

Riverfront Property

Adapted from: “Reaching Your Limits” in Project WET: Curriculum & Activity Guide. Bozeman: The Watercourse and the Council for Environmental Education, 1995.

Grade Level: Basic

Duration: One class period
(approximately 40 minutes)

Setting: Classroom

Summary: Students inherent and develop a piece of riverfront property. They then consider how the land use on their property causes water pollution and strategies to reduce that pollution.

Objectives: Students will be able to identify the impacts of various land uses on water quality. They will be able to define point and nonpoint source pollution and be able to give examples of each. Students will be able to identify Best Management Practices (BMPs) and other strategies to mitigate the negative impacts of various land uses on water quality.

Vocabulary:

Point source pollution, nonpoint source pollution (NPS), Best Management Practices (BMPs), riparian

Related Module Resources:

- See land use related items in the Additional Module Resources section

Materials (Included in Module):

- Riverfront Property Worksheet
- List of potential land uses (paper and transparency versions)
- Fact Sheet and Overhead Transparency: “Major Sources of NPS Pollution and BMPs”
- Fact Sheets:
 - “Land Use and Water Quality
 - “Water Pollution Prevention”
 - “Land Use Impacts on Water Quality”
- Activity Envelope with: Headwaters and Mouth signs on cardstock, Red and blue poker chips, River Pollutant Load bag

Additional Materials (NOT Included in Module):

- Drawing materials (markers, crayons, colored pencils)
- Projector/Smart Board

ACADEMIC STANDARDS: (ENVIRONMENT & ECOLOGY)

7th Grade

- 4.1.7.B. Understand the role of the watershed.
 - Explain factors that affect water quality and flow through a watershed.
- 4.1.7.C. Explain the effects of water on the life of organisms in a watershed.
 - Explain how water is necessary for all life.
- 4.2.7.C. Explain natural resource distribution.
 - Analyze the effects of management practices on air, land and water in forestry, agriculture, fisheries, wildlife, mining and food and fiber production
- 4.3.7.B. Describe how human actions affect the health of the environment.
 - Identify land use practices and their relation to environmental health.
 - Identify residential and industrial sources of pollution and their effects on environmental health.
 - Explain the difference between point and nonpoint source pollution.
 - Explain how nonpoint source pollution can affect the water supply and air quality.
- 4.8.7.C. Explain how human activities may affect local, regional and national environments.
 - Explain how a particular human activity has changed the local area over the years.

10th Grade

- 4.1.10.E. Identify and describe natural and human events on watersheds and wetlands.
 - Identify the effects of humans and human events on watersheds.
- 4.8.10.C. Analyze how human activities may cause changes in an ecosystem.
 - Analyze and evaluate changes in the environment that are the result of human activities.
 - Compare and contrast the environmental effects of different industrial strategies (e. g., energy generation, transportation, logging, mining, agriculture).

12th Grade

- 4.1.12.E. Evaluate the trade-offs, costs and benefits of conserving watersheds and wetlands.
 - Evaluate the effects of human activities on watersheds and wetlands.

BACKGROUND:

Water is the liquid of life; all living things depend on it for survival, including humans. Therefore, our water resources, particularly our waterways, are extremely valuable and thus should be protected, not only for our own health and well being, but also for that of the aquatic organisms living in our waterways. Despite our dependence on waterways for drinking water, edible aquatic organisms, aesthetics, recreation and other uses, many human activities adversely affect our waterways; because of these threats, water pollution is a serious issue for most waterways. Water pollution is either point source pollution or nonpoint source pollution. **Point source pollution** occurs when pollutants are discharged (emptied) into the environment from a single, identifiable source.

Nonpoint source pollution (NPS) is a more difficult

source of pollution to pinpoint because this pollution type enters the environment from a widespread land area.

