

**WATER QUALITY AWARENESS IN URBAN ENVIRONMENTS**

**LESSON 2**

**HOW DOES YOUR FOOTPRINT AFFECT  
THE WATER QUALITY OF LOCAL  
RIVERS, LAKES AND THE OCEAN?**



## LESSON 2: How Does Your Footprint Affect the Water Quality of Local Rivers, Lakes and the Ocean?

**Subject Overview:** Water quality is impacted by direct and indirect human action. How does your daily routine affect the health of local rivers, lakes, and the ocean? Water contaminants come in many different forms from various sources. Chemicals (chlorine, pesticides, fertilizers), automotive fluids, restaurant fats, and packing products are just a few items that we come in contact with on a daily basis which have the potential to become a hazardous water contaminant. Water pollution occurs when contaminants reach levels that impair the health of an ecosystem.

**Activity Concepts:** Affects of water contaminants.

**Subject Links:** Science: water contaminants.

**Vocabulary:** contaminant; pollution; dissolved oxygen; nitrogen (ammonia, nitrate, and nitrite); pesticides, pH; phosphorus; salinity; turbidity. (**See supplemental material.**)

**Purpose of activities:** Youth will have the opportunity to explore how water is affected through daily activities.

**Overview of activities:** Youth will explore how their actions affect the health of local waters through hands-on activities.

**Time Required:** Approximately 1 hour.

### Getting Ready:

- Pour enough water into aquariums so they are approximately  $\frac{3}{4}$  full.
- Divide the youth participants into three small groups.
  - Group One – Local government (Scenario #1)
  - Group Two – Homeowners (Scenario #2)
  - Group Three – Business Owners (Scenario #3)
- Pass out a “scenario and solution worksheet” to each group.
- Provide each group with flip chart paper and markers.

### Materials Needed:

- **Handout** – Scenario #1, Scenario #2, Scenario #3
- (2) Aquariums or other large containers to hold water
- Water (enough to fill each aquarium  $\frac{3}{4}$  full)
- Trash bag for cleanup
- Measuring cups (1/4, 1/2, 3/4 cups)
- Representative Materials as suggested in the Contaminant Key on page 4

### Opening Questions:

**Ask the youth to discuss these questions in their groups, record their thoughts on the flip chart paper provided, and share their ideas with the other groups.**

- What are some things you know about water pollution?
- Where do you think water pollution comes from?

## Activity – Decision Lake

### Exploration (Procedure):

- Allow the groups 10 – 15 minutes to read, discuss, and come to a decision about each of the situations for the assigned scenario. **Ask the youth to record their thoughts on the flip chart paper provided.**
- **Ask each group to explain to the other youth why they chose their answer.**
- Discuss the various pollutants as a result of their actions. **Using the “contaminant key”, ask members of each group to add the material which represents their contaminant to the “water body” as each one is being discussed.**

### Contaminant Key:

<u>Contaminant(s)</u>	<u>Representative Material</u>
Dirt and/or asphalt	Sand (1/2 cup) and Charcoal (1/4 cup)
Nitrate and phosphorus	Green food coloring (4 drops)
High salinity	Table salt (1/4 cup)
Feces	Chocolate sprinkles or Raisins, mashed (1/2 cup)
Sewage	Mud (3/4 cup of soil + enough water to create a runny consistency)
Oil and gasoline	Vegetable oil (1/2 cup)
Fats and grease	Squeezable margarine (two squeezes)
Trash	Shredded paper (1 cup)
Pesticide	Red food coloring (2 drops)
Ash	Ground pepper (1/4 cup)

Additional contaminants and representative materials may be utilized as determined by facilitator.

### **Sharing, Processing, and Generalizing:**

Once the youth have completed their worksheet, discuss the questions below as a large group:

- What were the consequences of their actions?
- What do they think the long-term effects of these contaminants would be?
- How do the students think they can personally make a difference?

