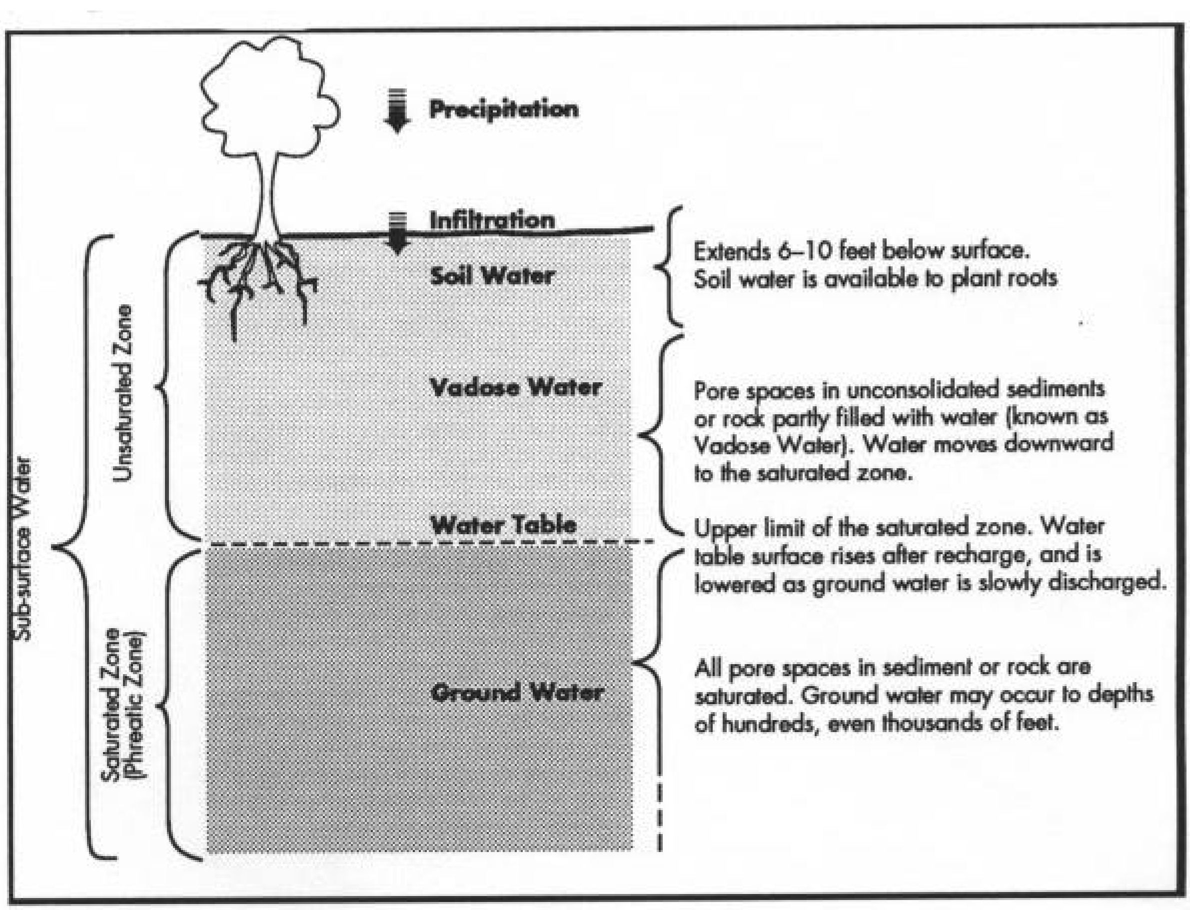
WHAT IS A WATER TABLE?

Most people know that the "water table" has something to do with ground water. The word table provides an image of a flat surface, like a tabletop, and it is commonly assumed that when a well is drilled it strikes water once it reaches below the water table. There is also a general understanding that in times of serious drought, water table levels may drop and wells may run dry. Understanding the terminology used to describe sub-surface water can help explain why water tables may rise and fall.

Ground water is sub-surface water, but not all sub-surface water is ground water. Having an appreciation of the types of sub-surface water and knowledge of local geology can explain why some water table levels may vary by tens of feet and others in the same area may only change by inches and some hardly at all. The upper surface of ground water is the water table. Below this surface, all the pore spaces and cracks in sediments and rocks are completely filled (saturated) with water. These saturated layers, known as the saturated zone (or the phreatic zone), are where ground water occurs. Strictly speaking only water found in the saturated zone is ground water.



In the top layers of soil, unconsolidated sediments or bedrock, pore spaces may not be completely filled with water. Some may contain water, some air, and some may only be partly filled with water. This is known as the unsaturated zone (also called the zone of aeration or the vadose zone). After heavy rainfall, this zone may be almost saturated, while during a long dry spell, it may become almost dry. Precipitation infiltrates downwards through the unsaturated zone. This infiltrating water is known as soil water when it is still shallow enough to be used by plants, and as vadose water when it is below root level, but still unsaturated. With further infiltration however, excess water will eventually reach the water table. [Just above the water table in sedimentary rocks there is a often a short vertical zone known as the capillary fringe, but further discussion of this is beyond the scope of this article.]

The vertical distance from the ground surface to the water table varies from place to place - it may be a few feet, or several hundred feet. Generally, the water table is deeper beneath hills and shallower beneath valleys. It is hardly ever flat! In any one place the water table usually rises with increased recharge from precipitation and declines in response to seasonally dry weather, drought, or excessive pumping of ground water. If however the water table is hundreds of feet down, it may take years for the infiltrating water to reach the saturated zone and there will be no seasonal change in water table levels. If ground water is "confined" by overlying impermeable rock formations, the well water levels represent a pressure level and NOT a water table level. (See topic #4 in this series).

The spaces between soil or sediment particles and cracks in solid rock are called voids or pores. Each sediment and rock type has differences in porosity, (the amount of water a rock formation can hold). Porosity is expressed as the ratio of pore space to solid material per unit volume. For example, saturated sand may have 30% pore space to 70% solid material, while fractured granite may have 1% pore space to 99% solid rock. The sand is therefore more porous than the fractured granite.

Imagine a cubic foot of granite and a cubic foot of sand with porosity of 1% and 30%. Now add water to each. The granite will "fill up" first because there is less pore space. If it were a real aquifer, the water table level in the granite would rise faster. Similarly, because there is less storage than in the sand, the fractured granite water table would decline more rapidly in response to pumping or drought. Ground water is always on the move, although usually very slowly. The discharge (or outflow) of water from aquifers occurs as part of the natural movement of water in the hydrologic system. Water table levels in aquifers therefore represent the combined effects of rates of recharge and rates of discharge. If pumping of aquifers takes place in excess of recharge then resource use will eventually not be sustainable. Careful monitoring of water levels in wells can show how water table levels change, and well data, with water levels and dates of the measurement are very important for ground water management.

For any well data however it is very important to know exactly which rock formations the well penetrates. There can be more than one aquifer beneath the surface! Water table information, in addition to other information about geology, precipitation and pumping rates are of great value when assessing ground water potential.