BEDROCK AQUIFER SYSTEMS OF VANDERBURGH 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.

Bedrock aquifer systems in the county are overlain by unconsolidated deposits of varying thickness in Vanderburgh County. The unconsolidated outwash aquifers near the Ohio River have far greater ground-water potential than any of the bedrock aquifers in the county. However, bedrock aquifers are widely used in Vanderburgh County because unconsolidated sediments throughout the rest of the county are relatively thin and unproductive. 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 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 Vanderburgh County. They are, from west to east and younger to older: McLeansboro Group of Pennsylvanian age and Carbondale Group of Pennsylvanian age.

Pennsylvanian -- McLeansboro Group Aquifer System

The outcrop/subcrop area of the McLeansboro Group covers about 72 percent of Vanderburgh County. Thickness of the McLeansboro ranges from 0 feet at its eastern contact with the underlying Carbondale Group to about 420 feet along the western county line near St. Wendel. This aquifer system consists in ascending order of the Shelburn, Patoka, Bond, and Mattoon Formations. However, the Mattoon Formation is not present in Vanderburgh County.

Formations within the McLeansboro Group consist primarily of shale and sandstone with minor amounts of siltstone, limestone, clay, and coal. Several sandstone units are widely utilized as aquifers in the county. The Shelburn Formation contains the Busseron Sandstone Member at or near its base. The sandstone is typically gray to tan in color, fine to medium-grained, and massive. It is interbedded in places with gray shale. In much of the area where the Busseron Sandstone is present, it lies at least 200 feet below land surface, yet is commonly used in places where shallower sandstone units are absent or unproductive. Overlying the Shelburn Formation is the Patoka Formation, which contains the Inglefield Sandstone Member, its chief water-bearing unit, near its base. The Inglefield Sandstone is gray to white in color, fine-grained, and thin to thick bedded. In the northwestern part of the county, this sandstone aquifer is more than 100 feet below the surface. Toward the east and south, the Inglefield Sandstone becomes progressively shallower (less than 10 feet below surface in places). Except where downcutting streams have removed it by erosion, the Inglefield Sandstone is present in the outcrop/subcrop area of the McLeansboro Group in Vanderburgh County and is relied upon for domestic water production regardless of its depth. The Bond Formation, which is only present in the uplands along the western county line, contains the St. Wendel Sandstone Member. Although this medium-grained, massive sandstone is quite shallow and nearly 70 feet thick in places, few wells are completed in the St. Wendel Sandstone. Rather, it is commonly bypassed in favor of the Inglefield Sandstone.

The depth to the bedrock surface in the McLeansboro Group is generally less than 30 feet in Vanderburgh County. Wells range in depth from 20 to 385 feet, but are typically 75 to 180 feet deep. The amount of rock penetrated commonly ranges from 55 to 160 feet. Static water levels in wells developed in this aquifer system range from 1 to 185 feet below land surface, but are generally between 30 and 90 feet below the surface. Domestic wells typically produce between 4 and 15 gallons per minute (gpm). A few (pumped) dry holes have been reported. The McLeansboro Group Aquifer System in Vanderburgh County is an important ground-water source with most wells producing from the Inglefield Sandstone.

Most of the McLeansboro Group Aquifer System contains fine-grained materials that limit the movement of ground water. However, in some areas alluvial and lacustrine materials directly overlie the bedrock surface. Therefore, the aquifer system is considered low to moderate risk to contamination.

Pennsylvanian -- Carbondale Group Aquifer System

The outcrop/subcrop of the Carbondale Group in Vanderburgh County occurs only in bedrock valleys in the eastern and southern parts of the county. The group consists in ascending order of the Linton, Petersburg, and Dugger Formations. The Carbondale Group consists mostly of shales and sandstones with some limestone and commercially important coals. Thickness of the Carbondale Group in Vanderburgh County ranges from about 350 feet in the deepest parts of the Ohio River Valley, where much of the Dugger Formation has been eroded, to about 450 feet.

