

LESSON 2: WHAT IS A WATERSHED?



ESSENTIAL QUESTION:

What combination of factors both natural and manmade is necessary for healthy river restoration and how does this enhance the sustainability of natural and human communities?

GUIDING QUESTION:

Healthy watersheds are vital for a healthy environment and economy. How can understanding watersheds and particularly the Elwha watershed help you protect the water and other natural resources?

OVERVIEW:

A watershed is an area where all precipitation either drains on the surface or underground into an outlet stream or river. Watersheds can vary by scale, with a large watershed containing many smaller ones. In addition to surface waters, much of the precipitation filters through the soil and bedrock into the aquifer. Aquifers are bounded by impermeable layers and once water reaches those, they begin to flow more horizontally. Groundwater flows along the rock layers until it reaches a surface point that is below the water table. Then, the water reemerges as springs or seep that flow over the surface.

TIME:

One class period

MATERIALS:

- **Lesson 2- What is a Watershed.pptx**
- **Lesson 2a- What is a Watershed.pdf**
- **Lesson 2 Demonstration/Lab Activity Sheet.doc**
- 4-5 clear jars
- A small measuring cup or spoon
- An eyedropper or siphon for water removal
- A small quantity of small gravel, clay or hardened mud, potting soil
- A bucket full of sand
- A slab of sandstone
- Stream Table
- Moss

- Reflection Journal Pages (Printable Handout)
- Vocabulary Notes (Printable Handout)

PROCEDURE:

1. Have students take a minute to write in their reflection journals. Ask them to talk about what they've written.
2. Present the PowerPoint Lesson. Have students define vocabulary words while watching. Not all words are in PowerPoint lesson.
3. Run Demonstration on Infiltration
4. Run Demonstration on aquifers, water table depth, and recharge
5. Run Demonstration on springs and seeps
6. Give students handout on groundwater features and have them identify the different parts
7. After the experiments have students write in reflection journals again.

ASSESSMENTS:

WASHINGTON STATE STANDARDS:

SCIENCE

1. **EALR 4:** Earth and Space Science
2. **ES2C** In the water cycle, water evaporates from Earth's surface, rises and cools, condenses to form clouds and falls as rain or snow and collects in bodies of water.
 - a. Describe the water cycle and give local examples of where parts of the water cycle can be seen
3. **ES2G** Landforms are created by processes that build up structures and processes that break down and carry away material through erosion and weathering.
 - a. Explain how a given landform (e.g., mountain) has been shaped by processes that... break down and carry away material (e.g., weathering and erosion).

READING

1. **EALR 1:** The student understands and uses different skills and strategies to read.
 - a. **Component 1.2** Use vocabulary (word meaning) strategies to comprehend text.

SOCIAL STUDIES

1. **EALR 5:** The student understands and applies reasoning skills to conduct research, deliberate, form, and evaluate positions through the processes of reading, writing, and communicating.
 - a. **Component 5.2:** Uses inquiry-based research.

WRITING

1. **EALR 2:** The student writes in a variety of forms for different audiences and purposes.
 - a. **Component 2.1:** Adapts writing for a variety of audiences.

ADDITIONAL RESOURCES AND ENRICHMENT:

<http://science.howstuffworks.com/watershed.htm>

<http://water.usgs.gov/outreach/OutReach.html>

[http://www.nps.gov/archive/wica/Hydrology Watershed Watershed.htm](http://www.nps.gov/archive/wica/Hydrology_Watershed_Watershed.htm)

<http://www.watershedactivities.com/projects/spring/scleanup.html>

<http://www.epa.gov/adopt/patch/patch2004.pdf>

VOCABULARY TERMS:

- **Precipitation:** Any form of water, such as rain, snow, sleet, or hail, that falls to the earth's surface.
- **Watershed:** The drainage basin where all precipitation (snow and rain) on the surface or below ground, drains into a single river or lake on the way to the ocean or to an endorheic basin.
- **Basin:** A catchment area where water drains into a depression.
- **Infiltration:** The seeping of surface water into the soil and down into the aquifer through the porous spaces between rock particles.
- **Aquifer:** Underground water flow formed by the infiltration of precipitation from the surface. It flows through a permeable substrate and is contained by impermeable layers below it. They are often the source for springs, where the topography drops below the elevation of the water table.
- **Water Table:** The horizontal depth of the top of the aquifer. Where the surface elevation drops below the water table elevation, surface water in the form of lake.
- **Permeable layer:** Surfaces that contain pores or spaces which liquids can pass through and into.
- **Impermeable layer:** Surfaces that lack pores or spaces and do not allow liquids to penetrate.
- **Springs:** A place where water comes from below ground to run on the surface. Often these are the headwaters from streams.

