OKLAHOMA COOPERATIVE EXTENSION SERVICE
4-H Youth Development

Water Quality of Streams and Lakes (Ages 9-11)

Oklahoma Cooperative Extension Service • Division of Agricultural Sciences and Natural Resources

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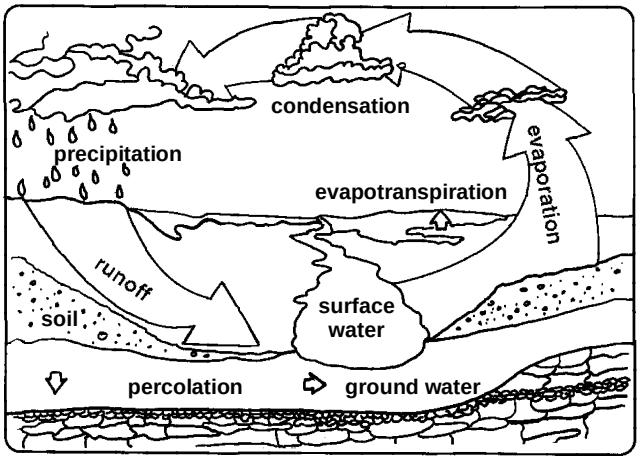
Water is necessary for life. We use water to cool us off when we are hot. We play in it and swim in it with our friends. We use water to wash our clothes and cook our food. In fact, we use water for nearly everything we do. Not only are people dependent on water, but plants and animals also need it for survival. Water quality is good when water is clean and well-suited for all of these uses.

The Water Cycle

All water is recycled through the water cycle. When it rains, water either soaks into the ground or runs off into lakes or streams. Water that soaks into the ground is called ground water. Water that runs off into lakes or streams is called surface water.

Heat from the sun causes water to **evaporate** into water vapor. The warmer air containing water vapor rises high into the atmosphere, forming clouds. As air becomes cooler, its water vapor **condenses**, forming water droplets. As water droplets become too heavy, they fall as rain, sleet, or snow. This is known as **precipitation**. Some ground water is drawn up through plant roots and stems and eventually evaporates from leaves to the atmosphere. This is known as **evapotranspiration**. Heat from the sun powers the water cycle, keeping it moving constantly.



The water cycle. (Adapted from *Oklahoma Aqua Times*)

Things That Influence Water Quality

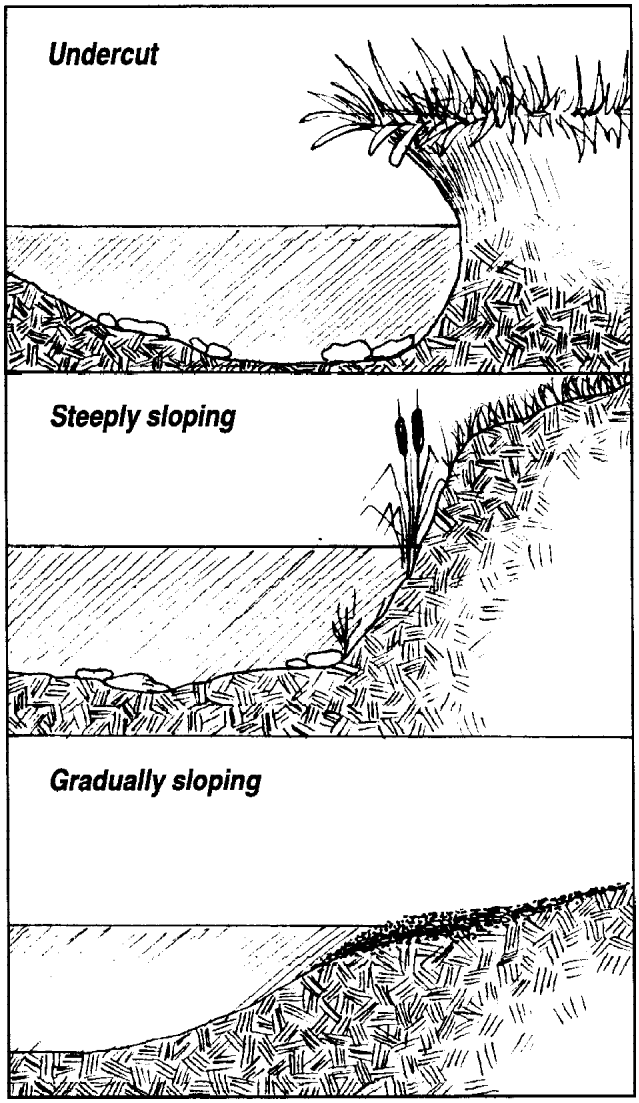
Lakes and streams are important parts of the water cycle. People depend on them as water sources for their homes and for recreation, such as fishing and swimming. Many animals and plants depend on lakes and streams for their home or habitat.

