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8:29 Freshwater Stream Field Study

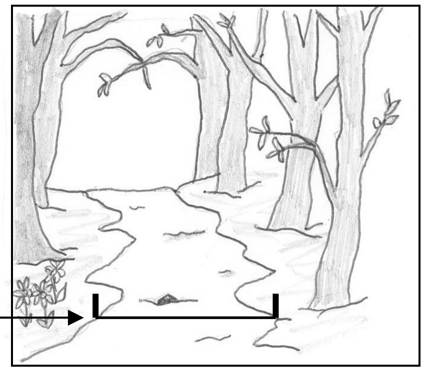
PURPOSE

To construct a transect to measure stream flow volume, velocity and predict stream direction, and to identify various riparian and stream macro-invertebrates

MATERIALS

Life jacket and or hip boots/ waders
Weighted depth rope or stake/pole
Tape measure
Stop watch or watch with second hand
Floating ball or small stick
Graph paper
Mesh bags
Leaves from the stream bank

Transect line



CAUTION: If there is any uncertainty about the depth at mid-channel, use a depth rope or pole before wading in.

PROCEDURE

<u>Part 1: Stream Transect</u>

- Measure the depths at regular intervals along a transect line across a shallow stream or creek. Record the interval used to plot the depths.

- Using the horizontal axis for width and the vertical axis for depth, plot the data to produce a transect profile or cross-section map of the stream. Remember to use a reverse scale on the Y axis with numbers that will indicate increasing depths. Follow the example on the next page.

- Because stream flow engineers use gallons per second for flow volume, measurements should be taken in feet.

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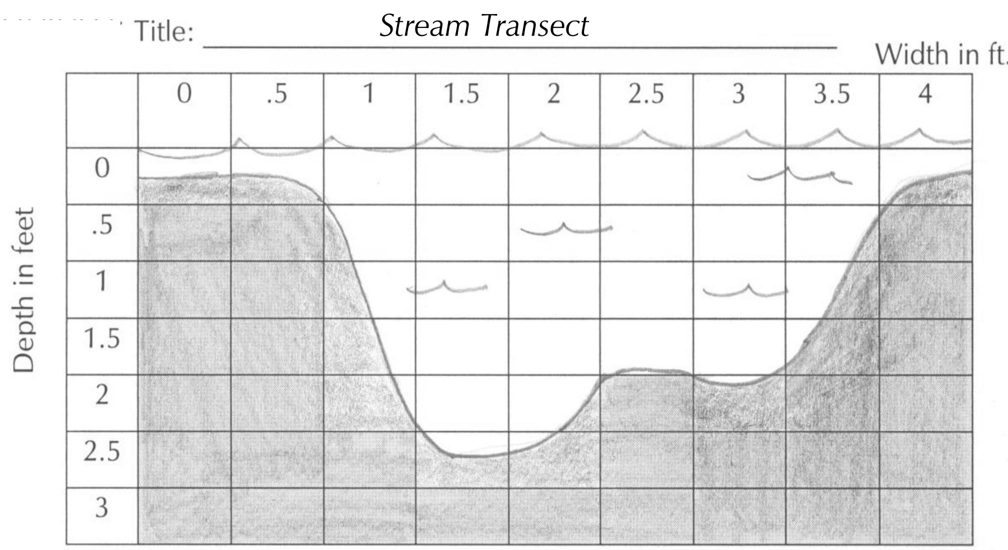
- Use graph paper to make a transect profile as shown in the example, but select measurements that fit your data.



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Part 2: Calculating Area of the Stream

- Calculate the area of one box in the graph by multiplying the width by the depth. Estimate how many boxes in the graph are covered by the stream (the open boxes above the bed.) Add up the total boxes and multiply by the area.

Area example: .5 ft. X .5 ft. = .25 ft^2 for each box on the graph

25 estimated boxes under water in the graph = 25 x .25ft^2 = 6.25 ft^2

1. What is the area of your stream? ____

Part 3: Calculating Stream Velocity

- Mark off 100 feet on the ground up or down stream from your survey spot. Mark the beginning and ending spot with stakes or have a person standing on shore at each end of the survey length.

