Bedrock Aquifer Systems of Ripley County, Indiana

by
Gregory P. Schrader
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, 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. In Ripley County, rock types exposed at the bedrock surface are relatively poorly productive limestones and dolomites with varying amounts of interbedded shales to poorly productive shales with limestone interbeds.

Bedrock aquifer systems in the county are overlain by unconsolidated deposits of varying thickness. Refer to the map for unconsolidated aquifer systems for more information. 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.

Two bedrock aquifer systems are identified for Ripley County. They are, from west to east and younger to older: Silurian and Devonian Carbonates and the Maquoketa Group of Ordovician age. The county is nearly evenly divided between the two bedrock aquifer systems by a north-northwest to south-southeast trending contact. The Maquoketa Group is also exposed in the western part of the county, where streams have incised deeply enough into the gently southwest-dipping strata to completely remove overlying Silurian and Devonian age rocks.

Bedrock aquifers are only minor sources of ground water in this county. Bedrock wells are more common in the southern part of the county (south of Versailles) where unconsolidated materials are thin. However, over 30 percent of bedrock wells in this area have extremely poor yields (dry holes or pumped dry when originally tested). Low-production large diameter wells using the unconsolidated materials above the shallow bedrock are also common in this area.

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 have complex

fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

Silurian and Devonian Carbonates Aquifer System

This bedrock aquifer system includes primarily Silurian and early Devonian age carbonates in the outcrop/subcrop area in Ripley County. This aquifer system also includes the overlying middle Devonian age Muscatatuck Group, where it is present in an extremely small area (about 1 square mile) in the southwestern part of the county. Because units of the Silurian and Devonian system are composed of similar carbonate rock types, and cannot easily be distinguished on the basis of water well records, they are considered as a single water-bearing system. It is composed mostly of limestone and dolomite with some interbedded shale units. The outcrop/subcrop area of the Silurian and Devonian carbonates covers roughly the western half of the county, but these rocks are absent where larger streams have cut down to expose the underlying Maquoketa Group. In this county the thickness of the Silurian and Devonian Carbonates Aquifer System is less than 100 feet.

The depth to the bedrock surface in the Silurian and Devonian Carbonates is generally less than 50 feet. Very few wells are completed in the Silurian and Devonian Carbonates Aquifer System in this county. Although some produce over 5 gallons per minute (gpm), most of these wells are reported to be dry or pumped dry. Most bedrock wells within the outcrop/subcrop area extend into the deeper carbonates of the underlying Maquoketa Group, because the Silurian and Devonian Carbonates Aquifer System lacks sufficient thickness to allow reliable well production for most domestic needs.

This aquifer system is generally not very susceptible to contamination from the land surface, except where karst development is significant or where overlying clay-rich till and residuum is thin or absent.

Ordovician -- Maquoketa Group Aquifer System

The outcrop/subcrop of the Maquoketa Group in Ripley County covers much of the eastern half of the county and many bedrock valleys in the western part of the county. The Maquoketa Group consists in ascending order of the Kope, Dillsboro, and Whitewater Formations. It unconformably overlies the Trenton Limestone and Lexington Limestone in the northwestern and southeastern parts of the county, respectively. Between these areas, in a band trending southwest to northeast, the Maquoketa Group directly overlies the Black River Group due to the absence of the Trenton and Lexington Limestones. The Maquoketa Group consists mostly of shales with interbedded limestone units. Although this system is approximately 800 to 900 feet thick in the county, few wells have used more than the top 100 feet for water production.

The Maquoketa Group is considered a minor ground-water source in the county. Most wells for homes, irrigation, and stock produce between 1 and 5 gpm. Localized yields may exceed 20 gpm; however, (pumped) dry holes are quite common.

The depth to the bedrock surface is typically 10 to 45 feet. Well depths in the Maquoketa Group range from 35 to 160 feet (a 500-foot deep dry hole is reported) but wells are commonly constructed at depths between 60 and 105 feet. The amount of rock penetrated by these wells commonly ranges from 30 to 90 feet with a maximum of 140 feet. Static water levels in the wells vary from 4 to 85 feet below the land surface, but are typically between 11 and 35 feet below the surface.

Except in areas of significant 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. Karst development is predominately confined to the outcrop/subcrop area of the Whitewater Formation.

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