Weather affects streams and lakes. If it doesn't rain for a long time, a stream may dry up completely. If it rains a lot over a short period of time, water can rise out of the banks causing a flood. The amount of sunlight is also important. Sunlight affects water temperature and the growth of plants in the water.

Human activities can help or hurt the water quality of a stream or lake. People who dump industrial and other types of waste into streams can hurt water quality. If not used correctly, fertilizer and pesticides from our farms, yards, and gardens can be carried by runoff into streams and lakes, hurting the quality of the water. Oil and antifreeze that leaks from cars can also run off into streams and lakes. In fact, anything spilled or dumped on the land can influence water quality. On the other hand, some human activities, such as planting trees and grass can improve water quality.

The Bank and Shore

The bank of a stream or shore of a lake starts at the low-water line and runs to the high-water mark.



Types of stream bank shapes. Courtesy Tennessee Valley Authority.

Shorelines and stream banks are important because plant and animal life are usually most abundant at the water's edge. Banks and shores provide many types of places or habitats where different kinds of plants and animals live and feed.

Shorelines and stream banks without vegetation erode easily. Erosion takes place when water loosens the soil and carries it away. Erosion can cause a stream or lake to appear muddy. When the water is muddy, light is not able to penetrate it. The muddy water blocks the sunlight needed by plants.

Weather also affects erosion and water clarity. During and after a heavy rain storm, more soil comes into the water from unprotected banks and shorelines.

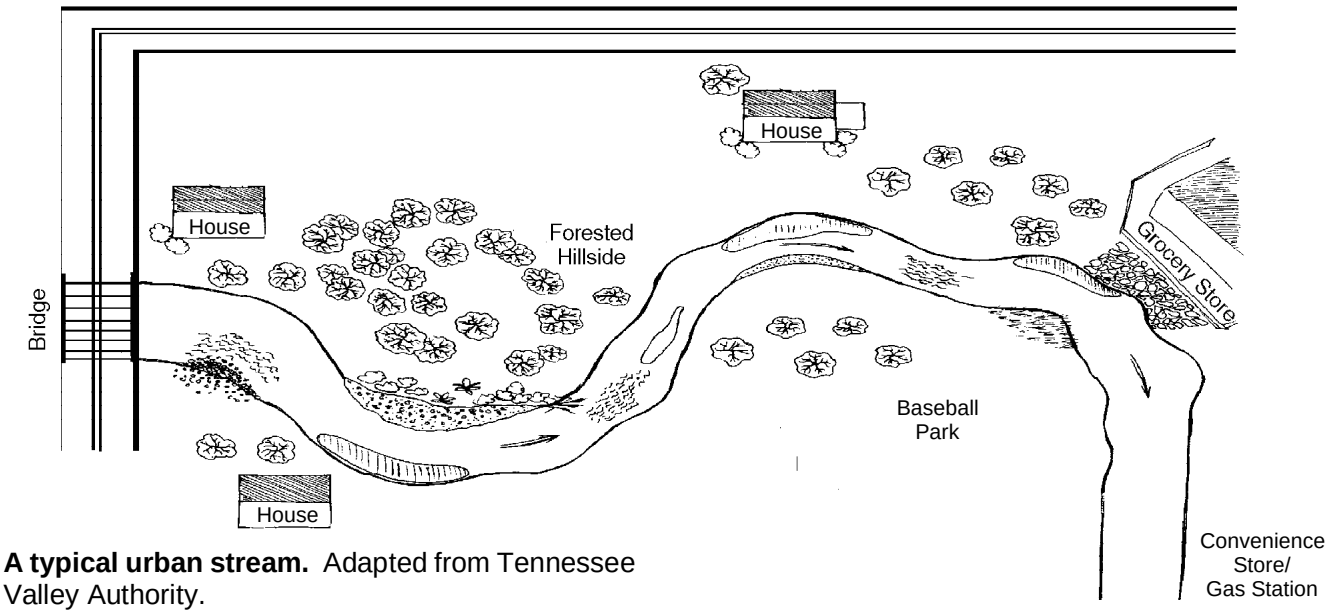
Some of the questions on the report form will help you characterize the shore or bank of the stream or lake you are studying.