Although many land uses, both those directly adjacent to waterways and those farther inland, affect water quality, waterfront land uses have the most immediate and direct impact on streams, rivers, and lakes. Waterfront areas are used for agriculture (cropland and livestock operations), real estate, urbanization, forestry, industry, recreation and numerous other human activities. These land uses are not inherently harmful to water quality; indeed, with measures such as **Best Management Practices (BMPs)**, the impact of land uses on waterways can be greatly reduced and can even be positive, as is the case when **riparian** (streamside) buffers and wetlands are maintained or restored. Unfortunately, BMPs and other sustainable land use strategies are not always implemented, the results of which range from increased erosion and toxin contaminated runoff to eutrophication and loss of habitat. And pollution due to poor land use practices not only impacts the waterway at the site where the pollution enters the stream, it also affects water quality from that point downstream. The landowner who decides to alter waterfront property ultimately has a decision to make: he or she may develop the land in such a way as to protect and even improve water quality, or in such a way as to degrade the waterway.

OVERVIEW:

Students “develop” a piece of riverfront property and consider the effects of that land use on water quality. They then devise “Best Management Practices” to reduce the negative impact of that land use on the waterway.

PROCEDURE:

Teacher Preparation:

1. Make photocopies of the Riverfront Property Worksheet for your students.
2. Locate the poker chips, the empty bag labeled “River Pollutant Load”, and the “Headwaters” and “Mouth” signs (on card stock) in the Activity Envelop in the module.
3. If students do not have drawing materials (crayons, colored pencils, markers, etc.), collect these for their use.
4. There are several ways to do this activity. If you elect to assign specific land uses to your students, fill in the “Land Use” line on the student worksheets beforehand. If you decide to have students choose from a list a land uses, either photocopy the list included in the module binder for the students or can project the list on your board [through this link](#). Or, if you choose to allow students to draw any land use they’d like, there is no additional teacher preparation necessary.

Student Activity:

1. If desired, stimulate a class discussion about water pollution (point and nonpoint source pollution) and how human land uses affect water quality. Or, you may just want to have students start with Step 2 below and discuss the connections between land use and water pollution after students have finished their land use drawings.
2. Distribute the Riverfront Property Worksheets to your students.
3. Explain to students that they have just been given some riverfront property to develop. Have the class decide on the name for the river and then have students fill in the name of the river on their worksheet. Explain to students that they are each the landowner of the blank space on their worksheet and that the land is theirs to develop.
4. If students are choosing their land use, have them do so and fill in the land use blank on their worksheets.
5. Have students draw their land use (either assigned or of their choosing—see Teacher Preparation Step 3 above) on the Worksheet. Ask them to be as detailed as possible, illustrating as many of the impacts of that land use on the river as they can.
6. Once students have completed their drawings, arrange the drawings in a straight line on the ground as a series of adjacent land uses along the river. Have students stand behind their land use drawing. Spread the blue and red poker chips out evenly behind the line of students. Designate one end of the river as the headwaters (or “beginning”) of the river and the other end as the mouth (“end”) of the river and place the corresponding signs at each end of the river.
7. Present the empty sealable bag labeled “River Pollutant Load” and explain that it represents the amount of pollutants (poker chips) in the river. The “Pollutant Load” bag is going to travel downstream as the students present their drawings, representing the water as it travels downstream past the various riverfront properties. Students will present their land use drawings to the rest of the class and explain how their land use affects the water quality of the river. Point out the poker chips on the ground behind the students and explain that each poker chip represents a unit of pollution. As students explain their drawings, they will pick up poker chips from behind them and add the poker chips to the River Pollutant Load bag for each type of pollutant that enters the river due to the land use on their property. Blue poker chips represent point source pollutants and red poker chips represent nonpoint source pollution. If their land use results in a large quantity of a given pollutant entering the stream, have them add several poker chips (maximum of 5 for extremely polluting land uses). If their land use adds a small amount of pollutants to the river, have students add only one or two poker chips to the River Pollutant Load bag. If their land use does not add any pollutants to the river, they should not add any poker chips to the River Pollutant Load bag. If, perchance, their land use *removes* pollutants from the water as a riparian buffer or wetland would do, then students should remove poker chips from the River Pollutant Load bag and hold on to the poker chips. As students add the poker chips to

the River Pollutant Load bag, they should explain which pollutant the chip(s) represents as well as if it is a point (blue poker chips) or nonpoint source (red poker chips) pollutant. Explain that due to the headwaters' position upstream of human land uses and its intact riparian (streamside) buffer, the river is virtually unpolluted at the headwaters. Therefore, the River Pollutant Load bag will be empty at the headwaters. Finally, explain that the size of the bag corresponds to the river's ability to handle pollutants. Therefore, if the bag is overflowing with poker chips, that indicates that the river is polluted beyond its capacity.

