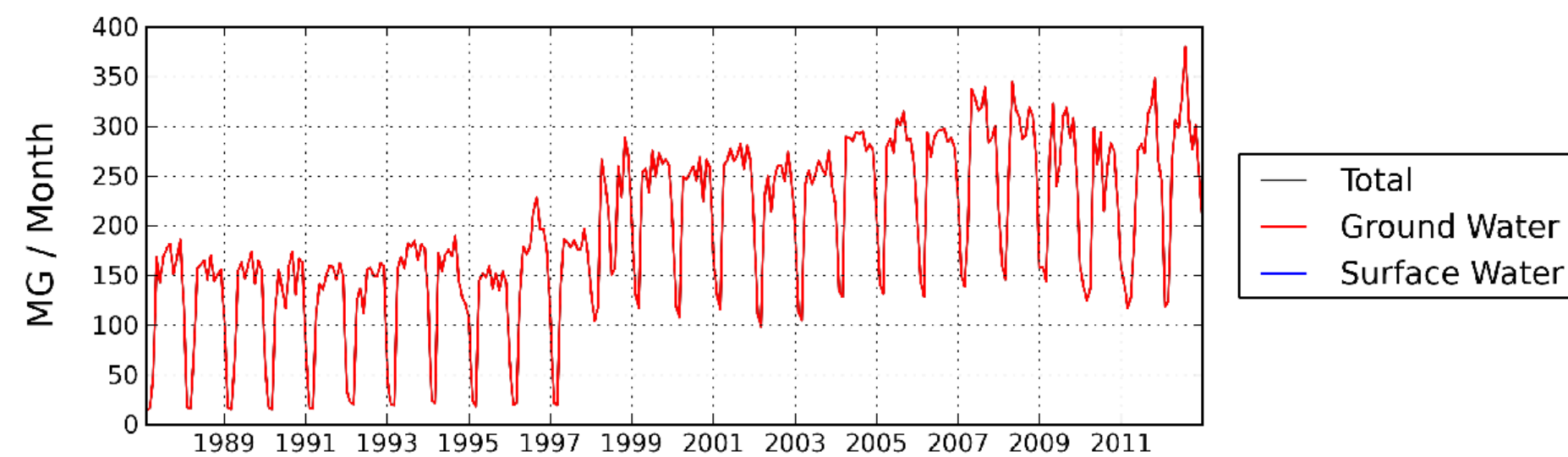
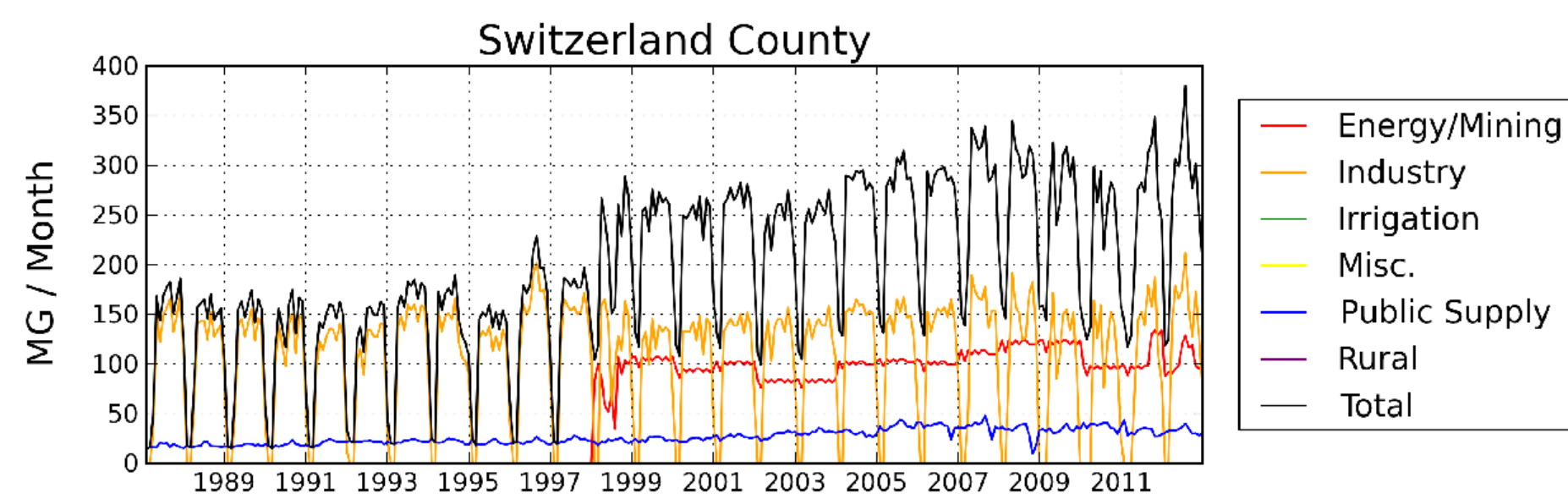


