA's Region 10 office (Seattle, Washington) to develop Streamwalk.

Instructions for Filling Out Streamwalk Site Survey Data Sheets

Below are directions on how to fill out the Streamwalk Site Survey Data Sheet. Please read these thoroughly before you begin your walk. If, while conducting your Streamwalk, you are not able to determine what the response should be, or if the question itself is unclear, just leave that space blank—but don't stop your walk. Remember this is not a test, and there are no right or wrong answers. **Walks can be done along the stream—you do not need to enter the water. Please be sure to read the tips on page 24 and safety guidelines on pages 42–44.**

Location

Give the stream name, county, and state of your site. Refer to the topo map if you have one. Note: There are some unnamed streams; in these cases you can indicate the stream, lake, or waterbody into which your stream flows and the name and number of the topo map. (If you want to share your information with a local or state environmental agency, it is useful to include the longitude and latitude of your site(s). This step is optional since computing this may be challenging. (See page 25.)

Weather

The concern with weather relates to amount of rainfall, which potentially can affect flow, clarity, and amount of water in a stream. Weather/rainfall reports are available in the daily newspaper or by calling the local Weather Service. Definitions of weather conditions established by the Weather Service are:

- **Rain -** 1/3 inch in 24 hours - light, steady rainfall.
- **Showers** - 1/3–1 inch in 24 hours, intermittent and variable in intensity.
- **Storm -** 1 inch or more rain in 24 hours, usually accompanied by high winds.

Stream Description

Depth and Width Estimates

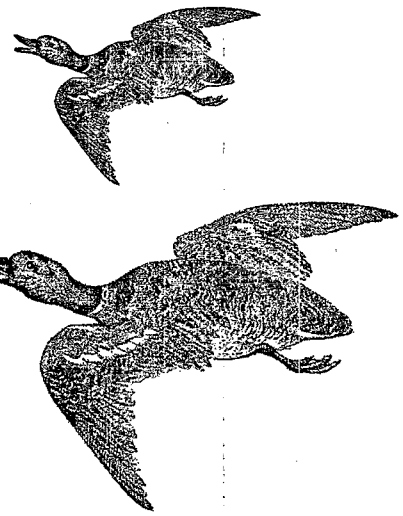
This information provides a description of the stream water at your site. Simply provide an estimate of the stream's width and depth. Do not enter the water—**just provide your best guess!**

Water Clarity

The clearness of the water is observed to determine if sediment pollution (dirt) is entering the stream. Cloudy or different colored water can be a result of natural processes or of land use in the surrounding watershed. Sediments can adversely affect habitat conditions such as food, health of fish, and breeding environment for macroinvertebrates. In some areas, grey or white water can be a result of natural processes such as glacial sources for streams.

Water Flow: Pools and Riffles

The variety of flow in relation to depth creates habitat to support fish and invertebrate life. Pools are deeper than adjacent areas. They provide feeding, resting, and spawning areas for fish. Riffles and/or runs are flows swift in comparison to surrounding areas. Riffles are shallow and fast water, runs are deep and fast water, and pools are slow and deep water.



Stream Channel Cross-Section Shape

Please check the box that matches the shape of the stream channel. If you are unable to see the shape of the bottom and banks, please estimate. You can base your estimate on the flow of water. *The slower the water in the middle of the stream, the flatter the bottom.*

Stream Bottom (substrate)

Indicate the most common type of material on the stream bottom.

- ***Silt/clay/mud***: This substrate has a sticky, cohesive feeling. The particles are fine. The spaces between the particles hold a lot of water, making the sediments behave like ooze.
- ***Sand*** (up to 0.1 inch): Sand is made up of tiny particles of rock. It feels soft underfoot.
- ***Gravel*** (0.1–2 inches): A gravel stream bottom is made up of stones ranging from tiny quarter inch pebbles to rocks of about 2 inches.
- ***Cobbles*** (2–10 inches): The majority of rocks on this type of stream bottom are between 2 and 10 inches. The average size is about that of a grapefruit.
- ***Boulders*** (greater than 10 inches): Most of the rocks on the bottom will be large, greater than 10 inches.
- ***Bedrock***: This kind of stream bottom is solid rock.

Width of Natural Streamside Corridor

Streamside corridor, riparian area and *zone of influence* are terms that describe the natural vegetated area on either side of the stream. Along with the stream, that area forms the habitat of the river. It includes vegetation that shades the water, holds the soil in place, adds nutrients to the stream in the form of leaves and during flooding, and provides living quarters for streamside wildlife. Estimate as best you can the width of the corridor at your site. **Indicate with an "x" on the bar graph. Note: Left and right are based on looking down stream.** If the vegetation is pasture or landscaped, this is not a natural state, so mark "o."

Streamside Vegetation

Vegetation acts as a filter for sediment and pollution coming in from the land nearby. It provides habitat for the many creatures that are dependent on and influence the stream. Branches, logs, and leaves enter the stream from this region. Vegetation also provides shade, which keeps the water cool. On the data sheet mark all the categories that apply.

- **Conifer:** A cone-bearing evergreen tree or shrub (e.g., a pine tree)
- **Deciduous tree**: A tree that sheds its foliage at the end of the growing season
- **Small trees or shrubs**: Either conifers or deciduous bushes less than 20 feet high.
- **Grasses:** Any of numerous plants with narrow leaves, jointed stems, and spikes or clusters of inconspicuous flowers.

Overhead Canopy (Stream Cover)

This is the amount of vegetation that overhangs the stream. It offers protection and refuge for fish and other organisms, shades the stream and keeps the water cool, and provides "launching" areas for insects that might fall into the river. Estimate, as best you can, about how much of the river is overhung by vegetation and whether the vegetation is grasses, shrubs, or trees. Please check the category that is appropriate for the current condition of your site. For example, if in the winter there are no leaves on the trees in your segment, you might check 0%–25%. However, in the summer when the trees have leaves, you might check 50%–75%.

Artificial Bank Protection

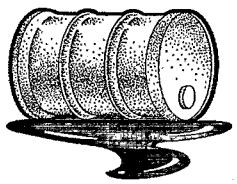
This category includes such streamside modification as riprap (a retaining wall built of rocks or concrete) and bulkheads. It may also include deliberately placed auto bodies, refrigerators, and washing machines. People in the past have thought that such modifications helped stabilize stream banks. Unfortunately, not only do they drastically degrade habitat for streamside and in-stream dwellers, but they also can cause bank erosion in flood conditions. Mark the categories that best describe the condition of the stream bank within your 500-foot segment.

Presence of Logs or Woody Debris in Stream

Logs and woody debris (not twigs and leaves) can slow or divert water to provide important fish habitat such as pools and hiding places. So please mark the general amount of logs and woody debris in the stream. DO NOT REMOVE THEM.

Organic Debris in Stream

The presence of other organic matter in the stream can be both good and bad. Dumped grass clippings are not good for stream health. On the other hand, naturally falling leaves and twigs can be beneficial.

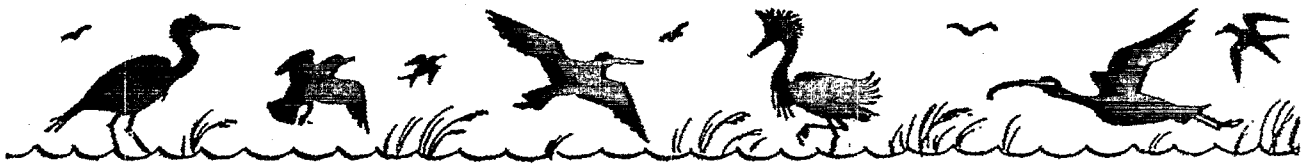


Fish in Stream

Can you see any fish? Mark it down! If you know what kind of fish it is, say so in the space next to the question. If you think there are fish but you cannot see them, mark "no."

Adjacent Land Uses

Adjacent land use has a great impact on the quality and state of the stream and riparian areas. Enter a "1" if the land use is present and a "2" if it is **clearly** impacting the stream. If you cannot determine the type of housing, industry, or development, please make your best estimate.



Conditions

This section is designed to get information about potential problems at your Streamwalk site. Enter a "1" if the condition is present and "2" if it is severe.

Stream Banks

- *Natural plant cover degraded:* Indicate if stream side vegetation is trampled, missing, or replaced by landscaping or cultivation.
- *Banks collapsed/eroded:* Note if banks or parts of banks have been washed away or worn down.
- *Banks artificially modified:* Indicate if banks have been artificially modified by construction or placement of rocks, wood, or cement supports or lining.
- *Garbage or junk adjacent to stream:* Describe human-made materials present.

Stream Channel

Mud/silt/sand on bottom/entering stream: Excessive mud or silt entering the stream and clouding the water can interfere with the ability of fish to sight potential prey. It can also clog fish gills and smother eggs in spawning areas on the stream bottom. Mud/silt/sand can be an indication of poor construction practices in the watershed, where runoff coming off the site is not adequately contained. It can also be a perfectly normal occurrence, especially if, for example, a muddy bottom is found along a very slow-moving segment or a wetland. Use your best judgment.

Artificial stream modifications: Please note if the stream water has been dammed, dredged, filled, or channelized through culverts or if other large-scale activities such as log removal are apparent.

Algae/scum floating/covering rocks: Evidence of algae (very tiny plants that can color the water green or can resemble seaweed) or scum in the water may point to an upstream source adding too much nutrient (fertilizer) to the water.

Foam or sheen: This is a bit of a tricky category because this type of thing can be naturally occurring or a problem. For example, an irridescent or shiny sheen on the water might be from rotting leaves or it might be from some upstream pollutant. If you are not sure, mark it on the checklist.

Garbage or junk in stream: This is your chance to point out very straightforward problems like batteries, tires, home appliances, car bodies, and garbage.

Other

Organic debris or garbage: The purpose is to determine if the stream is being used as a dump site for materials that would not be present naturally. Debris can be anything from a soda can to vegetation brought from outside the stream corridor.

