

Ground Water and Wells in the Maryland Piedmont

Ground water is the primary source of drinking water for most residents in the rural areas of Maryland. Ground water occurs in a variety of hydrogeologic settings, reflecting the geological diversity of the State. This fact sheet describes ground water and wells in the Piedmont physiographic province of Maryland, and the factors associated with well-water availability and quality.

Geology of the Maryland Piedmont

The Piedmont physiographic province in Maryland is located between the Blue Ridge and Coastal Plain provinces (figure 1). The Piedmont is underlain primarily by metamorphic and igneous crystalline rocks, with smaller amounts of sedimentary rocks. Over time the rocks have been folded, faulted, and fractured to varying degrees, and the region is commonly referred to as fractured-rock terrane (Nutter and Otton, 1969). The boundary between the Piedmont and Coastal Plain provinces is known as the Fall Line, and it separates the hard, fractured rocks of the Piedmont from the unconsolidated sediments of the Coastal Plain.

Unlike the Coastal Plain sediments, where ground water flows through pore spaces between the sediment grains, the Piedmont aquifers are composed of mineral grains that are tightly connected and do not easily transmit water. However, the fractures that have developed in the rocks over time are capable of conveying sufficient quantities of water to a well.

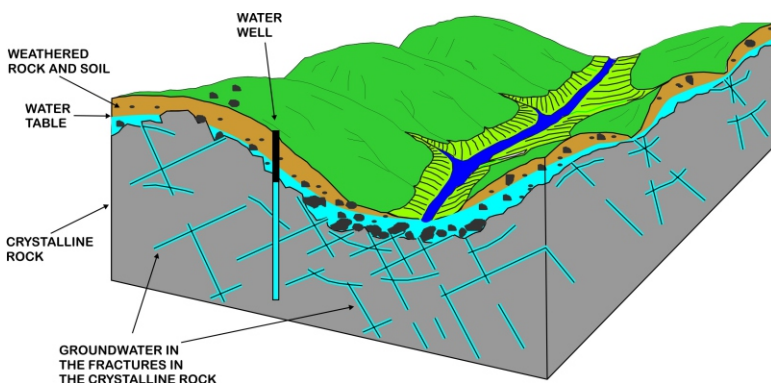


Figure 2. Block diagram showing the location of the ground water in fractured-rock terrane (modified from Heath, 1983).

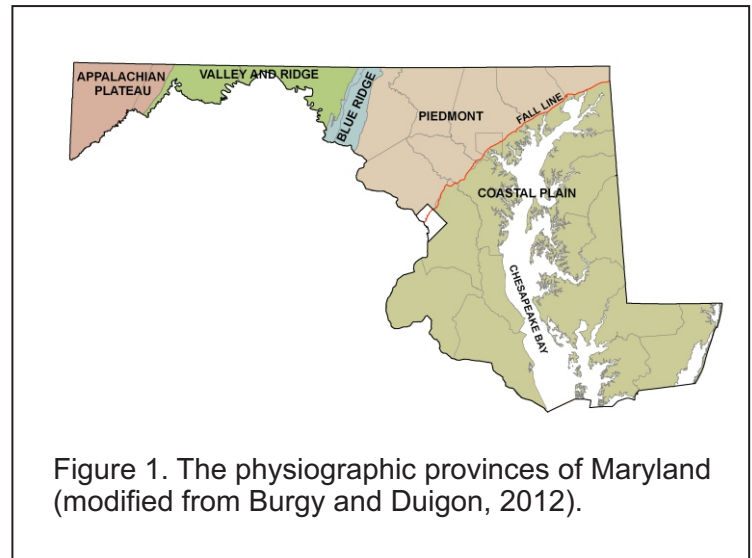


Figure 1. The physiographic provinces of Maryland (modified from Burgy and Duigon, 2012).

Where does ground water come from?

Ground water in the Maryland Piedmont is derived from rain and snow that falls within the watershed where the well is located. By contrast, ground water in the Maryland Coastal Plain may have traveled many miles from where it entered the ground-water system to where it is withdrawn from a well. In the Piedmont, precipitation percolates downward through the soil and rock until it reaches the water table (the point below which the ground is saturated with water) (figure 2). The saturated zone below the water table is called an aquifer.

Most aquifers in the Piedmont are unconfined aquifers (also called water-table aquifers), meaning that there is no overlying impermeable layer to protect ground water from surface-based sources of contamination. The water table represents the top of the unconfined aquifer. Because they do not have a protective layer above them, unconfined aquifers are susceptible to contamination from substances released on or near the surface, including fertilizers, pesticides, road salt, leaking underground storage tanks, and runoff from impermeable surfaces.

