

# Water Cycle in a Fractured Rock Environment

A large percentage\* of the rain and snow falling on this environment is returned to the atmosphere by **evapotranspiration**. Evapotranspiration is a measure of the water returned to the air through **evaporation** from the soil, rock and water surfaces, and moisture lost through plant surfaces (**transpiration**).

*\*The Mountain Ground Water Resource Study in Jefferson County, Colorado measured evapotranspiration at an evergreen forest site as 75% and 97% of precipitation in two consecutive years.*

## Evapotranspiration

A small percentage of rain and melted snow moves over the land's surface toward streams. This is referred to as **runoff**. Once in the **streams**, it is considered **surface water** although a small amount makes its way into the fractures below. Most of the stream water moves quickly down hill, and out of the area.

## Precipitation

Rain and snow are the primary sources of water in the mountains. A portion of the **precipitation** infiltrates the ground and is considered **ground water**.

Siting **septic systems** on rocky land can be challenging and expensive, due to the scarcity of soil and loose surface materials. Steep slopes can also be problematic due to soil erosion, and increased excavation costs. The typical septic system filters wastewater through a leach field prior to its release into the environment. Leach field construction requires a fairly level site, and incorporates layers of soil and gravel for filtering. If not available onsite, these materials need to be trucked-in. The separation of well and leach field is an important step in protecting ground water quality. Jefferson County, Colorado requires a minimum separation of 200 feet.

"**Regolith**" is a relatively shallow layer of loose surface materials on top of bedrock. This is where the **shallow subsurface ground water flow** occurs. The amount of water moving within this layer varies according to precipitation and season. Many of the old hand-dug wells were located in the regolith.

Dry Fracture  
Periodically Wet Fracture  
Wet Fracture

Water levels in fractures and in wells vary, sometimes considerably, due to precipitation and season.

Many mountain wells deliver a reliable supply of water through drilling into **water-rich fractures** in the bedrock. These fractures are usually more dependable when connected to a larger network of similar fractures. This is because they are periodically "**recharged**" from rain and snow melt.

## Fractured Bedrock

The typical bedrock in western mountain environments is full of narrow cracks or "**fractures**" that were created over millions of years. They are the result of natural movements called "**folding**" and "**faulting**" of the earth's crust that led to the creation of the mountains. Some of these cracks, often as narrow as a human hair, contain water, and some are dry.

## Regolith

Seasonal Shallow Subsurface Flow

A portion of the subsurface flow seeps into the deep rock fractures and "**recharges**" the ground water held in the rock. This water supplies many mountain residential wells.

**Hand-dug wells** are less common today than in the past. Prior to current drilling technology, hand-dug wells were often the only available option. They were usually shallow, and located close to streams or springs. Some are still in use today.

**Springs** are the result of water-filled fractures emptying out at the surface.