Livestock in or with unrestricted access to stream: Are livestock present or is there an obvious path that livestock use to get to the water from adjacent fields? Is there stream-side degradation caused by access?

Actively discharging pipes: Are there pipes with visible openings dumping fluids or water into the stream? Please note, even though you may not be able to tell where they come from or what they are discharging. **Do not touch this effluent!**

Other pipes: Are there pipes entering the stream? Please mark even if you cannot find an opening or see matter being discharged.

Ditches: Are any ditches draining into the stream?

Stream Symptoms

Shiny surface or rainbow colors—If you see rainbow colors on the water's surface or if you smell oil (a gas station smell), oil might be polluting your stream. Oil can come from a pipeline leak, a storm sewer, or illegal dumping. Oil kills fish and can make kids who play in the water sick.

Green water—Too much algae. Algae are small plants that are found in the water. Fertilizers from farms and lawns can get into streams and cause too much algae to grow. When algae break down or decompose, oxygen is used up and fish don't have enough to breathe.

Brown or muddy water—Too much dirt or sediment in the water. Dirt clogs fish gills so fish can't breathe. Dirt kills stream insects when it settles to the bottom and buries them. Dirt blocks light to underwater plants, and they die too.

Orange water—Orange water can indicate the presence of iron in the water. Iron can be naturally present where the soils are high in iron. This is not a pollution problem. However, orange water can indicate acidic runoff from mining activities. Acidic water kills fish and other stream life.

Foam or suds—Some foam or suds in the stream is natural. If you see foam in the stream that is more than 3 inches tall, looks like bubble bath, and doesn't break apart easily, detergent may have entered the stream. Soap can come from homes, factories, or car washes. Soap harms stream insects because it breaks the surface tension of the water and insects like water striders sink and drown.

Strange odors—A chemical smell can mean harmful chemicals are polluting your stream. A rotten egg smell can mean sewage is getting into the stream from cows, sewage treatment plants, or people's homes. Sewage or chemicals can make people and animals ill.

Reprinted with permission from Izaak Walton League of America

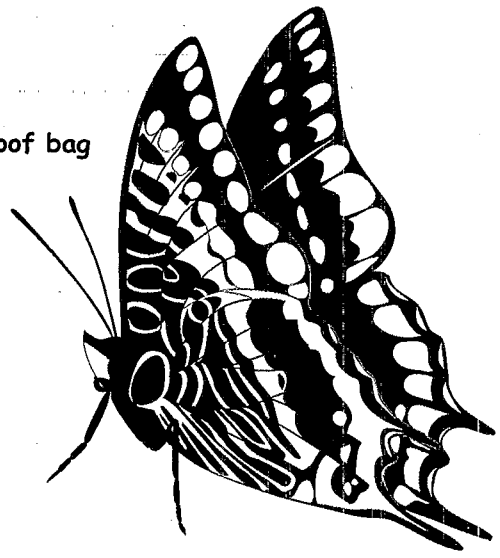
Streamwalk Tips

Also review Safety Guidelines on pages 42–44

- Get the permission of landowners to cross any private land, posted or not. **Do not enter areas without permission.** It is recommended that you use public access points (such as city/county/state parks and campgrounds).
- Only record what you see, not what you have previously seen. For example, if you think fish are present but you can't see them, mark your sheet "no fish present."
- Do not put yourself in danger to gather survey information.
- Be careful of ticks, poison oak, nettles, and insects. Bring repellent. Wear long pants and boots; wind breakers help fend off nettles.
- Watch out for dogs, snakes, alligators, and large animals.
- Do not drink the water—it is unsafe.
- Do not walk on unstable banks; your footsteps could speed erosion.
- Be alert for spawning areas (redds) in the stream. Do not walk on them. They will look like a round or elliptical area of clean gravel about 1–3 feet long. During fall through spring, when redds are evident, try not to walk in the stream. In the summer, if you are careful, the streambed might be the easiest route for conducting your Streamwalk. Be aware that the streambed can be very slippery, uneven, and unpredictable.
- **Do not attempt to walk across streams that are swift and above the knee in depth. You can be swept away in an instant!**
- Be careful of streamside vegetation. Disturb it as little as possible.
- **If for any reason you feel uncomfortable about the stream conditions or surroundings, please stop your Streamwalk immediately. You and your students' safety are much more valuable than the Streamwalk!**

Recommended list of items to take along:

- Photocopies of topo map of stream to be walked
- Comfortable rubber boots
- Snag- and thorn-proof clothing that is appropriate for the weather
- Clip board with waterproof cover
- Streamwalk data forms
- Two pencils
- Folding ruler or tape measure
- Camera and film and/or video recorder in waterproof bag
- Leather gloves
- Bottled water
- Whistle
- First aid kit (See page 42 for suggested contents)
- Cell phone
- If you are away from urban or residential areas, the following are also recommended for safety:
- Extra clothes in a waterproof bag
- Toilet paper and hand wipes
- Fire starter (candle, cheap lighter, tinder)
- Flashlight and extra batteries
- Global positioning device, compass
- Aluminum-foil blanket (for winter excursions)



Streamwalk Site Survey Data Sheet (Complete One Sheet per Site)

Location

Stream name: _____ Date: _____

County: _____ State: _____

School Name: _____

Contact Name: _____ Phone: _____

Site (name, description or number): _____

_____

Latitude: _____ ° _____ ' _____ " N

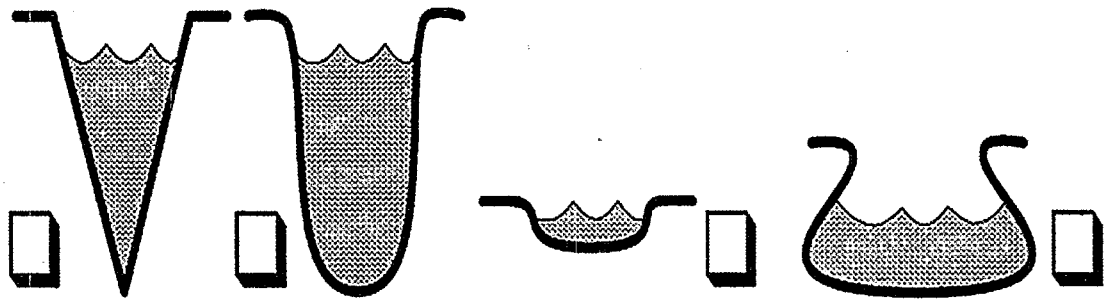
Longitude: _____ ° _____ ' _____ " N

Weather *(see instructions on page 19)*

❑ Clear ❑ Overcast ❑ Rain ❑ Showers ❑ Storm

Stream Description *(see instructions on pages 19)*

1. **Depth *(estimated)*:** feet
   Width *(estimated)*: feet
2. **Clarity: Does water appear** ❑ Clear ❑ Cloudy
3. **Water Flow:** *(check all that apply):* ❑ Pools ❑ Riffles ❑ Runs
4. **Stream Channel Cross Section Shape:** *(at site) (Estimated)*



Streamwalk Site Survey Data Sheet (Complete One Sheet per Site)

5. **Stream bottom:** *(check the most common)* *(see instructions on page 20)*
   - ❑ Clay/Mud
   - ❑ Sand (up to 0.1 inch)
   - ❑ Gravel (0.1- 2 inches)
   - ❑ Cobbles (2–10 inches)
   - ❑ Boulders (over 10 inches)
   - ❑ Bedrock (solid)

6. **Width of Natural Streamside Corridor:** (average) *(see instructions on page 20)*
   Left looking downstream:_____meters Right looking downstream:_____meters

7. **Streamside Vegetation:** *(see instructions on page 20)*

	None/Sparse	Occasional	Common
Conifers	❑	❑	❑
Deciduous	❑	❑	❑
Small trees and Shrubs (< 20 feet)	❑	❑	❑
Grasses	❑	❑	❑

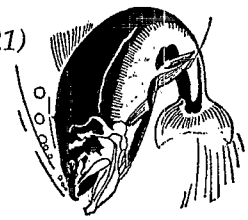
Vegetation appears ❑ natural ❑ cultivated ❑ mixed (w/weeds)

8. **Extent of Overhead Canopy:** *(see instructions on page 21)*
   ❑ 0%–25% ❑ 25%–50% ❑ 50%–75% ❑ 75%–1 00%

9. **Extent of Artificial Bank Protection:** *(see instructions on page 21)*
   ❑ 0%–25% ❑ 25%–50% ❑ 50%–75% ❑ 75%–1 00%

10. **Presence of Logs or Large Woody Debris in Stream:** *(see instructions on page 21)*
    ❑ None ❑ Occasional ❑ Common

11. **Presence of Other Organic Debris in Stream:** *(see instructions on page 21)*
    ❑ Occasional ❑ Common



12. **Any fish present?** *(see instructions on page 21)*
    ❑ Yes ❑ No

Other Comments? _____

_____

_____

Site Survey Data Sheet (Complete One Sheet per Site)

Adjacent Land Uses

(see instructions on page 21)

Check "1" if present, "2" if clearly impacting stream:

1	2	**Residential/industrial**
❑	❑	Single-family housing
❑	❑	Multi-family housing
❑	❑	Commercial development
❑	❑	Light industry
❑	❑	Heavy industry
❑	❑	Road/bridge construction
		Roads, etc.
❑	❑	Paved roads or bridges
❑	❑	Unpaved roads
		Construction under way on:
❑	❑	Single-family housing
❑	❑	Multi-family housing
❑	❑	Commercial development
❑	❑	Light industry
❑	❑	Heavy industry
		Agricultural
❑	❑	Grazing land
❑	❑	Feedlots or animal holding areas
❑	❑	Cropland
		Other
❑	❑	Mining or gravel pits
❑	❑	Logging
❑	❑	Recreation

Conditions

Check "1" if present, "2" if impact seems severe:

1	2	**Stream banks**
❑	❑	Natural streamside cover degraded
❑	❑	Banks collapsed/eroded
❑	❑	Banks artificially modified
❑	❑	Garbage/junk adjacent to stream
		Stream channel
❑	❑	Mud, silt, or sand in or entering stream
❑	❑	Artificial stream modifications(dams, channels, culverts, etc.)
❑	❑	Algae or scum floating or coating rocks
❑	❑	Foam or sheen
❑	❑	Garbage/junk in stream
		Other
❑	❑	Organic debris (garbage, grass clippings, etc.)
❑	❑	Livestock in or with unrestricted access to stream
❑	❑	Actively discharging pipe(s)
❑	❑	Other pipe(s) entering
❑	❑	Ditches entering

Other Comments? _____

_____

_____

_____

Follow-Up Questions for the Streamwalk

1. What animals or plants did you observe? Write the names or make sketches.

2. What three pieces of evidence did you find for ways that people use this water?

3. What evidence did you find for ways that other animals and plants use this water?

4. What color was the water? Was it clear? Did it smell?

5. From what you learned and observed while visiting the stream, what can you say about the quality of the water? You may want to study the "stream symptoms" on page 22 for some help.

