

Excerpts from the Active Watershed Education Curriculum (AWESome!) developed by the RI Southern Conservation District and updated by Denise Poyer, Program Director, Wood-Pawcatuck Watershed Association

## *Unit VIII:*

# *Introduction to Water Quality Issues*

## **Unit VIII Water Quality Issues Introduction**

Minimum water quality standards for all states are established by the US Environmental Protection Agency (EPA), based on the mandates of the Clean Water Act. Additionally, most states also set minimum water quality standards, often more stringent than that of EPA. Counties, cities and towns may add additional requirements, especially concerning drinking water standards. These standards not only protect the environment but also protect human health. If a water body is not meeting these standards, then the state or EPA may require that a Total Maximum Daily Loading (TMDL) be conducted. This means that the problem pollutant(s) must first be identified. Then the maximum allowable daily dosage of the pollutant into the water body that will not cause environmental damage needs to be determined. Finally, management plans need to be formulated that will reduce the daily dosage, or loading, of the pollutant to less than the maximum that was calculated.

*The Rhode Island Department of Environmental Management (RIDEM) has established water quality standards for waterbodies throughout Rhode Island. These standards reflect water quality goals and designate appropriate uses for classified waters. The water quality standard set for Narrow River is Class SA; defined as suitable for bathing and contact recreation, shellfish harvesting for direct human consumption, and fish and wildlife habitat. However, according to several reports, the River's water quality is more characteristic of Class SB; water suitable for bathing and other primary contact recreation, shellfish harvesting but only after depuration, and fish and wildlife habitat. In other words, Narrow River is not living up to the standards set for it.*

*Since 1959, the Narrow River has consistently failed state standards set for total coliform bacteria levels. High coliform levels have prompted RIDEM to restrict shellfishing activities in portions of the estuary since 1979, and bacterial levels have regularly exceeded safe standards set for swimming. Stimulated by high levels of nitrogen and phosphorous, increased algal growth has been observed in the River since the early 1970's. Recorded numbers of finfish and shellfish have also dramatically decreased over the years. Clearly, the Narrow River estuary has suffered a serious degradation of its water quality, fisheries, and recreational value.*

*The Narrow River Preservation Association (NRPA) has been conducting volunteer water quality monitoring since 1992 through the URI Cooperative Extension Watershed Watch program. In 2002 they monitored twelve sites, including three freshwater sites on Gilbert Stuart Stream, Mettatuxet Brook, and Mumford Brook. Every other week monitors take Secchi depth measurements to check for water clarity. They also record temperature, test for salinity and dissolved oxygen, and take chlorophyll samples. Five times during the monitoring season, about once a month, monitors collect water samples and bring them to the Watershed Watch labs to be tested for bacteria, nitrogen, phosphorus, and pH. This citizen monitoring program provides vital information to the regulatory agencies to supplement their data. NRPA monitoring data have been used in both the 1999 Revised Special Area Management Plan (SAM Plan) for Narrow River*

*generated by the RI Coastal Resource Management Council and the 2001 Fecal Coliform TMDL for the Pettaquamscutt reported by the RIDEM.*

*Most of the studies conducted on water quality in the Narrow River indicate that there are two major kinds of pollution in the estuary: bacterial contamination and nutrient loading. Bacterial contamination is measured by monitoring for coliform bacteria. Coliforms themselves are not harmful, but serve as an indicator of fecal contamination and the possibility that pathogenic (disease-causing) organisms may be present in the water. Direct measurements of pathogens are not used for three reasons: 1) there are dozens of disease-causing organisms; measurements for each one would take too much time and cost too much money, even if it were possible; 2) easy and reliable methods for identifying and counting most pathogens in a water sample are not available; and 3) since the numbers and kinds of disease-causing bacteria may differ from one day or location to the next, monitoring for these organisms would have to be exhaustive. The best solution is to periodically test the water for coliform bacteria, and to estimate the potential for human health hazards based on these measurements. According to the 1999 Narrow River SAM Plan, the primary sources for bacterial contamination are old or failing septic systems, storm drains, and fecal material from domestic animals and wildlife.*