Soil Types

Soils are composed of particles with an infinite variety of sizes. The smallest particles are too small to see without a microscope. They are called clay. The largest particles are sand, and the mid-sized particles are silt.

Soil texture refers to the proportion of sand, silt and clay in the soil. Sand and silt erode more easily than clay, but clay particles are so small that even a tiny amount will keep the water cloudy for a long time.

When you rub soil through your fingers, sandy soil feels gritty, like sugar or salt. Silty soil, when moist, feels floury or velvety rather than gritty (similar to flour or baby powder). Clay soil feels sticky and plastic when it is wet—similar to play dough. When wet and pinched between the thumb and finger, clay can form a flexible ribbon that is one or more inches long.



A typical urban stream. Adapted from Tennessee Valley Authority.

The Lake and Stream Bottom

The bottom of a lake or stream is important to water quality and to the types of vegetation that can grow there. Different types of plants and animals live in a lake or stream that has a rocky bottom compared to one that has a sandy or clayey bottom. Also, some types of plants and animals live in shallow water while others live in deep water.

The soil of the stream or lake bottom and banks influences how cloudy or muddy a lake appears. Usually, if the river bottom and banks are covered with vegetation or rocks, the water will be clear. Other factors, like how people use the land near a lake or stream and how much of that land erodes can also influence how muddy the water will be.

To help characterize the bottom of your lake or stream, answer the questions on the report form.

Water and Things That Live There

The general appearance of a stream or lake can tell you a lot about its water quality and the kinds of plants and animals that will be found there. Following are some characteristics of lake and stream water that you can measure.

Turbidity

Turbidity refers to the cloudiness or muddiness of the water. If a lake is clear, light will penetrate deeply into it, providing energy for healthy and productive plants. If a lake is not very clear or has high turbidity, the light will not penetrate the water more than a few inches. Just as a garden won't grow in the dark, a very turbid water body will not support much plant life.

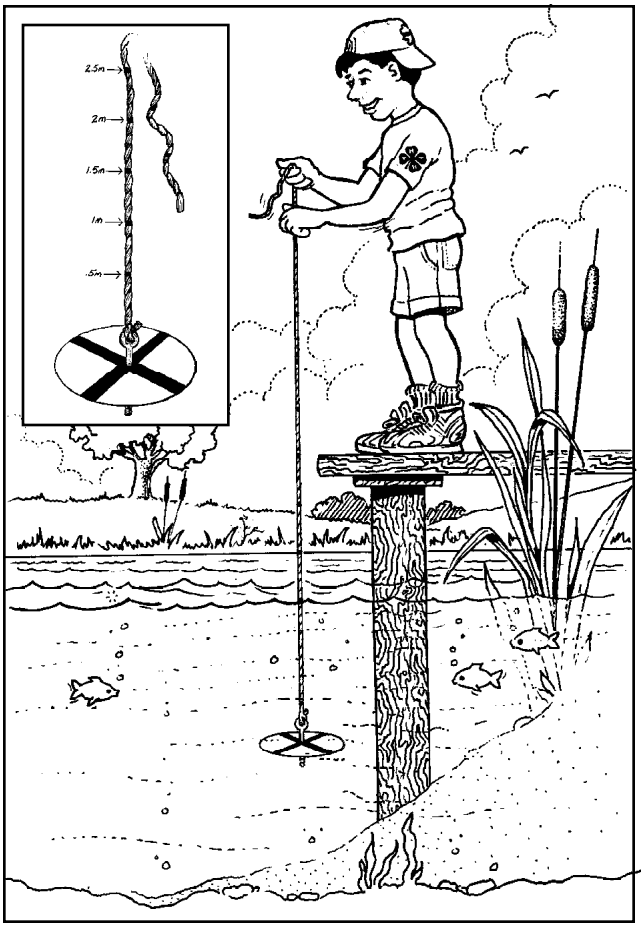
Measuring Turbidity

Instructions for making a Secchi (pronounced 'sek-e) disk are given in *Made at Home Sampling Equipment*., Lit. # 27.

