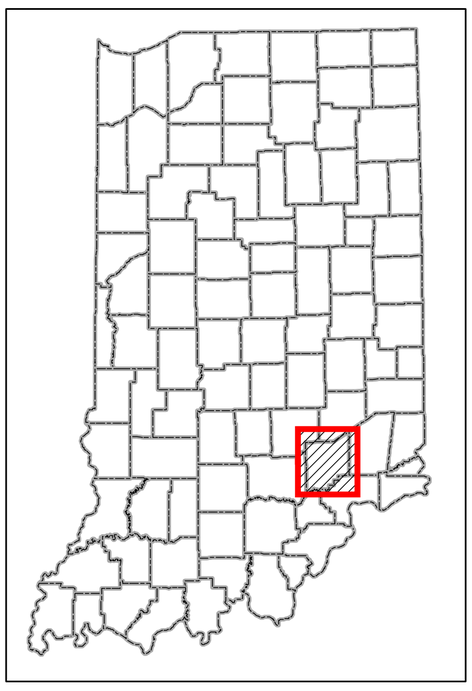
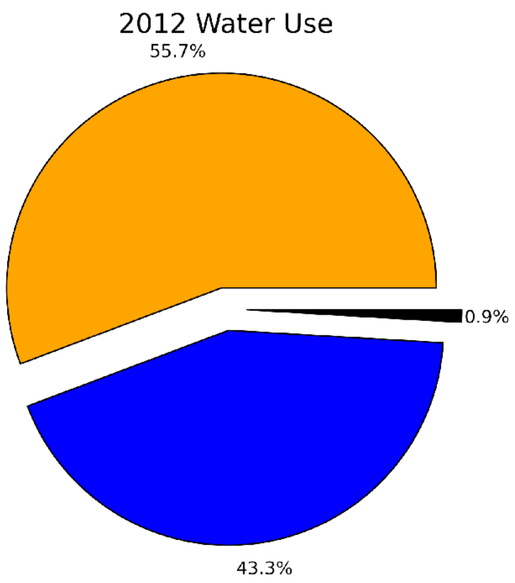