*The other major kind of pollution documented in the Narrow River is nutrient loading. Excessive levels of nitrogen and phosphorus can cause excessive algal growth and a decrease in oxygen levels, resulting in eutrophic conditions. Eutrophic waters are characterized by low water clarity, abundant algae and/or rooted aquatic plants, mucky bottom sediments, and periods of oxygen depletion. Nutrient loading in the watershed is often the result of septic system failures and lawn/garden fertilizers.*

*Other water quality problems in the Watershed include petroleum hydrocarbons that may enter Narrow River from recreational boating and road runoff through storm drains. Boats may also introduce solvents, antifreeze, antifouling paints, heavy metals, acids/alkalis, surfactants present in most detergents and other cleaning agents, nutrients, bacteria, floatables/plastics, and creosote from pilings. There is also concern about commercial and residential structures that may have underground fuel tanks storing heating oil. It is nearly impossible to identify how many of these tanks still exist in older homes until they are sold.*

*Water quality problems in the Narrow River are compounded by the basin's physical characteristics, primarily steep slopes that drain into a narrow, poorly flushed river. Because the Narrow River's unique geological structure, a composite of an estuary, fjord-like ponds, and a river, it is less able to handle increased pollutant loadings. Constricted and poorly flushed, the River's sluggish flow severely restricts its ability to cleanse itself. This allows pollutants to accumulate both in the water column and in bottom sediments. Because the upper basins are highly stratified and very deep, and exhibit minimal overturn, they act as huge catch basins for pollutants. Substances introduced from the River's headwaters, surface runoff, and groundwater flow can be expected to remain in the basins for long periods of time. Under average conditions, a*

*contaminant introduced into the upper basin will take 77 days to move down the estuary and out the mouth off Narragansett Beach. When these basins do “overturn” (mix), the effect of the turnover may be much greater due to the accumulation of pollutants and their sudden release from the bottom waters.*

*Due to the consistently high bacterial counts in the Narrow River and its tributaries, RIDEM completed a TMDL study for Fecal Coliform for the Pettaquamscutt River Watershed in 2001. TMDL stands for Total Maximum Daily Loading of a contaminant. This study established where bacterial contamination was entering the River system and what maximum daily limits should be set in order to improve and maintain the River at the intended use classification of SA. The study also made recommended mitigation measures that would achieve the goals set for TMDL of fecal coliform in the Watershed. A significant remedial action is the retrofitting of storm drains to include structural BMPs designed to treat current flows and pollutant loadings at the storm sewer outfalls. Other recommendations are: 1) replace an outhouse adjacent to Gilbert Stuart Stream on the grounds of the Gilbert Stuart Birthplace (done in 2002); 2) identify/repair failing septic systems near Mumford Road; 3) connect to town sewers and eliminating illicit sanitary and gray-water connections to storm sewers; 4) properly dispose of pet waste; 5) minimize fertilizer applications; 6) leave an uncut vegetated buffer along river-front property lines to discourage grazing waterfowl, such as Canada geese; and 7) encourage residents and visitors not to feed the waterfowl.*

*Water quality is directly related to human activity in the Watershed. Since land use activities in the Watershed are primarily residential, this means that most of the pollution comes from Watershed residents. Water quality can be improved by eliminating or altering common everyday activities that pollute, such as picking up after pets, making sure that household hazardous wastes are properly disposed, being careful about how lawn and garden products are used, taking care of cars so that they don't leak oil or antifreeze, keeping storm drains clean and free of pollutants, and not feeding wildlife. The Narrow River Handbook is an excellent source of information, ideas, and alternative methods for Watershed residents. To learn more about water quality in the Narrow River Watershed call NRPA at (401) 783-6277. For more information on monitoring contact URI Watershed Watch at (401) 874-2905.*

**References:**

Applied Science Associates, Rhode Island Watershed Watch, SAIC Engineering, Inc., Urish, Wright, and Runge. 1995. *Narrow River Stormwater Management Study Problem Assessment and Design Feasibility*, prepared for the Towns of Narragansett, South Kingstown, and North Kingstown.