Wait for a clear, sunny day, and take your measurement between 9 a.m. and 3 p.m. Lower the Secchi disk slowly into the water until the white areas barely disappear. Then slowly raise the disk until they just reappear. When the white area reappears, note the point on the string that is at the surface of the water. Hold the string at that point and lift the disk out of the water. Count the marked intervals of the string that were underwater and record the distance. This is called the Secchi depth and is a measure of turbidity. A smaller Secchi depth means greater turbidity.

Velocity

Just as you can measure how fast a car is going, you also can measure the speed or velocity of a stream. Velocity affects the kinds of organisms that can live in the water. Some organisms like fast-moving water because it brings lots of food rapidly to the organisms. These organisms often have the ability to attach to rocks or plants and hold on in the strong current. Some prefer slow-moving water because they cannot attach to things and would be washed away.



Using a Secchi disk to measure turbidity. Illustrations by Jon Dickey.

Measuring Velocity

To measure velocity, you need two people, two stakes, a measuring tape, a watch with a second hand (or stopwatch), and an orange. Place the stakes approximately 20 to 30 feet apart along the shoreline. Measure the distance between the two stakes exactly. Place the orange in the water upstream from the first stake and start timing when it floats past the first stake. When the orange reaches the second stake, record the time in seconds. Divide the distance between the stakes (in feet) by the time (in seconds). The result is the velocity of the current. Repeat the experiment three times and take the average of the readings to get an accurate estimate of velocity.

For example: The distance between the two stakes is 20 feet. The time it took for the orange to

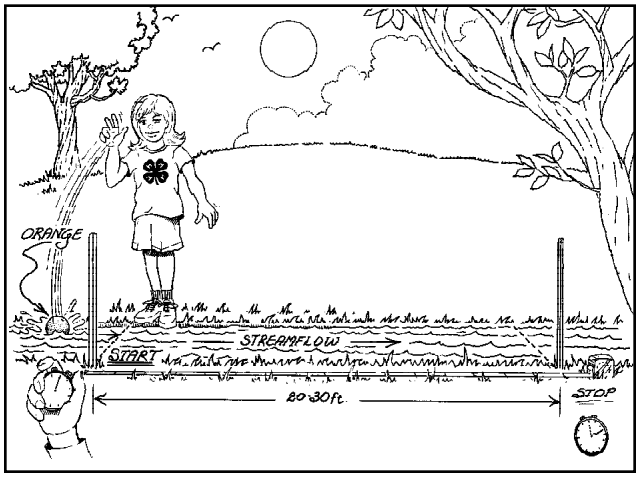
float from the first stake to the second stake is 10 seconds, 12 seconds and 11 seconds. First, average these three numbers. In this example,

average time = $\frac{10+12+11}{3}$ = 11 seconds.

Divide this average into the distance. In this case,

velocity = $\frac{20(feet)}{11(sec)}$ = 1.8 ft/sec.