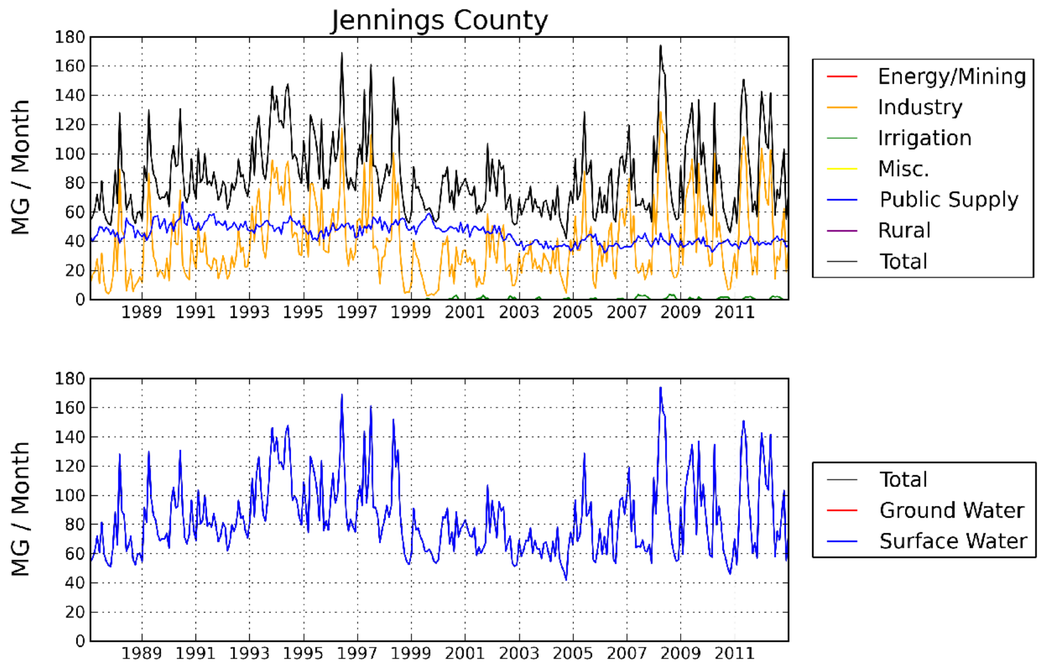
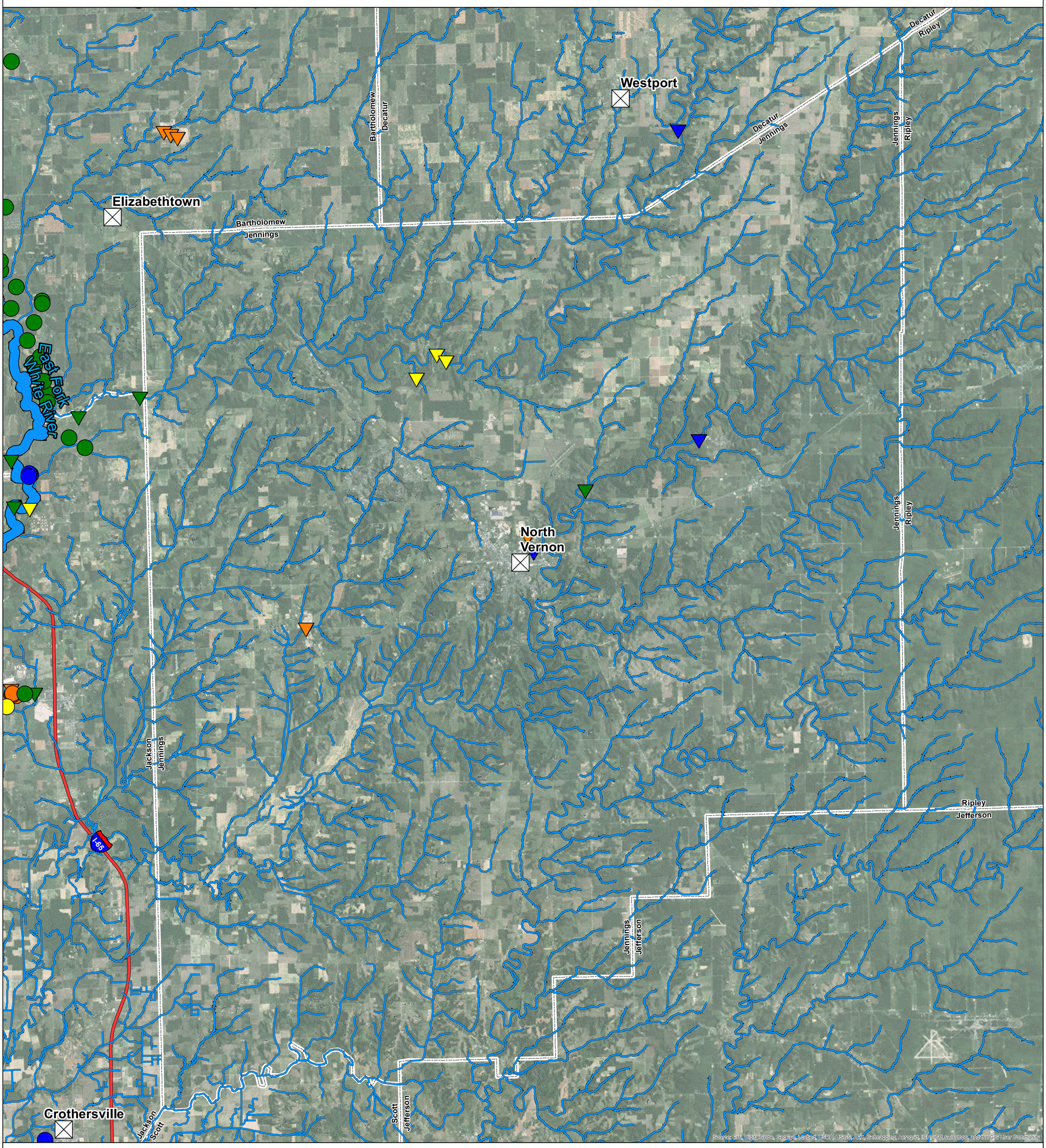




