

Bedrock Aquifer Systems of Switzerland County, Indiana

By

Randal D. Maier

Division of Water, Resource Assessment Section

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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 Switzerland 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.

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

Three bedrock aquifer systems are identified for Switzerland County. They are, from west to east, youngest to oldest: the Silurian and Devonian Carbonates; the Maquoketa Group of Ordovician age; and the Trenton/Lexington, and Black River Carbonates of Ordovician age.

Silurian and Devonian Carbonates Aquifer System

In Switzerland County, the Silurian and Devonian Carbonates Aquifer System is limited to the upland area in the extreme northwestern corner of the county. This system includes mainly lower Silurian carbonate rock units (limestone and dolomite) of the Louisville Limestone through the Brassfield Limestone.

Few reported wells penetrate the Silurian and Devonian Carbonates Aquifer System in Switzerland County. The aquifer system is thin and most wells are completed in the

underlying Ordovician bedrock of the Maquoketa Group. However, the Silurian and Devonian Carbonates Aquifer System is described in bordering counties (Jefferson and Ripley). The system is reported to have the capability of sustaining yields for domestic users with yields that range from 1 to 10 gallons per minute (gpm); although some dry holes are noted. Static water levels range from 10 to 35 feet.

Most of the Silurian and Devonian Carbonates Aquifer System in Switzerland County is overlain by variable clay thicknesses. Therefore, the aquifer system is considered at low to moderate risk to contamination.

Ordovician -- Maquoketa Group Aquifer System

The outcrop/subcrop area of the Maquoketa Group includes nearly all of Switzerland County. The Maquoketa Group consists of in ascending order: the Kope, the Dillsboro, and the Whitewater Formations. This bedrock aquifer system includes mostly shale with some interbedded limestone units. However, the uppermost Whitewater Formation includes a greater percentage of limestone. Thickness of the Maquoketa Group in Switzerland County is up to 850 feet and thins as it dips beneath the Silurian rocks to the northwest.

Few wells have been reported in this system in Switzerland County. The depth to the bedrock surface is generally 15 to 30 feet. Reported depths of wells drilled in the Maquoketa Group range from 60 to 150 feet with the amount of rock penetration typically 5 to 55 feet. Well yields range from less than 1 gpm to 10 gpm with static water levels ranging from 15 to 30 feet. However, many practically dry holes have been reported.

Except in areas of limited karst development or where overlying clay-rich till and residuum is thin or absent, this aquifer system is not very susceptible to contamination from the land surface.

Trenton/Lexington and Black River Carbonates Aquifer System

The Trenton/Lexington and Black River Carbonates Aquifer System outcrop/subcrop area is present along a narrow strip of the Ohio River Valley that extends roughly from the mouth of Indian Creek upstream to the county line. In Switzerland County this system only includes rocks of the Lexington Limestone and the underlying Black River Group. Thickness of the Lexington Limestone is approximately 200 to 250 feet and includes fossiliferous limestone with some interbedded shale. The underlying Black River Group is about 275 feet thick in Switzerland County and is described as a dense crystalline limestone.

Few wells utilize the Trenton/Lexington and Black River Carbonates Aquifer System. This is mainly due to the highly mineralized and saline water from the carbonates, and, the availability of thick outwash sediments along the Ohio River floodplain. However, not all of the Trenton/Lexington and Black River Carbonates Aquifer System outcrop/subcrop area is overlain by outwash and a few wells are completed in the bedrock. Reported well depths range from 40 to 255 feet with the depth to bedrock ranging from 10 to 120 feet. Well yields range from less than 1 gpm to 7 gpm with some dry holes reported. Static water levels range from 15 to 80 feet below surface.

Susceptibility of the Trenton/Lexington and Black River Carbonates Aquifer System is moderate to high where outwash sands and gravels directly overlie bedrock and low where clays and silts are present.

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