Average Daily Use: 8.7 MGD

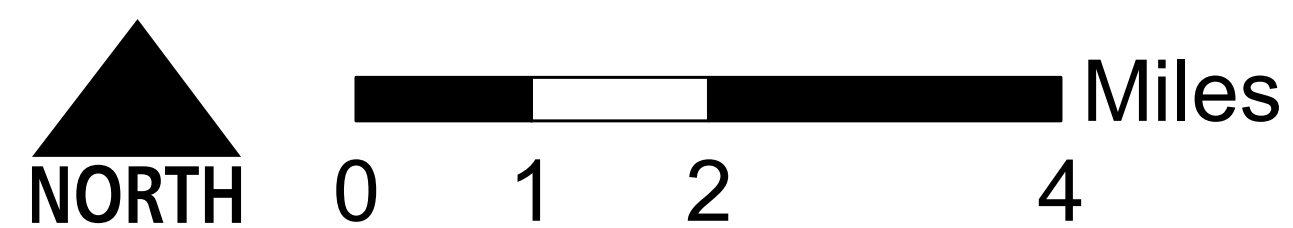


Water Resources and Use in Switzerland County

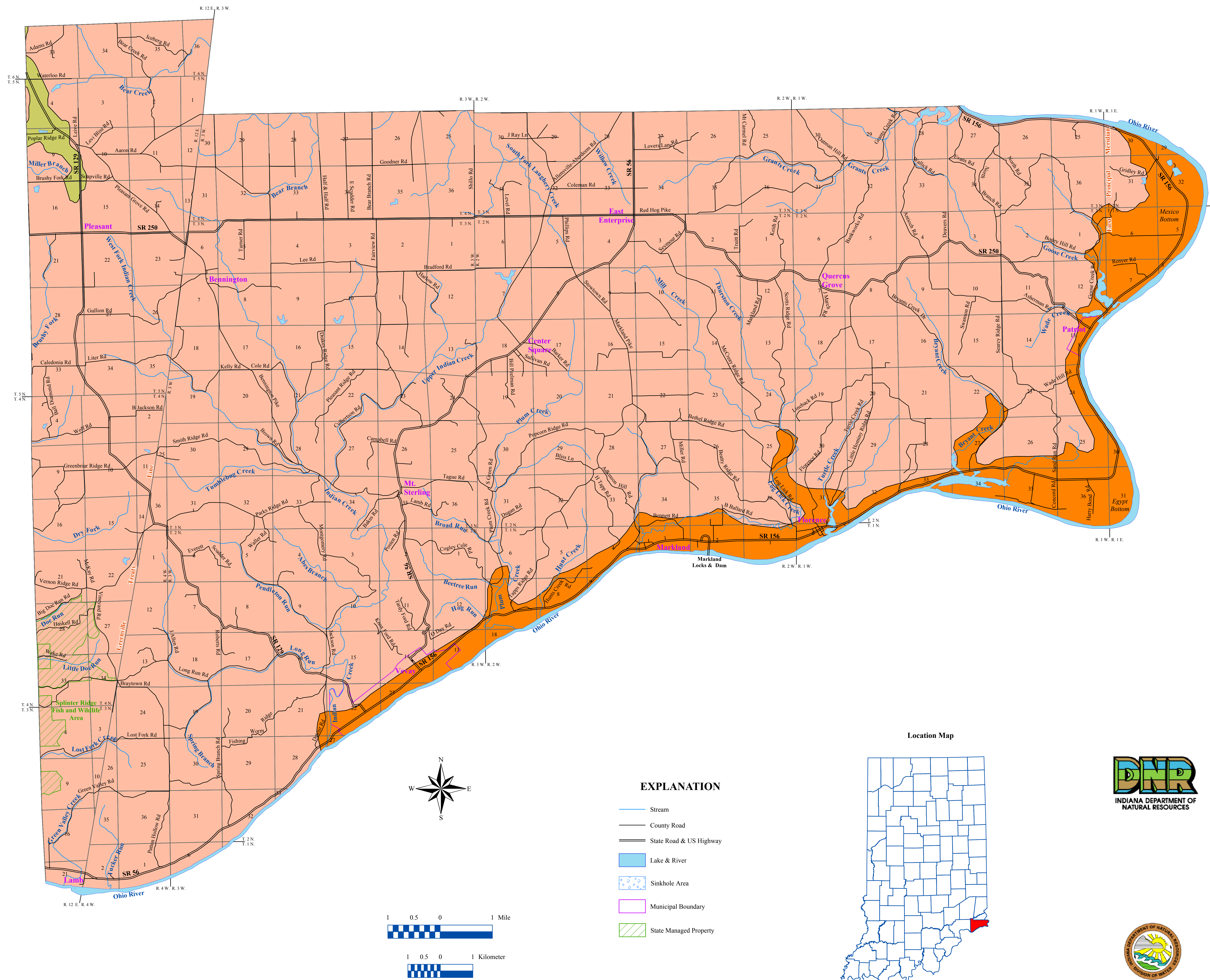
Data Sources: U.S. Geological Survey and Indiana Department of Natural Resources