Average Daily Use: 3.0 MGD





Water Resources and Use in Jennings County

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

Withdrawal Location

WELL INTAKE

- Energy/Mining
- Industry
- Irrigation
- Misc.
- Public Supply
- Rural Use

River

7Q2 Flow (MGD)

- <10 MGD
- 10 - 50 MGD
- 50 - 100 MGD
- 100 - 500 MGD
- > 500 MGD

- Major Lakes
- Interstate
- County
- City

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

NORTH

0 1 2 4 Miles

BEDROCK AQUIFER SYSTEMS OF JENNINGS 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 Jennings County, rock types exposed at the bedrock surface are poor to moderately productive limestones and dolomites with varying amounts of interbedded shales to poorly productive shale.

Bedrock aquifer systems in the county are overlain by unconsolidated deposits of varying thickness. Refer to the map of unconsolidated aquifer systems for more information. 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 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.

Three bedrock aquifer systems are identified for Jennings County. They are, from west to east and youngest to oldest: New Albany Shale of Devonian and Mississippian age; Silurian and Devonian Carbonates; and the Maquoketa Group of Ordovician age. The county is nearly evenly divided between the New Albany Shale and the Silurian and Devonian Carbonates by a northwest to southeast trending contact. The Silurian and Devonian Carbonates are also exposed in many major stream valleys where the New Albany Shale has been eroded away. The Maquoketa Group is only exposed in the eastern part of the county where streams have incised deeply enough into the gently southwest-dipping strata to completely remove overlying Silurian and Devonian age rocks. Bedrock aquifers are not highly productive in this county. However, bedrock wells represent over 80% of all wells completed in the county.

The quality of water in bedrock aquifer systems in this county is generally acceptable for domestic use. However, some drillers report "sulfur water" in scattered wells within the outcrop/subcrop area of the New Albany Shale. The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Just as recharge for bedrock aquifers cannot exceed that of overlying unconsolidated deposits, susceptibility to surface contamination will not exceed that of overlying deposits. However, 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.

Devonian and Mississippian -- New Albany Shale Aquifer System

The New Albany Shale Aquifer System in Jennings County is an extremely limited ground-water resource. This aquifer system consists mostly of brownish-black carbon-rich shale, greenish-gray shale, along with minor amounts of dolomite and dolomitic quartz sandstone.

In Jennings County the thickness of the New Albany Shale ranges from 0 to about 120 feet and generally thickens as it dips southwest. The outcrop/subcrop area for the New Albany Shale includes much of the central, southern, and western parts of the county. It is overlain by unconsolidated deposits that range in thickness from about 0 to 90 feet, but are commonly 15 to 50 feet thick.

This aquifer system is considered a poor aquifer resource and is often described as an aquitard. Over 95 percent of the wells penetrating this system are completed in the underlying Silurian and Devonian Carbonates Aquifer System. However, there are a few wells in the county that utilize the New Albany Shale Aquifer System whose production is suitable for domestic needs. The permeability of shale materials is considered low. The New Albany Shale Aquifer System, therefore, has a low susceptibility to contamination introduced at or near the surface.

Silurian and Devonian Carbonates Aquifer System

In Jennings County this aquifer system consists primarily of middle Devonian age carbonates of the Muscatatuck Group and underlying Silurian carbonates. It is composed of only Silurian carbonates along the eastern edge of the county and in several stream valleys where Muscatatuck Group rocks have been removed by erosion. Because individual units of the Silurian and Devonian systems are composed of similar carbonate rock types and cannot easily be distinguished on the basis of water well records, they are considered as a single water-bearing system. Total thickness of the Silurian and Devonian Carbonates Aquifer system ranges from 0 to about 200 feet.

In nearly half of the county this aquifer system is overlain by New Albany Shale, which is commonly 5 to 30 feet thick. However, in almost all cases drillers bypass the shale to complete wells in the underlying Silurian and Devonian carbonates because the New Albany Shale is considered to be a poor aquifer. Although recharge may be reduced in these areas, productivity of the Silurian and Devonian Carbonates Aquifer System is not significantly different in areas where the New Albany Shale is present. Wells penetrating this system have reported depths ranging from 28 to 298 feet, but are commonly 60 to 115 feet deep. The amount of rock penetrated in the Silurian and Devonian Carbonate Aquifer System typically ranges from 25 to 75 feet, although a few of the deeper wells may also reach the upper portion of the underlying Maquoketa Group.

