

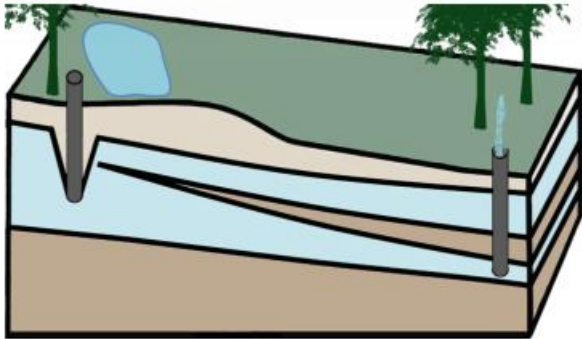
# Module 8: Weathering, Erosion, and Groundwater

## Topic 6 Content: Groundwater Systems

### Introduction

#### Groundwater Systems

##### Introduction



Groundwater is water that flows beneath the surface of the Earth through pore spaces in rock. Groundwater forms when precipitated water infiltrates Earth's surface. The force of gravity pulls the water deeper into the Earth until it reaches a layer of impermeable rock. In this activity, click **NEXT** to learn the parts of the groundwater system.

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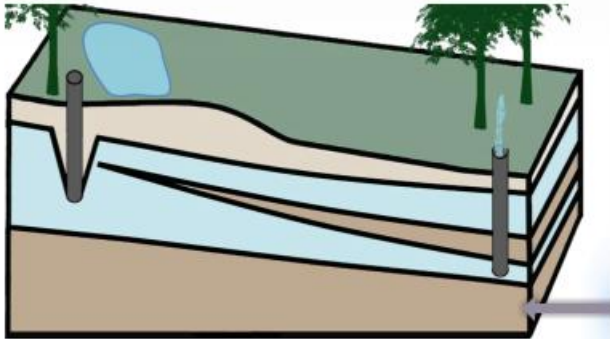
## Module 8: Weathering, Erosion, and Groundwater

### Topic 6 Content: Groundwater Systems

#### Impermeable Rock

**Groundwater Systems**

**Impermeable Rock**



Underneath the zone of saturation is a layer of impermeable bedrock. This layer of bedrock stops water from traveling further down into the Earth. The water backs up and creates the groundwater system.

The diagram illustrates a cross-section of the ground. At the top, there is a green surface with trees and a blue pond. Below the surface is a light brown layer representing the zone of aeration. Underneath this is a blue layer representing the zone of saturation. At the very bottom is a thick, dark brown layer representing impermeable bedrock. Two vertical pipes are shown: one on the left that goes down into the zone of saturation, and one on the right that goes down into the impermeable bedrock. A blue arrow points from the text box to the bedrock layer.

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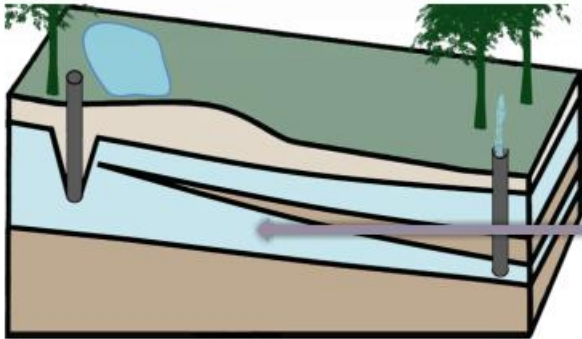
## Module 8: Weathering, Erosion, and Groundwater

### Topic 6 Content: Groundwater Systems

#### Zone of Saturation

**Groundwater Systems**

Zone of Saturation



Directly below the zone of aeration is the saturated zone, also called an aquifer. Aquifers are huge storage areas of water that exist underground. Even though the zone of saturation is a permeable layer, all of the pore spaces are filled with water. Below this zone is impermeable rock that stops the water from traveling any further.

