

# **Bedrock Aquifer Systems of Bartholomew 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, such as jointing, fracturing, and solution activity, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability is generally 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 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 the bedrock aquifers are highly variable.

Three bedrock aquifer systems are identified for Bartholomew County. They are, from west to east, youngest to oldest: the Borden Group of Mississippian age; the New Albany Shale of Devonian and Mississippian age; and the Silurian and Devonian Carbonates.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Just as recharge for bedrock aquifers cannot exceed that of overlying unconsolidated deposits, susceptibility to surface contamination will not exceed that of overlying deposits. However, because the bedrock aquifer systems may have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

## **Mississippian -- Borden Group Aquifer System**

In Bartholomew County, the Mississippian age Borden Group Aquifer System is present in most of the western third of the county. This bedrock aquifer system is composed mostly of siltstone and shale, but fine-grained sandstones are also common. Although carbonates are rare, discontinuous interbedded limestone lenses are present, mostly in the upper portion of the group.

The Borden Group in Bartholomew County is up to 600 feet thick and generally thins as it dips to the southwest beneath younger rock formations. Depth to bedrock is typically 20 to 55 feet. Well depths in the Borden Group Aquifer System range from 30 to 400 feet. However, wells are typically completed at depths of 40 to 85 feet and typically penetrate 5 to 50 feet of bedrock.

Because the Borden Group is generally not very productive, it is typically used only where overlying deposits do not contain an aquifer. The Borden Group is commonly described as an aquitard, and yields of wells completed in it are usually quite limited. Many wells, however, are able to produce sufficient water for domestic purposes by relying on extra well-bore storage created by drilling relatively large diameter and relatively deep wells. The yield of most domestic wells completed in the group is less than 10 gallons per minute (gpm). Dry wells have been reported. Static water levels are typically between 10 and 35 feet below surface.

The Borden Group is composed primarily of fine-grained materials that limit the movement of ground water. In areas where overlying clay materials are present, the Borden Group Aquifer System is at low risk to contamination from the surface or near surface. However, in some areas the bedrock is overlain by outwash materials that may be capped by thin deposits of eolian derived loess, colluvium, or lacustrine silt. These areas are at moderate risk to contamination.

### **Devonian and Mississippian -- New Albany Shale Aquifer System**

The New Albany Shale Aquifer System in Bartholomew County is an extremely limited ground-water resource. This aquifer system consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone.

The New Albany Shale in Bartholomew County can be up to 120 feet thick and generally thickens as it dips southwest beneath younger strata. The outcrop/subcrop area is present along an approximate north-south band of the west-central portion of the county and along the eastern south-central edge of the county. Depth to bedrock is typically 30 to 75 feet. Completed well depths are typically 60 to 130 feet and penetrate 10 to 70 feet of bedrock.

This aquifer system is considered a poor ground-water resource and is generally described as an aquitard. However, a few domestic wells have been completed in this system. Typical yields are 10 gpm or less with some dry holes reported. Static water levels typically range from 10 to 40 feet below surface.

The permeability of shale materials is considered low. The New Albany Shale Aquifer System, therefore, has a low susceptibility to contamination introduced at or near the surface.

## **Silurian and Devonian Carbonates Aquifer System**

In Bartholomew County, the outcrop/subcrop area of the Silurian and Devonian Carbonates Aquifer System is present along most of the eastern half of the county. This system includes middle-Devonian age carbonates (limestone and dolomite) of the Muscatatuck Group and the underlying carbonates of Silurian age. Because carbonate units of Silurian and Devonian age are similar, and cannot easily be distinguished on the basis of water well records, they are considered as a single water-bearing system.

The Muscatatuck Group in Bartholomew County is up to 75 feet thick and generally increases in thickness as it dips to the southwest beneath younger rock formations. The underlying Silurian carbonates are up to 150 feet thick and also thicken as they dip to the southwest. The combined thickness, therefore, is up to 225 feet with depth to bedrock typically 20 to 50 feet below surface. Completed well depths range from 20 to 365 feet, but are typically 60 to 110 feet. The typical amount of bedrock penetrated ranges from 25 to 70 feet.

In Bartholomew County, water wells in the Silurian and Devonian Carbonates Aquifer System are capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields range from 5 to 20 gpm. Two facilities with high-capacity wells have reported yields that range from 90 to 450 gpm. Static water levels range from 15 to 40 feet below surface with some drillers reporting “flowing” wells.

Most of the Silurian and Devonian Carbonates Aquifer System is overlain by thick clay deposits. Therefore, most of the aquifer system is considered at low risk to contamination. However, in some areas the aquifer system is overlain by unconsolidated deposits composed primarily of sand and gravel outwash materials. These deposits may have thin clay at the surface. In such areas, the aquifer system is considered at moderate to high risk.

### **Registered Significant Ground-Water Withdrawal Facilities**

There are two registered ground-water withdrawal facilities (total of 7 wells) in the county using the Silurian and Devonian Carbonates Aquifer System. Refer to Table 1 for some details on the wells and to the maps for facility locations.

### **Map Use and Disclaimer Statement**

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