Aquatic Plant and Animal Life



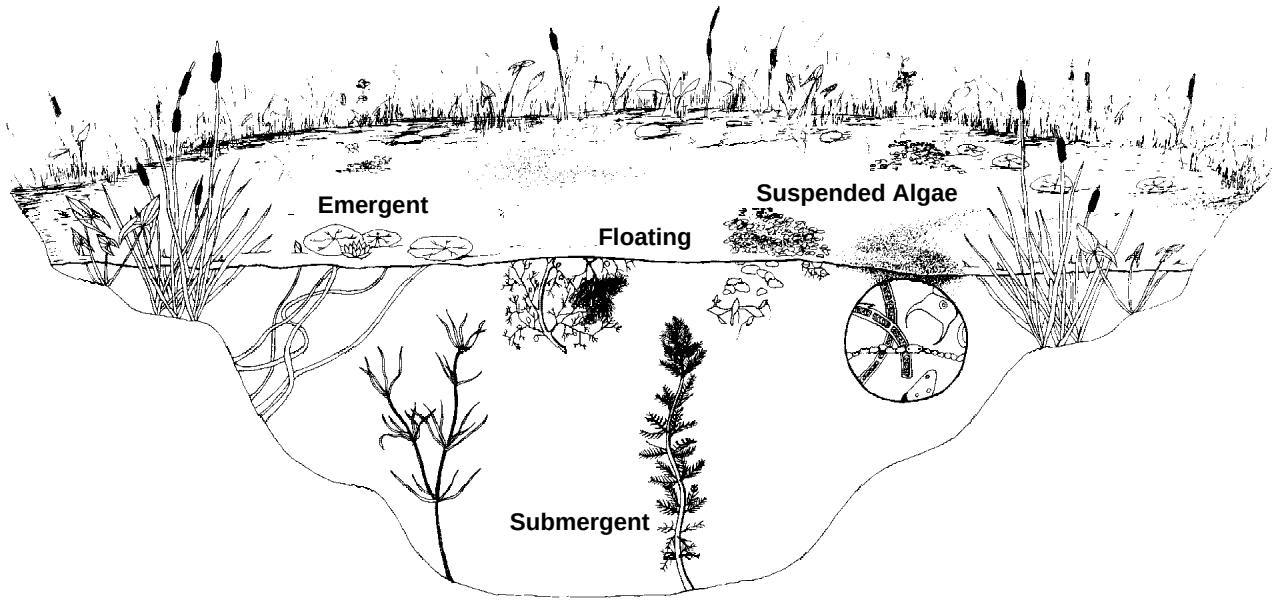
Measuring velocity. Illustration by Jon Dickey.

The kinds and numbers of plants and animals that live in or near a stream also affect the quality of the water. Rooted plants near the stream help hold the soil in place and prevent erosion. In turn, plants use water for growth and remove some pollutants from the water. Animals, too, rely on the stream for water and food.

Plants and animals depend on each other for food. Plant material that grows or falls in the water feeds animals that live in the water. Animals help plants in return by leaving nutrients that feed the plants. Both plants and animals leave behind decaying material that provides nutrients for plant growth.

Aquatic plants can be classified in four main categories: submergent, floating, emergent, and suspended algae. **Submergent plants** are usually rooted in the bottom and live entirely or almost entirely underwater. **Floating plants** also have roots, but most of their leaves float on top of the water. **Emergent plants** are rooted in the bottom, but their stems and leaves grow above the water. **Suspended algae** do not have roots. They are usually microscopic, and, when mixed throughout the water, give the water a green color. Some algae also grow attached to rocks and other plants in the water. This makes the rocks feel hairy or slippery.

Some of the questions on the report form help you describe the types of vegetation growth and animal life in the stream or lake. Stores that carry aquarium supplies usually sell small dip nets that you can use to collect aquatic organisms.



Aquatic plant groups. Adapted from University of Georgia Cooperative Extension Service.

Seasonal Changes

The time of year that you look at a stream or lake makes a difference in the water body's appearance. Throughout the year, water in streams or lakes is always changing. The number of plants and algae is usually greatest during spring and summer and least during winter. In winter, there usually is less light because the days are shorter than in the summer. However, some well-shaded streams actually receive more sunlight in the winter, when the leaves are off the trees. Such streams can grow more algae in the winter.

You may notice some decaying debris, such as leaves and sticks, while working around a stream or lake. The debris feeds some kinds of organisms in the stream or lake. However, if too much debris is dumped in the water, it may hurt the water quality.

Animal Impacts

Cattle, deer, and other grazing animals can help control plant overgrowth on shores and banks. However, too many animals can kill trees, brush, and grasses needed to hold the soil in place.

History

Every stream or lake has a story to tell. Things that happened in the past can explain why the water body looks the way it does today.

