



# Your Water, Your Future

by Dauphin County Conservation District

Dauphin County's Stormwater Publication for Municipalities  
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## The Groundwater-Stormwater Connection

*Your Water, Your Future* is produced as part of Dauphin County Conservation District's Municipal Stormwater Outreach Initiative. This issue, the third in the series, features groundwater as it relates to managing stormwater runoff in your municipality.

Please contact Gil Hirschel at 921-8100 regarding questions, comments, and requests for additional information.

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In Issue 2, we listed groundwater as an essential part of the water cycle. This issue will explore in greater depth the nature of groundwater and how it relates to municipal water resource issues.

### What is Groundwater?

Groundwater is stored in the pore spaces of soil or rock formations

underground (see Figure 1). Rain and melting snow seep through the land surface, then continue to trickle down, or *infiltrate*, into underground layers of soil and rock. First, the

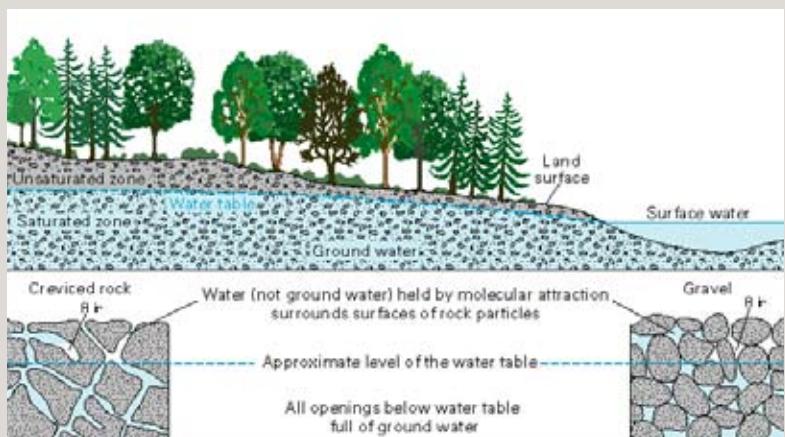


Figure 1. Groundwater Illustration

Courtesy of USGS

water soaks through the unsaturated zone near the surface, where pore spaces in the soil contain both air and water. Eventually, the water reaches the saturated zone. Here, pore spaces in the soil are completely filled with water. The top of the saturated zone is called the *water table*.

Groundwater continues to seep down through the soil and cracks in rock layers until it meets an impermeable layer of rock, where it then flows along the

contour of the rock layer. Eventually the groundwater discharges to a spring, lake, or stream. It is groundwater that supplies a stream's flow during dry periods, or *baseflow*.

*Aquifers* are underground layers of rock or soil that hold water. Drilling a well from an aquifer supplied by groundwater can produce enough water for human needs over a large region, depending on the size of the aquifer. For example, the Ogallala Aquifer in the U.S. Midwest provides enough water to support crop farming and cattle ranching across seven states in the typically arid climate of the Great Plains region!

The amount of water contained in an aquifer and how fast it moves depend on the type of soil or rock that make up the aquifer. Most of Dauphin County is composed of sandstone and shale aquifers. These aquifers yield moderate amounts of water. Several areas in central and southern Dauphin County have carbonate aquifers that can yield substantial amounts of water, but are more susceptible to contamination.

## Quiz - True or False

1. Groundwater provides drinking water to 40% of the total US population and 89% of the nation's rural population.
2. Forested land allows 50% of total rainfall to infiltrate into the ground; urban areas only allow 15%.
3. The Stormwater Management Act (Act 167) and the Municipal Planning Code (Act 247) do not enable municipalities to address groundwater protection.
4. Proper installation of stormwater BMPs in areas of new development can help assure adequate aquifer recharge.
5. Municipalities are the only government entity authorized to assure adequate infiltration of groundwater and, therefore, protection of groundwater quantities.

Answers on reverse side, bottom of the page.

