

WATER EDUCATIONAL TRAINING  
Science Project

at  
Eastern Michigan University



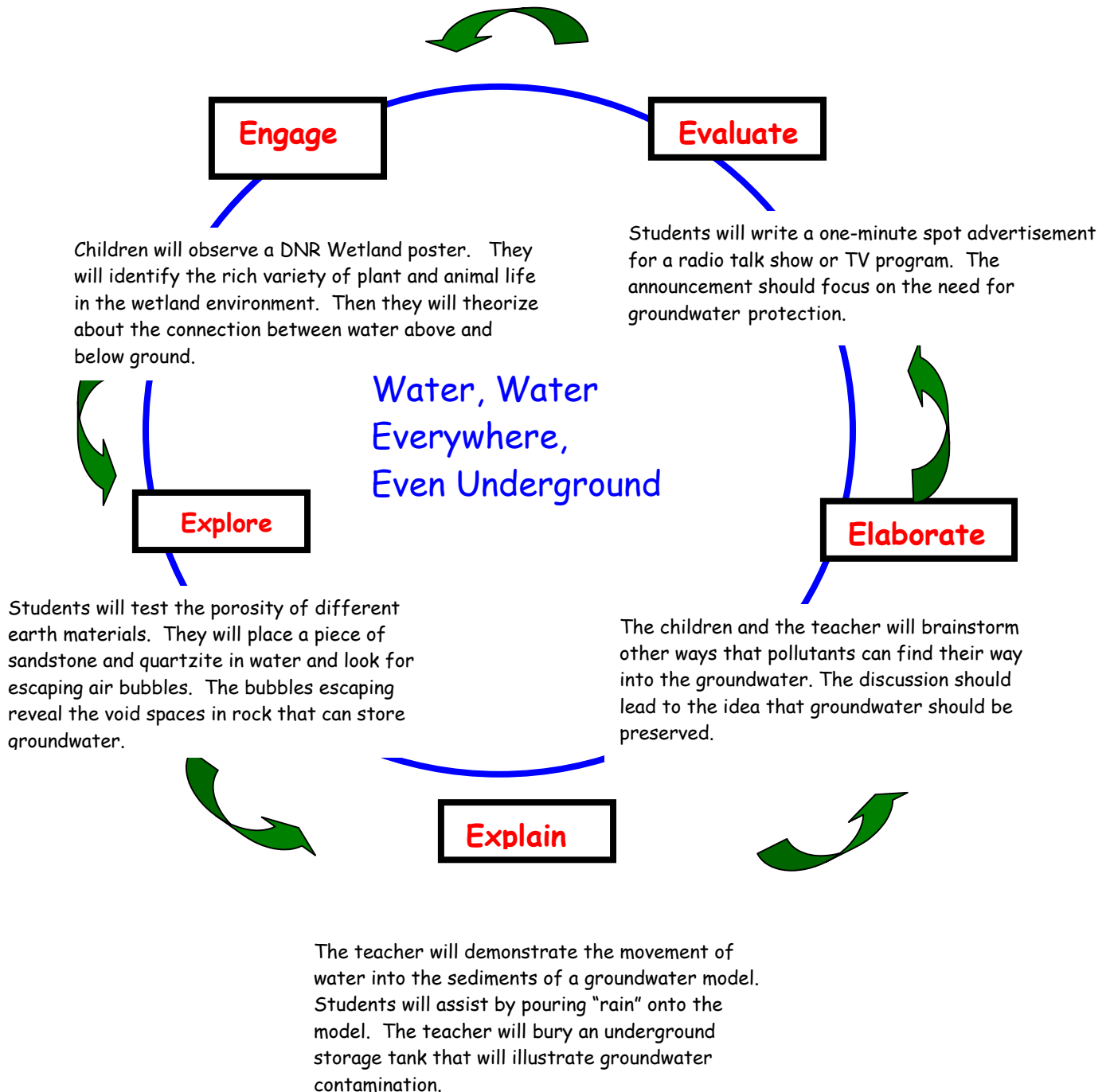
**WET SCIENCE LESSON #8: Water, Water  
Everywhere, even Underground**

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# WET Lesson #8: Water, Water Everywhere, Even Underground

## 5-Step Learning Cycle Outline



## WET LESSON #8: Water, Water Everywhere, even Underground!

A lesson about groundwater and the concept of porosity.