6. Do you think water quality is a problem at this site? What evidence do you have for your answer?

7. We just spent time surveying the land uses adjacent to the site. Do you think this has an effect on the quality of the water? Do you think that there is strong connection between impacts on the land and water quality?

8. Do we have enough evidence to say whether the water is polluted or what it is polluted with? What else might we need to learn? Where can we get some additional information about the quality of our watershed? (Hint: Your state is required to submit information regularly to the Environmental Protection Agency about the quality of your state's watersheds. You can visit the Watershed Information Network (http://www.epa.gov/win) to find your watershed and learn about its health.)

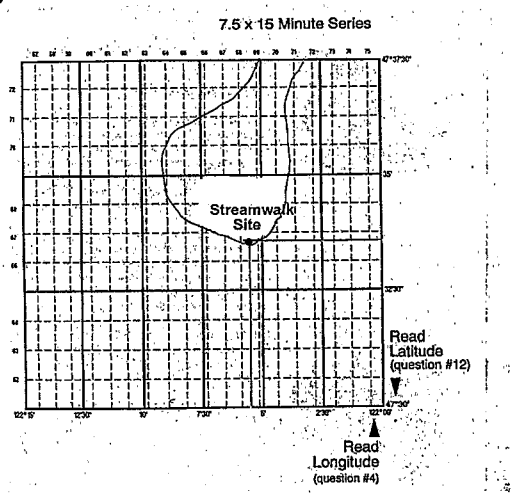
Did You Know?

Water is the only substance necessary to all life. Many organisms can live without oxygen, but none can live without water!

Water makes up about 65 percent of our bodies. Humans and all other animals, as well as plants, require water to live. Without it, we would not be able to survive more than one week!

Instructions for Defining Latitude and Longitude

Latitude and longitude are defined in degrees, minutes, and seconds. There are 60 seconds in a minute and 60 minutes in a degree. The symbols are as follows ° = degrees, ' = minutes, and " = seconds. The following example may help you determine the latitude and longitude for your walk.



Longitude

Look at the right side (upper or lower corner) under the map name, or the second of two numbers separated by "x", to find the width scale (longitude) of the map:

	Your Work	Example
1. If "7.5 MinuteSeries," enter 450. If "15 Minute Series," enter 900. If "7.5x15 Minute Series," enter 900. If "15x30 Minute Series," enter 900.	_____	900
2. Using a ruler, measure the width of your map east to west (exclude borders).	_____ cm	10 cm
3. Divide #1 by #2 to the nearest whole number.	_____ sec/cm	90 sec/cm
4. Enter the longitude located in the lower right corner.	_____	122°00'
5. Using a ruler, measure (centimeters) from your site, straight across, to the right side of the map.	_____ cm	3.7 cm
6. Multiply #5 by #3 (to the nearest whole number).	_____	3.7x90=333
7. Convert #6 to minutes and seconds by dividing by 60. Your whole number after division is the number of minutes, and the remainder is the number of seconds. (Do not use a calculator.) For example, 215 can be divided by 60 three times. 215 - 180 = 35. So 215 converts to 3'35".	_____	333/60=5 (300 with 33 left over, or 5'33")
8. Add #4 to #7.	_____	122°
	_____	5'
	_____	33"

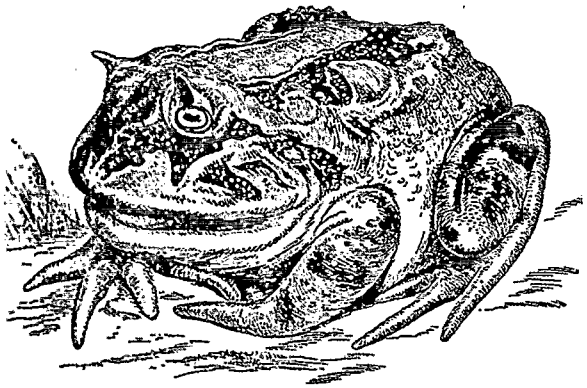
The answer for #8 is the longitude of your site.

Latitude

Look at the right side (upper or lower corner) under the map name, or the second of two numbers separated by "x", to find the height scale (latitude) of the map:

	Your Work	Example
9. If "7.5 Minute Series," enter 450. If "15 Minute Series," enter 900. If "7.5x15 Minute Series," enter 450.	_____	450
10. Using a ruler, measure the length of your map north to south (exclude borders).	_____ cm	10 cm
11. Divide #9 by #10 to the nearest whole number	_____ sec/cm	45 sec/cm
12. Enter the latitude located in the lower right corner.	_____	47°30'
13. Using a ruler, measure (centimeters) from your site, straight down, to the bottom of the map.	_____ cm	4.8 cm
14. Multiply #13 by #11 (to the nearest whole number).	_____	4.8x45=216
15. Convert #14 to minutes and seconds by dividing by 60. Your whole number after division is the number of minutes, and the remainder is the number of seconds. (Do not use a calculator.) For example, 215 can be divided by 60 three times. 215 - 180 = 35. So 215 converts to 3'35".	_____	216/60=3 (180 with 36 left over, or 3'36"
16. Add #15 to #12.	_____	47°
	_____	33'
	_____	36"

The answer for #16 is the latitude of your site.



Stream Insects

This activity can be done in conjunction with the Streamwalk (page 18). **Please be sure to read the Streamwalk tips on page 24 and safety guidelines on pages 42-44.**

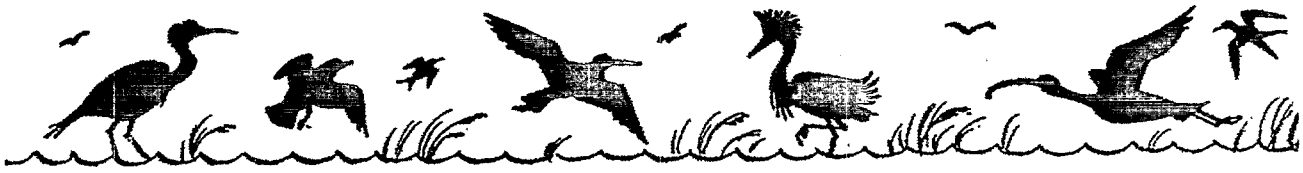
There is a whole world of life in rivers and streams. Living alongside fish, amphibians, reptiles, and wildlife are ***macroinvertebrates***—creatures that are large (macro) enough to be seen with the naked eye and that lack a backbone (invertebrate). Aquatic insects, clams, snails, crayfish, worms, and leeches are all macroinvertebrates. Some, like snails, live their whole lives in the water; others, like dragonflies, leave the water as adults to feed and reproduce. In streams most macroinvertebrates live under or attached to submerged rocks, logs, and plants. Like all living things, they need oxygen to breathe, water of the right temperature to thrive and reproduce in, suitable habitat, and the right kind of food. When these requirements are not met, these creatures will not survive.

Scientists and trained volunteers study macroinvertebrates to learn about stream water quality. Macroinvertebrates and crustaceans are an "indicator" species—in other words, their presence is used as a way to assess the health of a waterbody. Any physical, chemical, or biological change in water quality that adversely affects living organisms is considered to be pollution. Some organisms are very sensitive to pollution, while others are more resilient and less vulnerable. Water quality monitors sample aquatic insect populations a few times a year to observe changes in stream conditions and to assess the cumulative impacts of environmental stressors. Scientists and volunteers monitor streams across the country using lots of different methods. This is not a protocol for assessing stream health; it is simply an investigative technique developed by EPA's Monitoring Branch.

Many aquatic species rely on macroinvertebrates for food, including most species of fish (e.g., trout, bass, salmon). In turn, aquatic birds, including great blue herons and kingfishers, rely on the fish that feed on the macroinvertebrates! Macroinvertebrates and crustaceans are, therefore, a very important component in the "web of life."

Some macroinvertebrates are more sensitive to pollution than others, so if you find a large diversity of macroinvertebrates that cannot tolerate pollution, you have found a healthy stream. On the other hand, if you find only macroinvertebrates that can live in polluted conditions, your stream may have a problem. While these aquatic insects are the first indicator of stream health, fish, frogs, turtles, birds, small mammals are all part of that picture as well!

Visit http://water.nr.state.ky.us/ww/vm.htm for a listing of volunteer monitoring homepages, maintained by Kentucky Water Watch. **Be sure to check out the on-line macroinvertebrate key at the bottom of the page!**



Before you plan a trip to your local stream, check with local monitoring organizations or local water quality officials. They may be willing to demonstrate correct monitoring techniques. Also, keep in mind that too much activity may have a negative impact on the stream's aquatic life. Disturb the site as little as possible and promptly replace all organisms. **Carefully read all safety guidelines on pages 42–44 before beginning this activity.** To locate macroinvertebrates in the stream, use one or more of the following methods:

For observing macroinvertebrates, you will need:

- A bucket (5- to 10-gallon)
- A shallow white pan. (Alternatives: white plastic plate or the bottom of a white plastic detergent jug)
- Tweezers
- Ice cube trays filled with stream water (for sorting insects)
- Magnifying glass lens
- Spray bottles
- Field guides (optional)

A. **Rock-rubbing method. (Use this method in streams with riffle areas and rocky bottoms.)** Remove several rocks from within a riffle area of your stream site (e.g., randomly pick one rock from each side of the stream, one rock from the middle, and one rock from in between). Try to choose rocks that are submerged during normal flow conditions. Each rock should be about 4 to 6 inches in diameter and should be easily moved (not embedded).