Water wells in the Silurian and Devonian Carbonates Aquifer System are generally capable of meeting the needs of domestic users in this county. Typical yields range from 2 to 15 gallons per minute (gpm). However, several dry holes have been reported. Static water levels typically range from 20 to 50 feet below land surface.

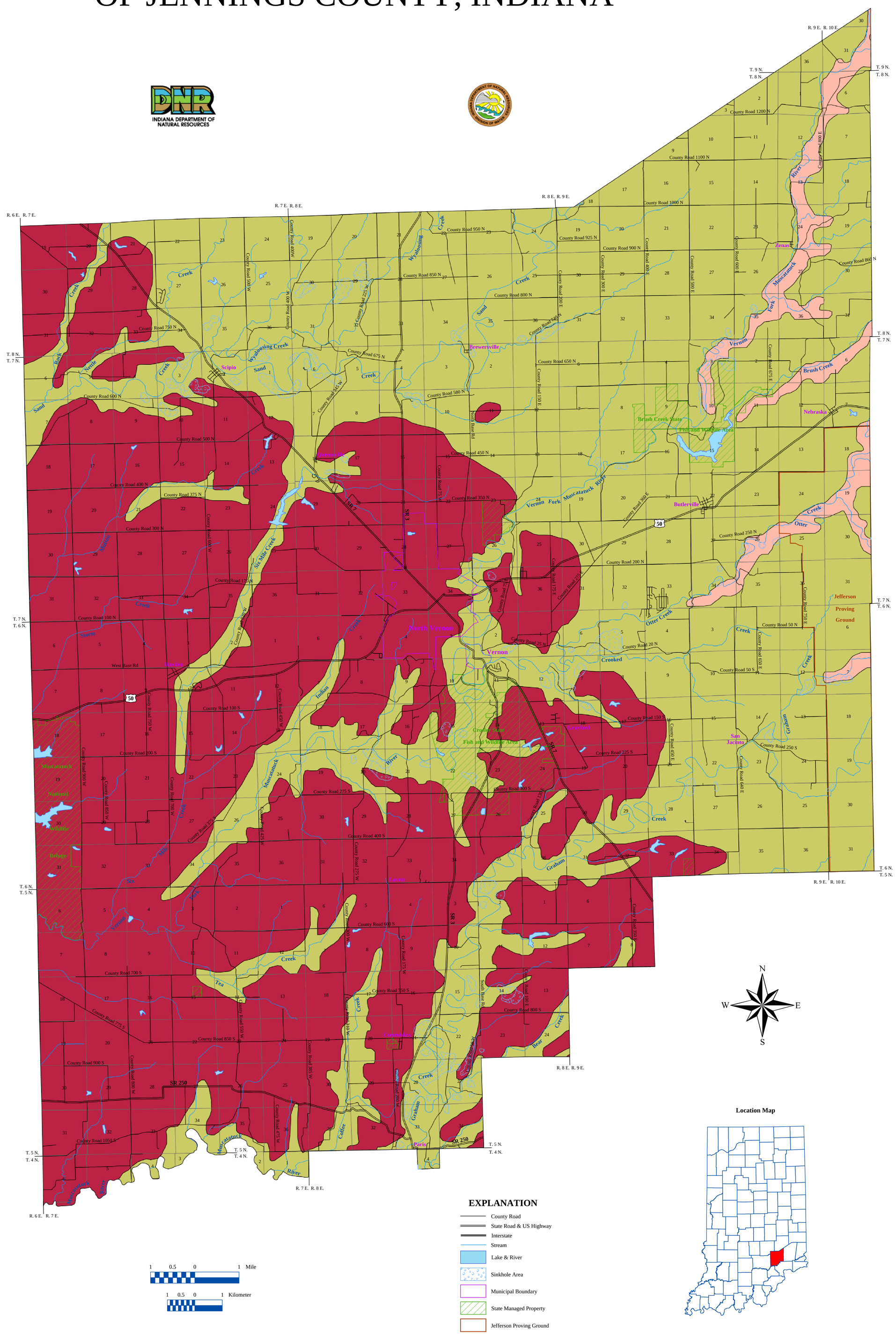
The Silurian and Devonian Carbonates Aquifer System is generally not very susceptible to contamination from the land surface, except where karst (see Karst Features and the Dissolution of Carbonate Rocks) development is significant or where overlying clay-rich till and residuum is thin or absent. This system is also at low risk to contamination where it is overlain by New Albany Shale.