- **Seeps:** A place where groundwater percolates to the surface or through cracks in the strata. They can form small wetlands that trickle into streams.
- **Groundwater,** Water that collects or flows beneath the Earth's surface, filling the porous spaces in soil, sediment, and rocks. Groundwater originates from rain and from melting snow and ice and is the source of water for aquifers, springs, and wells. The upper surface of groundwater is the water table
- **Substrate:** An underlying layer;



**Elwha River Restoration
What is a Watershed?
Reflection Page 1**

You've probably heard the word "watershed" before in school; what do you already know about watersheds?

What questions do you have about watersheds?



**Elwha River Restoration
What is a Watershed?
Vocabulary Notes**

Precipitation:

Watershed:

Basin:

Infiltration:

Aquifer:

Water Table:

Permeable layer:

Impermeable layer:

Springs:

Seep:

Groundwater:

Substrate:



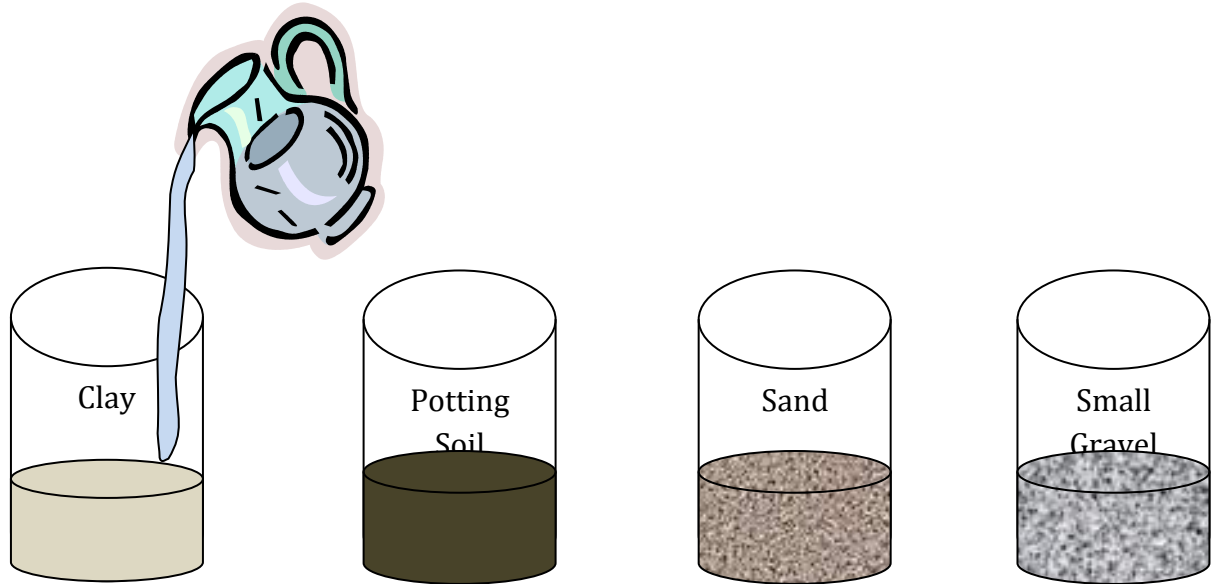
Elwha River Restoration
What is a Watershed?
Reflection Page 2

What have you discovered about watersheds and what do you think you can do to help protect the water and natural resources of the Elwha River Watershed or the watershed in your area?

What other questions do you have about watersheds now that you've found out a little more? How can you go about finding answers to your questions?

