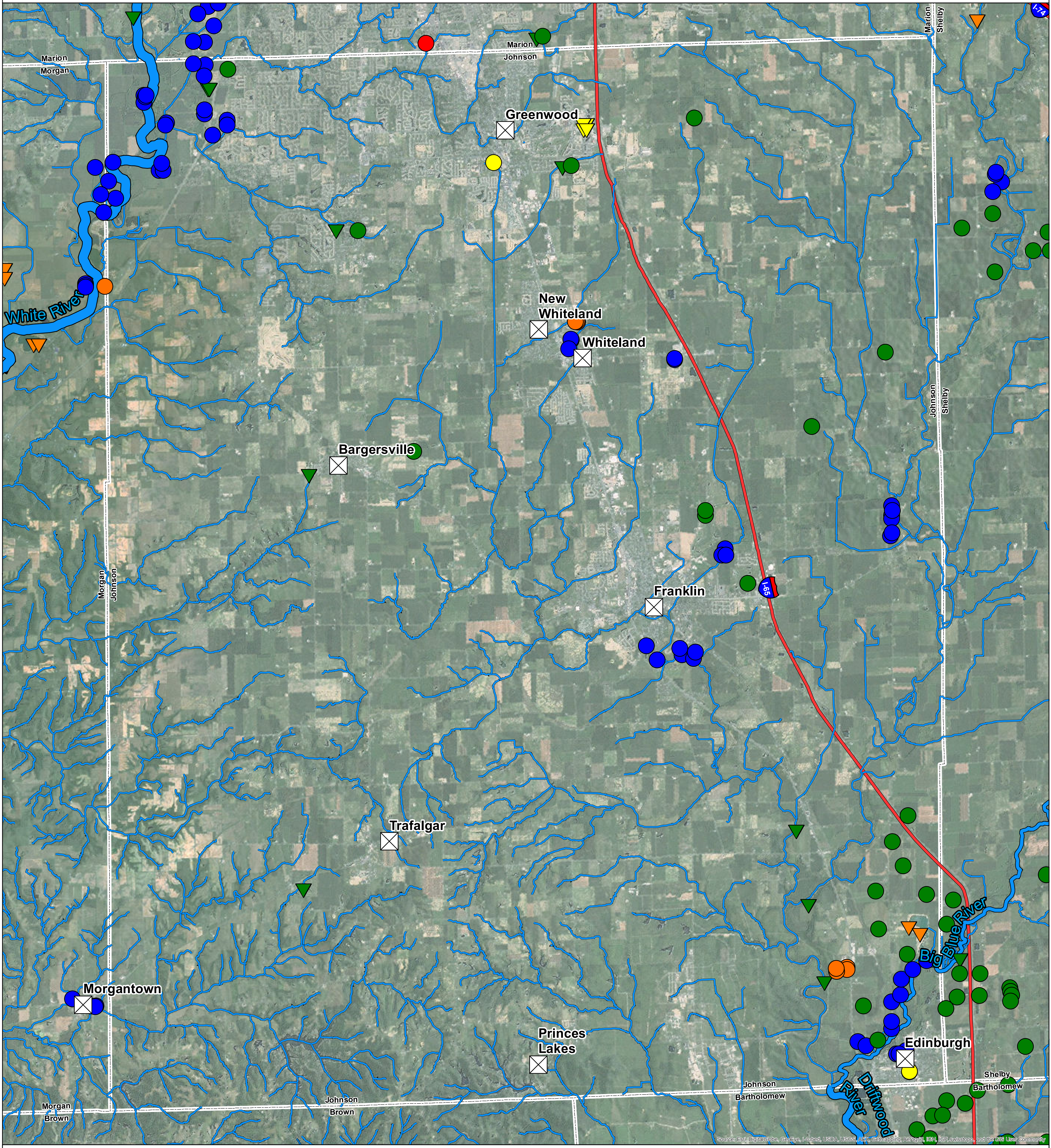
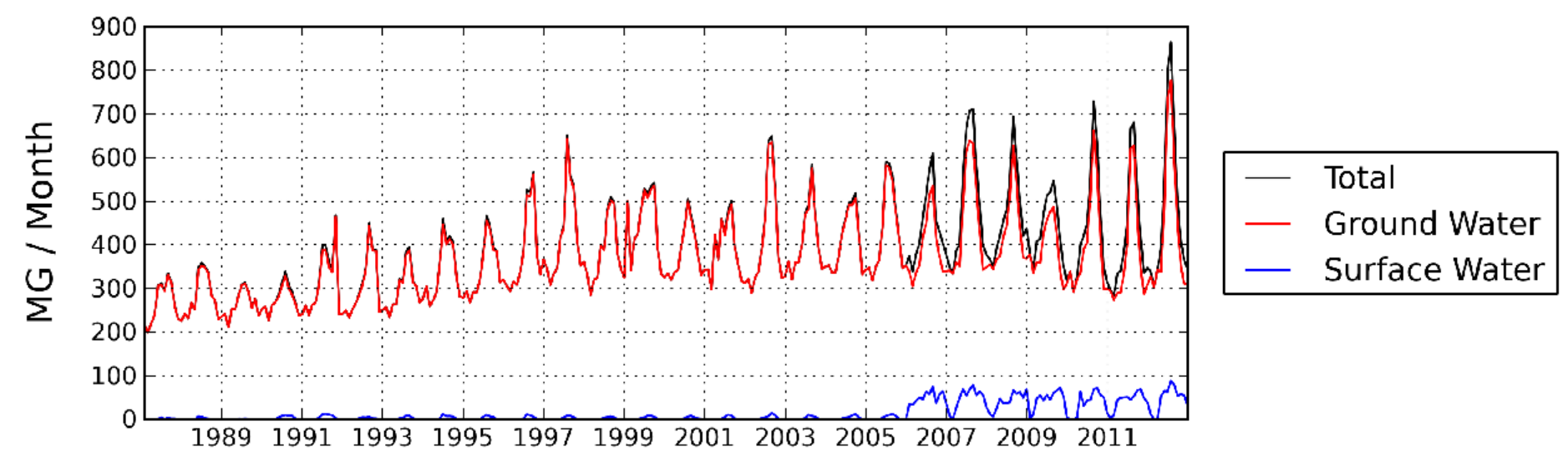