(Continued on reverse)

## The Groundwater-Stormwater Connection (cont.)

### Groundwater Importance/Threats

Groundwater is a major source of water supply for the nation. According to the United States Geological Survey (USGS), groundwater is the source of drinking water for 51% of the nation's total population, and 99% of the nation's rural population. You may recall the statistic from Issue 1, that 17% of Dauphin County residents get their drinking water from private wells, and an additional 10% of residents receive water from a public utility supplied by groundwater.

Human activities that can negatively affect groundwater quality include waste disposal, mining, agricultural practices, and growth and development. This newsletter focuses on growth and development in particular, and its impact on groundwater conditions.

A study by the Minnesota Department of Natural Resources determined that 50% of

rain falling on forested land infiltrates into the groundwater supply, compared to an infiltration rate of only 15% in a typical urban area. This represents a 70% reduction in groundwater recharge due to development!

Less groundwater recharge plus more water pumped from the ground to meet the demands of new development will eventually cause "mining" of groundwater supplies; long-term effects include permanently lowering the water table and reduced streamflow, which adversely affects aquatic life. Further, the substantial amount of water diverted from infiltrating into the ground will remain on the surface as runoff, contributing to flooding issues, pollution and streambank erosion.

Effective stormwater management strives to maintain pre-development conditions, such as infiltration rates that will assure aquifer replenishment. Stormwater



Rain Gardens filter pollutants and infiltrate runoff into the ground.

Best Management Practices (BMPs) incorporated into site development plans can help replicate the natural processes of infiltration or pollutant removal from runoff; some BMPs, like rain gardens, perform both functions. BMPs that address pollutant removal help reduce the possibility of groundwater contamination. Recall the water cycle – if groundwater is contaminated, the streams it feeds will also be contaminated.

### Regulatory Perspective/Solutions

Each level of government plays a role in preserving groundwater quality. The federal Safe Drinking Water Act and Clean Water Act are intended to protect groundwater from contamination. Pennsylvania is given the responsibility to implement some elements of these federal laws, and has enacted additional state regulations that address groundwater quality. However, none of this legislation specifies maintaining the health of water resources at pre-development levels or ensuring adequate groundwater quantity. It is up to our municipal governments to maintain and protect aquifers in their jurisdictions through effective stormwater and land management.

The Stormwater Management Act (Act 167) and the Municipal Planning Code (Act 247) enable municipalities to address groundwater protection. Act 167 authorized a comprehensive watershed stormwater management program that requires local implementation and enforcement.

In Dauphin County, the Conservation District develops stormwater plans for each watershed within the county. After each plan is approved, every municipality in the watershed must adopt ordinances consistent with the plan. Design engineers then incorporate Stormwater BMPs (see article above) into development plans in order to meet the goals of ordinances that establish infiltration rates and address pollutant removal.

Through adoption and enforcement of these ordinances, municipalities can achieve more effective stormwater management, while continuing to provide for growth and development.

The Municipal Planning Code authorizes municipalities to regulate land use. This authority should not be underestimated when it comes to managing groundwater. Because municipal governments

control the nature and placement of new development, they can determine the level of impact new development will have on the land and local water resources. For example, an ordinance allowing for open space development would require that new site plans include a specified amount of land to be retained as undeveloped open space, which can be used for park areas, forested trails, etc. This open space provides permeable surface to allow runoff to infiltrate into the groundwater supply, thereby lessening the impact of development on the underlying aquifer.

Municipalities can also designate and protect critical aquifer recharge areas. These are areas of land that act as the main source of recharge for water supply aquifers. Protecting these areas assures a reliable water supply for homes, water supply providers, commercial establishments, and industries withdrawing water from that aquifer.

Municipalities' vital role in managing stormwater includes protecting our water resources on the surface and below the ground in terms of both quality and quantity. Enacting measures that can reduce pollution will help preserve the health of groundwater and streams; measures that encourage infiltrating runoff into the groundwater supply will help ensure its availability for future use. If we desire reliable, clean sources of groundwater supply in Dauphin County, we need your help in making adequate stormwater management a priority. □

### Next Issue: Floodplains, Wetlands & Buffers

#### Quiz Answers

1-False; 2-True; 3-False; 4-True; 5-True