Lesson 4: Young Stream and Stream Cutoffs Lab

Stream #1: Young Stream

Introduction

Running water is a powerful force and carries soil and other earth materials from land surfaces to oceans. As a result, valleys and canyons have been carved out. Valleys carved by streams pass through three stages: youth, early maturity, and full maturity (old age). Each stage has its own characteristics. In this lab we will reconstruct these stages and make observations of the water movement, the valley formation, and the course of the stream.

Directions

1. **Read all the directions before starting.**
2. Shape the sand into a smooth sloping surface toward the end with the drain.
3. End the slope in a sharp edge at the "lake" which is the sandless end of the table around the drain.
4. Carve a straight narrow channel from the top of your channel to the edge of the lake. Do NOT make the channel so deep that you see the black plastic at the bottom.
5. Determine who will oversee controlling the water and who will oversee watching the drain.
6. Slowly start water and allow the water to drain down the valley.
   Note: If you see overland flooding happening, the water is too fast. Slow water speed and adjust sand as needed.
7. You should watch, **WITHOUT TOUCHING ANYTHING**, at least two gallons worth of water travel through the stream.

8. **Create a video with your partners and include the following:**
   - □ Discuss the following vocabulary words:
     - o Stream
     - o Headwaters
     - o Mouth
     - o Stream Gradient
     - o Meander
     - o Thalweg
     - o Erosion
     - o Deposition
     - o Delta
   - □ Describe the course/pathway of the stream when you first began pouring water.
   - □ Describe how the stream course changed the longer the water ran.
   - □ Describe how the walls of the valley differ with a "young" stream compared to the "older" or "more mature" stream.
   - □ All partners must be seen or heard on the video.

Stream #2: Stream Cutoffs

Introduction

When a stream reaches its last stage in the erosion cycle, commonly referred to as "old age", the meanders become so deep that the channel curves back on itself. The loops continue to deepen, until the water instead of taking the long curving path along the meander, breaks through the narrow neck of land between its two ends. The stream channel is shortened and the meander, cut off from the course, forms an oxbow lake. If it dries up, remnants of the channel remain as a meander scar.

Directions

1. **Read all the directions before starting**
2. Shape the sand into a smooth sloping surface toward the end with the drain.
3. Cut a sharply meandering channel leading from the start of your stream and down the entire length of the slope. Make at least 3 meanders:

4. Determine who will oversee starting water and who will oversee watching the drain.
5. Gently put water into the start of your stream and allow it to flow down the channel.
6. Wait until a cutoff occurs and forms an oxbow lake. This may take several gallons of water. **DO NOT FORCE IT!**

7. **Create a video with your partners and include the following:**
   - □ Discuss the following vocabulary words:
     - o Stream
     - o Headwaters
     - o Mouth
     - o Stream Gradient
     - o Meander
     - o Thalweg
     - o Erosion
     - o Deposition
     - o Cutbank
     - o Point Bar
     - o Oxbow Lake
     - o Delta
   - □ Discuss where you saw the thalweg – outside of the meander, inside of the meander, upstream, downstream, etc.
   - □ Discuss what happened in the old channel after the cutoff occurred.
   - □ All partners must be seen or heard on the video.

Lesson Title	**Stream Table Labs:** **Lesson 4 - Young Stream and Stream Cutoffs** **Lesson 5 - The Great Flood**
Time	2 - 50 min class periods These labs days are dependent on you having access to stream tables. If you do not have school stream tables you can check with your local soil conservation, watershed, or river organizations to see if they have tables that you can borrow. If you do not have access to stream tables – skip these two days. If you do have access to stream tables – combine this lesson with lessons 4 and 5 to allow students to have more access to the stream tables with smaller group sizes. For example - on day 4 of this unit, have two small groups of students at stream tables working on "Lesson 4 - Young Stream and Stream Cutoffs" and have two groups of students working on "Lesson 6 - Flooding Causes". The following day, swap these two groups. On days 6 and 7, split groups between "Lesson 5 - The Great Flood" and "Lesson 7 - Flood Risk Management".
Resources	● Stream Tables (2) ● Materials for "The Great Flood" lesson bank stabilization (monopoly houses, sponges, bright green felt, green mesh, fish tank trees/plants, Lincoln logs, popsicle sticks, fun animals, etc.) ● Young Stream and Stream Cutoffs Worksheet ● The Great Flood Worksheet
Objective	SWBAT demonstrate how erosion and deposition occur in different ages of rivers. SWBAT identify components that lead to flooding and natural erosion control methods.
Standard	HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Plan	**<u>Lesson 4 – Young Stream and Stream Cutoffs</u>** **Introduction** ● Hand back Quiz – River Anatomy and Age of Rivers. ● Review differences between young streams and mature/old age streams. **Activity** ● Demonstrate to students how to use the stream tables. ● Students should read through all "Young Stream and Stream Cutoffs Worksheet" prior to starting. ● Students set up a straight "young" stream and observe river flow and where erosion is happening. ● Students will make a video describing their river using vocabulary. ● Students will make a meandering "old" stream and will attempt form a stream cutoff or an oxbow lake. ● Students will make to video demonstrating a cutoff using river vocabulary. **Closing** ● If time, students can share videos of streams with other groups. ● Students clean up stream table supplies and prepare table for the next group. **<u>Lesson 5 – The Great Flood</u>** **Introduction** ● Ask students to brainstorm ideas on how nature prevents erosion. ● Have students turn and talk to a partner about their ideas. **Activity** ● Students should read through all "The Great Flood Worksheet" prior to starting. ● Students will gather materials to create their flooding scenario. ● Students will create a meandering stream on the stream table and use different materials to stabilize the banks of the river so that their cabins stay safe during a flood event. ● Students will create a video describing their river, where they put the cabins and why, and their flood management strategies. ● Students will turn water on to an average flow to see how their river holds up under normal river conditions. ● Students will increase the flow of water to observe how their river holds up to flood conditions. ● Students will create a video commentating on how their flood management strategies worked. **Closing** ● Students will answer application questions about river and flood management