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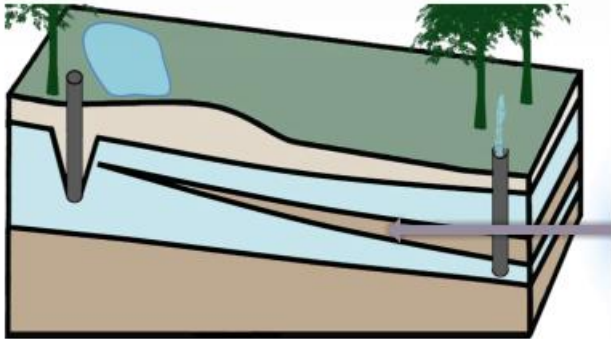
## Module 8: Weathering, Erosion, and Groundwater

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#### Aquitard

**Groundwater Systems**

**Aquitard**



An area of impermeable rock that is found in the zone of saturation is called an aquitard. Aquitards prevent the flow of groundwater.

The diagram shows a cross-section of the ground with a water table. A lens-shaped layer of impermeable rock (aquitard) is shown within the saturated zone, preventing groundwater from flowing through it. A well on the left is in the upper aquifer, and a well on the right is in the lower aquifer, with an arrow indicating flow from the right well towards the left well, blocked by the aquitard.

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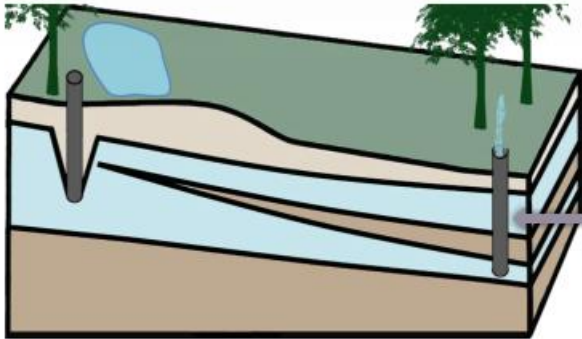
## Module 8: Weathering, Erosion, and Groundwater

### Topic 6 Content: Groundwater Systems

#### Artesian Well

**Groundwater Systems**

**Artesian Well**



An artesian well is a type of well that requires no pump. Artesian wells are drilled where water is located between two areas of impermeable rock. In the example, the aquitard blocks the water above, and bedrock blocks the water below. This causes the water to become pressurized. Once the well is drilled, water will flow freely to the surface.

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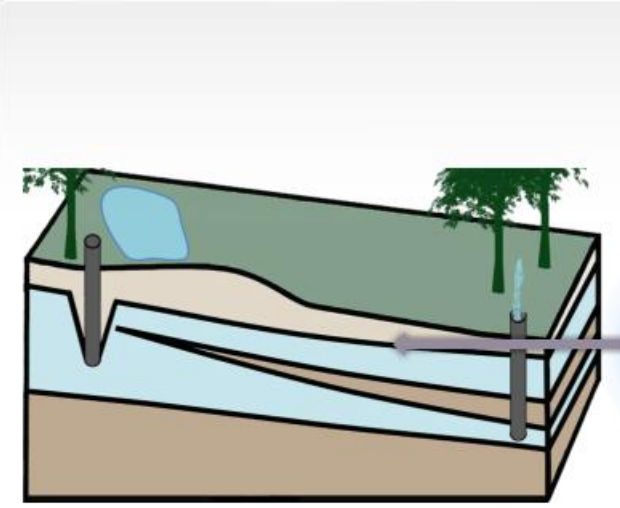
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### Topic 6 Content: Groundwater Systems

#### Water Table

**Groundwater Systems**

**Water Table**



The very top of the zone of saturation is called the water table. The location of the water table is very important. A drought can lower the water table and shrink the zone of saturation. Heavy rains can raise the water table, which causes the water table to become larger and closer to the surface.