Withdrawal Location		River	
WELL	INTAKE	7Q2 Flow (MGD)	
●	▼	—	< 10 MGD
●	▼	—	10 - 50 MGD
●	▼	—	50 - 100 MGD
●	▼	—	100 - 500 MGD
●	▼	—	> 500 MGD
●	▼	—	
●	▼	—	
●	▼	—	
●	▼	—	

■	Major Lakes
—	Interstate
□	County
⊠	City



BEDROCK AQUIFER SYSTEMS OF SWITZERLAND 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, such as jointing, fracturing, and solution activity, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability is generally greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers.

Bedrock aquifer systems in Switzerland County are overlain by unconsolidated deposits of varying thickness. 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 bedrock aquifer systems may have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system it will be difficult to track and remediate.

Three bedrock aquifer systems are identified for Switzerland County. They are, from west to east, youngest to oldest: the Silurian and Devonian Carbonates; the Maquoketa Group of Ordovician age; and the Trenton/Lexington, and Black River Carbonates of Ordovician age.

Silurian and Devonian Carbonates Aquifer System

In Switzerland County, the Silurian and Devonian Carbonates Aquifer System is limited to the upland area in the extreme northwestern corner of the county. This system includes mainly lower Silurian carbonate rock units (limestone and dolomite) of the Louisville Limestone through the Brassfield Limestone.

Few reported wells penetrate the Silurian and Devonian Carbonates Aquifer System in Switzerland County. The aquifer system is thin and most wells are completed in the underlying Ordovician bedrock of the Maquoketa Group. However, the Silurian and Devonian Carbonates Aquifer System is described in bordering counties (Jefferson and Ripley). The system is reported to have the capability of sustaining yields for domestic users with yields that range from 1 to 10 gallons per minute (gpm), although some dry holes are noted. Static water levels range from 10 to 35 feet.

Most of the Silurian and Devonian Carbonates Aquifer System in Switzerland County is overlain by variable clay thicknesses. Therefore, the aquifer system is considered at low to moderate risk to contamination.

Ordovician - Maquoketa Group Aquifer System

The outcrop/subcrop area of the Maquoketa Group includes nearly all of Switzerland County. The Maquoketa Group consists of, in ascending order, the Kope, the Dillsboro, and the Whitewater Formations. This bedrock aquifer system includes mostly shale with some interbedded limestone units. However, the uppermost Whitewater Formation includes a greater percentage of limestone. Thickness of the Maquoketa Group in Switzerland County is up to 850 feet and this as it dips beneath the Silurian rocks to the northwest.