### Major Scientific Concepts

- Models
- Change
- Cause and Effect

### What do we want students to discover?

- Soils and bedrock are capable of storing water.
- Groundwater is water stored beneath the surface of the earth in soil and bedrock.
- Groundwater can become contaminated by human activities on the surface of the earth.
- The water stored beneath the surface of the earth is an important natural resource that we must protect.
- There are laws and government agencies dedicated to the protection of groundwater and the prevention of groundwater contamination.

### Michigan Curriculum Framework: Content Standards

- trace the path that rain water follows after it falls, .MCF Science V.2.2. elem.
- Describe the origins of pollution in the hydrosphere, MCF Science V.2.3. middle.

### Materials: (for 25 Students)

- 12 transparent plastic disposable cups
- 6 pieces of sandstone and granite
- 1 gallon of tap water
- 1 plastic funnel
- 1 half-gallon bag of play sand for 25 students
- small bottle of food coloring (red)
- 1 [ground water model](#); ([Denver Earth Science Project](#))

### ENGAGE (5-10 minutes)

Students will observe and explain the components of the Wetland Poster (Appendix A). They will be encouraged to identify as many different species of plants and animals that live in and near the wetland. They should be able to identify a wetland as an area that captures water on the surface. They will recognize the inputs of rain to this feature. They should be led to an understanding that the wetlands filter the water and some of it is used to refill the water stored beneath the surface. Wetlands are considered a **recharge area** for groundwater.

### EXPLORE (15 MINUTES)

1) Instruct the students to fill their cups with water about half full. This should be enough to cover the pieces of rock completely.

2) They should place the sandstone into the water and observe anything that happens. Hopefully they will see bubbles of air float from the rock. Ask where is the air coming from? The answer is from the void spaces in the piece of sandstone. As the water finds its way into the sandstones void spaces, the air is squeezed out and appears as bubbles.

3) Do the same thing with the piece of Granite. Ask the students to predict what will happen this time? Very little should happen—fewer void spaces if any.

4) Ask the students to write the results in their student journals for the quartzite and sandstone experiments.

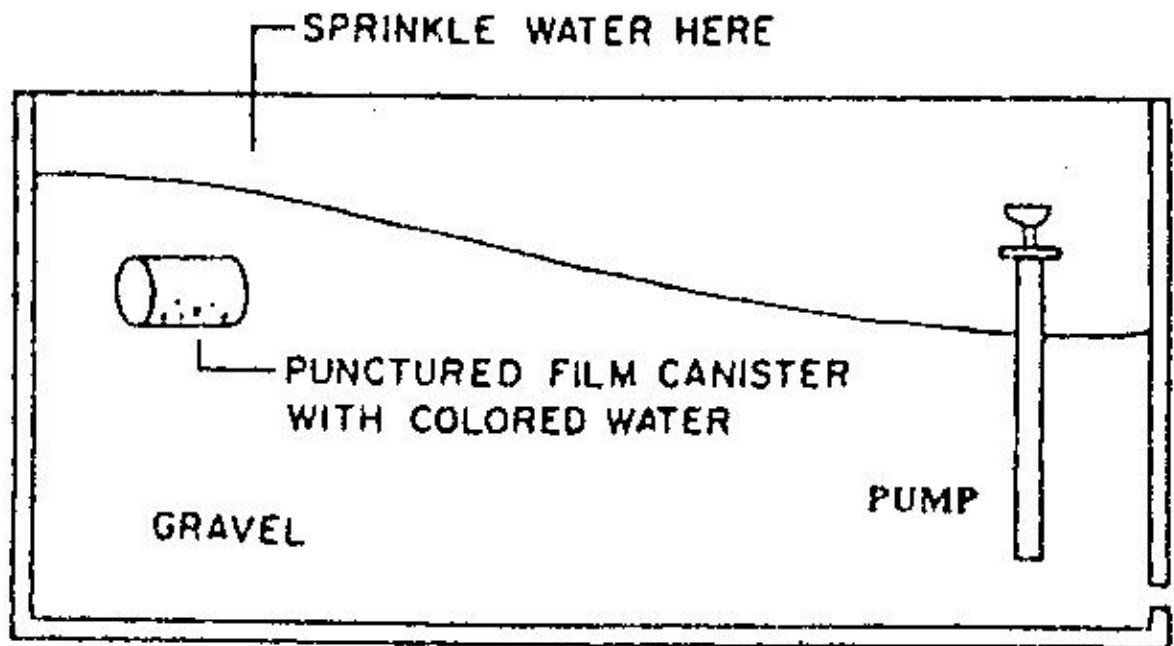
- **Science Process Skills: Compare and Contrast**

