

LESSON PLAN

Area and/or Course: Groundwater Protection Education #1: Aquifers

Teacher Goal(s):

1. To help students gain general knowledge of groundwater protection in the Southern Willamette Valley.

Lesson Title: Southern Willamette Valley Aquifers **No. Periods:** 1 – 50 minute periods

Objectives:

The student will be able to (TSWBT).

1. Define an aquifer and identify the differences between unconfined and confined.
2. Understand the relationship between surface and groundwater.
3. Identify the declared Southern Willamette Valley Groundwater Management Area (SWVGWMA).

Standard met by Objectives:

1. H.1 Structure and Function: A systems; characteristics, form, and function are attributed to the quantity, type, and nature of its components.
2. H3S2. Conduct a controlled experiment, field study, or other investigation to makes systemic observations about the natural world including the collection of sufficient and appropriate data.

Materials, Equipment, Audio-visual aids: <ol style="list-style-type: none">1. Computer, PowerPoint Projector2. Groundwater Model3. Sand, 2 beakers, clear plastic tube, 3 plastic pipets, food coloring, graduated cylinder, spoon, marker4. Aquifer Activity Worksheet	References: Southern Willamette Valley Groundwater Management Action Plan
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Anticipatory Set/Introduction/Motivation/Interest Approach:

Introduction:

(This introduction would be for the initial piloting of this lesson)

Member of the Groundwater Management Area (GWMA) staff attends this lesson to share that the GWMA was declared because of consistent nitrate levels in groundwater over 7parts per million (ppm). Students will learn some general groundwater information to help understand the GWMA's purpose and what we can all do to be a part of the solution.

(As a teacher introduced lesson)

Ask students if they know where their personal drinking water supply comes from. Write it down on the board. Options could be: well, springs, town, unknown.

Subject Matter Outline/Problem Stated (Application Points lace in throughout lesson). Modeling/Guided Practice/Checking for Understanding	Strategy/Objectives Met/Handout Points/Student Activity/Method/ Approach
<p>What we will cover:</p> <ol style="list-style-type: none"> 1. Where drinking water comes from. 2. What is groundwater? 3. What is an aquifer? 4. How groundwater moves in the aquifer. <p>Where does drinking water come from? Surface water: lakes, rivers, reservoirs, streams Groundwater: aquifers, springs</p> <p>What is Groundwater? Groundwater is water located beneath the ground surface in pore spaces and in the fractures of rock formations. The top of the area in which the pore spaces become completely saturated is referred to as the water table. The saturated area holding a usable amount of water is known as the aquifer.</p> <p>25.92% of freshwater resources on earth come from groundwater sources.</p> <p>In Oregon: Groundwater is a major source of water for irrigation, rivers, lakes, streams, and wetlands</p> <p>In Oregon 50 % of residents rely on groundwater as their source of drinking water, 90% of rural residents rely on groundwater.</p>	<p>Room should be set with computer, Lesson #1 Aquifers Power point (PPT). smartboard, lab materials</p> <p>This short lecture can be done with the PPT provided, overhead (color slides can be made from PPT graphics) or whiteboard.</p> <p>May go back and forth between slide 3 and 4 on PPT.</p> <p>What is the population of Oregon? 2009 estimate was 3,825,657 translating into approximately 1.9 million of our state residents relying on groundwater supplies for their drinking water.</p> <p>According to the SWVGWMA Action Plan the 2002 Census shows that within the GWMA the urban population (within city limits) was 12,538 and the total population was 21,221.</p>

What is an Aquifer?

Groundwater is housed within aquifers. An aquifer is the saturated zone of water that fills pore spaces underground. There are two types of aquifers – confined and unconfined.

Confined aquifer – An aquifer is that is protected from surface contamination by a layer of bedrock or a heavy clay soil layer. This layer is what “confines” or helps protect the aquifer. Confined aquifers are typically found at deeper depths.

Unconfined aquifers - An aquifer that has little to no protection from surface contamination. They normally occur at shallower depths and may have faster draining or sandy soil above them.

There is a strong relationship between surface water and the groundwater. In the water cycle, precipitation infiltrates into the ground or runs off the surface of the ground into ditches, streams etc.. Water that infiltrates into the surface can be used while in the root zone of plants. Water that moves past the root zone continues its travels downward through the soil and rock pore spaces until it meets the saturated zone. This is the zone that is referred to as the water table.

Groundwater Movement

Groundwater flows within the aquifer and tends to move towards lower elevations, for example from the hills towards the Willamette River. Lower locations tend to be areas where rivers, lakes, and streams are. This direction of flow can change with the seasons. In the drier months groundwater is typically flowing towards rivers, lakes, and streams. In the wetter months there are times when these same bodies of water may actually provide some recharge to the aquifer.