   Either inspect the rock's surface for any living organisms or place the rock in a light-colored bucket or shallow pan, add some stream water, and brush the rock with your hands. Try to dislodge the foreign particles from the rock's surface. Also look for clumps of gravel or leaves stuck to the rock. These clumps may be caddisfly houses and should be dislodged as well.

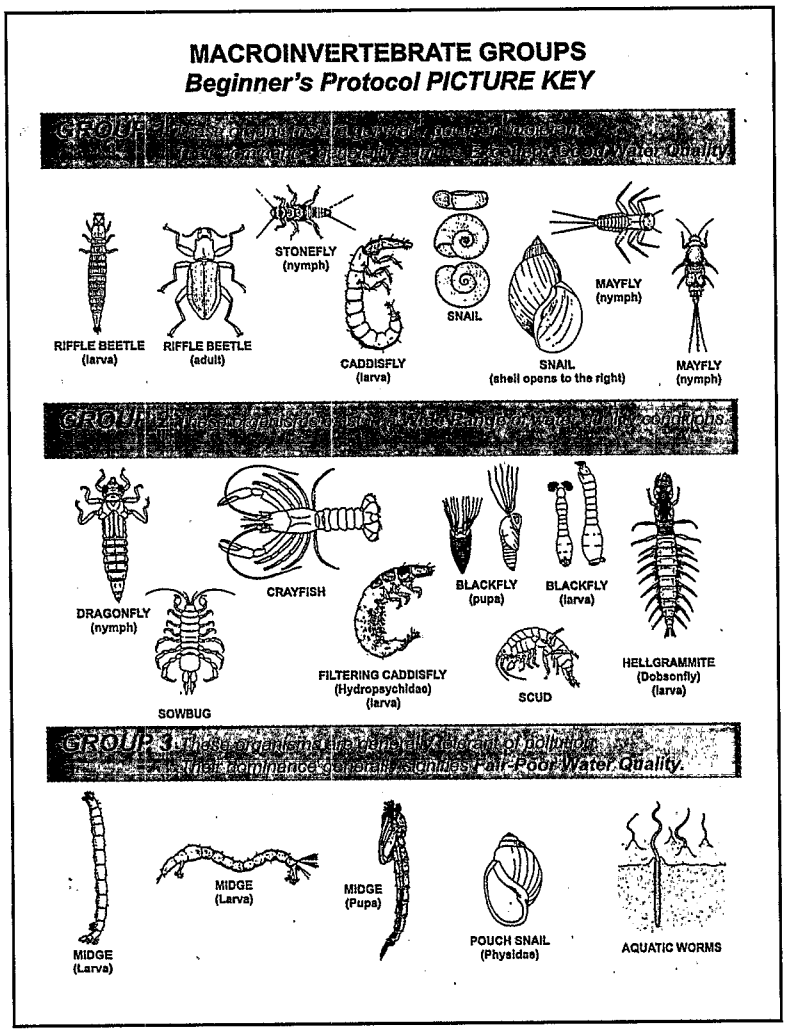
B. **Stick-picking method. (Use this method in streams without riffles or without a rock bottom.)** Collect several sticks (approximately 1 inch in diameter and relatively short) from inside the stream site, and place then in a bucket filled with stream water. Select partially decomposed objects that have soft, pulpy wood and a lot of crevices and are found in the flowing water, but not buried in the bottom. Pick the loose bark from the sticks to find the organisms.

   Fill the shallow pan with water from the stream, and remove one of the sticks from the bucket. Examine the stick, making sure you hold it over the pan so no organisms are lost. Remember that the organisms will have sought shelter, and they could be hiding in loose bark or crevices. After examining the sticks, it might be helpful to break up the woody material. Examine each stick carefully. Using tweezers, carefully remove anything that resembles a living organism and place it in the pan. Also examine the bucket contents for anything that has fallen off the sticks.

C. **Leaf pack-sorting method. (This method can be used in streams with or without a riffle or rock bottom.)** Remove several handfuls of submerged leaves from the stream and place them into a bucket. Remove the leaves one at a time and look closely for the presence of insects. Using tweezers, carefully remove anything that resembles a living organism and place it in a pan containing stream water. Also, examine the water in the bucket contents to see if anything has fallen off the leaves.

Note: A **riffle** is a shallow, gravelly area of streambed with swift current used for spawning by salmonids and other fish species.

After collecting macroinvertebrates, examine the types of organisms by gross morphological features (e.g., snails or worm-like). Use a magnifying glass lens to observe the organisms in water so you can clearly see the legs, gills, and tails.



Note the relative abundance of each type on the data sheet. Students can use the ice trays filled with stream water to sort and group the insects (e.g., all the caddisflys in one, all the midges in another). Do this activity in the shade so that the insects do not die from the direct sunlight. Also, it's a good idea to keep a spray bottle on hand if the insects have been out of the water for an extended period of time. When finished, **return all the organisms to the stream.**

Many types of macroinvertebrates can be found in a healthy stream. Because different species can tolerate different levels of pollution, observing the variety and abundance of macroinvertebrates can give you a sense of the stream's health. For example, if pollution-tolerant organisms are plentiful and pollution intolerant ones are found only occasionally, this might indicate a problem in the stream. Types of organisms you may find include:

- Worm-like organisms (like worms and leeches) either adhere to rocks or sticks or move slowly. They are generally tolerant of pollution.
- Crustaceans include crayfish that look like lobsters or shrimp. They are generally somewhat tolerant of pollution.
- Snail-like organisms include snails and clam-like organisms. They range from somewhat tolerant of pollution to somewhat intolerant.

Insects include a wide variety of organisms that generally have distinct legs, head, bodies, and tails and often move quickly over rocks or sticks. They come in many sizes and shapes as well as a wide range of pollution-tolerance levels.

Macroinvertebrate Survey Data Sheet

Which type of method did the class use?

- ☐ Rock-rubbing method: From cobbles and large stones selected from riffles.
- ☐ Stick-picking method: From woody objects in streams with sandy, silty bottoms
- ☐ Leaf-pack sorting method: From submerged leaves in streams with either a rocky or sandy, silty bottom.

Were macroinvertebrates present?

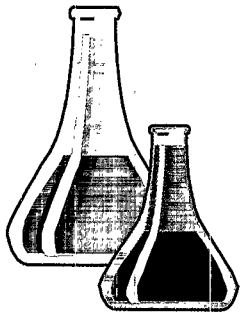
☐ No ☐ Yes, but rare ☐ Yes, abundant

If present, describe the types of macroinvertebrates found. Mark all that apply:

Wormlike	☐ Occasional	☐ Plentiful
Snails/clamlike	☐ Occasional	☐ Plentiful
Insects	☐ Occasional	☐ Plentiful
Crayfish	☐ Occasional	☐ Plentiful

Note: This is not a protocol for assessing stream health; it is simply an investigative technique developed by EPA's Monitoring Branch.

Getting Started in Volunteer Monitoring

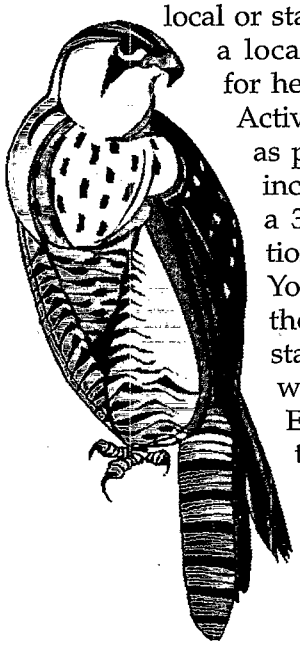


Monitoring macroinvertebrates requires training in safety considerations, field methods, insect identification, and analysis of results. Organizations interested in macroinvertebrate or other forms of stream monitoring should get in touch with a local program that trains volunteers in these activities. There are currently more than 770 volunteer monitoring programs around the country, plus several that are national in scope. Check out EPA's National Directory of Volunteer Environmental Monitoring Programs to find a group near you that may help train your school. (Call 1-800-490-9198 and ask for EPA publication 841-B-98-009.) EPA's Adopt Your Watershed Web page at http://www.epa.gov/adopt can also link you up with volunteer groups in your watershed.

Two national organizations that also can help you get started are the Izaak Walton League of America's Save Our Streams program (for macroinvertebrate/biological monitoring training and kits, publications and equipment) at 1-800-BUG-IWLA or http://www.iwla.org/sos, and Earth Force (for low-cost chemical water quality monitoring kits to test for pH, dissolved oxygen, and other substances in the water) at 1-800-23-FORCE or http://www.earthforce.org. Earth Force/Global Rivers Environmental Education Network (GREEN) recently launched a new Web site that allows student users to enter, analyze, and share data!

Watershed or Groundwater Festival

By sponsoring a watershed or groundwater festival at your school or in your community, you can help raise awareness about the importance of clean water and the need for watershed protection. A watershed or groundwater festival celebrates the unique aspects of a given watershed through educational activities, exhibits, and entertainment. The water festival concept is an enormously successful way to educate both children and adults. Make your event something that will inspire and motivate people to protect their watershed!



Schools may want to partner with their local or state water quality agency or a local watershed organization for help in planning the festival. Activities should be as hands-on as possible. Some ideas might include the *Enviroscape Model*, a 3-dimensional representation of a watershed (see box). You may want to check with the education office in your state water quality agency or with the local Cooperative Extension Service office—they might have a model to loan out. *Aquifer in a Cup* is a simple hands-on demonstration of how pollution moves through an aquifer (See EPA's Web site at http://www.epa.gov/safewater/kids). A *Household Hazardous Ring Toss* where rings listing household products are tossed onto stands representating disposal options is another idea. Be creative!

