

EARTH'S FRESH WATER


The Water Cycle

The constant moving of water from Earth's surface into the atmosphere, back to the Earth's surface, and into bodies of water is called **the water cycle**. Water **evaporates** from bodies of water (lakes, oceans and rivers) and is **transpired** by plants. This water vapor **condenses** to form clouds. This water **precipitates** out of the clouds as rain, snow, sleet or hail (or a combination of these) and returns to the Earth's surface. Some of this **precipitation** falls directly back into oceans, lakes and rivers. The rest falls on the land. **Runoff** is water that moves over the land to return to rivers and, ultimately, the ocean.



How Is Water Stored?

The largest water body on Earth is the oceans. The second largest is the atmosphere. The third largest is groundwater and the fourth is precipitation.



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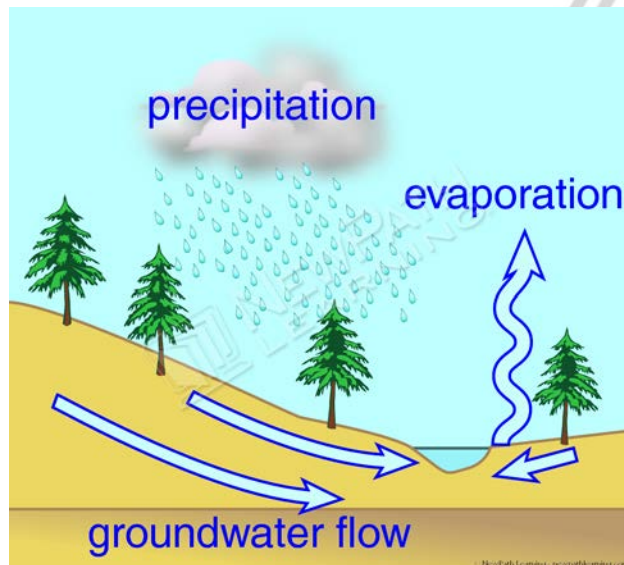
Surface Water

Fresh water moves over the surface by an interconnected system of streams and rivers. Small streams that feed water into larger rivers are called **tributaries**. Rivers are closely interconnected and flow from higher to lower elevations where the water collects in larger and larger rivers until it ultimately flows into the oceans. A geographical region of land which includes its main river or rivers and all the tributaries that feed the rivers is called the **drainage basin** or **watershed**. High geographical regions, such as mountain chains, separate drainage basins from one another. A geographical feature separating drainage basins is called a **divide**. The Rocky Mountains in western United States is known as the **Continental Divide**. Precipitation that falls to the east of the Rockies drains to the East, and that which falls to the west of the Rockies drains to the West.

Lesson Checkpoint:

Which water features does the Continental Divide separate?

Groundwater



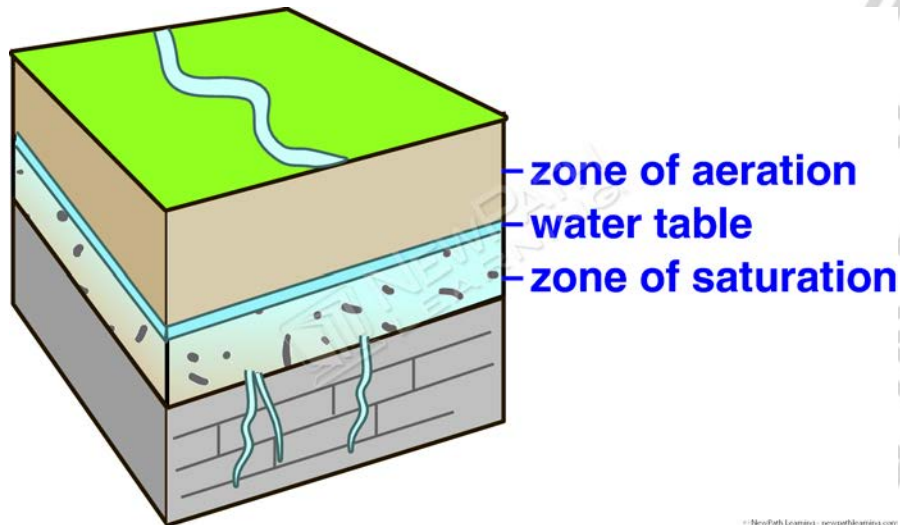
Water that
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The force of gravity pulls water down through the pores of soil and rocks. The spaces between particles of soil and rocks are called pores. The amount of space between particles is called porosity. The greater the amount of space (that is, the higher the porosity) the more water the ground can hold. This water cannot move through the ground, however, if the spaces are not connected to each other. The measure of the connectedness between spaces is **permeability**. A layer of rock that can both store ground water and allow it to move through the rock is called an **aquifer**. For a rock to be considered an aquifer, it must be both **porous** and **permeable**.



