KIDS ENVIRONMENTAL LESSON PLANS

This lesson plan developed by:

New England Aquarium

Everything Flows Downstream

Overview:
Students demonstrate how everyone contributes to the pollution of a river as it flows through a watershed and recognize that everyone's "contribution" can be reduced.

Ocean Literacy Principles:

1. The Earth has one big ocean with many features
6. The ocean and humans are inextricably interconnected
7. The ocean is largely unexplored

Key Concepts:

- Distinguish between point and nonpoint source pollution
- Recognize that everyone contributes to and is responsible for a river or lake's water quality
- Identify best practices to reduce pollution

Materials:

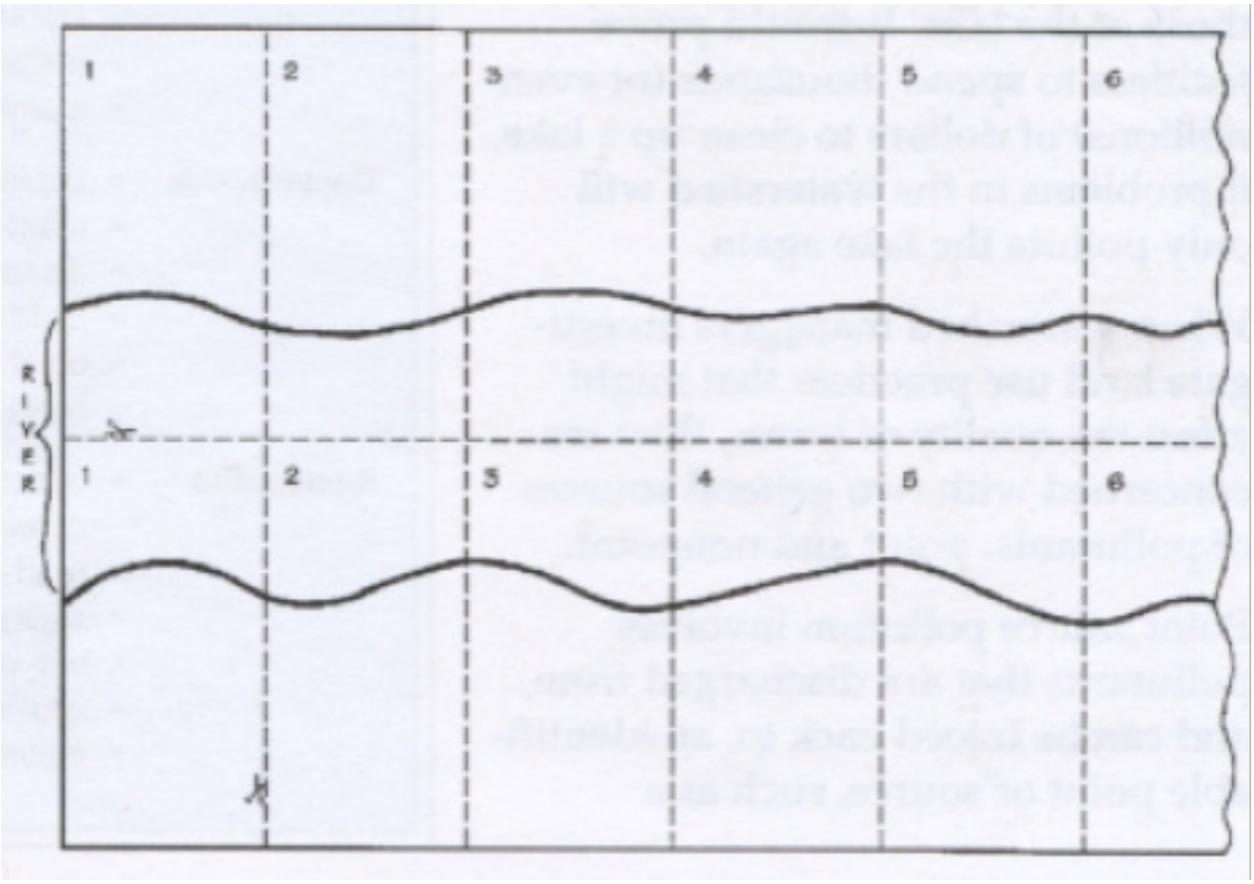
- large piece of poster paper
- drawings pens and pencils

Set-up Prior to Activity:

- Using a blue marker, draw and color a river on the poster paper, as shown below.
- Divide the stream in half down the middle and crosswise into sections. Each section should include a bit of river and black space to allow room for students' drawings. The number of sections should correspond with the number of students or groups of students working together.
- Number the sections on one side of the river in sequential order, placing numbers in the

upper-left hand corners and repeat for the other side.

- Cut out the sections of the stream.



Duration:
1 hour

Physical Activity:
Low

Background:
The quality of water in a river of lake is, to a large extent, a reflection of land uses and natural factors found in its watershed. If soil near a river or lake naturally erodes, chances are the river has sediment and turbidity problems. If the land has stable vegetative covers, erosion is kept in check. When humans settle and develop land, water quality is affected. Breaking sod, cutting forests, building cities, mining and other land uses make an impact upon water quality.

Everyone bears a responsibility for the health of a watershed and the water systems (rivers, lakes, wetlands etc.) within a drainage basin. Individual actions, both negative and positive, add up. Understanding a river of lake's water quality and quantity involves investigating the condition of the contributing watershed. If the watershed is polluted, the river will likely be polluted.

Everything Flows Downstream (cont.)