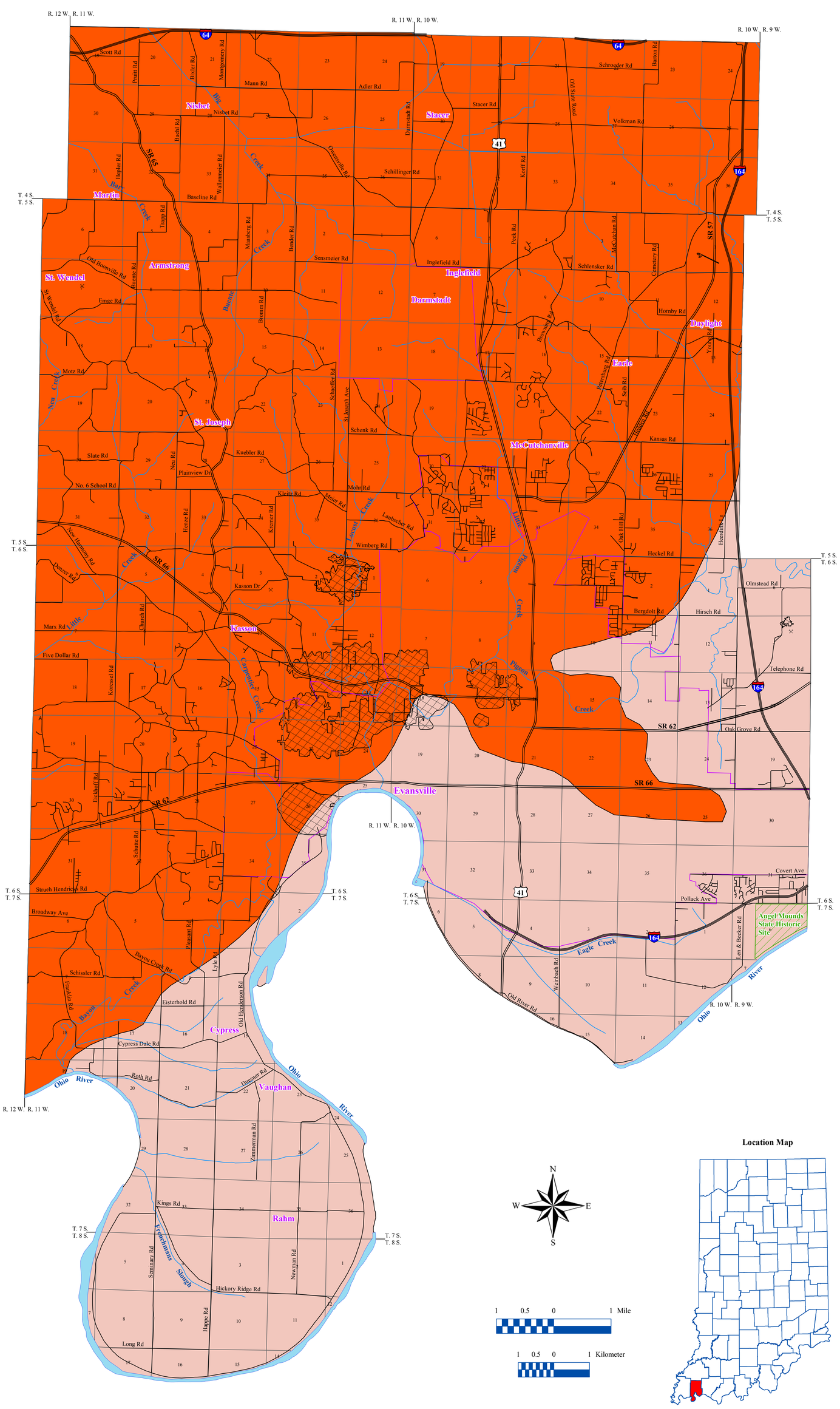
The depth to the bedrock surface in this aquifer system is typically 25 to 95 feet. Well depths range from about 40 to 290 feet, but are generally completed at depths of 100 to 190 feet and commonly penetrate 40 to 130 feet of bedrock. The Carbondale Group is considered a minor ground-water source with domestic wells typically producing 2 to 10 gpm. Static water levels in the wells vary from 2 to 160 feet below the land surface, but are generally between 20 and 50 feet below the surface.

Commonly, water is produced from the thicker sandstone and coal units in the upper formations of the Carbondale Group. Localized yields are greater in areas where outwash and alluvial sands and gravels directly overlie bedrock. A few (pumped) dry holes have been reported. However, one discontinued coal mine dewatering well near the Warrick County line was completed in a deeper sandstone near the base of the Linton Formation. This well had a reported yield of 200 gpm. The natural quality of well water degrades and the water gets progressively more mineralized as wells are drilled deeper than about 300 feet.

In areas where overlying clay materials are present, the Carbondale Group Aquifer System is at low risk to contamination. However, in some areas outwash, alluvial, and lacustrine materials directly overlie the bedrock surface. These areas are at moderate to high risk from surface contamination.

Underground Mine Areas

In about 2 percent of the county various coal seams within the Carbondale Group have been removed by underground mining methods. In underground mines, approximately 50 percent of the coal seam was typically removed, leaving the potential for storage of substantial amounts of water in the larger mines. Although the Division has no records of wells drilled into these mines, yields of a few hundred gpm are possible. A limitation on use of the water could be its more mineralized nature.



EXPLANATION

- Small Underground Mine (Abandoned)
- County Road
- State Road & US Highway
- Interstate
- Stream
- Lake & River
- Municipal Boundary
- State Managed Property

INDIANA DEPARTMENT OF NATURAL RESOURCES

Location Map

1 0.5 0 1 Mile

1 0.5 0 1 Kilometer

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This map was created from several existing shapefiles. Underground Coal Mines in Southwestern Indiana (polygon shapefile, 20001002), Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621), and County Boundaries of Indiana (polygon shapefile, 20050621) were all from the Indiana Geological Survey and based on a 1:24,000 scale, except the Bedrock Geology of Southwestern Indiana (polygon shapefile, 20001124), which was at a 1:500,000 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. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scales.

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