Authors	Amanda Oanes and Jill Wold – West Fargo Public Schools
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Lesson 5: The Great Flood Lab

The Great Flood

Introduction

Land erosion, stream migration, and flooding are natural processes. However, they can cause havoc when they occur near human populations. As technologies and techniques have advanced in finding ways to secure our land from the constant effects of erosion, we begin to see that perhaps modernizing these efforts might not be the only way to approach these issues. Long before we began manipulating our environment, nature had run its own course. It is possible then, that we can look to nature for examples to follow to make life near eroding or flood-prone waterways less risky AND leave as minimal a footprint as possible.

In this simulation you are a developer that just bought land along this stream and you want to build 10 cabins. You will need to determine what types of natural elements will slow erosion and stabilize the bank allowing you to build successfully.

Directions

1. **Read all directions before starting.**
2. Before you start, make sure there are no props in the stream table.
3. Create a thin, deep stream channel that **includes at least two meanders and some hills** – feel free to get creative with your design.
4. Put some water in very slowly to stabilize your stream channel and then **STOP the water.**
5. Using the materials provided, arrange them as you see fit to help maintain your stream channel's current shape and prevent erosion. **You must use at minimum 1 sponge, 1 piece of felt, and 1 piece of green mesh along the stream bank to slow erosion.**
    - **Sponge** = wetland – must be touching the sides & bottom of the stream of the table to work correctly
    - **Bright Green Felt** = landscaping – use toothpicks to secure to wet sand, wet strips as well
    - **Green Mesh** = native vegetation (like tree roots) – push into wet sand and secure with toothpicks if needed
    - **Trees** = trees
    - **Large Lincoln Logs** = fallen trees
    - **Small Lincoln Logs =** cabins
    - **Popsicle Sticks** = landscape timbers
6. Place **10** cabins (standing up, no more than 2" from stream banks and spaced at least 2" from each other)
7. **Create a video with your partners and include the following:**
    - Part 1
        - □ Describe the channel
        - □ Describe the bank stabilization strategies
        - □ Describe where you put your cabins and why
    - Part 2
        - □ Input water slowly
        - □ Observe and discuss any changes to your stream channel
    - Part 3
        - □ Increase the speed of the water until you reach a "flood event"
        - □ Observe and discuss the rates of erosion during a flooding event
        - □ Observe and discuss what is happening with different materials on the banks

Application Questions

1. Where would you build your cabin? Explain why you chose that location.

2. How effective were the different materials in stabilizing the bank?

3. Rank the materials from best to worst for how well each worked.

4. How do buildings placed along a stream bank affect the stream?

5. If you were a city engineer, where would you recommend flood waters be stored during a high-water event? In other words, what places in a city should be located near a river so that they are flooded during a large flood event?

(ANSWER KEY)

Application Questions

1. Where would you build your cabin? Explain why you chose that location.
   Students should see that building near a river, even on the point bar side, is unstable for any building because of the river meanders.

2. How effective were the different materials in stabilizing the bank?
   Answers will vary.
   The felt should work the best if it was secured with toothpicks. The sponge will act as a wetland to absorb runoff water.

3. Rank the materials from best to worst for how well each worked.
   Answers will vary

4. How do buildings placed along a stream bank affect the stream?
   Buildings add extra weight to the stream bank and can increase erosion.

5. If you were a city engineer, where would you recommend flood waters be stored during a high-water event? In other words, what places in a city should be located near a river so that they are flooded during a large flood event?
   Students should think about ball fields, golf courses, parks or other areas that could hold water to prevent houses or businesses that are much more expensive to fix.