Watershed Experience Lesson 3:

Human Impacts on Streams

ACTIVITY TYPE: *Stream Table Day 2 of 3*

AUDIENCE: *High School*

TIME FRAME: *1 hour 15 minutes*

SUMMARY:

In this session students will build on the lessons from last week's look at stream tables to start answering the guiding question: ***How does human activity affect the quality of water in our watershed?*** *By adding human-made features to the stream table, students can see how our infrastructure changes stream flow.*

MATERIALS:

Info on how to make model stream infrastructure is below. Much of the model infrastructure can be created using craft sticks, hot glue, and plastic tubes.

- Lab sheets: Lab Sheet
- Watershed PowerPoint: Lesson 3 Presentation
- Model Stream Crossings: bridges, bottomless arches, culverts
    - Bridge: craft sticks glued flat
    - Culverts and arches: short PVC pipe *(arch: cut length-wise)*
- Model Riparian Buffers: concrete wall, riprap, vegetation
    - Concrete wall: craft sticks glued flat
    - Riprap: flat, 3 cm. stones *(should hold steady with stream flow)*
    - Vegetation: burlap or sponges *(to hold sediment and simulate plant roots)*

PREPARE AHEAD:

For this lesson, you need at least two educators and stream tables. With just two rotations, the groups are larger than last time, but you have more time at each station.

ENGAGE:

Begin with a PowerPoint presentation of aerial images of the river where humans and the river connect. Start by asking students what kinds of infrastructure humans build around rivers. Do you think these might affect river hydrology?

We will look at two types of stream infrastructure: stream crossings (bridges, bottomless arches, and culverts) and bank stabilization (concrete walls, riprap, and vegetation).

Show the PowerPoint with images of this infrastructure in your area. This will give students real life examples of these things that might be familiar to them. They can picture these while they work at the stream tables. Emphasize that they should observe how patterns of erosion & deposition change as stream infrastructure changes.

PROCEDURE:

<u>Rotation 1: Stream Crossings</u>

For this rotation you'll need model bridges, culverts, and bottomless arches.

1. Look at each of the models with the students and ask what is different about them. How will sediment interact differently with each of these methods? Where might the stream be affected and how?
2. Carve a slightly winding stream into the sediment and set up a bridge a quarter of the way down from the top. Run the water and point out erosion & deposition. Note where

these take place and see if the bridge remains stable. Remind students to take notes and sketch what they see.

3. Reset and do the same with the bottomless arch, and then with the culvert. Students should observe that with the bottomless arch and the culvert, less sediment is moved from the structure location, but the erosion is much heavier downstream. This is due to Bernoulli's Principle, discussed in the Background section below.

4. Have students draw and note effects of each of the types of infrastructure on their lab sheets and ask what should be considered when a stream crossing needs to be built in a city.

Rotation 2: Stream Buffers

For this rotation, you'll need model concrete walls, riprap, and vegetation.

1. Ask students why people might want to stabilize a riverbank? What are the benefits? Can you think of any risks that might be involved?
2. Model each of the methods as in rotation 1, carving out a stream and adding the infrastructure ¼ way down it. Put the buffers on both sides of the stream, taking up about 5 inches of stream length.
3. Start with the concrete wall, then the riprap, then the vegetation. The concrete wall will cause erosion downstream due to Bernoulli's principle; the rocks will cause less erosion downstream but might get eroded in place; and the vegetation should hold the sediment right on site and not cause higher erosion downstream.
4. Talk about the results and ask students what other benefits of using vegetation. If there are so many benefits, why don't we do that all the time?
5. Again, make sure the students are taking notes and sketching.

CAREER CONNECTIONS:

Ask the students what kinds of careers might be involved in the work they did today. Add to the running list.

Wrap Up

Gather as a class to debrief some key ideas and ask students to share their big takeaways and add to their notes as needed.

Background

For human society to live around rivers, it is inevitable that we alter some of the hydrology and ecology. It is important to do it in mindful ways that support both the river ecosystem and the community around it. This lesson's purpose is to demonstrate how the changes affect hydrology, so in the next lesson they can start making decisions about planning a city built along a river.

The alteration of where along the streambed gets eroded and where sediment gets deposited based on the type of infrastructure is a critical takeaway here. When deciding where to build certain parts of their city on the river, they will want to know what areas are prone to erosion and deposition. Have students draw this on their lab sheet as they go.

A basic understanding of Bernoulli's Principle is important in explaining how structures like culverts and concrete walls create higher erosion downstream. When liquid flows through a tighter space, it speeds up. Water that gets squeezed through a culvert or narrow passageway is faster upon release, causing more erosion downstream. Bridges and vegetation don't cause this phenomenon since the sediment is allowed to flow consistently along the stream.