Ernst, L. M., L. K. Miguel, and J. Willis. 1999. *The Narrow River Special Area Management Plan*. Coastal Resources Management Council, South Kingstown, RI.

Green, L. T., and E. Herron. 2002. *URI Watershed Watch Land and Pond Monitoring Manual*. Natural Resources Science Technical Report 98-3, College of Environment and

Life Sciences, Department of Natural Resources Science, URI Cooperative Extension, Kingston, RI.

Lehrer, A. 1992. *Bacterial Monitoring of Surface Waters*. Natural Resources Fact Sheet 92-1, University of Rhode Island, College of Resource Development, Department of Natural Resources Science, URI Cooperative Extension, Kingston, RI.

Narrow River Preservation Association. 2002. *The Narrow River Handbook – A Guide to Living in the Watershed*, second edition. Narrow River Preservation Association, Narragansett, RI.

Office of Water Resources, Rhode Island Department of Environmental Management. 2002. *Fecal Coliform TMDL for the Pettaquamscutt (Narrow) River Watershed, Rhode Island*. Rhode Island Department of Environmental Management, Providence, RI. <http://www.state.ri.us/DEM/programs/benviron/water/quality/rest/pdfs/narrivdr.pdf>

## ACTIVITY II: WATER QUALITY ISSUES – WHERE DO YOU STAND?

**OBJECTIVE:** Students will learn about how differing opinions and values create issues.

**METHOD:** Students will take a survey asking their opinions about water quality issues and compare and discuss results.

**MATERIALS:** surveys, pencils

### **PROCEDURE:**

1. Discuss how issues are formed from people having different beliefs and values about a particular topic. Have students list examples of environmental issues.
2. Explain that they will be filling out a survey that asks them about their beliefs and values as they pertain to certain water quality issues. Remind them that there are no “correct” answers; everyone is entitled to have their own beliefs and values.
3. After they fill out their surveys, use chart to summarize the responses.
4. For which statements were there wide differences of opinion? Why do these differences exist?
5. Ask students to analyze the values that underlie their responses. Which of their responses reflect ecological values? Which reflect economic values? What other values are reflected?
6. Did the class responses load on the “neutral” category? If so, why? Could this be changed with more information? If so, why information would be needed? For example, if in statement #4 you knew that all factories pre-treated their waste so that their effluents would not alter the water quality of the river, would this change your response?
7. Why is it difficult to resolve an environmental issue where there are strong and differing value positions? See if the class can come up with working compromises to any or all of the statements.

# WATER QUALITY ISSUES SURVEY

## Summary Chart

---

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

## **YOU CAN HELP KEEP THE (YOUR WATERSHED HERE) WATERSHED CLEAN!**

- ◆ Use the least toxic product you can find and never buy more than needed.
- ◆ Dispose of or recycle chemicals properly. All paints, oils, grease, antifreeze and cleaning products should be disposed of properly. Many of these items need special processing which dumping down the storm-drain or even a household drain can not do. Watch the papers for household hazardous waste collection days.
- ◆ Take used motor oil and antifreeze to a gas station with an oil-recycling program.
- ◆ Use fertilizers sparingly, only as needed and follow directions carefully – **MORE IS NOT BETTER.**
- ◆ Do not over water your lawn. Over watering causes fertilizer to move too far down into the soil. The roots cannot reach it and the underlying groundwater can become contaminated with fertilizer. Local news broadcasters often give suggestions during the summer months.
- ◆ Conserve water, this will help conserve money.
- ◆ Test for leaking toilets by adding food coloring to the tank. Without flushing, note if any color appears in the bowl after 30 minutes. If color appears, you have a leak.
- ◆ Run dishwashers only when you have a full load.
- ◆ Take short showers instead of baths.