Enviroscape Models

EnviroScape interactive units dramatically demonstrate water pollution—and its prevention. Models cover Nonpoint Sources, Wetlands, Coastal, Hazardous Materials and Landfills, Riparian Areas, and Groundwater. Setup videos and curriculum are also available.

Schools may want to check first with the education office in their state water quality agency or with a Cooperative Extension Service—they often have models to loan out (look in the blue pages of your phone book). Or, schools can contact Enviroscape directly and ask for assistance in locating a model for loan. Call Erin Foster at 703-631-8810, ext. 12.

For more information, visit the Enviroscape Web site at http://www.enviroscapes.com

E-mail: info@enviroscapes.com

Steps for Organizing a Festival

The first steps are to define the watershed and then set up a committee to begin organizing the event. You should begin this process well in advance of your planned festival. The committee should:

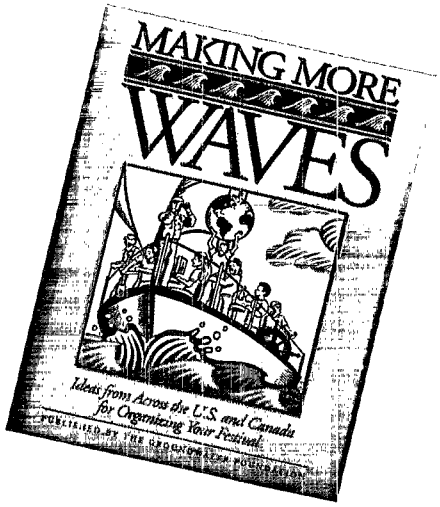
1. Decide the size of the event
2. Select the location and date
3. Identify and recruit activity presenters
4. Organize volunteers
5. Contact potential financial and in-kind donators
6. Provide information to the media about the event
7. Evaluate event afterwards

Festival Resources

- *Walk Your Watershed Festival Organizing Kit,* free (while supplies last) from the Water Environment Federation, provides instructions on how to plan, implement, and advertise a watershed festival. Send your request to WEF, 601 Wythe Street, Alexandria, Virginia 22314-1994; 1-800-666-0206 or e-mail public-education @wef.org.

- *Making Ripples: How to Organize a School Water Festival* offers a step-by-step process for organizing a water festival at your school. ($14.95)
- *Making Waves: How to Put on a Water Festival* is a guide to organizing a groundwater festival from getting started to writing fundraising letters and news releases. ($12.75)
- *Making More Waves: Ideas From Across the U.S. and Canada for Organizing Your Water Festival* highlights the best and the brightest ideas from festivals around the U.S. and Canada. ($12.75)
- *Making a Bigger Splash* features groundwater festival activities from all over. All activities are hands-on and fun, and they teach important water concepts. The activity book will help add new elements to already established events or provide activities for new festivals or for teachers in the classroom. Activities include the popular "Fish Olympics," "Danger in Our Town," and "Top Secret Water Rockets." ($12.75)

Making Ripples, Making Waves, Making More Waves, and Making a Bigger Splash can all be obtained by calling or writing to The Groundwater Foundation, P.O. Box 22558, Lincoln, NE 68542-2558; http://www.groundwater.org; 1-800-858-4844.



Build Your Own Aquifer

BACKGROUND: Many communities obtain their drinking water from underground sources called aquifers. Water suppliers or utility officials drill wells through soil and rock into aquifers to obtain groundwater for drinking water purposes. Homeowners who cannot obtain their drinking water from a public water supply have private wells drilled on their property. Unfortunately, groundwater can become contaminated by harmful chemicals, including household and lawn care products, paints, bleach, cleaners, fertilizers, pesticides, and oil. These chemicals can percolate down through the soil and rock and into the aquifer—and eventually the well. Such contamination can pose a significant threat to human health. The measures that must be taken by well owners and operators to either protect or clean up contaminated aquifers are quite costly.

NOTE: This demonstration should follow a discussion on potential sources of drinking water pollution.

OBJECTIVE: To illustrate how water is stored in an aquifer, how groundwater can become contaminated, and how this contamination ends up in the drinking water well. Ultimately, students should get a clear understanding that what happens above the ground can potentially end up in the drinking water below it.

MATERIALS NEEDED:

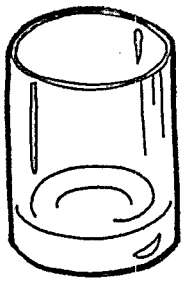
- 1 6-inch x 8-inch clear plastic container that is at least 6–8 inches deep (shoe box or small aquarium)
- 1 lb of modeling clay or floral clay
- 2 lb of white play sand
- 2 lb of aquarium gravel (natural color if possible) or small pebbles (Because any small rocks may have a powdery residue on them, you may wish to rinse them and dry them on a clean towel prior to use. It is best if they do not add cloudiness to the water.)
- 1 drinking straw
- 1 plastic spray bottle (be sure the stem that extends into the bottle is clear)
- 1 small piece (3-inches x 5-inches) of green felt
- 1/4 cup of powdered cocoa
- red food coloring
- 1 bucket of clean water and small cup to dip water from bucket
- Scotch tape

PROCEDURE:

1. To one side of the container place the small drinking straw, allowing approximately 1/8 inch clearance with the bottom of the container. Fasten the straw directly against to the long side of the container with a piece of tape. Explain to the students that this will represent two separate well functions later in the presentation (if not placed at this time, sand will clog the opening).
2. Pour a layer of white sand completely covering the bottom of the clear plastic container, making it approximately 1 inch deep. Pour water into the sand, wetting it completely but leaving no standing water on top of sand. Let students see how the water is absorbed in the sand but remains around the sand particles as it is stored in the ground and ultimately in the aquifer.
3. Flatten the modeling clay (like a pancake) and cover half of the sand with the clay (try to press the clay into the three sides of the container in the area covered). The clay represents a "confining layer" that keeps water from passing through it. Pour a small

amount of water onto the clay. Let the students see how the water remains on top of the clay, only flowing into the sand below in areas not covered by the clay.

4. Use the aquarium rocks to form the next layer of earth. Place the rocks over the sand and clay, covering the entire container. To one side of your container, slope the rocks, forming a high hill and a valley. Now pour water into your aquifer until the water in the valley is even with your hill. Let students see the water around the rocks that is stored within the aquifer. They will also notice that a "surface" supply of water (a small lake) has formed. This will give them a view of both the ground and surface water supplies that can be used for drinking water purposes.
5. Next, place the small piece of green felt on top of the hill. If possible, use a little clay to securely fasten it to the sides of the container it reaches.
6. Using the cocoa, sprinkle some on top of the hill, while explaining to students that the cocoa represents improper use of lawn chemicals, fertilizers, etc.
7. Put a few drops of food coloring into the straw, explaining to students that often old wells are used to dispose of farm chemicals, trash, and used motor oil. They will see that it will color the sand in the bottom of the container. This is one way pollution can spread throughout the aquifer over time.



EPA's Groundwater/Drinking Water Web Page at http://www.epa.gov/ogwdw has dozens of games and activities and science and art projects.

8. Fill the spray bottle with water. Now make it rain on top of the hill and over the cocoa. Students will quickly see the cocoa (fertilizer/pesticide) seep down through the felt and also wash into the surface water supply.
9. Take another look at the well you contaminated. The pollution has probably spread farther. Now remove the top of the spray bottle and insert the stem into the straw, depressing the trigger to pull up the water from the well. (Water will be colored and "polluted.") Explain that this is the same water a drinking water well will draw up for them to drink.

The Awesome Aquifer Club

The Awesome Aquifer Club (AAC) sponsored by The Groundwater Foundation empowers students with an understanding of how groundwater benefits their lives through classroom lessons and hands-on experiments. Although ideal for 4th and 5th grade students, ACC participation is open to groups of all ages. Likewise, the program is effective in settings outside the classroom such as environmental clubs, scout troops, and church groups. In addition to teaching about groundwater, AAC provides students with the opportunity to become involved in groundwater protection activities in their hometown. For more information about AAC and other educational programs, contact The Groundwater Foundation at 1-800-858-4844 or send an e-mail to info@groundwater.org. On the Web at http://www.groundwater.org.

Schoolyard Habitats and Wildlife Conservation

You can make your school or backyard a home for birds, butterflies, and other wildlife by including trees, shrubs, and plants that attract wildlife. Below are two programs that can help you get started.

Backyard Conservation Kit

The Natural Resources Conservation Service of the United States Department of Agriculture offers a free Backyard Conservation Program. To obtain a 28-page booklet that outlines 10 conservation projects, including a wildlife habitat project, call 1-888-LANDCARE. Or download tip sheets at http://www.nhq.nrcs.usda.gov/CCS/Backyard.html.

NWF Schoolyard Habitat Program

In 1995 the National Wildlife Federation (NWF) formally created the Schoolyard Habitat Program to focus specifically on assisting schools, teachers, students and community members in the use of school grounds as learning sites for wildlife conservation and cross-curricular learning. On request, NWF will send you an application package and instructions. If your application and plan meet the criteria, you will receive a certificate and, if you wish, a sign to show your commitment to wildlife conservation. To date, NWF has certified more than 800 schools nationwide! For more information, contact:

Schoolyard Habitat Program
National Wildlife Federation 703-790-4582
8925 Leesburg Pike
Vienna, VA 22184-0001
On the Web: http://www.nwf.org

Precautions to Remember!

A few precautions can be taken to avoid unwanted encounters with animals. Avoid setting out food that may attract scavengers such as raccoons. Keep garbage cans in a secure shed or garage, or use metal cans that scavengers cannot chew through. Check the exterior of your house for loose or rotted boards that could allow access by mice or other rodents. Remember that these animals are wild, and if threatened they can bite. Raccoons can be particularly aggressive. All of these species can carry diseases. Do not handle them.

Laws on wildlife issues vary from state to state. If you have questions or concerns about wildlife, check with your state's Department of Natural Resources or Conservation Department before taking any action (see the blue pages in your phone book).