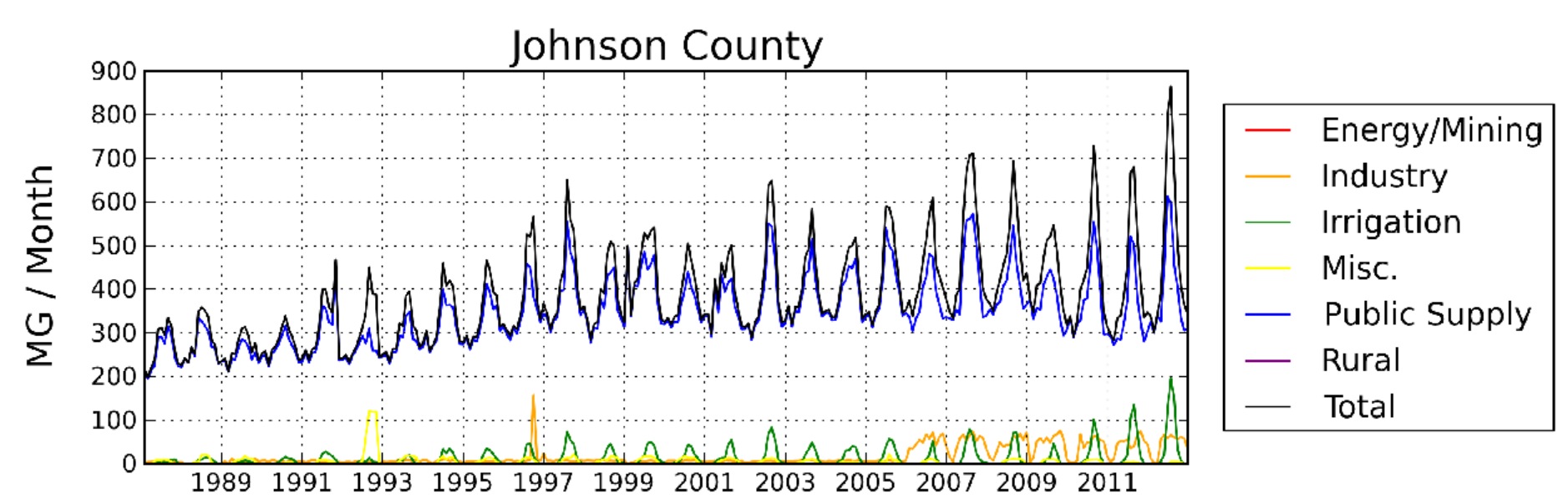