Give it some thought; we're sure you can come up with lots of ways to conserve water and other resources.

*Clean water is an asset to all, young and old. We owe it to our children to provide it for their future.*



## SUPPLEMENT: FIELD INVESTIGATIONS –

To get students involved with community issues, you could consider looking for water quality concerns near your school. Enforcement personnel working for the local stormwater manager often welcome assistance in identifying illegal discharges. Be sure to check with them first before you take your students out. In the field, teachers and students could look for the following:

1. Discharges from pipes – Sometimes this is difficult to distinguish from storm water discharges which do not require a permit. It is best to look during a period of dry weather. Pipes that still have some sort of flow in the absence of any rain could be an illegal discharge. Document where the pipes are situated, what water body they flow into, date and time flow noticed, and weather at least one week before the flow is noticed. Also note the color, odor, and amount of discharge (trickle vs. strong flow).
2. Floating Foam, oil sheen, or solids – No discharger is permitted to discharge effluent with these characteristics. Be careful not to be fooled by natural foam. Even pristine streams may have some white or coffee colored foam downstream of a falls or dam. This foam is from the natural oils in trees and vegetation. One way to distinguish the difference is to see if the foam breaks apart easily. If it does not, it may be an illegal discharge.
3. High temperatures – Check the temperature of the effluent of permitted discharges to make sure they are not exceeding their permit limit (Usually 83° F)
4. Compliance with pH requirements – Check the pH of the effluent of permitted discharges to make sure it is within the permit limits.
5. Water flowing over dams – The water level should never be below the dam. A rule of thumb is that the water running over the dam should match the run of the river (flow upstream and downstream of the dam site).

If you have any questions or would like to report a possible illegal discharge into the (**your watershed here** [*Flat River Reservoir*]) or its tributaries, contact your local Public Works Department.

# SUPPLEMENT: LITTER CLEANUP

## A Volunteer's Guide to Organizing a Litter Cleanup And Survey in Rhode Island

*Applicable to Coastal and Freshwater Areas*

Henry Herbermann and Meg Kerr  
The University of Rhode Island  
Coastal Resources Center  
Graduate School of Oceanography  
Narragansett, Rhode Island 02882

During a late afternoon walk on a nearby beach or along a stream bank, you notice an excessive amount of litter or debris. Is it harming the environment? Where did it come from? What can be done to get rid of it?

Apart from being an eyesore, man-made debris is clearly a threat to the environment. Plastics, which can last hundreds of years are an especially serious problem. Birds, fish and mammals often become entangled in such items or mistake plastics for food. With plastic filling stomachs, animals may die of starvation or poisoning. Other types of debris left or thrown around coastal or watershed areas can interfere with spawning beds, leak toxic substances, as well as injure wildlife and people.

Participating in a volunteer group cleanup or organizing one yourself are two ways to rid Rhode Island's coastline and freshwater banks of debris. A record or tally of the debris collected, however, is even more valuable than the actual cleanup. Chances are, if you return to the area you cleaned several weeks or even days later, you'll find it in its pre-cleanup condition. To permanently rid a shoreline of litter you need to identify and stop its source. Data from a cleanup may identify the source and force the offenders to change their habits.

### **Participating in an Annual Cleanup & Survey**

Every September the Center for Marine Conservation in Washington, DC organizes an international coastal cleanup day. In 1991, volunteers across 35 states and 12 foreign countries descended on the world's coastline to cleanup and survey litter. Over 2,800,000 pounds of debris were tallied and removed.