Ordovician -- Maquoketa Group Aquifer System

The outcrop/subcrop area of the Maquoketa Group is limited to the deeply incised stream valleys in the eastern part of the Jennings County. The Maquoketa Group consists in ascending order of the Kope, Dillsboro, and Whitewater Formations. The Maquoketa Group consists mostly of shales with interbedded limestone units. Few wells have been completed in or near the outcrop/subcrop area of the Maquoketa group in this county. These wells generally use little more than the top 100 feet for water production, although this system is approximately 700 to 850 feet thick in the county.

The Maquoketa Group is considered a minor ground-water source in the county. Although well data are sparse for this aquifer system in Jennings County, expected water production from the Maquoketa Group should be similar to that in neighboring Ripley County, where most wells for homes, irrigation, and stock produce between 1 and 5 gpm. Localized yields may exceed 20 gpm. However, (pumped) dry holes are quite common in this system in Ripley County and dry holes have also been reported in Jennings County.

Except in areas of significant 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. In this system, karst development is predominately confined to the outcrop/subcrop area of the Whitewater Formation, the uppermost formation in this aquifer system.



EXPLANATION

- County Road
- State Road & US Highway
- Interstate
- Stream
- Lake & River
- Sinkhole Area
- Municipal Boundary
- State Managed Property
- Jefferson Proving Ground

Location Map

Map generated by Jennifer K. Mc Millan and Gregory P. Schrader
IDNR, Division of Water, Resource Assessment Section

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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 and Sinkhole Areas and Sinking-Stream Basins in Southern Indiana (polygon shapefile, 20020717), which were based on a 1:126,720 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.

Bedrock Aquifer Systems of Jennings County, Indiana

by
Gregory P. Schrader
Division of Water, Resource Assessment Section

May 2004

UNCONSOLIDATED AQUIFER SYSTEMS OF JENNINGS COUNTY, INDIANA

Five unconsolidated aquifer systems have been mapped in Jennings County: the Dissected Till and Residuum; Alluvial, Lacustrine, and Backwater Deposits; the Buried Valley; the New Castle / Muscatatuck Plateau / Scottsburg Lowland Till Aquifer Subsystem; and the White River and Tributaries Outwash. The first system includes relatively thin deposits left by continental ice sheets as well as eroded residuum (a product of bedrock weathering). The next four systems comprise sediments deposited by, or resulting from, glaciers, glacial meltwaters, and post-glacial precipitation events. Boundaries of these aquifer systems are commonly gradational and individual aquifers may extend across aquifer system boundaries.

The entire county has been glaciated in Pre-Wisconsin times and Wisconsin glaciers also reached the northwestern part of the county. However, aquifer materials within the Wisconsin drift are too thin and shallow to have a significant impact on the groundwater potential of any of the unconsolidated aquifer systems mapped in this area. The thickness of unconsolidated sediments in Jennings County is quite variable. Unconsolidated materials overlying bedrock are less than 30 feet thick in much of the county. However, thickness of unconsolidated materials is greatest, commonly over 50 feet thick, in the northern and western parts of the county. These areas now mark the general path that fed outwash to the East Fork White, Vernon Fork Muscatatuck, and Muscatatuck Rivers.

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, which covers about 88 percent of Jennings County, has the most limited groundwater resources of the unconsolidated aquifer systems in the county. Unconsolidated materials of this aquifer system predominantly consist of thin, eroded bedrock residuum and pre-Wisconsin tills. Some Wisconsin age tills are also present in the northwestern part of the county. Also included in this aquifer system in many stream valleys are relatively thin deposits of alluvium and colluvium. Total thickness of this system in the county typically ranges from about 15 to 40 feet.