### EXPLAIN (20 MINUTES)

1) Introduce the word **POROSITY**. Porosity refers to the void spaces or pores found in sediments, soil and rock. Define the term and ask the students how this word is involved with the exercises they just finished. Ask them to name other things that are **porous**—towels, sponges, etc.

2) Select 2 students to demonstrate the porosity of sediments. They will fill one of their cups halfway with sand and one cup with some water. They will add a few drops of food coloring to the water. They will slowly pour the colored water into the sand-filled cups and watch what happens. They should be able to see the colored water percolate through the sand.

3) Set up the **GROUNDWATER MODEL** as shown in the diagram below.



### **LEAKING UNDERGROUND STORAGE TANK**

Discuss with the children that the plastic box represents a small slice of the earth. Below the surface is the soil that can hold groundwater. This water originates as precipitation that falls on the ground. At this point either you or one of the students can sprinkle some rain on the soil in the model. Ask them if they remember how the colored water moved through the sand in their cups? At this time take the film canister, tilt it on its side and slowly pour in some colored water. Cap the canister and slowly roll it into the scooped out place in the soil. Position the container so the punched holes are facing into the soil. This will allow the fluid inside to LEAK out. As the leaking happens discuss with the students what this

scene represents in real life. Remind them that this is a MODEL. Elicit from them the concept of **Leaking Underground Storage Tanks**. Where might we find examples of this, in the real world? Gas stations, farms, factories would be some of the expected answers. Point out that this is a serious form of contamination of our groundwater.

- **Science Process Skills: Observing**

### ELABORATE (10 MINUTES)

Using the overhead transparency or large illustration demonstrating a cross-section of urban and rural economy ([EPA Poster](#), Safe Drinking Water). Have the students point out as many different ways that pollutants can enter the atmosphere, and waterways. Explain how this could eventually lead to groundwater contamination.

From the illustration, the following Groundwater contamination sources could be observed:

- |               |  |
|---------------|--|
| <b>Rural-</b> | --farming practices: pesticide and fertilizer applications<br>--underground storage tanks for oil or gas<br>--animal waste products  |
| <b>Urban-</b> | --Manufacturing practices—air pollutants from smokestacks<br>--injection wells and lagoons for by-product wastes<br>--Automobiles: emissions, oil disposal, road salt on highways,<br>--underground storage tanks at gas stations<br>--Landfills---garbage dumps<br>--Residential Lawncare—fertilizer and pesticides |

After you have discussed the very negative aspects of groundwater contamination, it is important to give the students a **sense of hope for the future**. Talk about ways that our groundwater can be preserved. What could the students do to prevent further contamination? Emphasize the need for awareness and education.

- **Science Process Skills: Observing, Comparing and Contrasting**

## EVALUATE (15 minutes)

Ask students to write a one-minute spot advertisement for a radio talk show. The announcement should focus on the need for groundwater protection. See Appendix D for directions to writing activities.

## REFERENCES AND RESOURCES

- 1) Janice Van Cleave, (1991) **Earth Science for Every Kid**. Wiley & Sons, New York. ISBN 0-471-54389-6
- 2) John Farndon, (1994) **How the Earth Works**. Dorling Kindersly, London

## WEBSITE RESOURCES

- [Digital Learning Center for Microbial Ecology: Microbe Zoo](#)
- [Ground Water](#)
- [Ground Water Model](#)
- [\(Denver Earth Science Project\)](#)
- [EPA Poster of Landscape](#)
- [Water in the City](#)
- [National Wildlife Federation](#)
- [Poetry Aid](#)

## APPENDIX

- A. DNR Wetland Poster Used in *WET* lessons 1-2. [Michigan Department of Natural Resources \(DNR\)](#), entitled "Michigan Wetlands a heritage worth saving."
- B. Directions for Elaboration/Evaluation and Writing activities, pages 8-11.

