

AMAZING AQUIFER LESSON PLAN

SOL Standards - High School

- ES.8 The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity.
- ENV.10 The student will investigate and understand that pollution and waste management affect an ecosystem
- ENV.11 The student will investigate and understand that global climate change is occurring. Key content includes
- ENV.12 The student will investigate and understand that their actions as an environmentally literate citizen will play a role in environmental policies.

Overview

Students will construct aquifer models to learn about how water is stored underground and can be removed and used. Students will identify aquifers' main components and why aquifers are important and need to be protected. Watch [HRSD's Potomac Aquifer video](#) for an overview of the Potomac Aquifer.

Essential Questions

- What are aquifers and why are they important to communities?
- What happens when you remove water from an aquifer?
- What is SWIFT?
- What is the connection between SWIFT and the Potomac Aquifer?

Materials

- Clear plastic 9oz. ups
- Grey or white clay (bedrock)
- Green, blue, and brown clay (land, water, and trees)
- Colorful clay (above ground features)
- Small gravel
- Sand
- Shells
- Straws (cut into thirds)
- Scissors

Vocabulary

- Aquifer
- Confining Layers
- Bedrock
- TMDL
- Groundwater
- Cone of Depression
- Non-porous
- Aquifer body
- Well
- SWIFT
- TMDL
- Saltwater Intrusion

AMAZING AQUIFER LESSON PLAN

- Watershed
- Ecosystem
- Estuary
- Nitrogen
- Phosphorus

Procedures

- **Review the water cycle**
 - Place an emphasis the difference between freshwater and saltwater
 - Discuss why the water cycle is important
- **Review the Chesapeake Bay Watershed**
 - The Chesapeake Bay watershed spans more than 64,000 square miles, encompassing parts of six states—Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia—and the entire District of Columbia.
 - [Chesapeake Bay facts](#)
 - [What is a watershed?](#)
 - The Chesapeake Bay is an estuary – a semi-enclosed, tidal, coastal body of water open to the sea in which fresh and saltwater mix
- **Introduce students to aquifers**
 - Over 30% of Earth’s freshwater is located underground!
 - This water is contained in aquifers. Aquifers are bodies of permeable rock (sand, gravel, silt) that can contain or transmit groundwater.
 - Aquifers are separated by confining layers made of clay or non-porous rock (bedrock).
 - Humans use freshwater from the Potomac Aquifer and pull it up from the ground using wells.
 - The Potomac Aquifer is the largest and deepest aquifer in Eastern Virginia and is the primary groundwater supply. It is several thousand feet thick and contains hundreds of trillions of gallons of pressurized water.
 - The Potomac Aquifer, stretches from New Jersey to North Carolina, supplying hundreds of thousands of homes and industries with fresh water.
- **Discuss Sustainable Water Initiative for Tomorrow**
 - Benefits of SWIFT
 - Helping the Chesapeake Bay by significantly reducing the amounts of nutrients (nitrogen, phosphorus) HRSD discharges into local waterways (TMDL).
 - The Chesapeake Bay Watershed covers NY, PA, MD, DC, VA, DE, and the District of Columbia.
 - The TMDL is like a “pollution diet”, to help clean up the Chesapeake Bay.
 - This “pollution diet” sets goals to reduce nitrogen, phosphorus, and sediment.
 - *Learn more about the Chesapeake Bay TMDL [here](#).*
 - Provides a sustainable source of groundwater
 - Prevents saltwater intrusion into the Potomac Aquifer
 - Helps reduce the rate at which land is sinking in Hampton Roads (land subsidence)

AMAZING AQUIFER LESSON PLAN

- **Provide each student with one clear plastic cup and a small chunk of grey or white clay** (enough to cover the bottom of the cup).
 - Instruct them to flatten the clay and press it into the bottom of their cups. They've now created their bedrock layer.
- **Provide each student with a small handful of gravel.**
 - Instruct them to place the gravel on top of their bedrock layer while angling it to form a hill. They've now created their aquifer body- the portion of the aquifer that will store and transmit groundwater.
- **Provide each student with a small chunk of grey or white clay.**
 - Instruct them to flatten it and place it on the high section of the hill of their aquifer body. This will form the top clay confining layer.
 - Optional- roll the clay in sand prior to flattening it into confining layers. Since we live in a coastal region, the clay confining layers in our aquifer systems contain sand and shells.
- **Provide students with green clay, brown clay, rocks and shells**
 - Instruct them to decorate the tops of their aquifer systems. This will represent land.
- **Pour enough water into each student's cup to cover the top of the exposed aquifer body.** This represents groundwater.
- **Provide each student with a straw portion.**
 - Instruct them to "drill" through their land to reach the groundwater in their aquifer body. This represents a groundwater well.

Discussion Questions:

- What happens if you remove water from an aquifer faster than it can recharge?
- How does groundwater relate to the water cycle?
- How do humans access groundwater?
- What are the layers that make up our Potomac Aquifer?
- Why is it important to conserve groundwater?
- Describe the groundwater level in the Potomac Aquifer like in the times of early settlers? Describe the ground water level after Hampton Roads' growth. Refer to the [Potomac Aquifer video](#), if needed.

Examples:

