Deep Subjects- Wells and Ground Water

Target Audience: 3-6
Subjects: Science & Geology
Time: 1 hour
H2O University Issues Addressed:
-Water Cycle
-Natural Processes
-Watersheds

Materials Required

- Flip chart or black board
- Markers
- 1 6” x 8” clear plastic container that is at least 6-8” deep (shoe box or small aquarium)
- 2 lbs. of aquarium gravel (natural color if possible) or small pebbles (As any small rocks may have a powdery residue on them, you may wish to rinse and dry them prior to use. It is best if they do not add cloudiness to the water).
- 2 lbs. of white play sand
- 1 plastic spray bottle (be sure the stem that extends into the bottle is clear)
- 1 lb. of modeling clay or floral clay
- 1 small piece (3x5) of green felt
- 1 bucket of clean water and a small cup to dip water from bucket
- Red food coloring
- ¼ cup of powdered cocoa
- 1 drinking water straw
- Water Maze handout (Handout 5)
- Scotch tape

Background Summary

Water that falls to the earth in the form of rain, snow, sleet or hail continues its journey in one of three ways: It might land on a waterbody and essentially go with the flow; it might run off the land into a nearby waterbody or storm drain; or it might seep into the ground. Water that seeps into the ground moves in a downward direction because of gravity. It passes through the pore spaces between the soil particles until it reaches a soil depth where the pore spaces are already filled, or saturated, with water.

In San Antonio, if this water falls in the Recharge Zone (located over the Hill Country), the water flows underground until it reaches the Edwards Aquifer. A water-bearing soil or rock formation that is capable of yielding enough water for human use is called an aquifer. In limestone aquifers, such as the Edwards Aquifer, water moves through cracks, or fractures. The limestone absorbs water like a sponge and allows the aquifer to hold large amounts of water. When water reaches the aquifer, it begins to move along with the ground water flow, which usually follows a downhill, or down slope, direction. Compared with water in rivers and streams, ground water moves very, very slowly, from as little as a fraction of a foot per day in clay to as much as three to four feet per day in sand and gravel.

In time, ground water “resurfaces”- perhaps when it intersects a nearby waterbody such as a stream, river, lake, pond or ocean; or perhaps when it emerges from a hillside as a spring or as water seeping out of a cutaway roadside rock formation. Groundwater is very much part of a nature’s water cycle. Another way ground water resurfaces is when it is withdrawn from the ground by way of a well. Wells are drilled and installed to draw ground water to the surface.

When pollutants leak, spill or are carelessly discarded onto the ground, they, like water, move slowly or quickly through the soil or into the recharge feature. It all depends on the soil, the nature of the pollutant, and the amount of extra help it gets from incoming precipitation.

If there is a water supply well near a source of contamination, that well runs the risk of becoming contaminated by polluted groundwater. If there is a nearby river or stream, that waterbody may also become polluted by the groundwater. Because it is located deep in the ground, ground water pollution is generally difficult and expensive to clean up. In some cases, people have had to find alternative sources of water because their own wells were contaminated.

Educational Goals

Students will be able to:

- Demonstrate knowledge about what ground water is in terms of how it exists in the ground.
- Explain how ground water moves through the Recharge Zone and how it interacts with surface water.
- Demonstrate knowledge about how ground water is extracted for use as drinking water.

Procedure

NOTE: These exercises may be completed over several class periods.

PART A-Brainstorming About Ground Water

1. Have a discussion with the class about ground water so that you can get some idea of what, if any, preconceptions exist. (Many adults still think ground water exists as an underground lake or river). Ask students to describe what they think ground water is, where it is, and how it got there. List the answers on the board or a flip chart.

2. Ask for a volunteer(s) to come to the board and draw a cross-section of what he/she thinks the ground water environment might look like. Allow the students to contribute to the drawing by making suggestions or even volunteering to draw their own versions. Keep the drawings on hand so you can refer back to them when you have completed the demonstrations.

PART B-THE WATER CYCLE CONNECTION

1. Take your students outside onto the school grounds. Ask them to think about the last time it rained. Where did the water go when it fell on pavement? Roofs? Soil?

2. Take a cup of water, and ask a student to pretend it is rain. Have the student pour the water on unpaved ground. What happens to the water? *First it makes a puddle and then, it soaks into the ground.*

3. Talk about how the Edward's Aquifer Recharge Zone works and what might happen to that water if it were over the Recharge Zone once it disappears into the soil.

PART C-DEMONSTRATING GROUNDWATER

You may want to do this exercise as a class or in small groups.

1. Ask the students to think of the container and sand and gravel models that they are about to make as part of a ground water system. Explain that the bottom of the container is similar to bedrock or clay that is found beneath the earth's soil layers. Because we can't see ground water, we make models to demonstrate how it looks.

2. To one side of the container, place the small drinking water straw, allowing approximately 1/8 of an inch clearance with the bottom of the container. Fasten the straw directly against the long side of the container with a piece of tape. Explain to the students that this will represent two separate well functions later in the presentation (if not placed at this time, sand will clog the opening).

3. Pour a layer of white sand completely covering the bottom of the clear plastic container, making it approximately 1" deep. Pour water into the sand, wetting it completely, but there should be no standing water on top of the sand. Let students see how the water is absorbed in the sand, but remains around the sand particles as it is stored in the ground and ultimately in the aquifer.

4. Flatten the modeling clay (like a pancake) and cover the sand with the clay (try to press the clay into the three sides of the container in the area covered). The clay represents a "confining layer" that keeps water from passing through it. Pour a small amount of water onto the clay. Let the students see how the water remains on top of the clay, only flowing into the sand below in areas not covered by the clay.

5. Use the aquarium rocks to form the next layer of earth. Place the rocks over the sand and clay, covering the entire container. To one side of your container, slope the rocks, forming a high hill and a valley. Now pour water into your aquifer until the water in the valley is even with your hill. Let students see the water around the rocks that is stored within the aquifer. They will also notice a "surface" supply of water (a small lake) has formed. This will give them a view of both the ground and surface water supplies which can be used for drinking water purposes.

6. Next, place the small pieces of green felt on top of the hill. If possible, use a little clay to securely fasten it to the sides of the container it reaches.

7. Using the cocoa, sprinkle some on top of the hill, while explaining to students that the cocoa represents improper use of lawn chemicals or fertilizers, etc. over the Recharge Zone.

8. Use the food coloring and put a few drops into the straw, explaining to students that often old wells are used to dispose of farm chemicals, trash and used motor oils. They will see that it will color the sand in the bottom of the container. This is one way pollution can spread throughout the aquifer over time.

9. Fill the spray bottle with water. Now, make it rain on top of the hill and over the cocoa. Students will see the cocoa (fertilizer/pesticides) seep down through the felt and also wash into the surface water supply.

10. Take another look at the well you contaminated. The pollution has probably spread further. Now remove the top of the spray bottle and insert the stem into the straw, depress the trigger to pull up the water from the well. (Water will be colored and "polluted".) Explain that this is the same water a drinking water well will draw up for them to drink.

PART D-WRAP-UP DISCUSSION

1. Have students review the earlier ground water brainstorming discussion to see how their answers might have changed as a result of what they now know about groundwater. What have they learned?

2. How might they modify their earlier ground water cross-section diagram?

3. Have students complete the water maze activity (Handout 4). This activity illustrates how water must find its way through available openings and paths in the limestone formations.

Source for Activity:

- Adapted from: Deep Subjects-Wells and Groundwater, Safe Drinking Water, Environmental Education for Kids, EPA, October 1995.

HANDOUT 5: Water Maze