Few wells have been reported in this system in Switzerland County. The depth to the bedrock surface is generally 15 to 30 feet. Reported depths of wells drilled in the Maquoketa Group range from 60 to 150 feet with the amount of rock penetration typically 5 to 55 feet. A few individual wells report yields that range from less than 1 gpm to 10 gpm with static water levels ranging from 15 to 30 feet. However, many practically dry holes have been reported.

Except in areas of limited 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.

Ordovician - Trenton/Lexington and Black River Carbonates Aquifer System

The Trenton/Lexington and Black River Carbonates Aquifer System outcrop/subcrop area is present along a narrow strip of the Ohio River Valley that extends roughly from the mouth of Indian Creek upstream to the county line. In Switzerland County this system only includes rocks of the Lexington Limestone and the underlying Black River Group. Thickness of the Lexington Limestone is approximately 200 to 250 feet and includes fossiliferous limestone with some interbedded shale. The underlying Black River Group is about 275 feet thick in Switzerland County and is described as a dense crystalline limestone.

Few wells utilize the Trenton/Lexington and Black River Carbonates Aquifer System. This is mainly due to the highly mineralized and saline water from the carbonates, and, the availability of thick outwash sediments along the Ohio River floodplain. However, not all of the Trenton/Lexington and Black River Carbonates Aquifer System outcrop/subcrop area is overlain by outwash and a few wells are completed in the bedrock. Reported well depths range from 40 to 255 feet with the depth to bedrock ranging from 10 to 120 feet. Well yields range from less than 1 gpm to 7 gpm with some dry holes reported. Static water levels range from 15 to 80 feet below surface.

Susceptibility of the Trenton/Lexington and Black River Carbonates Aquifer System is moderate to high where outwash sands and gravels directly overlie bedrock and low where clays and silts are present.

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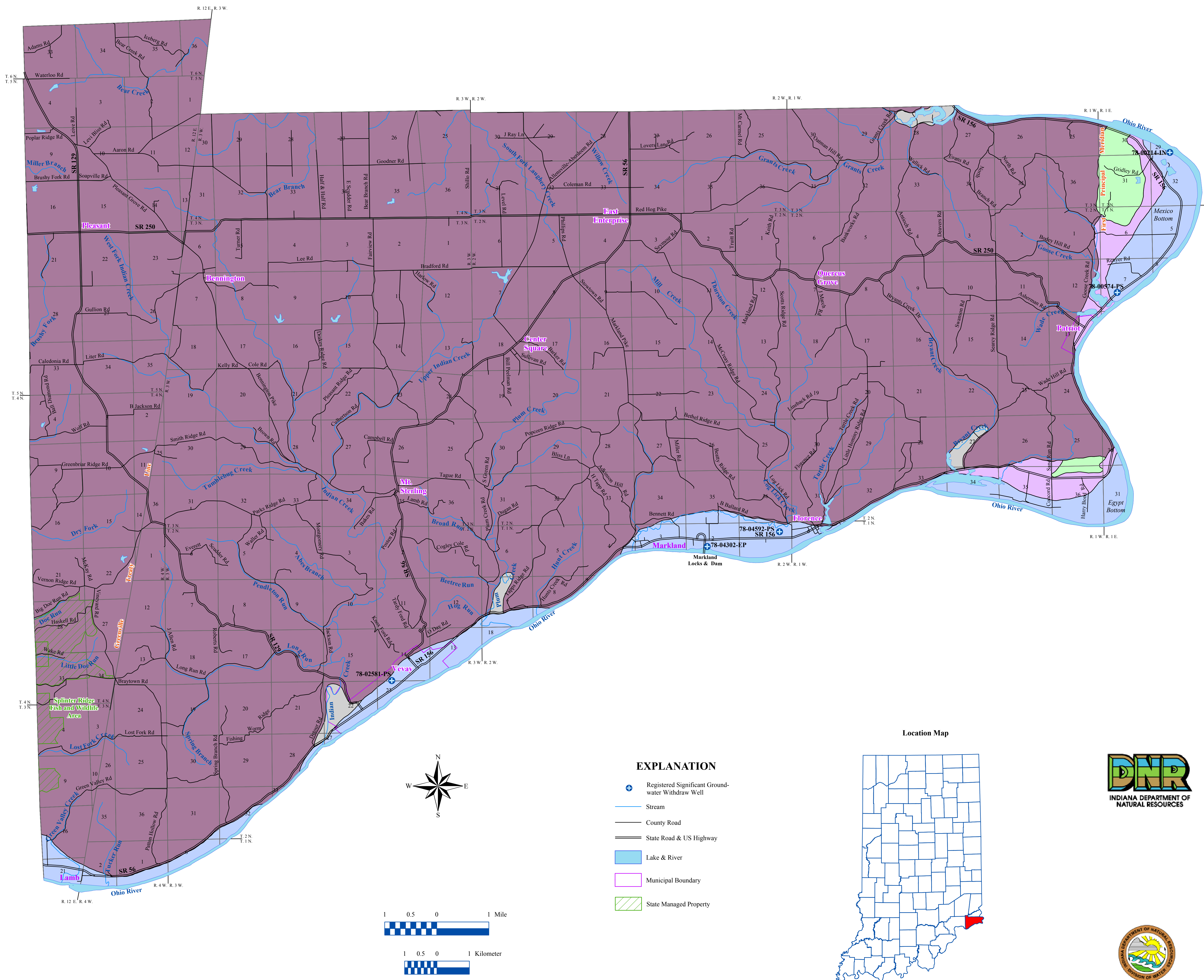
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Bedrock Aquifer Systems of Switzerland County, Indiana