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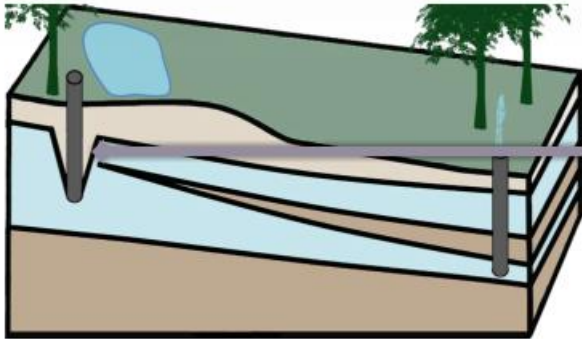
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### Topic 6 Content: Groundwater Systems

#### Well

**Groundwater Systems**

**Well**



The diagram illustrates a cross-section of the ground with a well. The ground is shown in layers: a top layer of soil and vegetation, a middle layer of water-saturated rock (aquifer), and a bottom layer of solid rock (bedrock). A well is drilled into the aquifer. A pump at the surface draws water from the well. The water table is shown as a wavy line. Near the well, the water table dips down, forming a cone of depression. The text explains that this is caused by overuse of the well, and if the cone of depression extends past the well, the well will no longer pump water to the surface.

The extraction of groundwater provides an important source of water for many people. In order to extract the groundwater, a well must be drilled into the zone of saturation. After the well is drilled, a pump will force water to the surface where it is consumed. Sometimes, a cone of depression forms as the water table dips in the proximity of the well. This is caused by overuse of the well. When the cone of depression extends past the well, the well will no longer pump water to the surface.

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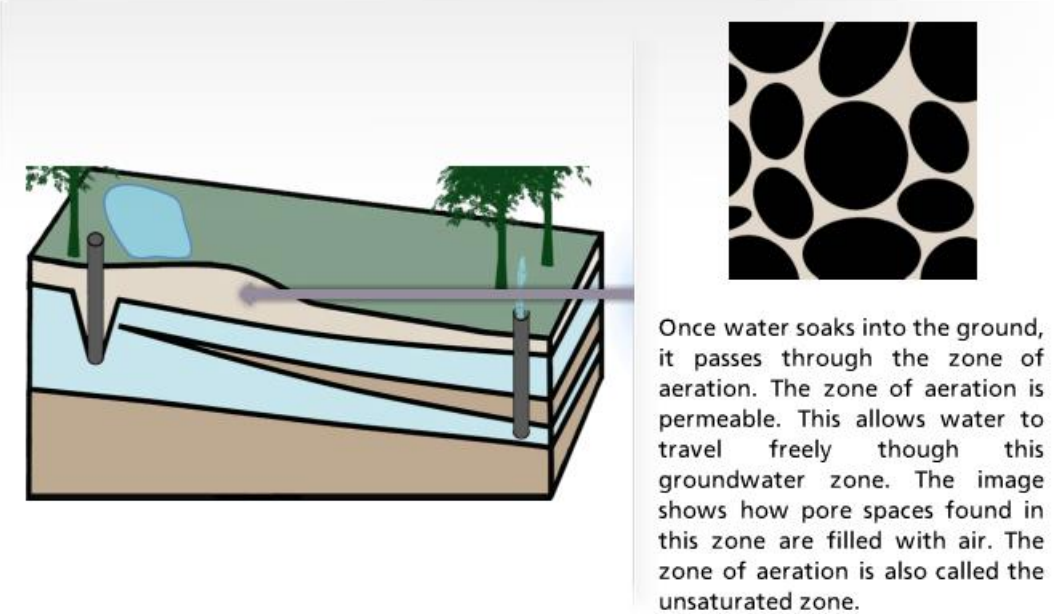
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### Topic 6 Content: Groundwater Systems

#### Zone of Aeration

**Groundwater Systems**

Zone of Aeration



The diagram on the left shows a cross-section of the ground. The top layer is the surface with trees and a blue pond. Below the surface is the zone of aeration, which is divided into the vadose zone (top) and the phreatic zone (bottom). The phreatic zone is a saturated layer of water. Below the phreatic zone is the basement rock. A purple arrow points from the surface down into the zone of aeration. A vertical well is shown on the left, and a horizontal well is shown on the right. The diagram on the right shows a cross-section of the zone of aeration with black circles representing pore spaces filled with air.

Once water soaks into the ground, it passes through the zone of aeration. The zone of aeration is permeable. This allows water to travel freely though this groundwater zone. The image shows how pore spaces found in this zone are filled with air. The zone of aeration is also called the unsaturated zone.

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