ALABAMA COOPERATIVE Extension SYSTEM

ALABAMA A&M AND AUBURN UNIVERSITIES

ANR-790-1.1.3

Getting To Know Water

Where Water Supplies Are Stored: Surface Water and Groundwater

What Is Surface Water?

Surface water supplies are quite familiar to most of us. They include streams, rivers, ponds, lakes, and springs.

Streams and rivers begin as precipitation. When water cannot infiltrate the soil, it flows over the soil surface and collects in channels to form streams, then rivers.

Ponds and lakes occur where nature obstructs the normal flow of surface runoff. People can also create water-holding depressions by building dams or excavating into the earth. Excavated ponds can be filled by surface runoff, by springs, or by a high water table.

Springs occur at the land surface where water from underground sources appears. Springs have specific points of exit and should not be confused with seeps, which do not have them. Springs can occur (1) where a depression meets the water table, (2) where an impermeable soil layer deflects the downward movement of water, and (3) where fractured rock intersects the land surface. Although springs originate from groundwater, they do appear at the ground surface, and therefore, they must be treated differently from groundwater to protect their quality.

What Is Groundwater?

Groundwater and the way it moves is not as easy to understand as surface water simply because we cannot see it. To some people groundwater is a mysterious resource—magical, pure, and inexhaustible. But groundwater has no magic; it follows natural laws. Groundwater is simply water filling spaces between rock grains or in fractures and fissures in rocks.

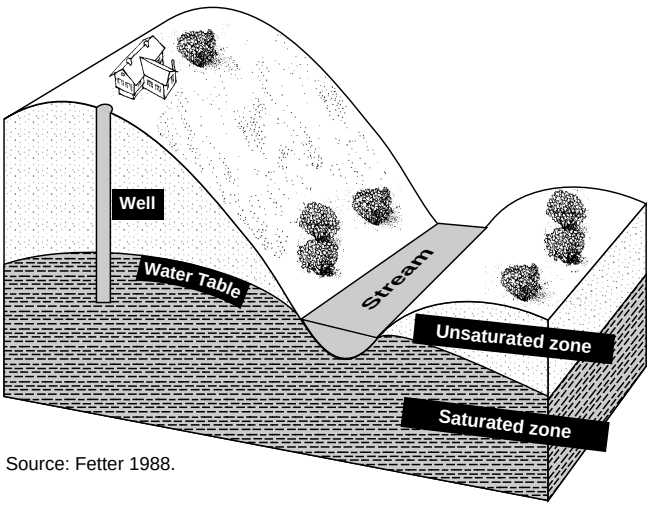
Groundwater does not go all the way to the core of the earth. Beneath water-bearing rocks everywhere, at some depth, rocks are watertight. This depth may be a few hundred feet, or more likely tens of thousands of feet.

Groundwater, like surface water, originates as precipitation. Rain falling on recharge areas, areas where precipitation infiltrates the soil, percolates downward to a **saturated zone** where all spaces between rock and soil are filled with water. The top of the saturated zone is the **water table.** The water filling the spaces between soil particles and rock in the saturated zone is groundwater. Major reservoirs of groundwater are referred to as **aquifers.**

Aquifers are an important part of the groundwater resource. Aquifers are water-bearing rock layers that supply sufficient water to serve as a water supply. Aquifers extend from near the surface to thousands of feet below. They can range in thickness from a few feet to thousands of feet. They can underlie a few acres to thousands of square miles.

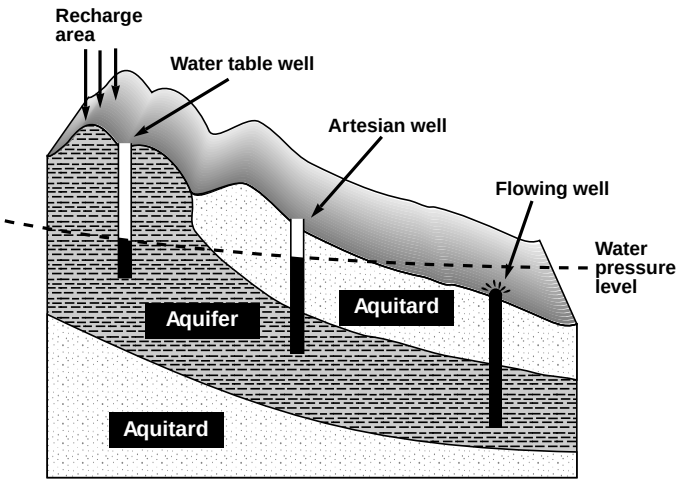
Aquifers function in two very important ways: they both transmit and store large volumes of groundwater. In a sense they act as both pipes and storage tanks. Aquifers are classified into two principal types—unconfined and confined.

Unconfined aquifers are overlaid by permeable layers of soil and rock and are generally found close to the land surface. Unconfined aquifers provide water to wells by draining the materials surrounding the well. (See Figure 1.)



Source: Fetter 1988.

Figure 1. Unconfined or water table aquifer.



Source: Fetter 1988.

Figure 2. Confined or artesian aquifer.

Confined or artesian aquifers are overlaid by impermeable rock layers that prevent free movement of air and water. Thus the water is confined under pressure, as in a pipe system. Drilling a well into a confined aquifer is like puncturing a water pipe. Water under pressure gushes into the well, sometimes even rising to the surface and overflowing. (See Figure 2.)

Groundwater is an important resource. Although it makes up less than 1 percent of the total amount of water on earth, it constitutes 98 percent of the fresh water that is suitable for human consumption.

What Is The Relationship Between Surface Water And Groundwater?

Movement of groundwater can be complex and is much different from the flow of surface water. Groundwater usually moves more slowly than surface water. Whereas surface water moves at the rate of tens or even hundreds of feet per minute, groundwater moves at the rate of inches per day or less. This is because groundwater must overcome more friction or resistance to move through small spaces between rocks and soil particles.

Once water enters an aquifer, it may remain there for centuries. If contaminated, an aquifer may need just as long to cleanse itself. Because groundwater must pass through soil and sediments, particulate matter can be filtered and some organic compounds absorbed. But some substances can continue to be leached and do contaminate groundwater. Passing through soil can also increase dissolved solids; thus, hardness can be higher in groundwater than in surface water in nearby streams.

Water contained in surface supplies is in most cases directly linked to groundwater. Water flowing into a stream is actually the continuation of an aquifer which has been intersected by the stream. During periods of very low stream flow, groundwater moves out of the aquifer and into the stream to supplement stream flow. During floods, water can flow from the stream into the surrounding aquifer. Therefore, surface water supplies directly impact groundwater supplies and vice versa. This should let us know that surface water and groundwater cannot be viewed as entirely separate resources.

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