A big flood may have eroded the stream bank and altered the stream channel. Roads or bridges may have changed the course of a stream or added sediment to a lake. Trees and brush may have been cleared away from the shore or stream bank, opening it up to erosion. Cattle may have grazed down plants on the shore or stream bank and trampled these areas. Houses may have been built close to a stream or lake, increasing the amount of rain that runs off, causing floods.

You can find out about a stream's or lake's past by talking to adults who have lived near it for many years and asking them questions. Some questions you might ask include:

- In the past, did you or other people fish in the stream or lake?
- Were there more or fewer fish than today?
- Have some kinds of fish disappeared, or have new kinds appeared?
- Did you or others swim in the water?
- Was it clearer or cleaner then, or now?
- Has the stream or lake become shallower, and if so, why?
- Has flooding on the stream or lake become worse over time, and if so, why?
- What is the highest the stream or lake has ever risen?

You can come up with questions of your own also. Your questions may lead to other memories the adult has about the stream or lake. Encourage the adult to talk about whatever he or she thinks is important about the stream or lake.

Another great way to learn about the history of a water body is through old photos. Ask permission to look through family albums of snapshot collections. Don't limit your search only to photos of the water. A family snapshot with a pond or lake in the background, photos from a fishing trip, or news photos could be useful. If you can, discuss the photos with someone who was there when they were taken. Try to figure out where features in or around the water body in the photo are today. This could provide clues about the movement of a bank or shoreline. Photos do not have to be very old, either. Some water bodies can go through great changes in just a few years.

Fun Facts

Mineral – any substance that is neither a plant nor an animal.

The Great Salt Plains Lake contains salt, which is a a **mineral**. This lake was formed by repeated flooding by sea water. Many crystals are found in this area because gypsum, another mineral, combines with the salty solution to form crystals.

Evapotranspiration – the total water loss from soil, including evaporation from the soil and transpiration through the plants.
Submergent plants do not **transpire**.

Photosynthesis – the process plants use to produce food from water and carbon dioxide.

All green plants use sunlight for photosynthesis.

Turbidity – the cloudiness or muddiness of the water due to suspended particles in the water.

Since Lake Tenkiller has had low **turbidity**, it has been popular for underwater sports like SCUBA diving.

Velocity – the speed at which something moves.
The world's fastest boat can travel at speeds over 200 mph.

Algae – microscopic plants without roots, stems, or leaves. They can be attached to rocks and other surfaces, or they can be suspended in the water.

Not all **algae** are green. Red **algae** can cause a phenomenon known as red tide.

For More Information

Reid, George. (1987). *A Golden Guide. Pond Life:* Golden Press, New York, N.Y.

An inexpensive book containing many descriptions and illustrations on plants and animal found in ponds. Also explains different characteristics of ponds.

Oklahoma Aqua Times. 4-H Publication No. 746. (In Oklahoma, available from county extension offices).

Explains different water properties and has numerous activities aimed at elementary students.

Illustration Credits

Oklahoma Aqua Times, 4-H Publication No. 746, Oklahoma Cooperative Extension Service.

Tennesse Valley Authority from *Tennesse Valley Authority Clean Water Initiative Volunteer Stream Monitoring Methods Manual* (Figure 2).

Jon Dickey, Graphics Coordinator, Oklahoma State University Cooperative Extension Service.

Identification and Control of Weeds in Southern Ponds, University of Georgia Cooperative Extension Service.

Credits

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OKLAHOMA COOPERATIVE EXTENSION SERVICE

Report Form
Water Quality of Streams and Lakes
(Ages 9-11)

4-H YOUTH DEVELOPMENT

No. 20

Name: _____ County _____
Dates of observations: _____

Year working on project (circle one): 1st 2nd 3rd

Report on either (a) 2 streams or 2 lakes or (b) one stream, lake or pond at two different times of the year. Complete a separate report form for each stream or lake and for each observation. Hole punch and put your report form and any extra pages in a folder with brads or a 3-ring binder. This will prevent any pages from getting lost.

Safety: Always go with an adult to your stream. When testing a the stream or lake do not attempt to take any measurements unless it is safe to do so. Do not sample in fast moving or deep water. Wear the appropriate clothing for the site (old tennis shoes, long pants). If the stream or lake is on private property, be sure to get permission before going to the site.

