

# **Bedrock Aquifer Systems of Sullivan County, Indiana**

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August 2010

The occurrence of bedrock aquifers depends on the original composition of the geologic material and subsequent changes which influence the hydraulic properties. Post-depositional processes, which promote jointing, fracturing, and solution activity of exposed bedrock, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability in many places is greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and glacial till act as aquitards, restricting recharge to underlying bedrock aquifers. However, fracturing and/or jointing may occur in aquitards, which can increase recharge to the underlying aquifers. Hydraulic properties of bedrock aquifers are highly variable.

Most bedrock aquifers are under confined conditions, mainly a result of low vertical hydraulic conductivity clay-rich materials, such as glacial till, overlying the bedrock. Therefore, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing zone.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Because the bedrock aquifer systems have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

Two bedrock aquifer systems are identified for Sullivan County. They are, from west to east and younger to older: the McLeansboro Group of Pennsylvanian age; and the Carbondale Group of Pennsylvanian age. Bedrock aquifer systems in Sullivan County are overlain by unconsolidated deposits ranging in thickness from about 4 to 132 feet throughout the county.

The unconsolidated sand and gravel outwash aquifers near the Wabash River have far greater groundwater potential than any of the bedrock aquifers in the county. However, bedrock aquifers are widely used in Sullivan County where unconsolidated sediments are relatively thin and unproductive. Approximately 57 percent of all wells in this county are completed in bedrock. There are no registered significant groundwater withdrawal facilities utilizing bedrock aquifers in this county.

## **Pennsylvanian -- McLeansboro Group Aquifer System**

The McLeansboro Group subcrop area is located in nearly all of Sullivan County except along the eastern portion of the county. This aquifer system consists in descending order of the Mattoon, Bond, Patoka, and Shelburn Formations.

The Mattoon Formation is composed predominately of sandstone, and the Bond and Patoka Formations are composed of sandstone, shale, mudstone, siltstone, and limestone. The underlying Shelburn Formation consists of sandstone, shale, siltstone, mudstone, limestone, and coal. Two important members of the Shelburn Formation include the West Franklin Limestone at the top of the formation and the Busseron Sandstone at the base. These are the primary aquifer units within the McLeansboro Group Aquifer System.

The depth to the bedrock surface ranges from about 4 to 132 feet throughout the county. Total well depths typically range from 30 to 280 feet. The amount of rock penetrated typically ranges from 10 to 200 feet. Most domestic wells produce less than 10 gallons per minute (gpm) with a few dry (pumped) holes reported. Static water levels typically range from 10 to 80 feet below the surface.

In the majority of Sullivan County, the McLeansboro Group Aquifer System has a low susceptibility to surface contamination where thick clay deposits overlie the system. However where overlying clays are thin or absent, these areas are at moderate to high risk to contamination.

## **Pennsylvanian -- Carbondale Group Aquifer System**

The Carbondale Group Aquifer System subcrops in portions of eastern Sullivan County. The group consists in ascending order of the Linton, Petersburg, and Dugger Formations. Bedrock deposits include mostly shale and sandstone with some limestone and commercially important coal.

Depth to the bedrock surface is typically from 10 to 126 feet throughout the county, and well depths generally range from 70 to 265 feet. The amount of rock penetrated ranges from 20 to 200 feet. The Carbondale Group is considered a minor groundwater source with most wells producing from the thicker sandstone and coal units found in the upper formations of the group. Domestic wells typically pump less than 10 gpm and static water levels in the wells are commonly between 10 and 95 feet below the surface with a few dry (pumped) holes reported. Water quality from the deeper bedrock units is highly mineralized.

Where the overlying sediment consists of thick fine-grained clay materials, the Carbondale Group Aquifer System in Sullivan County is at low risk to contamination from the surface or near surface sources. Where bedrock is shallow, risk to contamination from the surface or near surface sources is high.

## **Underground Mine Areas**

In approximately 14 percent of the county various coal seams, primarily within the Carbondale Group, have been extracted by underground mining methods. About 50 percent of most coal seams are removed during mining operations leaving the potential for storage of substantial amounts of water. Although the Division has no records of wells drilled into these mines, yields of a few hundred gpm may be possible. A limitation on use of the water could be its more mineralized nature.

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