by
 Randal D. Maier
 Division of Water, Resource Assessment Section
 December 2005

UNCONSOLIDATED AQUIFER SYSTEMS OF SWITZERLAND COUNTY, INDIANA



Five unconsolidated aquifer systems are mapped in Switzerland County: the Dissected Till and Residuum, the Alluvial, Lacustrine, and Backwater Deposits, the Buried Valley, the Ohio River Outwash, and the Ohio River Outwash Subsystem. Boundaries of these aquifer systems are commonly gradational, and individual aquifers may extend across aquifer system boundaries. However, in areas where the topography is steep, boundaries between aquifer systems are more distinct.

Thickness, type, and aerial extent of unconsolidated sediments in Switzerland County are variable. Pre-Wisconsin glacial sediments and bedrock residuum extend across most of the county. Wisconsin Age and younger outwash, alluvial, and lacustrine sediments are confined to the Ohio River Valley and its tributaries. Sediments that overlie bedrock range from less than five feet thick in areas where only residuum or thin glacial drift is present, to as much as 180 feet thick in the northeastern part of the county near Mexico Bottoms. In this area glacially derived silt, outwash, alluvial, and lacustrine deposits have filled part of the Ohio River Valley.

Regional estimates of aquifer susceptibility to contamination from the surface can differ considerably from local reality. Variations within geologic environments can cause variation in susceptibility to surface contamination. In addition, man-made structures such as poorly constructed water wells, unplugged or improperly abandoned wells, and open excavations, can provide contaminant pathways that bypass the naturally protective clays.

Dissected Till and Residuum Aquifer System

The Dissected Till and Residuum Aquifer System is mapped over most of Switzerland County. It is the most limited ground-water resource of the five unconsolidated aquifer systems in the county.

This aquifer system consists of extremely thin pre-Wisconsin till deposits with very thin layers of outwash sand and gravel, or thin, eroded bedrock residuum. Thickness of these sediments generally range from less than 5 feet (where only residuum is present) to about 40 feet. Potential aquifer materials consist of thin sand and gravel deposits that are typically less than 5 feet thick.

Because this aquifer system is generally thin and not very productive, most drillers prefer to complete wells in the underlying bedrock aquifer system. However, large diameter bucket wells may be successful in meeting the needs of some domestic users. Well capacities are typically less than 5 gallons per minute (gpm) with dry holes common.

Because of the low permeability of the surface materials, this aquifer system is not very susceptible to contamination from surface sources.

Alluvial, Lacustrine, and Backwater Deposits Aquifer System

In Switzerland County the Alluvial, Lacustrine, and Backwater Deposits Aquifer System is mapped along portions of larger tributaries of the Ohio River. These include: Grants Creek in the northeast portion of the county; Bryant Creek in the southeast portion of the county; Plum Creek in the south-central portion of the county; and Indian Creek in the southwest portion of the county.