What factors affect the yield of my well?

In the Piedmont, most ground water is stored in the overburden (the weathered material that overlies bedrock), and is transmitted to the well via fractures that intercept the well bore (figure 3). The number of fractures, topographic position of the well (hill or valley), thickness of overburden above the aquifer, amount of precipitation, and type of rock are all factors that can influence well yield (Nutter and Otton, 1969). Because many fractures are close to vertical, adjacent wells of similar depths can have very different yields because they may not intercept the same number of fractures.

Characteristics of wells and ground water in the Maryland Piedmont

- Wells in the Piedmont are typically drilled to a depth of several hundred feet. The upper part of the well is drilled through overburden (weathered material derived from the underlying rock). The lower part of the well is drilled through unweathered bedrock. Because aquifer permeability tends to decrease with depth, the open hole is used largely to store water.
- Casing is installed in the upper part of the well to keep the well from collapsing. Well-construction regulations in central Maryland require wells to have a minimum casing length of 20 feet and a minimum seating distance of 2 feet into unweathered bedrock (Code of Maryland Regulations, 2012)
- The lower part of the well is usually left open (that is, no lining or screen is installed). Water enters the open hole through fractures that connect the open hole to the saturated overburden (figure 3).
- Well yields in the Piedmont are typically low (a few gallons per minute). This is because the water is stored in fractures, unlike in the Coastal Plain, where water is found in sandy, unconsolidated aquifers. Yields are often higher in wells drilled in marble or highly fractured rock.
- Piedmont wells are more likely to be affected by drought and other climatic events than are Coastal Plain wells, because they draw water from unconfined aquifers.
- Water quality in the Piedmont is typically slightly acidic (pH 5 to 7) and typically contains low amounts of dissolved solids. Elevated levels of nitrate (from septic effluent, or current/former agricultural land use) and chloride (from road salt) are common contaminants.

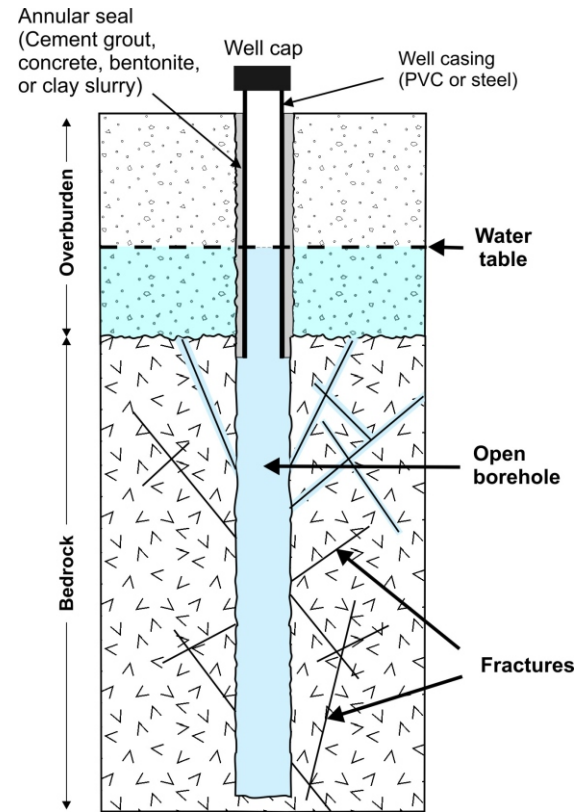


Figure 3. Diagram showing typical well construction in fractured-rock terrane (from Burgy and Duigon, 2012).

References

Burgy, K. and Duigon, M.T., 2012, Preliminary assessment of factors affecting well yields in the fractured rock terrane of Frederick County and portions of Carroll and Montgomery Counties, Maryland: Maryland Geological Survey Report of Investigations No. 79, 104 p.

Code of Maryland Regulations, 2012, Well Casing: Title 26 (Department of the Environment), Subtitle 04 (Regulation of Water Supply, Sewage Disposal, and Solid Waste), chap. 04 (Well Construction), Regulation 07D (3) <http://www.dsd.state.md.us/comar/getfile.aspx?file=26.04.04.07.htm>. Accessed 29 April 2013.

Heath, R.C., 1983, Basic ground-water hydrology: U.S. Geological Survey Water Supply Paper No. 2220, 84 p.

Nutter, L.J., and Otton, E.G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56 p.

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