USING TOPOGRAPHIC MAPS AND DATA TABLES TO DETERMINE SURFACE WATER QUALITY

6-8

SUBJECTS:
Ecology, Geography

TIME:
2 class periods

MATERIALS:
topographic or relief map of watershed area
student sheet

OBJECTIVES

The student will do the following:

1. Describe the physical features of land areas surrounding area waters.
2. Distinguish drainage areas that will flow into existing bodies of water.
3. Analyze data obtained from a sampling of surface waters.

BACKGROUND INFORMATION

A watershed is a drainage area that includes all the rivers, streams, and sloping land which flow into a specific body of water. A watershed is impacted by activities that occur within the specific sloping area. Pollution from industries and individuals can affect the quality of water in a watershed. Other activities that can damage a watershed include farming, construction, and industrial activities.

Water monitoring sites can be established along watershed drainage areas to determine the quality of the water entering the downstream body of water. Data can be collected and analyzed at various sites along the drainage areas. Downstream impact can be determined by measuring the dissolved oxygen content, pH of the water, turbidity, and the biological diversity of organisms located in the drainage areas. By analyzing these parameters, students can compare information from several monitoring sites and determine the relative quality of the surface waters in the watershed area.

Geological watershed maps can be obtained from state geological surveys, the United States Geological Survey, or from local map dealers.

Terms

biological diversity: a wide variety of plant and animal life.

dissolved oxygen (DO): oxygen gas (O_2) dissolved in water.

drainage basin: an area drained by a main river and its tributaries.

monitoring: scrutinizing and checking systematically with a view to collecting data.

nonpoint source pollution (NPS): pollution that cannot be traced to a single point (Example: outlet or pipe) because it comes from many individual places or a widespread area (typically, urban, rural, and agricultural runoff).

pH: a measure of the concentration of hydrogen ions in a solution; the pH scale ranges from 0 to 14, where 7 is neutral and values less than 7 are progressively acidic, and values greater than 7 are progressively basic or alkaline; pH is an inverted logarithmic scale so that every unit decrease in pH means a 10-fold increase in hydrogen ion concentration. Thus, a pH of 3 is 10 times as acidic as a pH of 4 and 100 times as acidic as a pH of 5.

point source pollution: pollution that can be traced to a single point source, such as a pipe or culvert (Example:

industrial and wastewater treatment plants, and certain storm water discharges).

topographic map: a map showing the relief features or surface configuration of an area, usually by means of contour lines.

turbidity: the cloudy or muddy appearance of a naturally clear liquid caused by the suspension of particulate matter.

watershed: land area from which water drains to a particular water body.

ADVANCE PREPARATION

I. Setting the stage

A. Display a topographic map of the local area and define the watershed area.

B. Discuss the major streams, rivers, and sloping areas indicated on the map.

C. Hypothesize the factors that could cause pollution problems in the drainage area of the watershed.

D. Prepare copies of the student sheet for each student.

II. Activity

A. Have the students use the student sheet to answer the questions about the streams located in the watershed.

B. Have the students analyze the information, discuss possible contributing factors, and determine what other types of investigations will be necessary.

III. Follow-Up

A. Have the students make visual observations of local streams and creeks and locate these on the watershed map.

B. Display topographic maps of other watersheds in other areas. Ask the students to compare the size of the drainage areas.

IV. Extensions

A. Take a field trip to a local park located on the watershed.

B. Develop site monitoring groups for area streams and rivers.

C. Develop a resource file of organisms known to indicate biological diversity in local waters.

RESOURCES

United States Geological Survey (USGS) topographic map of local watershed.

Person, Jane L., Environmental Science: How the World Works and Your Place in It, Lebel Enterprises, Dallas, Texas, 1995.

SAMPLING INFORMATION OBTAINED FROM WATERSHED MONITORING SITES

SITE #	DO	pH	DIVERSITY	TURBIDITY (M)
1	.6	7.0	GOOD	.2
2	.8	7.5	POOR	.4
3	.7	7.0	GOOD	.1
4	.9	6.2	FAIR	.4
5	.4	5.0	POOR	0

QUESTIONS

1. At which site was the water most turbid?_____
   _____
2. Does the topographic map indicate any reasons for the high turbidity at that site? _____
   Explain._____
   _____
3. Which site illustrates the lowest dissolved (DO) oxygen content? _____
   What could have caused the low DO at this site?_____
   _____
4. What could have caused the pH to be more acidic at site 5?
   _____
   _____
5. Does DO seem to cause poor biodiversity? _____Explain. _____
   _____
6. What variables are present in monitoring of test sites?_____
   _____
7. List the types of land use that might have an effect on each of the following:

   dissolved oxygen_____

   pH_____

   turbidity_____

   other_____
8. Based on the information given for each of the five sites, which site do you consider to be the healthiest?
   Explain._____
   _____