The Audubon Society of Rhode Island along with the Department of Environmental Management are this state's coordinators for the event. If you wish to become involved call the Audubon Society, (401) 231-6444, for the date and a list of cleanup sites in your area. Volunteers who show up at designated sites on the morning of the cleanup, are given 30 gallon paper bags and inventory sheets to tally the garbage they collect. The surveys are recorded as part of an international database which in the past, was presented at congressional hearing in support of the Marine Plastic Pollution Research and Control Act (MPPRCA) and currently to aid in enforcement of the act. (The MPPRCA bans all dumping of plastics in rivers, streams, lakes, or coastal waters of the US.)

On a smaller scale, biannual cleanups in the Providence area are run by Keep Providence Beautiful. These are usually held every April and October. Call KPB at (401) 351-6440 for more information.

### **Planning Your Own Group Cleanup/Survey**

The first step in planning a litter clean-up/survey is to designate a coordinator an/or a steering committee. Their roles are to logistically plan the clean-up/survey and, if it is a large scale event, interact with the media.

#### Utilize Local Resources and Involve the Community

1. Coordinators should directly contact local environmental and school groups, scout troops, etc., about participating.
2. Generating media coverage can help to increase public awareness and recruit more volunteers. Posters, brochures or press releases should be sent to local newspapers,

television and radio stations. Public service announcements (PSAs) are a great way to get your message on the radio for free. Type an announcement that takes between 10 seconds and one minute to read and send it to the station along with a cover letter.

3. Write a letter to your local grocery store asking for free food and refreshments for this community project.
4. Contact hardware stores about donating rakes, trash bags, gloves, etc.
5. Be sure to credit any store or organization which donates equipment for your clean-up/survey.

#### Safety Considerations for Volunteers

1. Volunteers should ALWAYS work in pairs.
2. Permission slips are a good idea for minors who would like to participate. A sample of one is included here.
3. The water is not safe to drink.
4. Volunteers should not attempt to walk across streams that are swift and above the knee in depth. These can be dangerous.
5. Volunteers should be careful to avoid:
  - medical wastes
  - slippery rocks
  - ticks, poison ivy, poison oak, nettles, insects, etc.
  - unfamiliar dogs

#### Organizing the Event

1. Contact the area municipality's Sanitation Department or a private trash hauler about removing the collected litter.
2. If working on a coastal area, schedule the clean-up survey to begin about 2 hours before low tide.
3. Coordinators make sure to secure landowners permission if any part of the shoreline is on private land.
4. Supplies your volunteers will need:
  - Bags, gloves, data cards, pencils, a list of important phone numbers:
    - Fire and Police Departments
    - Central Command Center
    - Coordinator
    - RI Dept of Environmental Management
    - Contacts if someone discovers an entangled marine mammal (see Post Cleanup)

Some supplies your volunteers *may* need:

Rakes, shovels, brooms, dust pans, brochures or fliers

5. Choose team leaders to lead groups over pre-measured clean-up/survey areas. Team leaders are also responsible for: bringing extra trash bags, looking out for everyone's safety and collecting equipment at the end of the day.
6. Some things to consider when designating a cleanup area:
  - Terrain (beach, streambank, rocky shore, etc.)
  - Age and physical capabilities of volunteers
  - Time of year (and weather)
  - Expected amount of trash to be removed

7. Designate spots along the clean-up zone for depositing trash and debris. Arrange for trash pick-ups at those sites.
8. It is recommended that you use the same debris tally sheets used during the annual coastal cleanup, a sample of which is included here. You can either make copies of this sheet or obtain additional ones from the Center for Marine Conservation (CMC, address below). Data from a litter survey is very important, as was explained in the introduction to this manual. A publication of compiled data from litter surveys around the world can be obtained from the CMC.
9. Some items volunteers should be encouraged to bring on a cleanup/survey:
  - Comfortable rubber boots or shoes
  - Old clothing that is also snag and thorn proof. (Clothes may be ruined.)
  - Gloves
  - Insect repellent
10. A short training session or even just a pep talk to better prepare volunteers is recommended. This could be run either the evening before the cleanup or immediately before it. Things volunteers should be made aware of:
  - Private property
  - Volunteers should avoid walking on delicate shoreline areas (dunes) and unstable stream banks. Their footsteps could speed erosion.
  - Volunteers should not walk on or near nesting or fish spawning areas. Spawning areas will look round or elliptical and clean of gravel.
  - Volunteers should disturb vegetation as little as possible.

