



Is groundwater better for water supplies than surface water?

Groundwater and surface water each have advantages.

Groundwater

- Low development costs
- Low treatment costs
- Low cost of expanding yield
- Relatively constant yield
- Natural filtration
- Constant chemical quality
- Constant low temperature
- Sediment-free supply
- No evaporation losses
- Development uses small land area

Surface Water

- Predictable yield
- High yield
- Easily accessible
- Easier to clean if contaminated



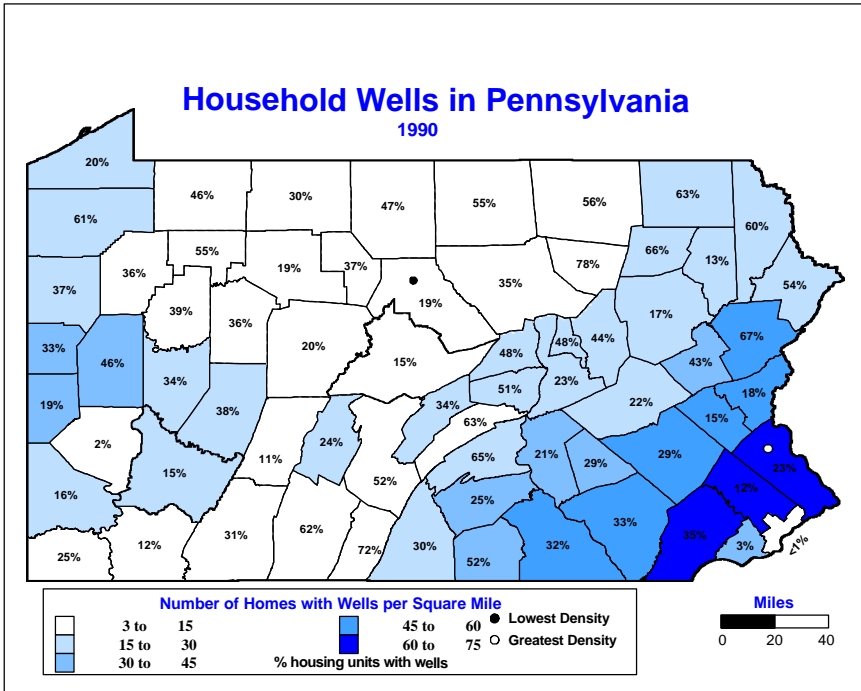
How do we get groundwater out of the ground?

All groundwater in Pennsylvania comes from either wells or springs. Most supplies use wells.

Wells

As of 1990, Pennsylvanians use about 1 million water wells for public and self-supplied domestic use.

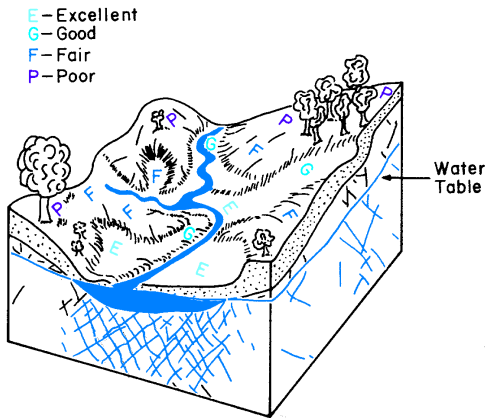
Wells supplying enough water for household use can be drilled almost anywhere in Pennsylvania. However, in determining the best location for a well, there are several factors to consider. The type of sediment or rock available for well development is a primary concern. Different sediments and rocks have different characteristics which make them better or worse aquifers than other sediments and rocks. Often, though, only one sediment or rock type is reasonably available to use for a water supply, particularly for a private home supply.



Because most groundwater in Pennsylvania’s bedrock flows through fractures and openings between rock layers, locating a well in an area with a high density of fractures may result in a higher yield, if the well is to be drilled into a bedrock aquifer. The more fractures that a well intersects, the better the chance of encountering an adequate supply of water.