Stream/Beach Cleanup Guidelines

Please read pages 41-44 before beginning this activity

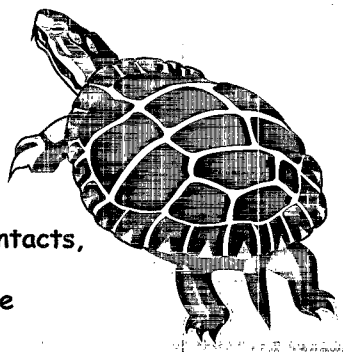
Stream, river, and beach cleanups can help raise awareness about the problems of trash and marine debris. Debris is one of the more widespread pollution problems threatening many of our watersheds and aquatic habitats. Debris comes from many sources, including beachgoers, improper disposal of trash on land, storm water runoff and combined sewer overflows to rivers and streams, ships and other vessels, and offshore oil and gas platforms.

Once litter gets into the ocean, it can seriously impact wildlife, the environment, and our economy. Thousands of marine animals are caught in and strangled by debris each year, while coastal communities lose considerable income when littered beaches must be closed or cleaned up. The fishing industry spends thousands of dollars annually for the repair of vessels damaged by debris. These problems are compounded by the increasing number of people living near our coasts, which increases the amount of trash entering the environment. Man-made materials (such as plastics) are of particular concern because they remain in the environment for years

Your school or organization can help by working with your local government to organize a local cleanup or by participating in nationally recognized cleanup efforts. The International Coastal Cleanup, which is held the third Saturday of every September, is sponsored by the Ocean Conservancy (formerly known as the Center for Marine Conservation). Since the Cleanup began in 1986, more than 1 million volunteers from more that 90 countries and 55 U.S. states and territories have helped to remove debris from the shorelines, waterways, underwater sites, and beaches of the world's lakes, rivers, and oceans. Information collected during the cleanup each year is compared to previous years' cleanup data and used to report on trends in marine debris. Participants learn about the sources of marine debris, how prevalent it is, and how they can help prevent the problem.

Suggested Items to Bring or Wear

- Shoes or boots that offer coverage and support, at least over the ankles
- Heavy rubber gloves (like dishwashing gloves) to protect hands and arms
- Safety vests (brightly colored): day-glo orange is best!
- Hats
- Large plastic bags
- First aid kit (see page 41 for recommended contents)
- Antibacterial soap for washing hands afterward (the kind that does not need water)
- Heavy sacks for sharp objects
- Sunscreen
- Medications (e.g., for bee allergies, diabetes, if needed)
- Insect repellant
- Bottled water
- List of emergency contacts, including a telephone number nearest to the site
- Cell phone

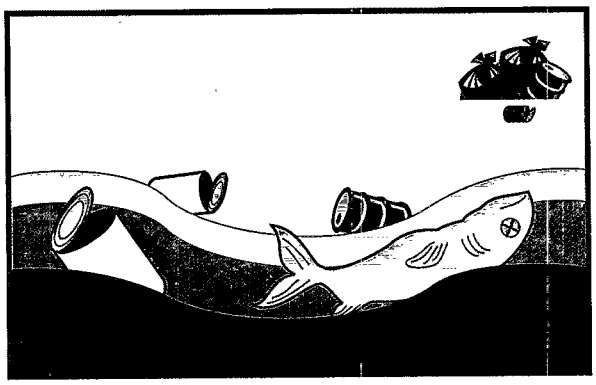


Before the cleanup...

- Check with your local Department of Health or State Environmental Office about potential health concerns with the waterbody (e.g., *Pfiesteria*, poor water quality, currents, mosquitos, rats). (Look in your phone book's blue pages.)
- Ask for necessary permission to cleanup at your site. Make arrangements with the appropriate local officials to let them know the location, days, and times of your cleanup so they can come and haul away the trash. They may be willing to give a talk about the history, wildlife, or environmental conditions.
- Listen to weather reports. Never conduct a cleanup if severe weather is predicted or a storm occurs while at the site. Someone could drown.
- Have a first aid kit handy. See Safety Guidelines on pages 42–44. It's best if at least one team member has first aid/CPR training.

At the cleanup site...

- Group students into teams. Teams of three, four, or five are probably best.
- Instruct students to leave syringes and needles alone! Notify someone at the health department and mark the spot with a flag or a large rock so someone can find it later.
- Instruct students NOT to walk on unstable stream banks. This could be dangerous as well as cause erosion. Stay off dunes and avoid nesting areas.
- If you must walk across the stream, use a walking stick because the stream bottom could be slippery or treacherous or contain deep pools. No one should walk across streams that are swift and above the knee in depth. These can kill.
- **All participants should wear rubber gloves (like dishwashing gloves) to protect hands and arms. Be careful with broken glass and rusty cans.**
- If you see anything abnormal (e.g., dead fish, oil spills, leaking barrels, bulk trash), contact your city or county environmental department right away and report the nature and location of the problem.



Safety Guidelines

One of the most critical considerations for any student program is the safety of its participants. For each of the field activities listed in this guide, children should be trained in safety procedures and should carry with them a set of safety instructions and the phone number of their program coordinator. **Safety precautions can never be overemphasized.** The following are some basic common sense safety rules for teachers and program leaders:

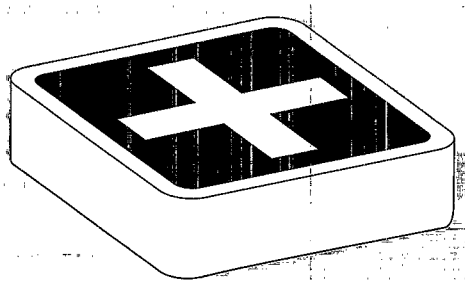
Before your activity

1. Always let the parents and the school principal know where you are and when you intend to return. Have a procedure in place if you do not come back at the appointed time.
2. Develop a safety plan. If you do not have a cell phone, find out the location of the nearest telephone and write it down. Locate the nearest medical center and write down directions on how to get between the center and your site(s) so that you can direct emergency personnel. Have each student complete a permission slip and a medical form that includes emergency contacts, insurance information, and pertinent health information such as allergies, diabetes, epilepsy, etc.
3. Have a first aid kit handy (see box below). Know any important medical conditions of team members (e.g., heart conditions, diabetes, or allergies). It is best if at least one team member has first aid/CPR training.
4. Listen to weather reports. Never go near the water if severe weather is predicted or if a storm occurs while at the site.
5. Carry a cell phone (if available) in case of an emergency.

First Aid Kit

At a minimum, a first aid kit should contain the following items:

- **Telephone numbers of emergency personnel such as the police and ambulance service**
- **Band-aids for minor cuts**
- **Antibacterial or alcohol wipes**
- **First aid cream or ointment**
- **Gauze pads 3 or 4 inches square for deep wounds**
- **Acetaminophen for relieving pain and reducing fever**
- **A first aid manual**
- **A 2-inch roll of gauze bandage for large cuts**
- **A triangular bandage for large wounds**
- **A large compress bandage to hold dressings in place**
- **A 3-inch-wide elastic bandage for sprains and applying pressure to bleeding wounds**
- **If a participant has a medical condition, include their doctor-prescribed medications**



Be sure you carry a cell phone (if available) and have emergency telephone numbers and medical information with you at the field site for everyone participating in field work (including you) in case there is an emergency.

In the Field

- ✔ **Never wade in swift streams or in water higher than your knees! These can kill. Cancel your field trip if you had a recent rain event or if the water level is high.**
- ✔ **Never drink the water in a stream. Provide bottled water for the students. After any of the field activities, students should immediately wash their hands with antibacterial soap.** Bring along the type that does not require water.
- ✔ **Assume that the water is not healthy—students should wear boots and rubber gloves.**
- ✔ If you drive, park in a safe location. Be sure that you don't block traffic.
- ✔ Put your wallet, keys, and cell phone in a safe place, such as a watertight bag you keep in a pouch strapped to your waist. Without proper precautions, wallet, keys, and phone might end up downstream.
- ✔ Never cross private property without the permission of the landowner. Better yet, conduct surveys and take samples only at public access points.
- ✔ Confirm that you are at the proper site location by checking maps, site descriptions, or directions.
- ✔ Watch for poison ivy, poison oak, sumac, and other types of vegetation in your area that can cause rashes and irritation.
- ✔ Watch for irate dogs, farm animals, wildlife (particularly snakes), and insects such as ticks, hornets, and wasps. **Know what to do if you or a student gets bitten or stung.**

Snakes

Snakes can be a concern when in an aquatic environment, especially slow-moving waters with overhead vegetation. Snakes must get out of the water to dry their skin and lie on flat surfaces exposed to sunlight. Snakes may also be found on flood debris hanging in streambank bushes and trees. If you have to approach your site through high grass, firmly thump the ground in front of you with your net pole or a large stick. Snakes will feel the vibrations and move away. **Snakes are deaf, so loud noises will not scare them away.** If you come upon a snake at close range, simply move away from the snake. If a snake bite occurs, seek medical assistance immediately.

Ticks and Insect Bites

Have students wear long pants, boots, and light-colored, long-sleeved shirts. Find out beforehand if any of the students are allergic to bites of insects, bees, or spiders. Bring all doctor-prescribed antihistamines or antidotes that will help subdue an allergic reaction.

Ticks are prevalent in grassy or wooded areas. It is very important that students check their bodies for ticks. Feel along the scalp for any bumps that are loosely attached to the scalp. Deer ticks, which are known to carry Lyme disease, are of particular concern. Lyme disease can cause serious illness. Symptoms include chills, malaise, fever, etc. If you or any of the students exhibit these symptoms after being in the field, seek medical treatment. If you do remove a tick, you may want to save it so that it can be identified (e.g., deer tick, dog tick, etc.)

Alligators, Turtles, and Other Large Animals

In some southern states, alligators and snapping turltes may present hazards. If these are sighted, it is best to leave the area immediately. Alligators under 18 inches in length are juveniles and may be near their mother. Female alligators are very protective of their young and may be dangerous. Snapping turtles will usually move out of the way if the water is disturbed by a large animal. Nevertheless, turtles should never be picked up. In the event of a bite from a turtle, stay calm and proceed to the nearest hospital as soon as possible.