#### On Day of the Survey

1. At the beginning sign-up sheets should be available for all volunteers so the coordinator knows exactly who is working in where at all times. This sheet may be used later to request help with similar projects.
2. Each pair of volunteers should be given a large paper bag and a tally sheet to record the types of litter removed from the shoreline.
3. Food and refreshments should be available for participants during as much of the day as possible.
4. Have a thank you party for all volunteers.

#### Post Cleanup

If the cleanup was along a coastal or freshwater area, please send any survey data to:

Center for Marine Conservation  
1725 DeSales Street, Northwest, Suit 500  
Washington, DC 20036

If you notice any pipes discharging waste or chemicals, or evidence of a faulty septic system, like heavy algal growth, write or call the Department of Environmental Management (listed below). Be sure to include: name of the town, street address if possible, your own name and a description of the problem.

Division of Water Resources, RI Dept. of Environmental Management  
291 Promenade Street, Providence, Rhode Island 02908  
(401) 277-3961

If you should encounter an entangled marine mammal please contact:

**Mystic Aquarium & Institute for Exploration's 24 hour Marine Animal Rescue  
Hotline at 860.572.5955 x 107 (until 5 pm) or x 134 (after 5 pm). Leave your name  
and a phone number where you can be reached.**

For their help in preparing this guide, special thanks to:

Audubon Society of RI  
Center for Marine Conservation  
Graduate School of Oceanography, URI  
Keep America Beautiful  
Keep Providence Beautiful  
RI Department of Environmental Management  
Save the Bay

## BEACH CLEANUP DATA CARD

Thank you for completing this data card. Answer the questions and return to your area coordinator or to the address at the bottom of this card. This information will be used in the Center for Marine Conservation's National Marine Debris Database and Report to help develop solutions to stopping marine debris.

Name \_\_\_\_\_ Affiliation \_\_\_\_\_

Address \_\_\_\_\_ Occupation \_\_\_\_\_ Phone (\_\_\_\_) \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ M \_\_ F \_\_ Age: \_\_\_\_\_

Today's Date: Month: \_\_\_\_\_ Day \_\_\_\_\_ Year \_\_\_\_\_ Name of Coordinator \_\_\_\_\_

Location of beach cleaned \_\_\_\_\_ Nearest city \_\_\_\_\_

How did you hear about the cleanup? \_\_\_\_\_

**Number of people working together on this data card** \_\_\_\_\_

**Estimated distance of beach cleaned** \_\_\_\_\_ **Number of bags filled** \_\_\_\_\_

**SAFETY TIPS**

1. Do not go near any large drums.
2. Be careful with sharp objects.
3. Wear gloves.
4. Stay out of the dune areas.
5. Watch out for snakes.
6. Don't lift anything too heavy.

**WE WANT YOU TO BE SAFE**

<p><b>SOURCES OF DEBRIS.</b> Please list all items with foreign labels (such as plastic bleach bottles from Mexico) or other markings that indicate the item's origin (such as cruise line names, military identification or debris with names and/or address of shipping/freighting or fishing companies, or oil/gas exploration activities)</p>	
<b>SOURCE</b>	<b>ITEM FOUND</b>
<b>Ex: ABC Shipping Company</b>	<b>plastic strapping band</b>

**STRANDED AND/OR ENTANGLED ANIMALS** (On the other side, please describe type of animal and type of entangling debris. Be as specific as you can.)

What was the most unusual item you found?