- Drop any small, floating object (ball, wooden stick, toy boat, etc.) in the water at the upper stake and record the time it takes to reach the lower stake.

Surface velocity in feet per second is equal to 100 ft. divided by the time in seconds. Average stream velocity is about .8 feet/second times the surface velocity because water travels faster at the surface than in deeper water.

Velocity example: $\frac{\text{100 feet}}{\text{45 seconds}}$ = 2.2 feet/second at the surface

2.2 X .8 = 1.76 feet/second average velocity

2. What is your stream velocity? ____

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Part 4: Calculating Flow Volume

- Multiply the total area (Part 1) by the average velocity given in feet/second (Part 2).

Flow Volume example: Total area X Flow Velocity = Flow Volume

6.25 square feet X 1.76 feet/second = 11 cubic feet/second

One cubic foot equals 7.5 gallons; therefore, cubic feet/second can be converted to gallons/cubic foot by multiplying.

11 cubic feet/second X 7.5 gallons/cubic foot = 82.5 gallons/second

Flow volume is generally stated in gallons per day. To convert, multiply the number of gallons/second by the number of seconds per day and then multiply by the flow volume in ft/sec. Since a day has 86,400 seconds (60 X 60 X 24), 82.5 X 86,400 = 7,128,000 gallons per day.

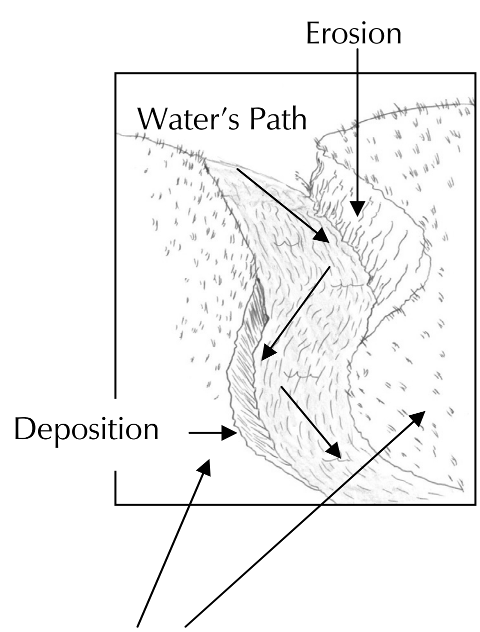
3. What is the flow volume of your stream? ________________________________

Part 5: Predicting Flow Direction

Water moves in a straight line path as it flows downstream. As it hits the banks, it is deflected much like a pool ball hits the edge of a pool table.

Erosion occurs faster on the outside curves of streams than on the inside curves. If the water flows through a wide valley or flat plain, the stream or river will begin to meander as it alternatively erodes and deposits sediment.

The flow of water will take the path of least resistance, and a meander may cut off the main stem of the river to form an oxbow lake.



The banks on either side of a water course are called the riparian zone.