The top of the body of water held in an aquifer is the **water table**. The water table marks the boundary between the **zone of aeration** above and the **zone of saturation** below. The water table rises and falls with the amount of precipitation in a region over a period of time. During drought seasons, the water

Water is also recharged either by rain or snowmelt. This process is called **recharge** of an aquifer.



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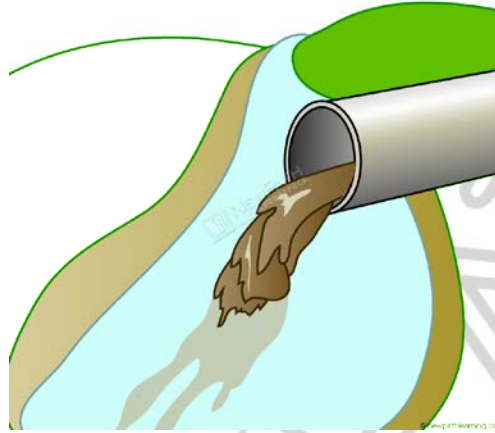
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Agriculture uses water from aquifers to water the crops. In the Midwestern United States, the Ogallala aquifer provides water to 8 states! Though enormous in size, but it is used so extensively that it is losing water faster than it is recharging.

Lesson Checkpoint:
What are the necessary characteristics of rock in an aquifer?

Water Quality and Water Pollution

Though traditionally thought of as a **renewable resource**, overuse and unmanaged pollution can eradicate a water resource, either depleting it completely or making it unusable for very long periods of time, turning it into a **nonrenewable resource**. Consequently, water preservation and pollution management is essential.



There are two categories of pollution, **point-source pollution** and **nonpoint-source pollution**. Point source pollution is pollution that comes from a specific, identifiable source, like a leaky underground fuel tank or a wastewater pipe from a factory.

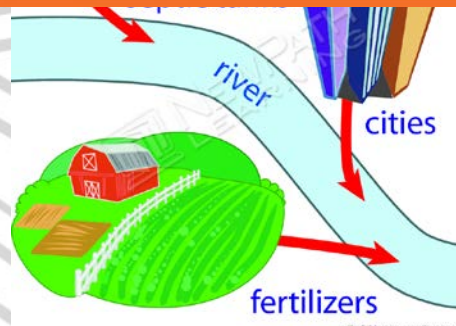
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If polluted water is returned to the ground, it becomes very, very difficult to clean. In fact, it moves so slowly through the aquifer that it will take extraordinary measures to get it out of the aquifer and make the aquifer usable again. Consequently, it is preferable to collect wastewater and transport it to a water purification facility where it can be properly treated so that clean, usable water can be returned to the environment.

Water treatment facilities clean water in two steps. The first is **primary treatment** in which particles are physically filtered out of the wastewater. The solid material that is removed from the water is called **sludge**. The remaining water enters **secondary treatment** where it is aerated with oxygen and treated with bacteria that consume dissolved waste and very small waste particles. In the end stages of secondary treatment, chlorine is added to the water to kill any remaining bacteria. At this point the water is returned to the environment.

In some cases water is polluted with industrial chemicals and other byproducts that cannot be easily removed and, at times, cannot be removed at all. Eliminating such scenarios is an imperative step of conservation and environmental preservation.

Lesson Checkpoint:

What is the key difference between the two categories of pollution described here?



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