Safety Guidelines for Water Quality Monitors:

1. Wear rubber gloves and boots. Do not monitor if the stream is posted as unsafe for body contact or if the water appears to be severely polluted.
2. Do not walk on unstable stream banks. Disturbing these banks can accelerate erosion and might prove dangerous if a bank collapses. Disturb streamside vegetation as little as possible.
3. Be very careful when walking in the stream itself. Rocky-bottom streams can be very slippery and can contain deep pools; muddy-bottom streams might also prove treacherous in areas where mud, silt, or sand have accumulated in sink holes.
4. **Never attempt to cross streams that are swift and above the knee in depth. These can kill!**
5. If at any time you feel uncomfortable about the condition of the stream or your surroundings, stop monitoring and leave the site at once.
6. Wash your hands after you've cleaned up your equipment.

If using chemicals:

1. Know your equipment, sampling instructions, and procedures before going out into the field. Prepare labels and clean equipment before you get started.
2. Keep all equipment and chemicals away from small children. Many of the chemicals used in monitoring are poisonous. Tape the phone number of the local poison control center to your sampling kit.
3. Avoid contact between chemical reagents and skin, eye, nose, and mouth. Never use your fingers to stopper a sample bottle (e.g., when you are shaking a solution). Wear safety goggles when performing any chemical test or handling preservatives.
4. Know chemical cleanup and disposal procedures. Wipe up all spills when they occur. Return all unused chemicals to your program coordinator for safe disposal. Close all containers tightly after use. Do not switch caps.
5. Know how to use and store chemicals. Do not expose chemicals or equipment to temperature extremes or long-term direct sunshine.

Glossary

Algae: A chlorophyll-containing plant ranging from one to many cells in size, that lives in fresh or saltwater.

Anadromous: Fish that return from saltwater to freshwater to spawn (e.g., salmon, steelhead).

Aquatic Insect: Insect species whose larval and/or juvenile forms live in the water.

Aquifer: Any underground geological formation containing water.

Bedrock: Unbroken solid rock, overlain in most places by soil or rock fragments.

Benthic: Bottom-dwelling. Benthic organisms are the animal life whose habitat is the bottom of a sea, lake, or river.

Channelized: The straightening and deepening of streams. Channelization reduces the ability of the stream to assimilate waste and disturbs fish breeding areas.

Clarity: The clearness of the water in the stream.

Conifers: A cone-bearing evergreen tree or shrub (a pine tree, for example).

Cover: Overhanging or in-stream structures (such as tree roots, undercut streambanks, or boulders) that offer protection from predators, shelter from strong currents, and/or shading.

Current: The velocity (speed) of the flow of water.

Deciduous: A tree that sheds its foliage at the end of the growing season.

Ecosystem: The interacting system of a biological community (plants, animals) and its non-living environment.

Effluent: The wastewater from a municipal or industrial source that is discharged into the water.

EPA: Environmental Protection Agency.

Erosion: The wearing away of the land surface by wind or water.

Estuary: A partially enclosed body of water formed where freshwater from rivers and streams flows into the ocean, mixing with the salty sea water. Estuaries and the lands surrounding them are places of transition from land to sea, and from freshwater to saltwater. Such areas include bays, mouths of rivers, salt marshes, and lagoons. These brackish water ecosystems shelter and feed marine life, birds, and wildlife.

Filling: The process of depositing dirt and mud in marshy areas(wetlands) or in the water to create more land. Filling disturbs natural ecological cycles.

Gradient: The slope or steepness of the stream.

Groundwater: The supply of freshwater under the earth's surface in an aquifer or soil.

Habitat: The specific environment in which an organism lives and on which it depends for food and shelter.

Headwaters: Small creeks at the uppermost end of a stream system, often found in the mountains, that contribute to larger creeks and rivers.

Mass Wasting: Downward movement of dry soil and rock caused by gravity (often called slides or avalanches).

Monitor: To measure a characteristic, such as streambank condition, dissolved oxygen, or fish population, using uniform methods to evaluate change over a period of time.

Nonpoint Source Pollution: "Diffuse" pollution, generated from large areas with no particular point of pollutant origin, but rather from many individual places. Urban and agricultural areas generate nonpoint source pollutants.

Nutrient: Any substance, such as fertilizer, phosphorous, and nitrogen compounds, which enhances the growth of plants and animals.

Point Source Pollution: A discharge of water pollution to a stream or other body of water via an identifiable pipe, vent, or culvert.

Pool: An area of relatively deep, slow water in a stream that offers shelter to fish.

Quality Control (QC): A system of checks used to ensure excellence, or quality, in a program such as a monitoring program. QC asks if we are doing things right.

Quality Assurance (QA): A way to see that QC is maintained and that the right things are being monitored to detect changes in water quality.

Reach: A stream section with fairly homogeneous characteristics.

Redd: A shallow depression in the streambed gravel in which a female salmonid deposits her eggs.

Riffle: A shallow, gravelly area of streambed with swift current. Used for spawning by salmonids and other fish species.

Riprap: A sustaining wall built of rocks.

Riparian Area: An area, adjacent to and along a watercourse, often vegetated and constituting a buffer zone between the nearby lands and the watercourse.

Run: A stretch of fast, smooth current, deeper than a riffle.

Runoff: The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually is returned to streams. Runoff can pick up pollutants from the air or the land and carry them to streams, lakes, and oceans.

Salmonid: Fish that are members of the family Salmonidae (includes salmon, trout, char, and whitefish).

Sediment: Fine soil or mineral particles that settle to the bottom of the water or are suspended in it.

Stormwater Runoff: Water that washes off the land after a rainstorm. In developed watersheds it flows off roofs and pavements into storm drains that may feed directly into the stream; often carries concentrated pollutants.

Substrate: The material that makes up the bottom layer of a stream, such as gravel, sand, or bedrock.

Stream Corridor: The lower and upper banks of a perennial or intermittent stream.

Stream Mouth: The place where a stream empties into a lake, an ocean, or another stream.

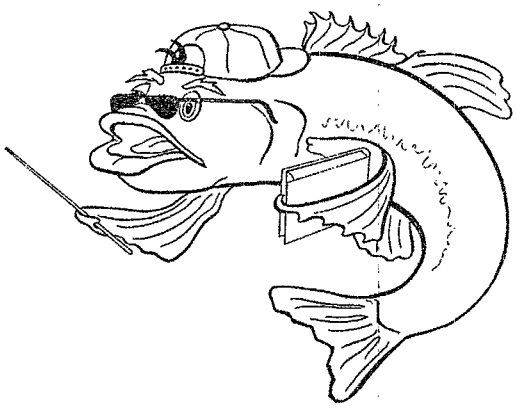
Suspended Sediments: Fine material or soil particles that remain suspended by the current until deposited in areas of weaker current. They create turbidity and, when deposited, can smother fish eggs or alevins. Can be measured in a laboratory as total suspended solids (TSS).

Topography: The configuration of a surface area including its relief, or relative elevations, and the position of its natural and man-made features.

USGS: United States Geological Survey.

Wetlands: Lands where saturation with water is the dominant factor determining the nature of soil development. Wetlands also can be identified by unique plants that have adapted to oxygen-deficient (anaerobic) soils. Wetlands influence stream flows and water quality.

Zoning: To designate, by ordinance, areas of land reserved and regulated for specific uses, such as residential, industrial, or open space.



Resources

Thanks to the cyber world, a tremendous amount of information is only a mouse click away (check out the list of Web sites on the inside back cover). Also, you can use the government pages of your telephone book to locate local agencies in your community or state. The following list includes some of the organizations that may be helpful to you:

- Cooperative Extension Service
- Department of Agriculture
- Department of Health
- Department of Natural Resources
- Environmental Quality Department
- Soil and Water Conservation District
- Wastewater Department

Educational Programs

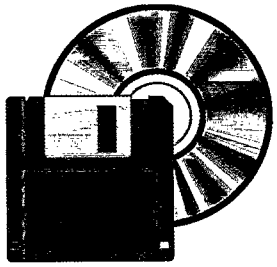
Adopt-A-Watershed uses a local watershed as a living laboratory in which students engage in hands-on activities, making science applicable and relevant to their lives. To get more information on activities you can do in your state/community go to http://www.adopt-a-watershed.org/contacts.htm and click on your state. You can also call 530- 628-5334 for a list of contacts for your state.

Coastal Cleanups. Visit http://www.cmc-ocean.org/ or call the Ocean Conservancy at 1-800-CMC-Beach for information about beach cleanups or how to participate in the annual International Coastal Cleanup.

Earth Force (G.R.E.E.N.). Earth Force is youth-driven. Through Earth Force, kids discover and implement lasting solutions to environmental issues in their community. In the process they develop life-long habits of active citizenship and environmental stewardship. For more information, call 703-299-9400 or visit the Web site at http://www.earthforce.org.

Earthwater Stencils. Their mission is to foster public awareness of, involvement in, and support for storm water pollution prevention. This is accomplished through community-based storm drain stenciling and related programs in local watersheds. For more information, call 360-956-3774 or visit http://www.earthwater-stencils.com.

EPA Safe Drinking Water Act Hotline (1-800-426-4791). You can call this number to report problems or to get information on safe drinking water practices.



EPA Water Resource Center (202-260-7786). You can obtain free fact sheets, coloring books, and other useful materials on wetlands.

Global Learning and Observations to Benefit the Environment (GLOBE) is a worldwide network of students, teachers, and scientists working together to study and understand the global environment. GLOBE students make environmental observations at or near their schools and report their data through the Internet. For more information on getting involved, call 1-800-858-9947 or visit GLOBE's Web site at http://www.globe.gov.

Izaak Walton League of America's Save Our Streams program provides educational material on stream and wetland monitoring. Visit http://www.iwla.org/sos or call 1-800-BUG-IWLA.