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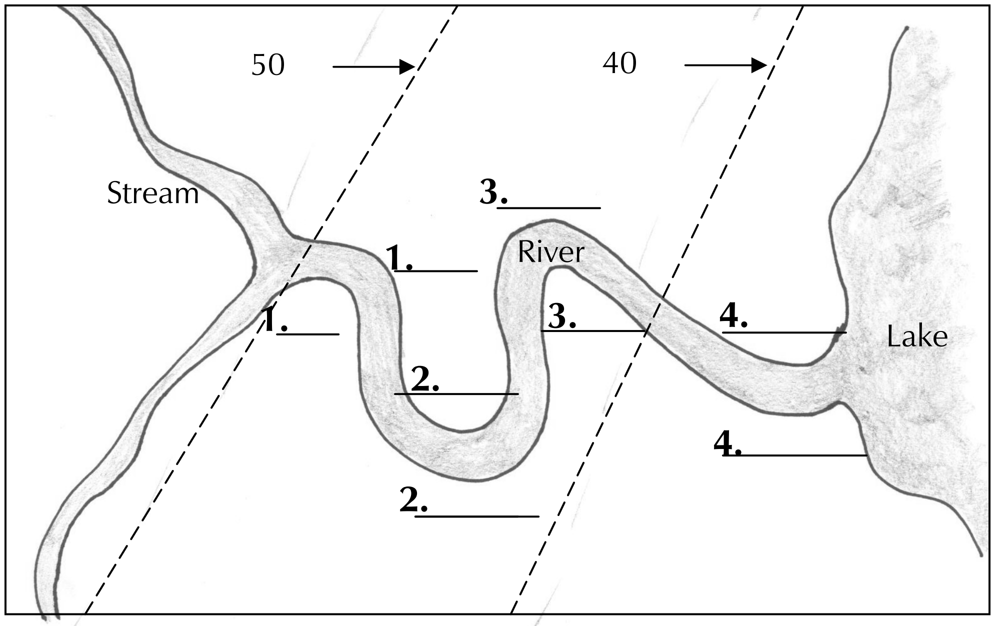
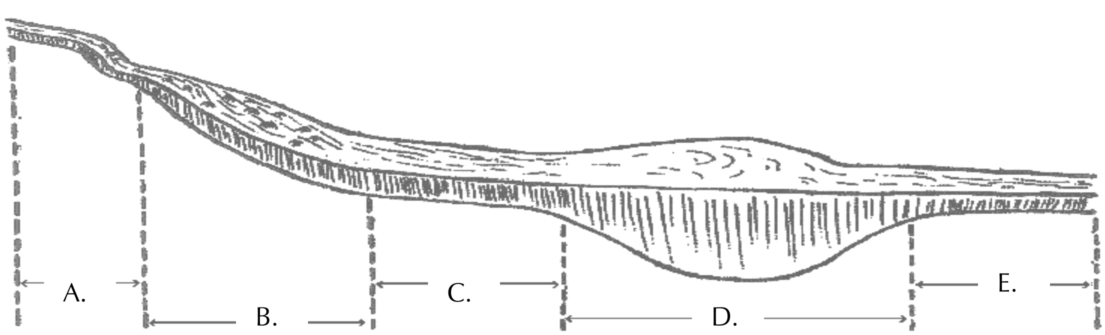
- On the diagram below, mark the direction that water is flowing. Using this information, mark the riparian zones on the diagram with an E for erosion and a D for deposition. Use the blanks provided for each of the four sets of meanders. Label the area that will become an oxbow lake.



Part 6: Labeling a Stream Diagram

Each area of a stream has its own characteristics and species. Variations in velocity and flow volume create riffles, runs, flats and pools in freshwater streams. Riffles are areas with fast, shallow water where fish come to feed in the mornings and late afternoon. Runs occur between the riffles and flats where the water is still fast but deeper than in the riffles. The flats lack the visual protection of moving water, but fish still feed in the shallow, calm water during the mornings and evenings. Pools with slow moving deep water are generally good for a variety of fish.

- Label the diagram using the terms from the previous paragraph.



A.__________ B. ___________ C. ___________ D._________________ E.____________

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Part 6: Survey of Stream Macro-invertebrates

- Place several handfuls of leaves into a mesh bag. (The bags that oranges and grapefruits come in at the supermarket are perfect. Submerge the bag into the stream and secure to a tree or rock. After several days, collect the bag and dump the bags into large trays. Sort through the leaves looking for invertebrates that have moved into this new habitat and remove the organisms that you find.

- Try to group the invertebrates by closely observing their feeding appendages. Shredding organisms depend on decaying leaves; while others scrape algae off rocks. Some are filter-feeders and others might be planktonic. Some water invertebrates move to the riparian zones as adults.

- Collect and draw invertebrates on the banks. After sketching your results, return the organisms to their home.

4. How many total organisms did you find? ______________________________

5. How many different species were present? ______________________________

6. How many feeding groups were represented? ______________________________

7. Was your macro-invertebrate study done in a riffle, run, flat or pool?

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QUESTIONS AND ANALYSIS

1. How do you explain differences in temperature from mid-stream to the banks?

2. Define a riparian zone.

3. What determines riparian erosion and deposition?

4. What is the relationship between flow velocity, elevation and the shape of the channel in rivers and streams?

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5. How does stream flow affect the species that live in riffles and pools?

6. In a stream, how does velocity change with depth, elevation, flow volume, stream area, and in contact with the banks? Explain

7. How are riparian macro invertebrates different from stream invertebrates?