Watershed investigations are conducted for many reasons. Some investigations monitor changes in river and stream flows over time, to protect fisheries, to regulate floods, or to meet seasonal demands. Other studies determine the best method of protecting a river or lake from pollutants. One aim of a researched might be to determine which areas of a watershed contribute the highest percentage of contaminants. This information is vital to policymakers and water managers when determining how best to spend money for improvements. For example, most lake improvement projects address problems in the watershed as well as those of the lake. It would prove fruitless to spend thousands (or even millions) of dollars to clean up a lake, if problems in the watershed will only pollute the lake again.

When watershed managers investigate land use practices that might affect the quality of the water, they are concerned with two general sources of pollutants: point and nonpoint. Point source pollution involves pollutants that are discharged from, and can be traced back to, an identifiable point or source, such as a factory's discharge pipe or a sewage ditch. Nonpoint source (NPS) pollution occurs when the source of a contaminant is unidentifiable; that is, the pollutant can come from one of many places. Examples of nonpoint source pollution include runoff fro agricultural fields containing fertilizers and pesticides, motor oil filtering from urban areas, and sediments from eroded stream banks.

Surface runoff and groundwater can transport both point and nonpoint source pollutants. Since point source pollutants are identifiable, they are easier to monitor. The protection of surface and ground water resources from NPS pollution presents an enormous challenge because of the widespread and diverse nature of the problem. Land and water managers rely on methods called *Best Management Practices*, or BMPs, to describe land use measures designed to reduce or eliminate NPS pollution problems. A list of nonpoint source pollution sources and suggested BMPs can be found in the sidebar above.

Activity:

Warm-Up

- Determine student knowledge about watersheds by asking them to name several major North American rivers (e.g. Mississippi, Columbia, Missouri, Hudson and Rio Grande). Where do these rivers originate (where are the headwaters) and end? How many states does each cross or touch?
- Discuss some of the predominant types of land uses found along one river as it flows through a single state. Do students think these practices could affect the river? What do students think the attitude of downstream state residents might be about the water received from their upstream neighbors?

1. Inform students that they have just inherited a piece of riverfront property and a million dollars. Have them list the ways they could use the land and the money.
2. Pass out "pieces" of property and drawing pens and pencils. Explain that the blue is water and the blanks space is land they own. They have one million dollars to develop the land as they wish. They can farm or ranch; build resorts, homes, factories, or parks; plant

forests, log, mine-whatever they like.

3. When students have completed their drawings, ask them to look in the upper left hand corner of their property for a number. Explain that each piece is actually part of a puzzle. Starting with number one, have students assemble their pieces. They will construct the stream pathway and adjacent land area in proper order. (The ones should face each other, with the twos next to them and so forth).
4. Have students describe how they developed their land and how they used water. They should identify any of their actions that polluted or added materials to the waterway. Have students represent each of their contributions to the river with an item from the room (e.g. book, piece of paper, pen, pencil, etc).
5. Tell students to take their item(s) and line up in the same order as their pieces of riverfront property. They are going to pass their pollution pieces downstream. Have them announce what kind of pollutant they are holding before they pass it on. The ones will pass their items to the twos, the twos will pass everything to the threes, and so on, until the last students are holding all the items.
6. Have students reclaim their items. Explain that the items easily identifiable as their own simulate point source pollution. Other items (e.g. pencils, pens, paper clips) may be more difficult to claim, because these kind of pollutants originated from multiple sources. Tell students these represent non-point source pollution.

Discussion:

1. How did the students toward the middle or end of the river feel? What about their property use plans?
2. Could a student downstream be affected by the actions of a student upstream? Could upstream users alter the water quality of those downstream?
3. How could a community be designed to minimize the contribution of pollutants to the watershed?
4. What are some examples of local watersheds? Do you think these same problems are happening there? What could be down about that?

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Major Sources of NPS Pollution and BMPs

Source:	Best Management Practices:
Roads and Streets	- dispose of paints, solvents, and petroleum products at approved disposal sites, not in storm drains or street cutters - fix automobile oil and leaks, and stop oil dumping on rural roads - use nonchemical deicers (sand and ash) on roads, sidewalks and driveways - construct a sediment catch basin to collect storm water runoff - reduce construction runoff by building terreces, catch basins and plant cover crops
Agriculture	- read and follow all labels and ask fro application directions before using chemicals, fertilizers, and pesticides - use conservation tillage, contour farming and strip cropping - leave filter strips and field borders along wetlands and streams - use a cover crop to protect exposed soil and rotate crops - plant shelter belts and windbreaks - institute pasture management - terrace areas prone to erosion - construct livestock waste collection and treatment ponds for confined livestock - use grassed waterways - seal abandoned or wast disposal wells - fence waterways to reduce riparian zone impact by livestock
Logging	- monitor water entering/leaving cut areas - prevent sedimetns from reaching streams and lakes by building terraces, catch basins, and natural filters - leave a vegetative buffer zone in riparian areas - maintain and restore effective watersheds - implement a plan ot reduce erosion from roads
Mining	- monitor all water entering/leaving mine sites - intercept and reroute uncontaminted water away from contaminated areas - construct catch basins and terraces, and plant cover crops, to catch sediment and prevent erosion from roads - catch and treat contaminated water - stabilize stream channels and mining waste areas to prevent release of materials - maintain strips along streams
Construction	- implement a sediment control plan - plant ground cover to reduce erosion - dispose of solvent, paint and other wastes at approved disposal sites - build temporary, small dikes to slow and catch runoff - build sediment catch basins to collect construction runoff - build earth berms and filter runoff before water enters stream
Residential	- use nonchemical diecers (sand and ash) on driveways and sidewalks - read labels prior to using pesticides and fertilizers - consider xeriscaping - use nonchemical fertilizers (compost) on gardens - dispose of household hazardous waste at approved disposal sites - maintain septic tanks if sewers are not available