The Nature of Groundwater

Age: High School

Objectives

- **Learn to define groundwater**
- **Learn to define aquifer**
- **To observe moves through different substrates to become groundwater**
- **To observe different movements of water through assorted substrates**
- **Learn to define the water table**
- **Learn how and why ground water levels can fluctuate**

Background Lesson

Fresh water is one of our planet's most valuable natural resources. In comparison to the total amount of water on Earth, fresh water is minute. Groundwater forms a large portion of the total amount of freshwater available for human consumption and use. Groundwater is the concentration of water below the Earth's surface that fills all the spaces of grains of sand, spaces between gravel or the cracks and crevices in the rock. Humans utilize this underground water through the use of wells.

The location of a layer of groundwater is called an aquifer. An aquifer is geologic formation of underground layers of porous rock or sand in which the movement of water is not restricted. An aquifer is not an underground lake as is often thought, but is a zone of saturation where water has infiltrated into the soil through pores, cracks and other spaces to fill these spaces that would otherwise be filled with air. Aquifers range in size and depth, and the quality and age of the water in an aquifer also varies.

Aquifers can be very susceptible to pollution. Land use practices must be taken in to consideration when development occurs nears an aquifer. Pollution from hazardous waste, chemicals, heavy metals and many other contaminants that deposit on the soil surface can infiltrate the soil through the aid of rain and runoff into the groundwater.

The groundwater in an aquifer moves by two main forces. Water either moves from higher elevation to lower elevation or from areas of higher pressure to areas of lower pressure. The groundwater moves from a "recharge zone", where water naturally infiltrates the soil, to a "discharge zone" above the surface such as a spring, lakes and streams. Because water has to infiltrate many layers of soil rock and other geological layers to reach an aquifer, recharge of an aquifer may be considerably slow.

The Activity

Materials

- 2 liter pop bottle x 2
- Rocks, gravel, sand
- A container of water
- A spray bottle
- A measuring cup
- Cheese cloth or pantyhose

Procedure

- Cut the bottom off one of the two liter pop bottles. This will become your groundwater model.
- Unscrew the cap of the bottle and cover the opening with a piece of cheesecloth or a piece of old pantyhose. You can even try to just stuff the hole with these materials. You want water to be able to escape, but not the eventual soil layers you will be putting in your model. Screw the cap back on after the material is secure.
- Place one cup of sand in the model. Have the students guess how much water the sand aquifer will hold by filling a measuring cup with water.
- Have the class slowly pour their measuring cup of water over the sand. What do they notice? Is the water soaking into the sand? Does the sand hold water? Why? How much will the sand aquifer hold?
- Pour more water over the sand. Watch as the water in the aquifer rises until it breaches the surface of the sand forming a lake once the aquifer is saturated.
- Once they have completed this have them drain their aquifers by opening the cap on their bottles. Watch as the level of the aquifer lowers as the water drains.
- For the second test use the second two liter bottle and construct your model the same way you did the first.
- With this bottle first put large rocks on the bottom. On top of this layer place a layer of medium sized pebbles, then a layer of smaller pebbles and finally a sand layer.
- With the spray bottle simulate a heavy rain storm and spray the sand layer until it becomes saturated and begins to infiltrate through the lower layers.
- Have the students repeat the rainstorm several times, measuring the height of the water level pooling at the bottom of the bottle. This is the level of the "water table"
- Form discussion on how surface cover would change the rate of infiltration. Some examples would be roads and sidewalks or vegetation. Will infiltration be faster or slower? Will the water be cleaner or more polluted?

Suggestion

- **You could try repeating the experiment a third time using the same layers as the second experiment, but on top of the final sand layer put a layer of sod or cloth. This will represent natural vegetation growth and the absorption ability of vegetation.**