Average Daily Use: 16.1 MGD



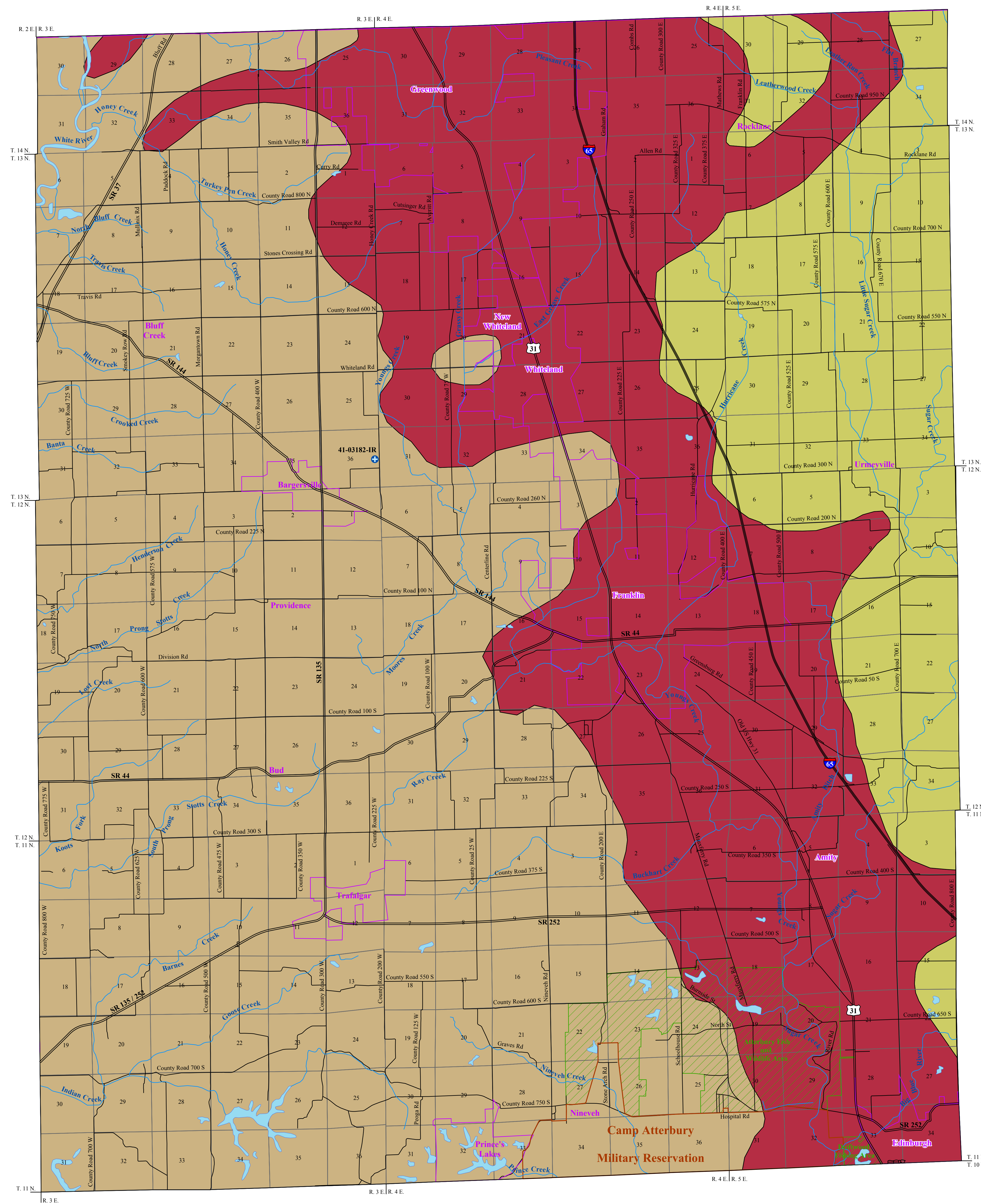
Water Resources and Use in Johnson County

