

# AQ – The Amazing Aquifer

**Activity Overview:** This activity will allow students to investigate the sources of groundwater, how it travels through the earth, and how it is extracted for our use. Students will also find out how pollutants affect our groundwater and how pollution can be prevented.

## Objectives:

Students will learn to:

- Identify the source of their drinking water (either groundwater or surface water)
- Understand that water travels underground
- Identify potential sources of groundwater contamination (underground storage tanks, landfill sites, spills, improper storage of chemicals, use of pesticides and herbicides, etc.)

## Time:

## Materials:

- Aquifer model
- Septic System model
- Aquarium pumps (2) – one for each aquifer model
- Water supply for the models
- Dye
- Gloves
- Syringe
- Electrical cords (2)

## Setup:

- Before the students arrive, fill the tank reservoir to the indicated fill line, and then turn on the pump. The submergible pump must be under the water. The fish tank pump must be filled with water.
- **Ensure the valves are closed before filling with water.**
- **DO NOT RUN THE PUMP IF THERE IS NO WATER CIRCULATING THROUGH IT.**
- Also, do not fill the tank above the fill line as this will prevent water from flowing through the model.
- **Only add a small amount of dye at a time, one drop goes a long way.**
- Please ask your Activity Steward for assistance if you are unsure how to set up the models.

## Takedown:

- Empty Aquifer models by opening the valve on the back – **do not tip the model to remove the water.**
- Gently place model back in case.

**Safety:** Ensure that the model is handled with care.

## Vocabulary:

**Groundwater** – water found below the ground

**Water table** – the top level of ground water

**Aquifer** – a layer of rock or sand that can absorb and hold water

**Reminders (before you start your activity):**

*Before you start your presentation, check with the teacher or chaperone that the entire group is present and ready to start.*

*Remember that **doing** an experiment and **discovering** the answer is more powerful than watching and listening to someone, so try to involve as many children as possible.*

**This activity involves the introduction of two (2) models:**

**Model 1** - illustrates aquifer systems (unconfined, water table sand aquifer; confined limestone aquifer; and a fractured bedrock aquifer)

**Model 2** – illustrates a septic system consisting of the plumbing in a house which discharges to a septic tank equipped with a baffle system, cleanout ports and siphon which discharges to a clay tile system which consists of perforated tile pipes and either an engineered permeable sand bed or a naturally occurring sand bed.

**What Will I Be Doing? (Procedure)**

**Say:** “Welcome to the Amazing Aquifer! In this activity you will learn where groundwater is from and how pollution affects it. You will also learn that it is hard to clean polluted groundwater since it moves so slowly.”

**Ask:** “What would the world be like, if all the water that fell from the sky stayed above the ground?”  
(Students may say we would have floods, we wouldn’t be able to get around, etc.)

**Say:** “Luckily when it rains all the water does not stay on the ground surface. Some water runs above the ground and into streams and lakes; some water is used by plants; some water evaporates, and some water seeps into the ground and becomes groundwater.”

**Say:** “Groundwater is stored in small spaces between rock and sand. The space that holds groundwater is called an aquifer.”

**Ask:** “Do you know where the water in your house comes from, groundwater or surface water?”

**Answer:** “In Peel, all of Caledon (except for Bolton) depends on groundwater for their water supply. If you live in Brampton or Mississauga, your tap water comes from Lake Ontario.”

Explain the components of Model 1 (aquifer) to the students (see detailed diagram at the end of script).

- Point out the features of the model: wells, groundwater, and aquifer.
- Add a SMALL amount of dye to one of the wells to simulate contamination. Use an example such as leaking gas from an underground storage tank (UST) at a gas station.
- Point out how the contamination from one well travels through the ground and affects the entire aquifer.
- **Say:** “Human activities can contaminate these aquifers. When we pollute, we affect the groundwater.”