Demonstration #1: Infiltration

- 1) Using clear trays or jars, add different materials to each to represent the different soil substrates. Some suggestions include sand, gravel, potting soil, and hardened clay.
- 2) The best way to prepare the hardened clay in advance is to take wet mud and place it in the jar. Place the jar in an oven at 200°F for several hours until the mud has hardened solid.
- 3) Next, slowly add water to the surface of each and examine how quickly water infiltrates into the soil type.
- 4) Students should make observations about where water stays on the surface, how long it takes to infiltrate and some hypotheses as to the reasons for the different rates.

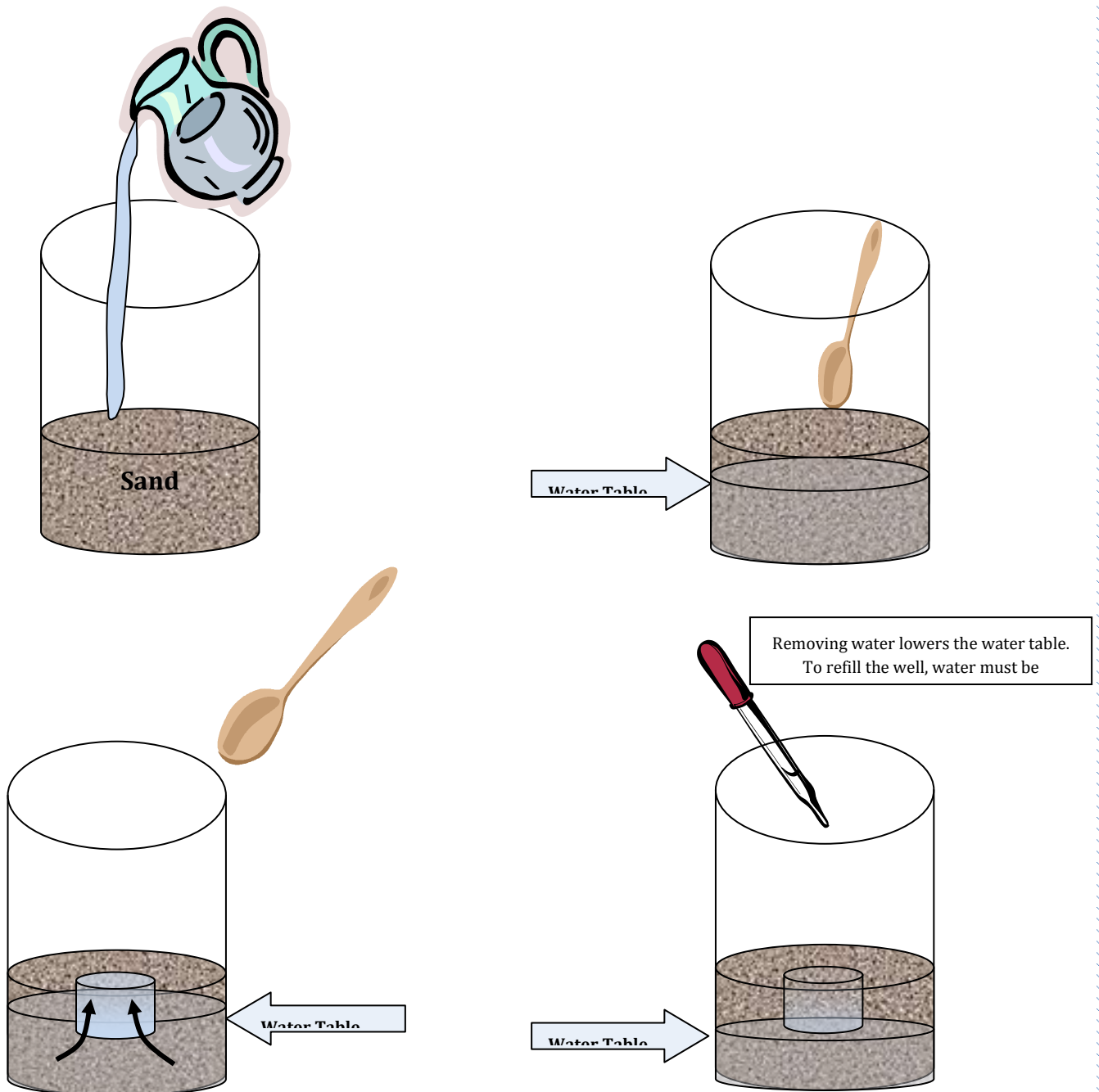


Next, using an eye dropper, add some drops of water to the surface of a slab of sandstone. Does the water bead up on the surface, spread out, or drain into the rock. Ask for hypotheses as to how or why the water may infiltrate. The rate of infiltration will depend on the particular type of sandstone present and its pore spaces.