This system consists of deposits that come from two primary sources. The first is alluvium deposited by streams along with colluvium eroded from valley walls and upland areas. The second is from pre-Wisconsin and Wisconsin fine-grained glaciolacustrine deposits formed in relatively static lake water. Typical materials include fine sand, silt, and clay deposits that are commonly greater than 25 feet thick. Aquifer materials typically include thin sand seams that are generally less than five feet thick. This aquifer system is a limited resource and there are no known wells that actually produce from these deposits. However, large diameter bored (bucket-ribs) wells may be adequate to supply the needs of some domestic users.

Thick deposits of silt and clay that have a low susceptibility to surface contamination generally mark this aquifer system. The susceptibility is greater in areas where the surficial silt and clay deposits are thin and directly overlie outwash deposits.

Buried Valley Aquifer System

Two small areas of northeastern and southeastern Switzerland County are mapped as the Buried Valley Aquifer System. In these areas pre-Wisconsin glacial outwash deposits filled the Ohio River Valley and were then subsequently buried by thick pre-Wisconsin glacial till and lacustrine deposits. There are no reported water wells completed in the Buried Valley Aquifer System. However, several soil borings penetrate through the unconsolidated materials to bedrock and provide some indication of aquifer potential.

Total thickness of unconsolidated deposits overlying bedrock is as much as 180 feet in places. The buried outwash deposits are up to 115 feet of continuous sands and gravels and are capped by clay and lacustrine deposits up to 90 feet thick. However, some borings report interbedded clay materials up to 45 feet thick that disrupt the continuity of the sands and gravels. Because thick aquifer materials are available in the Buried Valley Aquifer System and are likely connected to the adjacent outwash system/subsystem, this system has the potential to meet the needs of domestic and some high-capacity users.

Potential for contamination is low due to thick clay and lacustrine deposits that overlie the aquifer sands and gravels.

Ohio River Outwash Aquifer System

The Ohio River Outwash Aquifer System in Switzerland County is mapped along most of the main valley of the Ohio River. Aggradation of the Ohio River Valley with large amounts of outwash sand and gravel from pre-Wisconsin and Wisconsin receding glaciers filled the river valley. Subsequent recent alluviation continued to fill the valley. These outwash and alluvial deposits form the most prolific aquifer system in the county.

This system is nearly 160 feet thick in places with up to 150 feet of continuous sand and gravel. Typical outwash thickness, however, ranges from 40 to 75 feet. Thickness of saturated sands and gravels can be as much as 95 feet but are typically 25 to 55 feet. Well depths are commonly 55 to 105 feet. In some areas 10 to 30 feet of sandy clay or silt overlie the aquifer materials.

The Ohio River Outwash Aquifer System has the greatest potential of any aquifer system in Switzerland County and can meet the needs of domestic and high-capacity users. Domestic well yields range from 10 to 30 gpm and static water levels are generally 25 to 60 feet below surface. There are five registered high-capacity facilities (12 wells) in this system. Reported well capacities are up to 3300 gpm, but are typically 350 to 2300 gpm.

In areas that lack overlying clays, this aquifer system is highly susceptible to contamination from surface sources. Where clay or silt deposits overlie the aquifer system, the aquifer is moderately susceptible to surface contamination.

Ohio River Outwash Aquifer Subsystem

The Ohio River Outwash Aquifer Subsystem is mapped along two areas in eastern Switzerland County. In general, this system (subsystem) is mapped parallel and adjacent to the Ohio River Outwash Aquifer System where the topographic position is higher and thickness of saturated outwash materials is considerably less than the main outwash system. Also, aquifer sand and gravels are generally overlain by greater thicknesses of silt, clay, or lacustrine deposits.

Thickness of unconsolidated materials overlying bedrock within this system range from about 70 to 130 feet with up to 35 feet of continuous sand and gravel. There are very few reported wells utilizing this system in Switzerland County. However, other counties where the Ohio River Aquifer Subsystem is mapped suggest that the subsystem in Switzerland County has the potential to meet the needs of domestic and some high-capacity users.

Areas within this aquifer system that have overlying clay or silt deposits are moderately susceptible to surface contamination; whereas, areas that lack overlying clay or silt deposits are highly susceptible to contamination.

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Unconsolidated Aquifer Systems of Switzerland County, Indiana

by
 Randal D. Maier
 Division of Water, Resource Assessment Section

December 2005

Switzerland County