### **Concept and Term Introduction:**

At this point, it is important to ensure the concept of water contaminants resulting from everyday actions have the potential to pollute local water bodies, aquatic life, and human life has been introduced or discovered by the youth. The following terms should also be introduced: nitrogen (ammonia, nitrate, nitrite); contaminant; pollution; dissolved oxygen; pH; phosphorus; pesticides; salinity; turbidity. (Note: The goal is to have the youth discover terms and concepts themselves.)

Discuss the following question with the youth:

- When do you think a water contaminant results in pollution?

### **Concept Application:**

- Develop a list of ways to improve the quality of runoff around your home or neighborhood. Present this list to your parents or care givers
- Develop a list of ways to improve the quality of runoff at school. Make a presentation to your class, your teachers and/or your principal. Ask the school to adopt clean up measures in order to help make the school more water friendly.
- Develop a plan to improve the quality of runoff in your community. Make a presentation to community leaders and propose your ideas. Write an article for a local paper that outlines your plan.

## Scenario # 1

You live in a city built several miles from a pristine lake, but the economy in the area has been suffering lately. As a city council member you need to boost the economy and bring jobs to the area. Three choices are brought before the city council. Each of these choices results in a certain level of impact on water quality.

1. Allow a new sports complex (baseball stadium and restaurants) to be built near the lake.
2. Allow an 18-hole professional golf course to be built surrounding the lake.
3. Keep the property and build a nature information center with campsites.

List how each choice could impact water quality of the lake, if any?

What could be done to diminish the impacts of the activities?

Which of these choices would you vote for your city?

LESSON HANDOUT

## Examples of Actions from Scenario # 1:

1. Allow a new sports complex (baseball stadium and restaurants) to be built near the lake.

*In building a new sports complex near the lake, a large parking lot contributes oil and gasoline from cars, fertilization of turf grass sports field and stadium landscape adds nitrates and phosphorus, trash is left in the stadium and in the parking lot, pesticide applications are made to control rodents, and restaurants improperly store fats and grease.*

**Add vegetable oil, green dye, shredded paper, red dye, and squeezable margarine to represent oil and gas, nitrate and phosphorus from fertilizer, trash, pesticides, and fats and grease respectively.**

2. Allow an 18-hole professional golf course to be built surrounding the lake.

*In developing an 18-hole professional golf course near the lake, a parking lot generating oil and gasoline from cars and asphalt is built; the golf course is fertilized heavily; high salinity occurs from the use of lots of fertilizers and water, pesticides are used to control insects, fungus, and weeds.*

**Add vegetable oil to represent oil and gas, charcoal to represent asphalt, green dye to represent nitrate and phosphorus in fertilizer, salt to represent salinity from excessive use of fertilizers and water, and red dye to represent insecticides, fungicides, and herbicides used to control pests.**

3. Keep the property and build a nature information center with campsites.

*In developing a nature information center with campsites near the lake, grading of dirt roads and campsites contributes to erosion, ash is created by campfires, and feces are left by human and animal visitors.*

**Add sand to represent erosion from roads and campsites, pepper to represent ash from campfires, and chocolate sprinkles to represent feces.**

## Scenario # 2

You moved into a beautiful home directly on the shore of the lake. You moved to the lake area as your family loves all types of water recreation including swimming, boating, and fishing. Upon moving into the home, you must address several issues. The first is that insects are plentiful and ant invasions into your home are frequent, the second is an aging septic system, and the third is the lack of a yard for your children to play.

Which of these issues would you rank as most important?

1. Hire a pest control service to control the insects in and around your home.
2. Wait to fix the septic system until next year when you can afford it.
3. Install a 5000 square foot turf grass area in the backyard of your home.

List how each choice could impact water quality of the lake, if any?

What could be done to diminish the impacts of the activities?