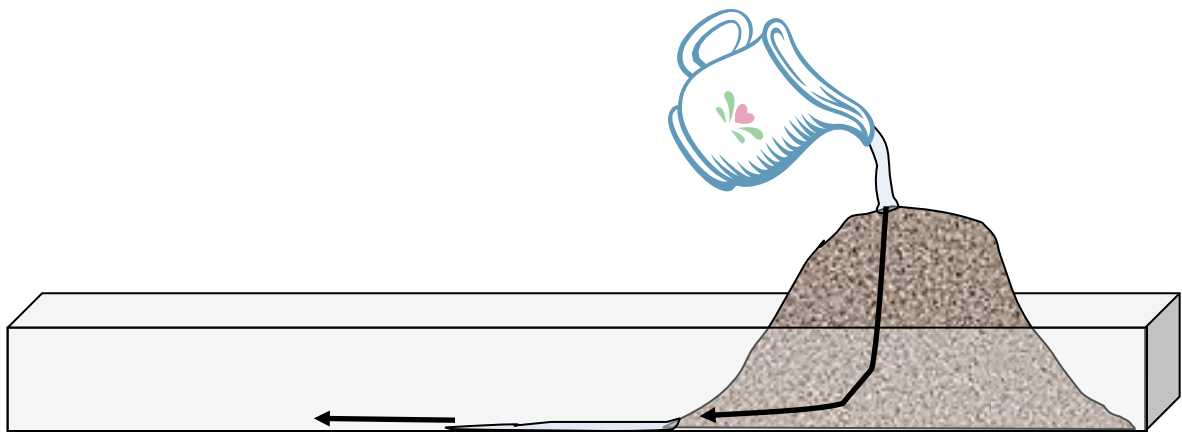
Demonstration # 2: The Aquifer and Water Table

- 1) An **aquifer** can be demonstrated by pouring water into a bucket of sand, such that the lower levels are saturated, but the upper portion remains still dry.
- 2) Next, using a measuring cup or spoon, dig a hole into the sand deep enough that it goes below the water table. Watch the bottom of the hole fill with water. The level of the water within the hole indicates the **water table**. This hole is similar to a well that is dug to reach groundwater.
- 3) As you take water out of the well with an eyedropper or siphon, more water will rush in from the aquifer to fill the space. But, as you remove more water from the system the water table will drop.
- 4) The only way to increase the water table level again is to add more water to the system via aquifer recharge.



Demonstration #3: Springs and Seeps

- 1) Pile slightly wet sand, so it will stick together, at one end of the stream table to represent a mountain.
- 2) Slowly pour water on top of the mountain, such that the surface does not wash away, but rather the water filters through the sand slowly and into the aquifer.
- 3) As the water percolates through the sand, it will hit the impermeable table surface and will then run along the base of the mountain, before emerging at the base of the sand hill.
- 4) Discuss the idea that aquifers move downhill due to gravity until they hit impermeable surfaces. Ask the students why the water is able to flow through the sand.
- 5) This water emerging on the surface at the base of the hill represents a spring or seep. Since the water will continue flowing down the streamtable, the spring is now the source of a stream.



Demonstration #4: The effects of vegetative cover on surface erosion.

- 1) Create a sand mountain similar to Demonstration #3. Add a layer of moss or some other permeable covering to the surface of the mountain. Try and make sure it has solid hold in the sand, perhaps burying the base a few millimeters into the sand.
- 2) Begin pouring water quickly over the steepest side of the surface (although not pouring so fast as to dislodge the moss and collapse the mountain).
- 3) Notice how the moss absorbs the water and slows the velocity of the water, so that the sand mostly stays in place.
- 4) Next, remove the moss or covering and make the mountain surface bare.
- 5) Begin pouring the water again at the same rate. Notice how gullies and slope erosion begins and observe how much sand begins flowing into the "stream" as compared to before.