Determining the rock unit and the fracture density require that the person selecting the well site have some geological knowledge. A simple way for anyone to increase the likelihood of a good yield is to locate a well in a valley. Other things being equal, wells drilled in valleys yield more water than those drilled on hillsides or hilltops.

The valleys exist because the rocks are more easily eroded there, indicating that it is a zone of weakness.



How topography reflects well-site potential

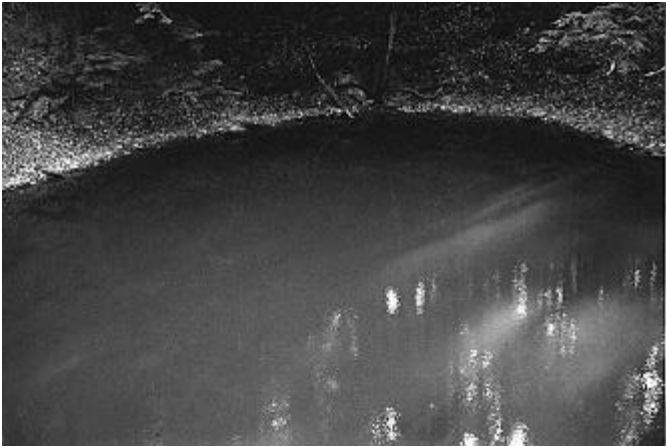
The source of that weakness in most of Pennsylvania, except the Ridge and Valley province, may be a concentration of fractures. The rocks beneath a valley are more likely to be highly fractured than rocks beneath hillsides and hilltops. Also, valleys are usually discharge areas. A larger recharge area is available for wells in valleys than for wells on hillsides or tops.

Springs



Big Spring- Bellefonte's water supply

Springs are found throughout Pennsylvania. Some springs provide enough groundwater for public and private water supplies. The state's largest springs occur in areas underlain by limestone and dolomite, such as in some of the large valleys in the Ridge and Valley, and Piedmont provinces. Cave systems commonly develop in these rock types. Because caves can store and transmit a lot of water, there is little water in surface streams where



Nippono Spring discharges about 18,000 gallons per minute, draining an extensive cave system.

the flow system within days or weeks of its recharge. As a result, discharge increases quickly after a rain, and also decreases quickly a short time later. Also, spring water is often much lower in dissolved solids than well water, because most spring water passes more quickly through weathered rock than deeper well water. Many people prefer the taste of spring water to public-supplied water, and can be seen filling bottles at roadside springs. However, this lack of ability to chemically alter the groundwater because of the short residence time also means that any contaminants introduced to the groundwater will more likely be soon reflected in the quality of the spring water. No water source should be used without determining that its quality is good.

Some springs are warmer and/or more highly mineralized than most. The water from warm springs has penetrated deep beneath the surface, where the temperature is

cave systems are well developed. Almost all of the water is groundwater in cave areas. Nippono Spring in Lycoming County is the largest spring in Pennsylvania.

Most springs are much smaller and discharge groundwater from the shallowest part of



Filling bottles with untested water at a roadside spring.

higher. Pennsylvania has few warm springs. Warm Springs in Perry County is the best known. Its temperature is only 10⁰ F to 15⁰ F warmer than surrounding groundwater. Warm and hot springs are more common in the western United States, where underground temperatures are higher.

The temperature of groundwater fluctuates considerably less than air temperature, because it is insulated from surface temperature extremes. Its temperature remains fairly constant year-round. This property makes groundwater useful for use in heating and cooling systems. Groundwater is warmer than the air in the winter, and cooler than the air in the summer.

Mineral springs, those with large amounts of dissolved solids (minerals) are more common than warm springs in Pennsylvania. In the past, many have had resorts, such as Bedford Springs, developed around them because of the perceived health benefits of the more highly mineralized water. Their water has either been underground for a long time, has flowed through rocks with easily dissolved minerals, or both.

Hopefully, you now have a better understanding of groundwater in general, and in Pennsylvania in particular. It is important to remember how much groundwater there is, and that groundwater and surface water are not separate entities. All Pennsylvanians depend on groundwater. Your increased understanding may allow you to better appreciate the abundant water resources that we have in Pennsylvania.