

Bedrock Aquifer Systems of Warren 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.

Unconsolidated deposits of varying thickness overlie bedrock aquifer systems in Warren County. Thickness of unconsolidated deposits overlying bedrock generally range from outcropping along isolated sections of the Wabash River and Big Pine Creek, to an estimated 380 feet where a section of a major bedrock valley, the Lafayette (Teays) Bedrock Valley System, is present. Most of the bedrock aquifers, therefore, 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 formation.

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.

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.

Three bedrock aquifer systems are identified for Warren County. They are the Pennsylvanian Raccoon Creek Group; the Mississippian Borden Group; and the Devonian and Mississippian New Albany Shale.

Pennsylvanian -- Raccoon Creek Group Aquifer System

In Warren County the Raccoon Creek Group Aquifer System subcrops throughout most of the western two-thirds of the county. In places, bedrock is at the surface along portions of Big Pine Creek. Bedrock consists of mostly sandstone and shale with minor amounts of mudstone, coal, and limestone.

The Raccoon Creek Group Aquifer System is generally considered a limited groundwater resource. Depth to bedrock generally ranges from 50 to 150 feet. Wells completed in this system are typically 110 to 250 feet deep with 30 to 150 feet of penetration into the bedrock. Domestic well capacities range from 4 to 15 gallons per minute (gpm) with static water levels of 30 to 80 feet below surface. Capacities up to 50 gpm have been reported in isolated areas. However, higher yields are associated with greater drawdown.

Areas where clay materials overlying bedrock are generally thick are considered at low risk to contamination. However, in places clay materials are thin or bedrock is at the surface. Therefore, these areas are considered at high risk to contamination.

Mississippian -- Borden Group Aquifer System

The Mississippian age Borden Group Aquifer System subcrop area is present in portions of the northern boundary and eastern third of Warren County. In places, bedrock outcrops along the northern half of the Wabash River. This bedrock aquifer system is composed of siltstone and shale, but fine-grained sandstones are also common. Although carbonates are rare, discontinuous interbedded limestone lenses are present, mainly in the upper portion of the group. Thickness of the Borden Group in Warren County is estimated up to 700 feet.

Few wells produce from the Borden Group Aquifer System in Warren County. Depth to bedrock ranges from 0 to 182 feet and well depths are from 50 to 356 feet for the few wells that appear to utilize the Borden Group Aquifer System. Domestic well yields range from 1 to 20 gpm with some dry holes reported. There is one registered significant groundwater withdrawal system (4 wells) with yields that range from 25 to 75 gpm. However, higher yields are typically associated with greater drawdown. Static water levels range from 5 to 125 feet below surface.

The Borden Group is composed primarily of fine-grained materials that limit the movement of ground water and is generally overlain with thick clay materials. The Borden Group Aquifer System, therefore, is at low to moderate risk to contamination from the surface or near surface.

Devonian and Mississippian -- New Albany Shale Aquifer System

The New Albany Shale Aquifer System in Warren County is an extremely limited groundwater resource. The subcrop area for the New Albany Shale is present along a portion of northeastern Warren County. This aquifer system consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone. Thickness of the New Albany Shale in Warren County is generally less than 100 feet.

The New Albany Shale is often described as an aquitard and yields of wells completed in it are typically quite limited. In Warren County no known wells are completed in the New Albany Shale due to the availability of prolific unconsolidated aquifer deposits overlying the bedrock surface. However, in nearby Benton and Tippecanoe counties domestic water well yields of up to 10 gpm have been reported along with many dry holes.

Because the permeability of shale materials is considered low and thick clay deposits generally overlie the New Albany Shale Aquifer System, susceptibility to contamination introduced at or near the surface is low.

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