There is little potential for water production in the Dissected Till and Residuum Aquifer System in Jennings County. However, nearly 10 percent of wells penetrating this aquifer system are completed in unconsolidated materials rather than the underlying bedrock. Large-diameter bored (bucket-rig) wells are typically used in this county to produce water from thin sands within the predominantly clay and silt materials of this aquifer system. These sands are commonly less than 2 feet thick. Static water levels in this aquifer system are typically 15 to 30 feet below land surface. In places there are several thin sand seams separated by tills within the saturated zone. Commonly constructed at depths of 30 to 45 feet with 30-inch diameter porous casing, these wells are built to maximize storage. Even though these wells typically yield only 0.5 to 4 gallons per minute (gpm), they are generally adequate for livestock and domestic use. The boundaries between the Dissected Till and Residuum Aquifer System and the New Castle / Muscatatuck Plateau / Scottsburg Lowland Till Aquifer Subsystem are transitional in many areas of the county. Because of the generally low permeability of the near-surface materials, this system is not very susceptible to contamination from surface sources.

Alluvial, Lacustrine, and Backwater Deposits Aquifer System

The Alluvial, Lacustrine, and Backwater Deposits Aquifer System is made up of heterogeneous bodies of alluvial, colluvial, and lacustrine materials within valley bottoms and terraces of some larger streams tributary to the East Fork White River.

Unconsolidated deposits within this system come from two sources. The first is alluvium deposited by streams along with colluvium eroded from valley walls and upland areas. The second source is glaciolacustrine deposits formed in bodies of relatively stagnant water. These deposits were formed when the valley of the East Fork White River was choked with outwash from receding glaciers. The outwash deposits effectively dammed the tributary streams, thus creating lakes in which fine-grained glaciolacustrine deposits accumulated.

This system is mapped in the southwestern part of the county along a portion of the Muscatatuck River at the Scott County line and along part of the Vernon Fork Muscatatuck River and its tributary, Six Mile Creek. A small area of Alluvial, Lacustrine, and Backwater Deposits Aquifer system is also mapped in the floodplain of Sand Creek in the northwestern part of the county. Total thickness of unconsolidated materials overlying bedrock in this system is commonly less than 50 feet. Sand and gravel lenses, where present, are typically only a few feet thick and may be confined within the glaciolacustrine deposits or directly overlie bedrock.

This aquifer system is a limited resource and the Division has no record of wells actually producing from these deposits. However, it is expected that many wells drilled in this system (especially large diameter bucket-rig wells) may yield sufficient water for domestic use. This aquifer system is marked by thick deposits of soft silt and clay that have low susceptibility to surface contamination.

Buried Valley Aquifer System

The Buried Valley Aquifer System consists of aquifer materials deposited in pre-glacial bedrock valleys. During valley development, layers of bedrock were eroded to create valleys that were subsequently filled with unconsolidated sediment of variable thickness. Although there are additional buried bedrock valleys in Jennings County, only the larger buried valleys that contain significant water-bearing sediments have been included as mapped units of the Buried Valley Aquifer System.

Identified primarily on the basis of surface topography, only one main buried bedrock valley is mapped in Jennings County. The meandering path of this narrow valley extends westward from about 2.5 miles west of Brewersville to about 1 mile northwest of Scipio. It cuts as deeply as about 100 feet into Devonian (Muscatatuck Group) bedrock and a few feet into Silurian strata in places at the eastern end of the valley.

The few wells penetrating this aquifer system in Jennings County were completed in the underlying bedrock. The record of one such well reported encountering a sand unit 30 feet thick directly overlying bedrock. Total thickness of unconsolidated materials at this site was reported to exceed 110 feet. Groundwater potential is expected to be limited in many places due to the fine-grained, commonly dirty nature of the water-bearing sand and gravel units. However, in some areas this aquifer system may have sufficient thickness of clean sand and gravel to support high-capacity wells.

The Buried Valley Aquifer System has a low susceptibility to surface contamination because tills and lacustrine silts and clays generally overlie outwash sediments occurring within the bedrock valleys. Although lenses of outwash sand and gravel may occur within the tills, the predominance of fine-grained sediments above the bedrock valleys generally limits the migration of contaminants from surface sources to the deep aquifers. However, modern stream valleys intersect the buried valley in places. Where recent alluvial materials are connected to intertill outwash, this aquifer system is highly susceptible to surface contamination.