National Wildlife Federation's Schoolyard Habitat program shows you how to help save a place for wildlife at your own school. Visit http://www.nwf.org/habitats.

Project WET is a nonprofit water education program for educators and young people, grades K–12, located on the Montana State University campus in Bozeman, Montana. The goal of Project WET is to facilitate and promote awareness, appreciation, knowledge, and stewardship. At project WET's homepage (http://ww.montana.edu/wwwwet) you can get more information from the contact in your state (see the State Project WET Program Coordinator list) or call 406-994-5392.

River of Words Poetry and Art Contest is a national poetry and art contest for grades K–12 that invites children to explore their own watershed through the arts. Visit http://www. riverofwords.org, e-mail info@riverofwords.org, or call 510-548-POEM.

River Network maintains a directory of river and watershed conservation groups. Visit http://www.rivernetwork.org/library/libnetdir.cfm.

The Groundwater Foundation is a nonprofit organization dedicated to teaching the public about the conservation and management of groundwater. Visit http://www.groundwater.org or call 1-800-858-4844.

The Water Environment Federation (WEF) is an international technical and educational services organization for water quality professionals. Visit http://www.wef.org for hands-on water environment activities from the Water Sourcebook. To receive a free kit on organizing a watershed festival and/or a schematic guide of the wastewater treatment process, e-mail public_education@wef.org.

Publications, CDs & Other Materials

50 Simple Things Kids Can Do to Save the Earth by Earthworks Group provides practical tips to kids on how they can conserve energy, recycle waste, and take on important environmental projects. Available in bookstores.

The *Backyard Conservation* booklet can show you things you can do to the land around your home and school to help protect the environment. Tip sheets and 28-page booklet are available for free by calling 1-888-LANDCARE (single copies only). On the Web at http://www.nrcs.usda.gov.

Getting Started in Volunteer Monitoring providesan introduction to volunteer monitoring. Visit the EPA Web site at http://www.epa.gov/volunteer.

Girl Scout Water Drop Patch Project encourages girls to make a difference in their communities. Call the National Service Center for Environmental Publications (NSCEP) at 1-800-490-9198 or visit http://www.epa.gov/adopt/patch. Ask for EPA document # EPA 840-B-99-004.

Give Water a Hand Activity Guide (http://www.uwex.edu/erc) provides information for youth about watersheds and ways to protect them.

What's Up with Our Nation's Waters presents key findings of EPA's National Water Quality Report in an easy-to-read fashion and includes projects for school or fun.. Available on the Web at http://www.epa.gov/owow/monitoring/nationswaters/waters.pdf or by calling NSCEP at 1-800-490-9198. Publication EPA-841-F-00-005. *The National Water Quality Inventory: Report to Congress* is available at http://www.epa.gov/305b or by calling 1-800-490-9198.

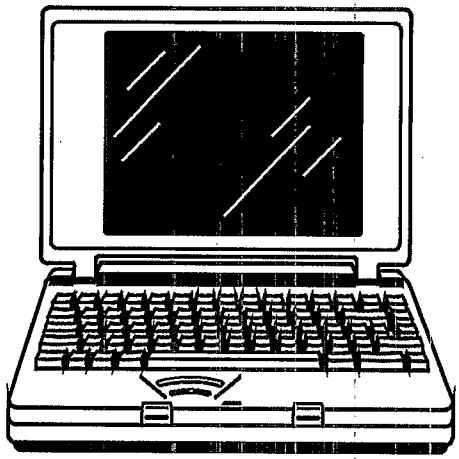
Splash (CD-ROM). This interactive tool provides information on nonpoint source pollution. Contact the Conservation Technology Information Center at 765-494-9555.

Turning the Tide on Trash: A Learning Guide on Marine Debris. Call NSCEP at 1-800-490-9198 or visit the Web site at http://www.epa.gov/OWOW/info/PubList/publist2.html. EPA document number 842-B-92-003.

Make Your Own Watershed kit. Available from the Terrene Institute. Phone: 703-548-5473. Internet http://www.terrene.org; $29.95 plus $5.50 shipping and handling.

Waters to the Sea: Rivers of the Upper Mississippi (CD-ROM). This interactive tool presents fundamental concepts of ecology, the water cycle, and watershed hydrology. ($39.95 plus shipping and handling). For more information, contact the Center for Global Environmental Education at 651-523-2480.

Mention of any commercial products, materials, or publications in this booklet does not constitute endorsement or recommendation for use by EPA. Visit the Adopt Your Watershed (http://www.epa.gov/adopt) or Office of Water Web page (http://www.epa.gov/ow) for a more complete list of other available resources.



Application for School or Class Recognition

Watershed or Waterbody Name: _____

School or Club: _____

Contact Person/Phone: _____

Address: _____

Number of Participants: _____

Brief Description of Class Activities: (100 words or less). Should demonstrate an ongoing commitment to the protection or restoration of a watershed.

_____

_____

_____

Partners: _____

_____

_____

_____

Project Highlights/Successes: _____

_____

_____

_____

_____

Please return to: Patty Scott, USEPA
Ariel Rios Bulding, 1200 Pennsylvania Avenue (4501T)
Washington, DC 20460

For More Information...

Hey Kids, Its Time to Take Action: http://www.afandpa.org/kids_educators/index.html. All types of recycling programs and information for kids from the American Forest and Paper Association. One feature of the site lists 20 ways to reuse a paper grocery bag.

National Water Quality Inventory: http://www.epa.gov/305b. At this site, you can find reports on the quality of our nation's waters, including summaries for your state.

EPA's Explorer's Kids Club: http://www.epa.gov/kids. Provides information and activities for kids to become familiar with the environment and what they can do to make a difference.

EPA's Volunteer Monitoring Homepage: http://www.epa.gov/volunteer. At this Web site you'll find information on volunteer monitoring, including a directory of U.S. programs and documents on how to monitor.

Surf Your Watershed: http://www.epa.gov/surf. Locate Your Watershed. Using the Watershed Information Network, you can check out local water conditions, find out about watershed training opportunities, identify volunteer monitoring and watershed programs to get involved in, or connect with federal and state agencies.

Office of Water Kids' Pages: http://www.epa.gov/water/kids.html. This Web site is loaded with information for kids of all ages, including projects, experiments, educational materials, and games.

Nonpoint Source Kids Page: http://www.epa.gov/owow/nps/kids. Check out the Masterbug Theatre for a cool movie about metamorphisis and macroinvertebrates.

Watershed Information Network: http://www.epa.gov/win. You can get a wealth of environmental information on your watershed from this EPA Web site.

USGS Water Science for Schools: http://ga.water.usgs.gov/edu. This Web site offers information on many aspects of water, along with pictures, data, maps, and an interactive center where you can give opinions and test your water knowledge.

Project WET

Project WET (Water Education for Teachers) promotes stewardship of water resources through the development of classroom-ready teaching aids and the establishment of state and internationally sponsored programs. For more information, contact Montana Water Resources Research Institute 406-994-5392. On the Web at http://www.montana.edu/wwwwet.

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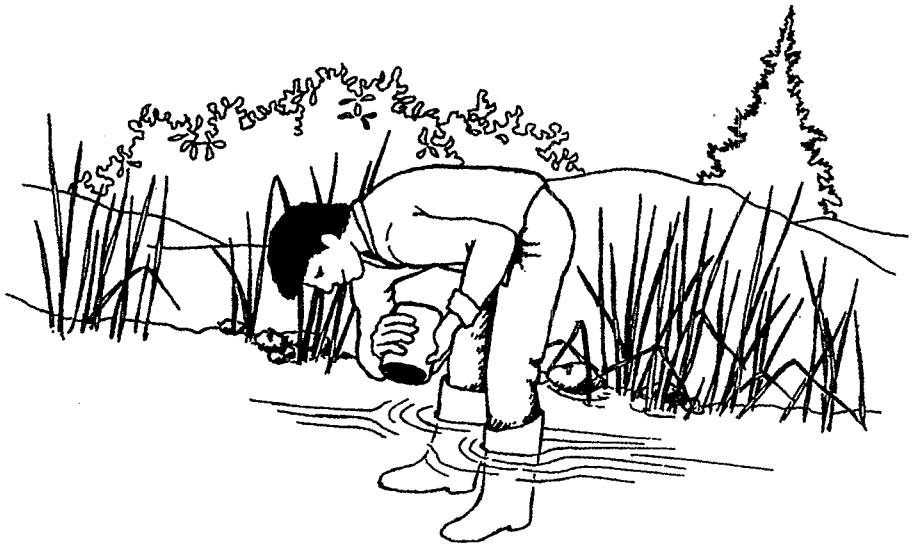
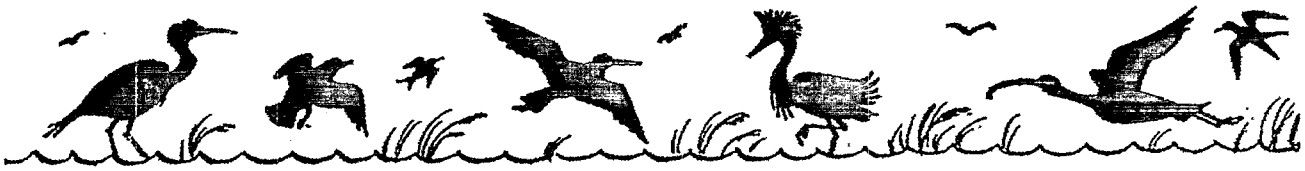


National Monitoring Day

On October 18, 2002, volunteer monitoring programs, water quality agencies, students, and the public are invited to test waters across the nation in celebration of the 30th Anniversary of the Clean Water Act. Everyone will be asked to test for temperature, pH, dissolved oxygen, and turbidity and enter their results into a national database. Data will be publicly available at http://www.yearof cleanwater.org.

To register testing sites, order low cost water testing kits (if needed), or find out more about Year of Clean Water events, visit www.yearofcleanwater.org. Year of Clean Water will also feature educational events, water festivals and widespread press coverage.