Bedrock Aquifer Systems of Madison County, Indiana

by
Robert A. Scott
Division of Water, Resource Assessment Section
August 2010

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 Madison County are overlain by unconsolidated deposits of varying thickness ranging from bedrock exposure in Fall Creek at Pendleton to over 350 feet in a buried bedrock valley located south of Chesterfield. Bedrock, in places, is at or near the surface along several streams in the county.

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 bedrock aquifers are highly variable.

Most bedrock aquifers in the county are under confined conditions, mainly a result of low vertical hydraulic conductivity clay-rich materials, such as glacial till, overlying the bedrock. Therefore, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing zone.

Two bedrock aquifer systems are identified for Madison County. They are, from west to east and younger to older: the Silurian and Devonian Carbonates and the Maquoketa Group of Ordovician age. Approximately 49 percent of all wells in this county are completed in bedrock.

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.

Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System subcrops throughout nearly all of Madison County. Wells penetrating the Silurian and Devonian Carbonates Aquifer System have reported depths ranging from 25 to 480 feet, but are commonly 90 to 220 feet deep. The amount of rock penetrated in this system typically ranges from 30 to 132 feet.

Wells utilizing the Silurian and Devonian Carbonates Aquifer System are generally capable of meeting the needs of domestic and some high-capacity users in this county. Domestic well yields commonly range from 8 to 26 gallons per minute (gpm). Static water levels typically range from 15 to 36 feet below the land surface. A few flowing wells have been reported for this bedrock aquifer system in the county. There are 12 registered significant groundwater withdrawal facilities (34 wells) utilizing the Silurian and Devonian Carbonates Aquifer System in Madison County. High-capacity well depths range from approximately 100 to 400 feet below the land surface. Reported high-capacity well yields range from 90 gpm to nearly 500 gpm.

This aquifer system is generally not very susceptible to surface contamination due to thick clay deposits over most of the county. However, there are localized areas, especially near the White River, where the bedrock surface is shallow. These areas, therefore, are at moderate to high risk to contamination.

Ordovician -- Maquoketa Group Aquifer System

The extent of the Maquoketa Group Aquifer System subcrop area is limited to a buried pre-glacial bedrock valley located in central Madison County. The Maquoketa Group consists mostly of shale with interbedded limestone units.

Few wells have been reported in this system in Madison County mostly due to the availability of overlying unconsolidated sand and gravel aquifer resources. However, wells completed in the Maquoketa Group Aquifer System are generally capable of meeting the needs of domestic users in this county. Reported depths of the few wells utilizing this system range from 170 to 270 feet with the amount of rock penetration typically 5 to 85 feet. Reported well yields range from 6 to 28 gpm with static water levels ranging from 22 to 42 feet. There are no registered significant groundwater withdrawal facilities utilizing the Maquoketa Group Aquifer System in Madison County.

The Maquoketa Group Aquifer System is generally not very susceptible to contamination from the land surface because thick layers of clay-rich material overlie the bedrock.

Map Use and Disclaimer Statement

We request that the following agency be acknowledged in products derived from this map: Indiana Department of Natural Resources, Division of Water.

This map was compiled by staff of the Indiana Department of Natural Resources, Division of Water using data believed to be reasonably accurate. However, a degree of error is inherent in all maps. This product is distributed “as is” without warranties of any kind, either expressed or implied. This map is intended for use only at the published scale.