

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

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The occurrence of bedrock aquifers depends on the original composition of the rocks 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.

Bedrock aquifer systems in the county are overlain by unconsolidated deposits of varying thickness. Most of the bedrock aquifers in the county are under confined conditions. In other words, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing zone.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and clay 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 the bedrock aquifers are highly variable.

Three bedrock aquifer systems are identified for Spencer County. They are, from west to east and youngest to oldest: the Carbondale Group of Pennsylvanian age; the Raccoon Creek Group of Pennsylvanian age; and the Buffalo Wallow, Stephensport, and West Baden Groups of Mississippian age. Bedrock aquifers are not highly productive in this county. However, bedrock wells represent about 60% of all domestic wells completed in Spencer County.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. However, 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.

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

The outcrop/subcrop area of the Carbondale Group is primarily in the southwestern quarter of Spencer County. Total thickness of the system ranges from less than 1 foot where the Raccoon Creek Group is exposed, to about 130 feet in southwestern Spencer County. The Carbondale Group consists in ascending order of the Linton, Petersburg, and Dugger Formations. The Carbondale Group consists mostly of shales and sandstones with some laterally persistent limestones and 4 of Indiana's commercially important coals.

This system is a minor ground-water source in the county. Most wells produce from the thicker sandstones such as the Coxville Sandstone at the base of the Carbondale Group. In Spencer County, the Coxville Sandstone is most productive where it is near the surface, especially where it is overlain by sand and gravel deposits in stream valleys. Additionally, the coal units in this group are potential ground-water sources.

Bedrock depth is typically less than 60 feet. However, along the Ohio River near the Warrick County line the depth to bedrock is greater than 100 feet. In Spencer County, domestic well depths in the Carbondale Group Aquifer System range from 59 to 265 feet. The amount of rock penetrated by these wells ranges from 19 to 255 feet. Most domestic wells produce less than 5 gallons per minute (gpm) with localized yields of up to 20 gpm. A few (pumped) dry holes have been reported. Static water levels in the wells vary from 6 to 110 feet below the land surface.

Water quality is generally good and the aquifer system is not very susceptible to contamination from the land surface because of low-permeability strata above water-bearing zones. The natural quality of well water gets progressively more mineralized as wells are drilled deeper than 250 feet. This aquifer system is moderately susceptible to surface contamination where overlain by unconsolidated deposits composed primarily of alluvial sands and gravels.

### **Pennsylvanian -- Raccoon Creek Group Aquifer System**

The Raccoon Creek Group Aquifer System outcrop/subcrop area covers most of Spencer County. The group primarily consists of sandstone and shale with minor amounts of mudstone, coal, and limestone. Total thickness of the Raccoon Creek Group ranges from less than 1 foot where the Mississippian rocks are exposed to about 700 feet in southwestern Spencer County. The basal formation of the Raccoon Creek Group, the Mansfield Formation, rests unconformably on the Mississippian rocks. The Pennsylvanian-Mississippian erosional contact surface is quite irregular in elevation, resulting in variable thickness of Mansfield rocks. The lowermost part of the Mansfield commonly contains a large percentage of sandstone.

The depth to the bedrock surface in this county is generally less than 30 feet on the uplands to over 125 feet along the Ohio River. Several of the deeper wells penetrate through the Raccoon Creek Group Aquifer System into the underlying Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System. Wells in the Raccoon Creek Group Aquifer System are commonly completed at depths of 90 to 175 feet. The amount of rock penetrated by wells typically ranges from 45 to 150 feet.

In general, the Raccoon Creek Group Aquifer System is a moderately dependable ground-water source in Spencer County with most wells producing from the Mansfield Formation or various coal seams in the Raccoon Creek Group. Domestic wells typically produce from 1 to 10 gpm with a few dry holes reported. Static water levels are commonly 20 to 90 feet below the surface.

Where the sandstones of the Mansfield Formation and the coal seams of the Raccoon Creek Group and other more porous or jointed rock units are overlain by sand and gravel, such as in a stream valley, somewhat higher sustained yields are possible. St. Meinrad Utilities reported testing a few wells at up to 70 gpm. The wells were drilled in a tributary stream valley to Blackhawk Creek about a mile northwest of Saint Meinrad. These wells were reportedly

producing water from a sandstone aquifer (Mansfield Formation) and a coal seam. However, there is typically little chance for development of high-capacity wells in this aquifer system in Spencer County.

The Raccoon Creek Group Aquifer System in Spencer County is not very susceptible to contamination from the land surface because of low-permeability strata above water-bearing zones. However, this aquifer system is moderately to highly susceptible where overlain by unconsolidated deposits composed primarily of sand and gravel alluvial materials.

### **Mississippian -- Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System**

This Upper Mississippian bedrock aquifer system consists of three groups, from oldest to youngest: West Baden, Stephensport, and Buffalo Wallow. Although present throughout the county beneath younger strata, this system only outcrops in a small area of the northeast corner of the county near the Anderson River. The Buffalo Wallow, Stephensport, and West Baden Groups consists primarily of shale, sandstone, and limestone. Many of the individual rock units are laterally (lithologically) discontinuous.

The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System is about 350 feet thick in northeastern Spencer County and thickens to over 700 feet as it dips beneath the younger Pennsylvanian rocks in the southwestern part of the county. This system is not regarded as a major ground-water resource in Spencer County and very few domestic water wells have been reported in this system. The Buffalo Wallow, Stephensport, and West Baden Groups Aquifer System in this county is moderately susceptible to surface contamination where overlain by unconsolidated deposits composed primarily of alluvial materials along the Anderson River valley.

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