LESSONHANDOUT

## Examples of Actions from Scenario # 2:

1. Hire a pest control service to control the insects in and around your home.

*Hiring a pest control service to control the insects in and around your home near the lake results in runoff of chemicals.*

*This results in pesticides applied to the inside and outside of the house on a monthly basis running into the lake as a result of irrigation and storm runoff.*

**Add 2 drops of red dye for each month of the year (24 drops) to represent the pesticides added to the landscape.**

2. Wait to fix the septic system until next year when you can afford it.

*By waiting to fix the septic system until next year when you can afford it, raw sewage seeps into the soil and groundwater.*

*This results in sewage leaking into the surrounding soil and groundwater over the course of the year.*

**Add ¼ of mud for each month of the year (3 cups) to represent the amount of sewage leaking into lake.**

3. Install a 5000 square foot turf grass area in the backyard of your home.

*By installing a 5000 square foot turf grass area in the backyard of your home, the homeowner increases the amount of fertilizer and pesticide applied next to the lake. Without proper irrigation these chemicals can easily move from where they are applied into the lake in irrigation and storm water runoff.*

*This results in nutrients (nitrate and phosphorus) entering the lake as well as any pesticides the homeowner uses to control insects and weeds in the lawn.*

**Add green food dye to represent nitrate and phosphorus from fertilizer and red dye to represent pesticides.**

## Scenario # 3

You own Rob's Water Recreation rental facility and business has been slow. You rent boats, jet skis, and other watercraft to locals and tourists. Besides business being slow, most of your rentals are old, leak oil, and are in need of major repairs or replacement.

What choice would you make if you were in this situation?

1. Lay off your mechanic and postpone repairs and purchasing of new equipment.
2. Sell your property to a developer that builds an amusement park complete with water slides, go-carts, and fast food restaurants.
3. Sell the property to the city where they decide to return the area into a natural shoreline complete with nature trail.

List how each choice could impact water quality of the lake, if any?

What could be done to diminish the impacts of the activities?

LESSON HANDOUT

### Examples of Actions from Scenario # 3:

1. Lay off your mechanic and postpone repairs and purchasing of new equipment.

*By laying off your mechanic and postponing repairs and purchasing of new equipment, leaking of oil and gasoline into the lake will continue and even increase if repairs are postponed or not done properly.*

**Add vegetable oil to represent the oil and gas continually leaking into the lake. Because the contaminants are a chronic problem add twice the amount listed on the key.**

2. Sell your property to a developer that builds an amusement park complete with water slides, go-carts, and fast food restaurants.

*By selling your property to a developer that builds an amusement park complete with water slides, go-carts, and fast food restaurants, a large parking lot will need to be built. The parking lot will generate trash left by visitors, oil and gasoline from leaking cars, and asphalt from erosion. The landscape will require fertilizer and irrigation will carry nitrate and phosphorus into the storm drains and into the lake. Pesticides will need to be used to control rodents. Restaurants wash fats and grease down the drain or store them improperly outside resulting in a sewage blockage and spill outside the restaurants.*

**Add shredded paper to represent trash, vegetable oil to represent oil and gas, charcoal to represent asphalt, green dye to represent fertilizer (nitrate and phosphorus), red dye to represent pesticides, squeezable margarine to represent fats and grease, and mud to represent sewage.**

3. Sell the property to the city where they decide to return the area into a natural shoreline complete with nature trail.

*By selling the property to the city where they decide to return the area into a natural shoreline complete with nature trail, erosion results from the construction of dirt access roads and trails.*

*Erosion results in a slight increase in soil entering the lake.*

**Add sand to represent erosion from access road and hiking trails.**

## REFERENCES AND RESOURCES:

ANR Publication 8118 *Self Evaluation Techniques: Evaluating Water Quality*,  
<http://ucanr.org/freepubs/docs/8118.pdf>

*Potential Pollutants Generated by Land Use Type*; California Stormwater Quality Association (CASQA)

U.S. Department of the Interior | U.S. Geological Survey  
URL: <http://ga.water.usgs.gov/edu/earthgwquality.html>

*What is a Pesticide?*; U.S. EPA; <http://www.epa.gov/pesticides/about/index.htm>

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