Slide 8 has a diagram of both types of aquifers

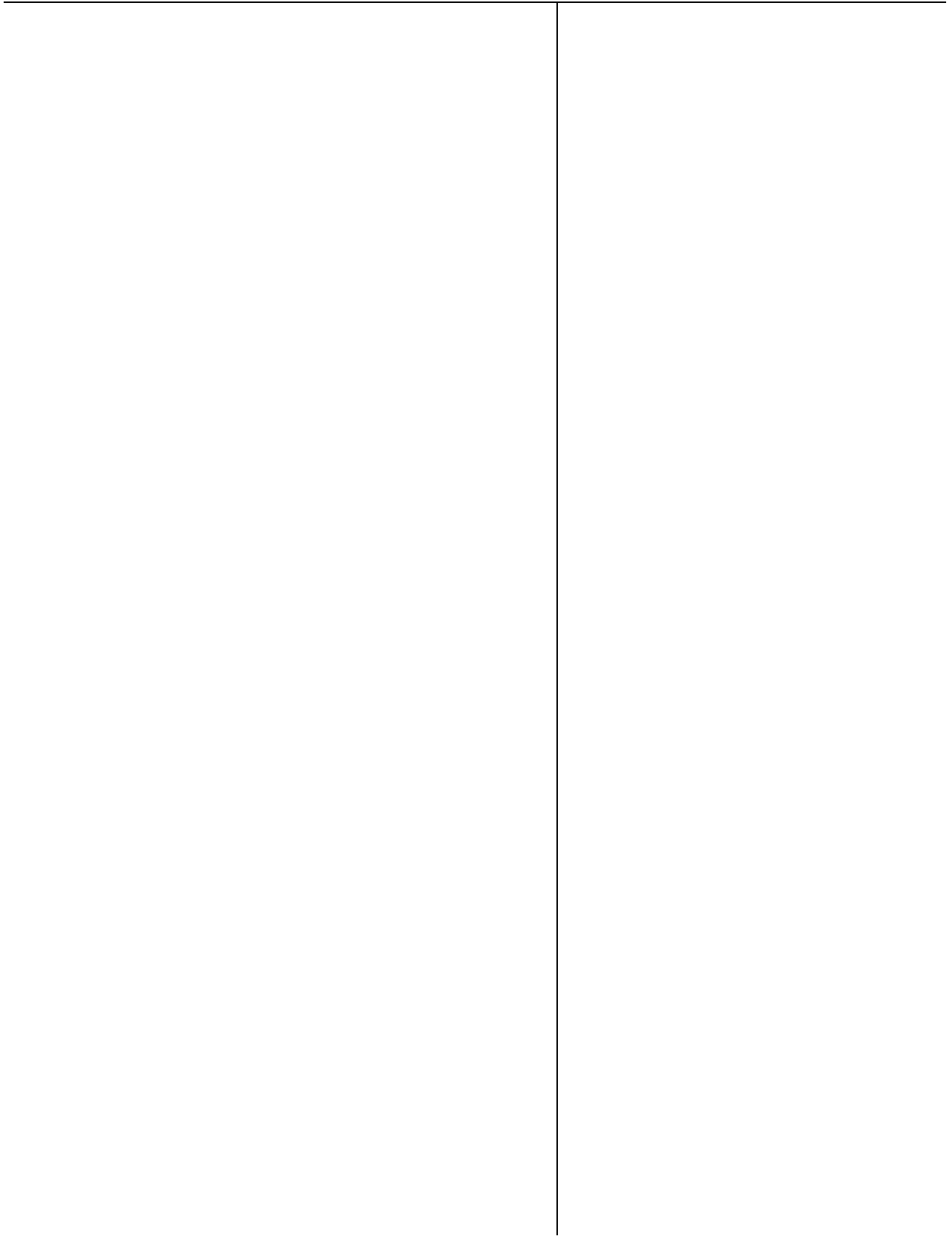
For reference, a faster draining soil would be soil that has larger soil particles and allows water to move through the pore spaces faster. An example would be sand.

What is the closest mountain range?
What happens to the precipitation falling at the top of the range?
Infiltrates or will runoff

For understanding of flow – water moves towards the path of least resistance so if you had two barrels connected at the bottom with a hose, and you filled one up, what would happen to the water? The water would flow into the other barrel until there was an equal amount in both barrels – keeping the pressure the same.

How long does the water take to get to the valley floor? Willamette River? Muddy Creek? Water can move very slowly, even within a small area in the aquifer a short distance can take many years for water to travel. Each aquifer is different and dependent on the amount of water recharge that occurs, and the geology of each aquifer.

Divide students into groups. Have each group do the Aquifer activity sheet.



Closure/Summary/Conclusion

Review the Aquifer Activity.

Answer any additional questions.

Evaluation: (Authentic forms of Evaluation, Quizzes, Written exam?)

Checking for understanding with questions throughout lesson.

Activity Sheet is optionally graded by instructor.

Assignments: (Student Activities involved in lesson/designed to meet objectives.)

Aquifer Activity Worksheet – questions to be turned in.