New Castle/Muscatatuck Plateau/Scottsburg Lowland Till Aquifer Subsystem

This system is mapped as several small areas, scattered throughout Jennings County. Many of these small areas were once connected, but downcutting by modern streams has separated them and reduced their areal extent. Larger areas mapped as the New Castle / Muscatatuck Plateau / Scottsburg Lowland Till Aquifer Subsystem in the western portion of the county are part of a greater Quaternary outwash drainage system, which carried glacial sediments southwestward out of Jennings County and across eastern and southern Jackson County.

In areas mapped as New Castle / Muscatatuck Plateau / Scottsburg Lowland Till Aquifer Subsystem, unconsolidated deposits overlying bedrock consist predominantly of pre-Wisconsin glacial materials that range in thickness from about 15 to 145 feet, but are commonly 45 to 70 feet thick. Wisconsin age glaciers deposited thin drift atop pre-Wisconsin deposits in northwestern Jennings County.

In some counties, this aquifer system is a limited resource, as evidenced by the lack of wells actually producing from the available unconsolidated deposits. However, in Jennings County, nearly half of the reported wells penetrating this system were completed in unconsolidated materials rather than in the underlying bedrock.

Wells in the New Castle / Muscatatuck Plateau / Scottsburg Lowland Till Aquifer Subsystem are commonly completed at depths ranging from 35 to 75 feet. Most of these wells are large-diameter (bucket-rig) wells which are constructed using 30-inch diameter porous casing to allow for maximum storage. Potential aquifer materials within the glacial till include discontinuous intratill sand and gravel units, which tend to be clearly described on water well records. Individual sand and gravel units within this system typically range from 3 to 15 feet thick and static water levels are typically 15 to 30 feet below land surface, so multiple saturated sand and/or gravel units are commonly utilized in a single well. Domestic wells typically yield from 2 to 35 gpm. However, one exceptional domestic well utilizing 9 feet of saturated gravel was tested at 80 gpm.

The New Castle / Muscatatuck Plateau / Scottsburg Lowland Till Aquifer Subsystem has a low susceptibility to surface contamination because intratill sand and gravel units are generally separated from the surface by till layers within the system.