## GROUNDWATER

### ELABORATION/EVALUATION

The exploration and elaboration activities within this lesson and "Groundwater" are part of the prewriting stage of writing. These activities are organized to help students realize the harmful effects of pollutants on the groundwater and the need to preserve our groundwater.

### ELABORATION/EVALUATION

1. Using an overhead or large chart paper, brainstorm ways that pollutants can find their way into the groundwater. Examples include:

Rural--Farming practices such as pesticide and fertilizers  
Underground storage tanks for oil and gas  
Animal waste products

Urban--Manufacturing practices such as air pollutants from smoke

Injection wells and lagoons for by-product wastes  
Automobile emissions, oil disposal, road salt,  
Underground storage tanks at gas stations  
Landfills for garbage dumps  
Residential lawn care such as fertilizer and pesticides

2. Have students brainstorm ways that our groundwater can be preserved. Examples may include:

Research on new pesticides and fertilizers  
Research on pollutants in the Wetlands  
Wetland Conservation Groups for alternatives for landfills,  
manufacturing practices, road salt  
Automobile legislation for oil disposal and alternative cars

3. Discuss the use of radio/TV advertisements to influence people to do or believe something by appealing to reason, character, or feelings.

4. Distribute the graphic organizer and show students how to record their ideas in each of the boxes. First have them create a stimulating, "attention getting" opener for a radio/TV advertisement in the first box. Next have them add reasons for becoming involved. Encourage them to use the list of ideas on the overhead or chart paper. Last, have them place adjectives and interesting words next to the boxes to appeal to reason or feelings of their listeners.
5. After students complete the graphic organizer, have them write their own radio/TV advertisement. You may share a model of an advertisement by sharing the enclosed model or one of your own.
6. After about 5-6 minutes, have some students share their writing. Be sure to give them specific praise about their writing (i.e., their use of adjectives, transition words, or descriptive words to appeal to reason, character, or feelings).
7. Have students continue writing for 5-6 minutes. Encourage others to share their writing as well.
8. Students may alternatively design a poster that announces the need for groundwater protection. Ask them to create a catchy slogan to serve as the title for the poster (Encourage them to use ideas from overhead or chart paper to help them come up with their catchy slogan). Then ask them to design their drawing for the poster in their journals or separate paper before beginning their poster. This shows them that artists use rough drafts and pre-drawing strategies just as writers use. Last they may begin to draw and illustrate their poster. Display these in the hallways for all to see.

## GROUNDWATER

### EVALUATION

#### SAMPLE RADIO/TV ADVERTISEMENT

Remember the blue herons circling above the pond, the dragonfly's wings glistening in the sunlight, the loons paddling silently across the water, the Canadian geese honking in the evening?

Remember the soft tails of the cattails waving in the gentle breeze; the sunshine yellow lily pads with a frog perched on a waxy leaf; the long, winding elodea that lies just below the surface of the pond?

Yes, these may become memories for us all. The wetlands of the Great Lakes are in grave danger; they have decreased 90 percent. These wetlands provide a habitat for fish and wildlife and a rich food supply for herons, egrets, ducks, and geese en route to their winter or summer homes. They also prevent shoreline erosion as they serve as a buffer between the winds and waves of storms. The wetlands also become trappers to protect our water supplies from pollutants and other impurities.

We can't sit and wait. We all need to support conservation groups that protect our wetlands, restore wetlands that have been dredged or drained, strengthen wetland legislation, and support research on the wetlands.

We can all make a difference. Call 1-800-WETLAND to see how you can make a difference.

**Ground Water: Radio Announcement Graphic Organizer  
(Student Worksheet)**

**Attention-Getting Opener**

**Statement #1**

**Statement #2**

**Statement #3**

**Conclusion**

**Ground Water: Radio Announcement Graphic Organizer  
(Overhead/Chart for Teachers)**

**Attention-Getting Opener**

*Remember the blue  
herons...the dragonfly's  
wings.....*

**Statement #1**

*Wetlands  
Decreased by  
90 percent*

**Statement #2**

*Wetland  
habitat and  
rich food  
supply*

**Statement #3**

*Prevent  
shoreline  
erosion*

**Conclusion**

*We all need to support conservation groups,  
research, and legislation. Call 1-800-WETLAND*