8. Before students explain their drawings, ask them to predict what the pollutant load will be at the mouth of the river as compared to at the headwaters. Based on a quick glance at the various riverfront land uses, do they think point or nonpoint source pollution will be more problematic for the river?
9. Proceed with the students' explanations of their land uses.

DISCUSSION:

Which land uses contribute the most pollutants to the river? *Answers will vary. Also refer to the "Land Use and Water Quality" document at the end of this activity.*

Which land uses contributed no pollutants to the river? *Answers will vary.*

Which land uses removed pollutants from the river? *Answers will vary.*

Which land uses resulted in point source water pollution? Which land uses resulted in nonpoint source pollution? Overall, was point source or nonpoint source pollution a bigger problem for the river (i.e., were there more blue or red poker chips added to the bag)? *Answers will vary.*

Would it be easier to reduce the amount of point source or nonpoint source pollutants entering the stream? *Point source pollution is generally easier to reduce because it comes from a single, identifiable source. NPS, however, is more difficult to reduce because it comes from a widespread area and is difficult to pinpoint.*

If the River Pollutant Load bag was overflowing, what impacts would this have had on aquatic life, humans, etc.? *Aquatic life would become ill, die, or move to more hospitable conditions. Humans might get sick or die from drinking/using the contaminated water, etc.*

Ask students whose property is at different points along the headwaters-mouth continuum to describe the pollutant load of the river at their property. What happened to the River Pollutant Load level as the water moved downstream? *It will increase, probably to the point where the bag is overflowing.* How did the land use practices of landowners upstream affect the water quality near their property? If the upstream land uses polluted the stream, how did they feel about the landowners doing the polluting? *Answers will vary.*

How might students change their land use practices in order to minimize the amount of pollutants they contribute to the stream? (If desired, have students add these measures to their drawings. You may even decide to do the poker chip portion of the activity again and compare the number of poker chips at the mouth when BMPs are used to the number of poker chips at the mouth when BMPs are not implemented.) *Answers will vary but are likely to include BMPs, restoring riparian buffers, using streambank fencing, etc. Also see the “Major Sources of NPS Pollution and BMPs” and “Water Pollution Prevention” documents at the end of this activity for other ways to prevent water pollution.*

What are some of the most common land uses in your community? How might they be affecting water quality? How do these land use practices affect you? How do these land use practices affect aquatic life? What might you do to help reduce the water pollution due to these land use practices? *Answers will vary.*

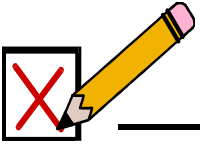
EVALUATION:

- Discussion questions above.
- Define point and nonpoint source pollution.
- Identify point and nonpoint source pollutants.
- Explain how various land uses affect water quality.
- Define Best Management Practices and give several examples of BMPs that protect water quality.

EXTENSIONS AND MODIFICATIONS:

- Do this activity both before and after a unit on water pollution or land use practices to evaluate how students’ knowledge of land use practices’ effects on water quality have changed as a result of the unit.
- Take on one or more of the ideas generated in response to the last discussion question as a class project.
- Have students research the government agencies responsible for regulating water quality. You may even invite representatives of these agencies (EPA, DEP) to visit your classroom.

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):

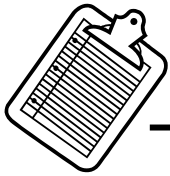


WORKSHEET : RIVERFRONT PROPERTY

Name _____ Date _____

Land-use: _____





LIST : RIVERFRONT PROPERTY POTENTIAL LAND USES

State Park/Recreation Area	Pristine Forest
Shopping Center	Timbering/ Forestry – poor land practices
School	Timbering/ Forestry – good land practices
Roadway/Interstate	
Dirt Road	Urban Area
Agriculture - poor land practices	Industry
	Industry/ Manufacturing
Agriculture - good land practices	Sewage Treatment Plant
Coal Mine	Urban Area
Construction	Agriculture - poor land practices
Housing Development - good land practices	Agriculture - good land practices
Housing Development- poor land practices	Suburban Area
Suburban Area	Pristine Forest
Golf Course	