Location of stream or lake, including a map (e.g., 4 miles east of Ada on Highway 1)

_____

_____

Take four photographs which show an overall picture, of the project area. One of these pictures should be an overall view of the stream, with the others showing major characteristics present along the stream. Include these photographs with your project and a brief statement explaining why you chose to photograph these areas. Label the pictures according to site and direction of view. Example: "View of vegetation along north shore" or "view of vegetation on west bank (facing downstream)"

Try to answer the following questions. Be as specific as possible. Add any other information that you think is important at the bottom of each section. Refer to fact sheet Lit # 19, ***Water Quality of Streams and Lakes*** for explanation and illustrations.

Bank/Shore

1. What is the slope of the bank? ____gradual ____steep ____undercut ____other (If other, please describe)

2. What is the soil type? (check the most appropriate one) ____sandy ____silty ____clay ____rocky ____gravelly ____other (If other please describe) _____

_____

3. Is the bank eroded? (check the most appropriate one) ____Heavily ____Somewhat ____Not much erosion

4. Is there vegetation growing on the shore or bank? ____yes ____no If yes, does it seem to hold the soil in place? ____yes ____no Describe the vegetation. (trees, flowers, grass, bushes) _____

_____

5. Describe what is near the shore or bank? (houses, pastures, roads, gardens, cropland, woods, parking lot, shopping center,other)_____

_____

_____

_____

6. Are there any wild or domestic animals living on or in the shore or bank? (If not sure, look for tracks) ____yes ____no What kinds of animals? List the animals you can identify. _____

_____

7. Is there any trash or evidence of some type of pollution? ____yes ____no If yes, what kind? _____

_____

_____

_____

Stream and Lake Bottom

1. What is the soil type? ____sandy ____rocky ____gravel ____other (explain) _____

_____

2. Are there any plants growing on the bottom? ____yes ____no If yes, are they ____submergent ____emergent ____floating Is there any algae? ____yes ____no Describe the plants you see. _____

_____

_____

3. Can you find any animals or insects living on the bottom? Hint: You may need to turn over some rocks to see if there are any living under them, or pass a small dipnet through areas of plants or over the surface of the mud on the bottom. Look carefully, some are very, very tiny. ____yes ____no Describe any animals you see and describe their habitat.

_____

_____

_____

_____

4. Is there any garbage or other material on the bottom that does not belong there? ____yes ____no Describe.

_____

_____

The Water and What Lives There

1. Is the water ____ clear ____muddy? If this is a lake, what is the secchi depth (in feet and inches)?_____

2. Is there any garbage or pollution floating in the water? _____yes _____no

3. Is there any natural debris floating on the water? (logs, leaves) _____yes_____no Describe the debris. _____

_____

_____

4. Are there any fish or other animals living in the lake or stream? Describe them and tell how you were able to observe them. _____yes _____no

_____

_____

5. If this is a stream, what is the velocity of the current? (Distance/time) _____

6. What is the color of the water? _____green _____orange-red _____muddy/cloudy _____milky/white _____multi-colored (oily sheen) _____clear _____others (If other, please describe) _____

_____

7. How is this stream being used by people now? (Drinking, washing clothes, waste disposal, transportation, watering livestock, recreation) _____

_____

_____

History

1. Interview an adult about the history of a stream or lake that they have lived by. On a separate sheet of paper, list the name of the person you interviewed, the length of time they have lived near the waterbody, and some the questions that gave you useful information and their answers. Also, write a short paragraph telling what you learned from the interview. (Limit to one page)

2. **(Optional)** Did you locate any old photos? If so, write a paragraph about what you learned from them. Include a hand drawn map or diagram, if it will help the reader understand the changes.

Fair Exhibits

Your fair exhibit must have two completed report forms.

Be sure to include:

- a map with location marked
- four photos of the stream
- history interview and optional photos

2nd and 3rd year projects

1. Write one or more paragraphs (not to exceed one page) comparing what you found this year with previous years and describing any changes. Include previous years reports in your folder or a 3-ring binder.