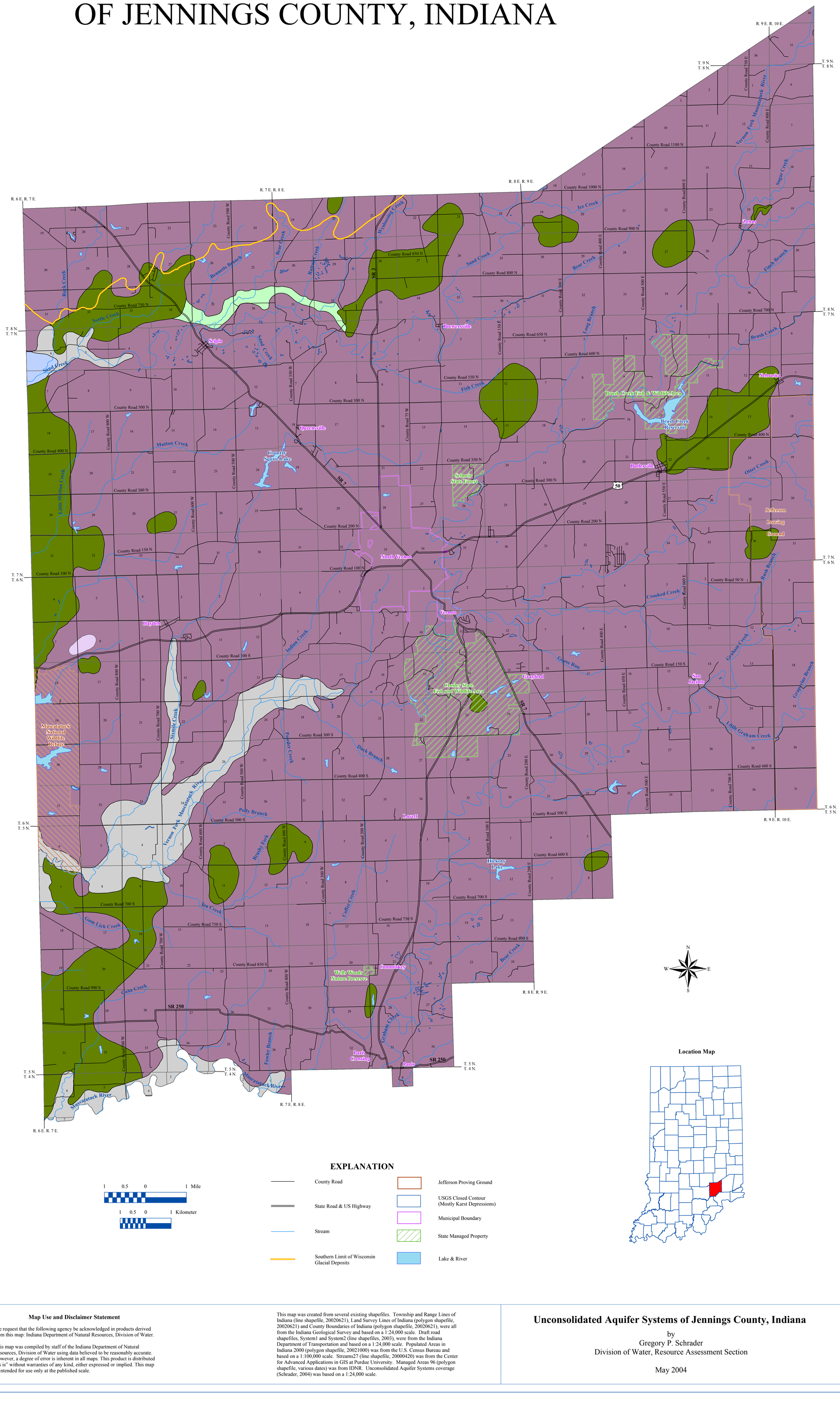
White River and Tributaries Outwash Aquifer System

The White River and Tributaries Outwash Aquifer System in Jennings County is limited to a small area in the northwestern part of the county along Sand Creek, where this tributary to the East Fork White River flows westward into Jackson County. This aquifer system contains large volumes of outwash and alluvial deposits that filled the main river valley of the East Fork White River and its major tributaries.

As the glaciers melted, the quantity of sediment was too large for the streams to transport. As a result, the increased sediment load was stored in the valley as vertical and lateral accretionary deposits. As long as the retreating glaciers continued to provide sediment in quantities too large for the streams to transport, the main valley continued to be filled. These deposits formed the most prolific aquifer system in the county.

Due to its limited areal extent within the county, there are no known wells producing from this aquifer system in Jennings County. However, the White River and Tributaries Outwash Aquifer System is extensive and is considered a major resource in neighboring Jackson County. In Jackson County, aquifer materials within this system include predominantly sand and gravel deposits that commonly range from 20 to 60 feet thick. In some areas 6 to 15 feet of clay or silt overlie the aquifer materials and static levels are typically between 5 and 15 feet below the land surface. Because the level of groundwater is near the surface, most of the aquifer materials are saturated. Domestic yields range from 7 to 30 gpm and this aquifer system is capable of supporting high-capacity wells producing 100 to 1000 gpm. Thus, it is expected that the White River and Tributaries Outwash Aquifer System also has similar aquifer characteristics and comparable groundwater potential in Jennings County.

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



EXPLANATION

- County Road
- State Road & US Highway
- Stream
- Southern Limit of Wisconsin Glacial Deposits
- Jefferson Proving Ground
- USGS Closed Contour (Mostly Karst Depressions)
- Municipal Boundary
- State Managed Property
- Lake & River

Location Map

INDIANA DEPARTMENT OF NATURAL RESOURCES

INDIANA DEPARTMENT OF NATURAL RESOURCES · DIVISION OF WATER

Map generated by Jennifer K. Mc Millan and Gregory P. Schrader
IDNR, Division of Water, Resource Assessment Section

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Unconsolidated Aquifer Systems of Jennings County, Indiana

by
Gregory P. Schrader
Division of Water, Resource Assessment Section

May 2004

Jennings County