BEDROCK AQUIFER SYSTEMS OF STARKE 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.

In Starke County thickness of unconsolidated deposits overlying bedrock ranges from approximately 35 feet in the southwest near the Kankakee River, to as much as 212 feet in the east-central portion of the county. 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.

Two bedrock aquifer systems are identified for Starke County. They are the Devonian and Mississippian Coldwater, Ellsworth and Antrim Shales; and the Silurian and Devonian Carbonates. Approximately 10 percent of all field located wells in Starke County are completed in bedrock.

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

In Starke County only the Ellsworth and Antrim Shale subcrops in the Coldwater, Ellsworth and Antrim Shales Aquifer System. The Ellsworth Shale is comprised of alternating beds of gray-green to brownish black shale. The Antrim Shale is typically described as brownish-black shale. However, in some places the lower portion of the Antrim Shale may contain some limestone. The subcrop area for the Antrim Shale includes most of central Starke County and the subcrop area for the Ellsworth shale includes the northwestern part of the county. In general, reported thickness of the Antrim and Ellsworth shales in the subcrop area ranges from 10 to 129 feet.

Few wells utilize the Coldwater, Ellsworth and Antrim Shales Aquifer System. Shale is commonly considered an aquitard and therefore, the system is an extremely limited groundwater resource. In Starke County, most domestic wells either produce from the overlying unconsolidated deposits or penetrate through the shale in favor of the underlying Silurian and Devonian Carbonates. However, a few wells report capacities up to 10 gallons per minute (gpm). Reported depth to bedrock generally ranges from 35 to 153 feet. It is likely that these wells are under the influence of overlying sands and gravels.

Because the permeability of shale materials is considered low, susceptibility to contamination introduced at or near the surface is low. However, areas where outwash deposits directly overly fractured bedrock are at moderate to high risk to contamination.

Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System subcrops along the southeastern and south-central portions of Starke County. The system includes Devonian age carbonate units of the Muscatatuck Group. Total thickness of the Devonian bedrock generally ranges from about 85 to 150 feet.

Few wells are reported in the Silurian and Devonian Carbonates Aquifer System. However, in some isolated areas drillers bypass the unconsolidated resources and utilize the underlying bedrock aquifer. Depth to the bedrock surface is approximately 150 feet, although most wells that reportedly use the system penetrate through the overlying Ellsworth and Antrim shales outside the subcrop area.

The Silurian and Devonian Carbonates Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Total well depths range from 80 to 301 feet. Domestic yields generally range from 1 to 45 gpm with static water levels from 6 to 36 feet. There are 8 registered significant groundwater withdrawal facilities (10 wells) utilizing the Silurian and Devonian Carbonates Aquifer System with reported yields of individual wells ranging from 90 to 850 gpm.

Much of the Silurian and Devonian Carbonates Aquifer System in Starke County is overlain by sands and gravels with intermittent clay deposits. These areas are generally considered at moderate to high risk to contamination. However, most wells completed in this aquifer system are outside the subcrop area and penetrate through the overlying Ellsworth and Antrim shales. These areas are at moderate to low risk to contamination.

INDIANA DEPARTMENT OF NATURAL RESOURCES

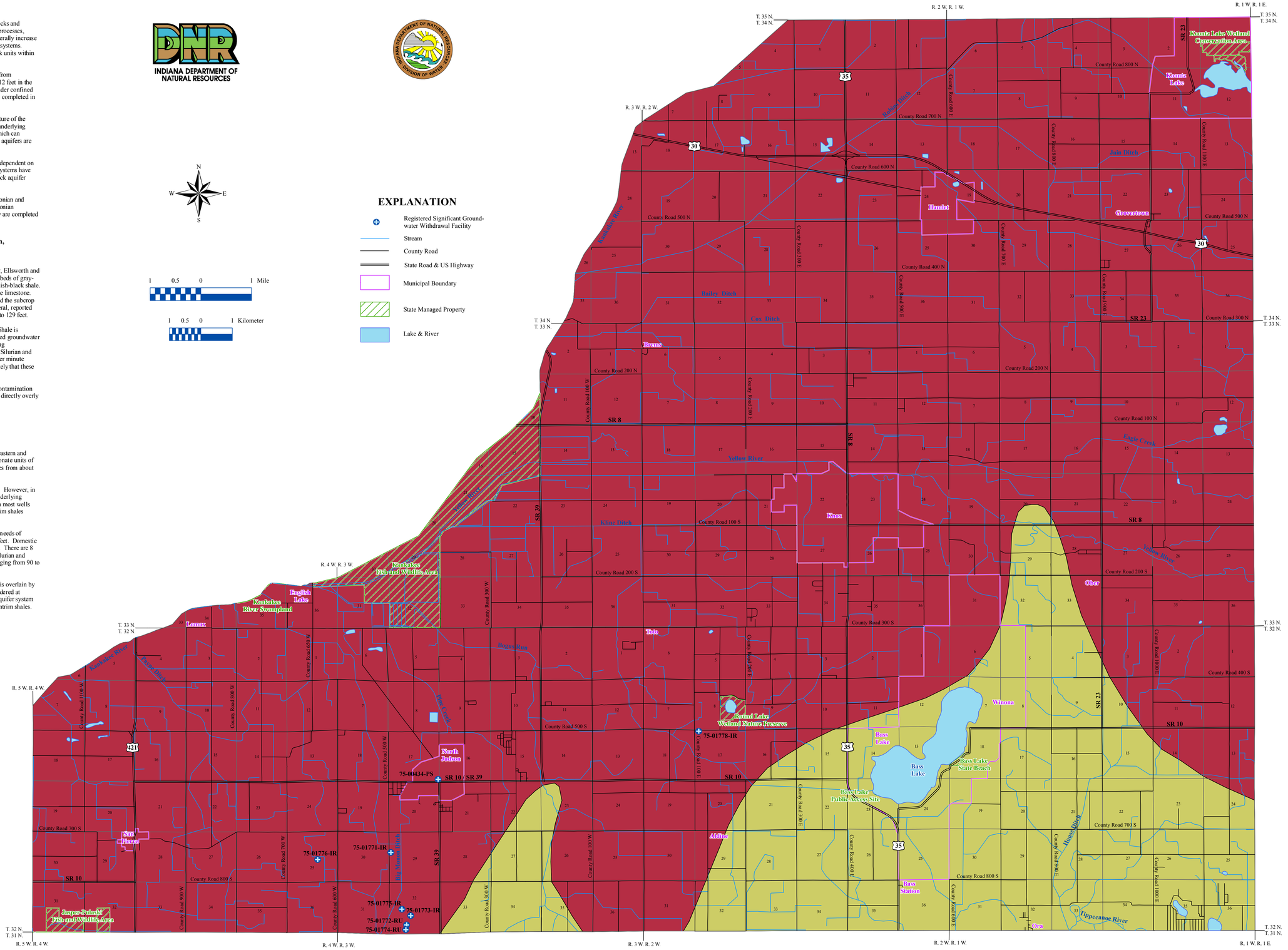
N W E S

1 0.5 0 1 Mile

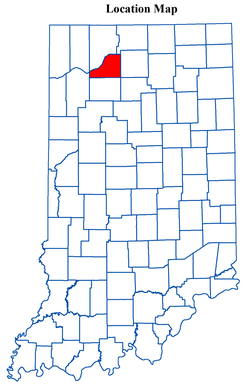
1 0.5 0 1 Kilometer

EXPLANATION

- Registered Significant Ground-water Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Municipal Boundary
- State Managed Property
- Lake & River



Location Map



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.

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