Explain the components of Model 2 (septic system) to the students:

- Point out the features of the model: toilet that leads to septic tank, access point (to clean out septic tank), outlet that allows clean water, aggregate and sand (filters the wastewater).
- **Say:** “Activities such as bathing and washing clothes and dishes can contaminate an aquifer if the septic system is not designed properly. If the septic system is properly designed, the groundwater will not become contaminated.”
- Demonstrate contamination by inserting a SMALL amount of dye into the sewer pipe.
- **Say:** “Septic systems are never located close to water supply wells. We can’t risk our drinking water being contaminated if there is a leak.”

After both models have been explained and demonstrated:

**Say:** “Even if you don’t get your tap water from the ground, you still have to be careful not to contaminate the groundwater, because it can end up in lakes and rivers which are a source of drinking water for most people in Ontario.”

**Ask:** “What can you do to help prevent groundwater contamination?”

*Examples include:*

- *Ask whoever is at home to avoid using chemicals on your lawn.*
- *Don’t put chemicals or medicines down the sink or toilet. Bring them to a Community Recycling Centre in Peel.*

**Recall with the students what you have taught them in this activity:**

1. Water is everywhere. Groundwater is important and although you can’t see it; it exists below your feet where you stand beneath the ground surface.
2. Contamination travels with groundwater just like something floating along a river or stream; however, groundwater flows at a much slower rate which makes it much more difficult to clean-up if it is contaminated.
3. With a few exceptions, groundwater moves very slowly, eventually appearing in a discharge area such as springs, streams, and lakes.
4. We must keep our lakes and well water pollution-free because it is hard to clean polluted groundwater since it moves so slowly.

**Background Information (for volunteer understanding)**

When rain falls, some of it flows over the ground to streams or lakes, some of it is used by plants, some evaporates and returns to the atmosphere, and some infiltrates (seeps) into the ground to the water table. Imagine pouring a glass of water into a sand box. Where does the water go? The water goes into the sand and occupies the spaces between the particles of sand.

**Groundwater** is water that is found below the ground surface in pore spaces and fractures (cracks) in soil and rock. When water fills the pore spaces and/or fractures in soil and rock, a surface is formed which is called the **water table**. The water table may be shallow and within a few metres of the surface of the ground or it may be deep and hundreds of metres below the ground surface.

The water table may rise or fall depending on many factors. Heavy rain events or melting snow may cause the water table to rise whereas drought may cause the water table to fall. These are usually referred to as seasonal variations in the water table.

As groundwater travels through the subsurface, it dissolves elements from the soil and rock such as calcium, magnesium, potassium, sodium, carbonates, chloride, etc. These elements naturally occur in nature and the environment. However, groundwater is often contaminated by man-made (anthropogenic) chemicals and compounds such as petroleum hydrocarbons (gasoline and diesel), road salt, solvents, etc. rendering it not safe to drink. The contaminants can travel great distances by the slowly moving groundwater. Clean up of contaminated groundwater is not only difficult, very expensive and time consuming, it may not be practical or even possible to clean-up.

Geologic layers (strata) of soil and rock that store groundwater are called **aquifers**. Aquifers can be localized and limited in size or very extensive measuring many square kilometres in area. Aquifers have recharge areas (which are generally areas of greater elevations such as hills) and discharge areas (such as streams, wetlands, and lakes). Rain falling on the ground will both run off as overland flow or infiltrate the water table and recharge the aquifer. Once at the water table, it will flow slowing through the aquifer and eventually discharge in the discharge area. Groundwater flow systems can be local or regional in size.

## Purple Activity Colour- Challenging

Almost one quarter of the people in Ontario rely on groundwater as their source of potable drinking water. In Peel, all of Caledon (except for Bolton) depends on groundwater for their water supply.

**Model 1** – Multiple Aquifers with Wells Demonstrating Recharge and Discharge Areas; Unconfined Water Table Aquifer; Confined Limestone Aquifer and Fractured Bedrock Aquifer



Explanation of Model 1 - Aquifer

