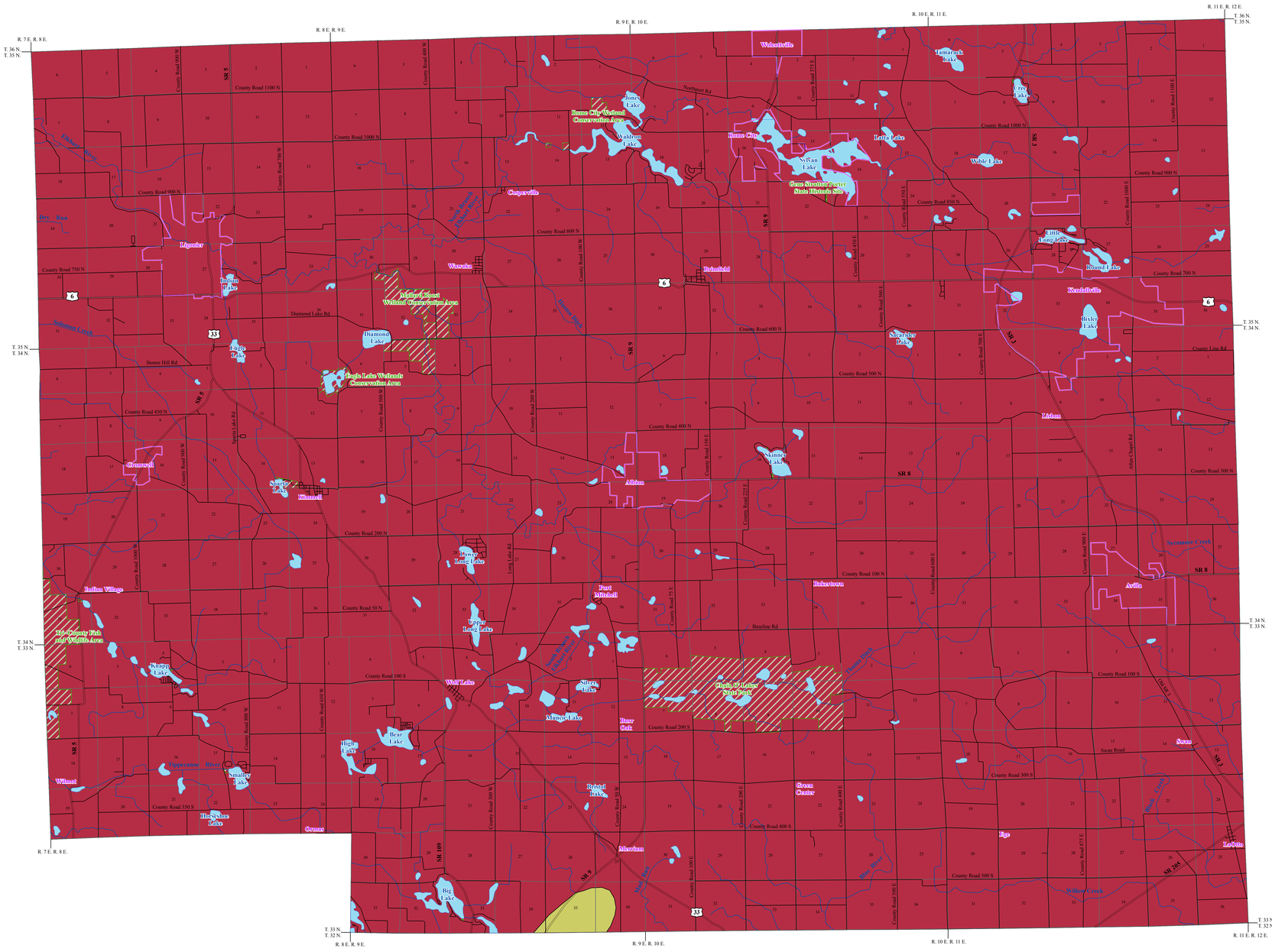
BEDROCK AQUIFER SYSTEMS OF NOBLE COUNTY, INDIANA



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.

The bedrock aquifer systems in Noble County are overlain by unconsolidated deposits of varying thickness, ranging from around 200 feet to more than 450 feet. The unconsolidated thickness is typically greater than 300 feet in the county. 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.

Two bedrock aquifer systems are identified for Noble County. They are, from younger to older: the Devonian and Mississippian Coldwater, Ellsworth and Antrim Shales; and the Silurian and Devonian Carbonates.

Devonian and Mississippian -- Coldwater, Ellsworth and Antrim Shales Aquifer System

The subcrop area for this system covers nearly all of Noble County, except for a small area south of Merriam where the system has been eroded away. The Coldwater, Ellsworth and Antrim Shales Aquifer System is overlain by between 200 and 450 feet of unconsolidated deposits. This system is generally less than 100 feet thick in Noble County; however, it reaches a thickness of approximately 250 feet along the northeastern corner of the county.

In Noble County the Coldwater Shale and Ellsworth Shale subcrop in the northern third of the county while the Antrim Shale subcrops in the southern two-thirds. The Coldwater is typically described as greenish to bluish shales, the Antrim Shale in Indiana is described as brownish-black shale and the Ellsworth is described as greenish-gray shale. These shales are commonly considered an aquitard; therefore, the system is an extremely limited ground-water resource. However, in some places the lower portion of the aquifer unit may contain some limestone.

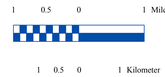
Due to the availability of ground water in the overlying unconsolidated aquifers no reported wells have been completed in the Coldwater, Ellsworth and Antrim Shales Aquifer System in Noble County. Because the permeability of shale materials is considered low and the overlying unconsolidated deposits are thick, susceptibility to contamination introduced at or near the surface is low.

Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System subcrops in a small area south of Merriam along the southern county line. In Noble County the only unit that subcrops in this aquifer system is the Muscatatuck Group of middle Devonian age. Total thickness of this aquifer system exceeds 870 feet in places. Depth to bedrock in this system ranges from around 350 to more than 400 feet.

Due to the availability of the overlying unconsolidated resources very few wells have been completed in the Silurian and Devonian Carbonates Aquifer System. The reported domestic wells utilizing this system in Noble County have depths ranging from 402 to 444 feet deep. The amount of rock penetrated in this system varies from 17 to about 25 feet. Domestic well yields range from 10 to 55 gallons per minute. Static water levels are between 72 to 100 feet below the land surface. In Noble County the Silurian and Devonian Carbonates Aquifer System has a low susceptibility to surface contamination because thick clay deposits overlie the system.

Location Map



EXPLANATION

- Stream
- County Road
- State Road & US Highway
- Municipal Boundary
- State Managed Property
- Lake & River

INDIANA DEPARTMENT OF NATURAL RESOURCES

Map generated by Scott H. Dean
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This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) and County Boundaries of Indiana (polygon shapefile, 20020621), were all from the Indiana Geological Survey and based on a 1:24,000 scale, except the Bedrock Geology of Indiana (polygon shapefile, 20020318), which was at a 1:500,000 scale. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Populated Areas in Indiana 2000 (polygon shapefile, 20021000) was from the U.S. Census Bureau and based on a 1:100,000 scale. Streams27 (line shapefile, 20000420 was from the Center for Advanced Applications in GIS at Purdue University. Managed Areas 96 (polygon shapefile, various dates) was from IDNR.

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