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

Withdrawal Location	River
WELL INTAKE	7Q2 Flow (MGD)
● Energy/Mining	— <10 MGD
▲ Industry	— 10 - 50 MGD
● Irrigation	— 50 - 100 MGD
▲ Misc.	— 100 - 500 MGD
● Public Supply	— > 500 MGD
▲ Rural Use	

■ Major Lakes	
— Interstate	
□ County	
□ City	

BEDROCK AQUIFER SYSTEMS OF JOHNSON 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 the 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 Johnson County. They are, from west to east and youngest to oldest: the Borden Group of Mississippian age; the New Albany Shale of Devonian and Mississippian age; and Silurian and Devonian Carbonates.

Mississippian - Borden Group Aquifer System

In Johnson County, the Mississippian age Borden Group Aquifer System is present in most of the western half of the county. This bedrock aquifer system is composed mostly of siltstone and shale, but fine-grained sandstones are also common. Although carbonates are rare, discontinuous interbedded limestone lenses are present, mostly in the upper portion of the group.

The Borden Group in Johnson County is up to 600 feet thick and generally thins as it dips to the southwest beneath younger rock formations. Depth to bedrock is typically 20 to 70 feet. Well depths in the Borden Group Aquifer System range from 10 to 375 feet. However, wells are typically completed at depths of 55 to 125 feet and typically penetrate 10 feet or less of bedrock.

The Borden Group is generally not very productive and it is typically used only where overlying deposits do not contain an aquifer. Many wells, however, are able to produce sufficient water for domestic purposes by relying on extra well-bore storage by drilling larger diameter and deeper wells. Typical yield of most domestic wells is less than 10 gpm with some dry holes reported. Yield may be greater in areas where thin outwash deposits overlie the bedrock. Static water levels are typically between 10 and 25 feet below surface.

The Borden Group is composed primarily of fine-grained materials that limit the movement of ground water. In areas where overlying clay materials are present, the Borden Group Aquifer System is at low risk to contamination from the surface or near surface. However, in some areas the bedrock is overlain by outwash materials that may be capped by thin deposits of silt, lacustrine silt, or colluvium. These areas are at moderate to high risk to contamination.

Devonian and Mississippian - New Albany Shale Aquifer System

The New Albany Shale Aquifer System in Johnson County is an extremely limited ground-water resource. The outcrop/subcrop area for the New Albany Shale in Johnson County is present along an approximate northwest to southeast trending band. This aquifer system consists mostly of brownish-black carbon-rich shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone.

The New Albany Shale in Johnson County is up to 120 feet thick and generally increases in thickness as it dips to the southwest beneath younger rock formations. Depth to bedrock is typically 25 to 130 feet. Completed well depths are commonly 55 to 140 feet with wells typically penetrating less than 15 feet of bedrock.

This aquifer system is considered a poor ground-water resource and is generally described as an aquitard. However, a few domestic wells have been completed in this system. Typical yields are 10 gpm or less with some dry holes reported. In some cases well productivity is enhanced where outwash materials overlie the bedrock surface. Static water levels typically range from 10 to 40 feet below surface.

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. However, in some areas the bedrock is overlain by outwash materials that may be capped by thin deposits of silt, lacustrine silt, or colluvium. These areas are at moderate to high risk to contamination.

Silurian and Devonian Carbonates Aquifer System

In Johnson County, the outcrop/subcrop area of the Silurian and Devonian Carbonates Aquifer System is restricted to portions of the eastern third of the county. This system includes middle-Devonian age carbonates (limestone and dolomite) of the Muscatatuck Group and the underlying carbonates of Silurian age. Because carbonate units of Silurian and Devonian age are similar and cannot easily be distinguished on the basis of water well records, they are considered as a single water-bearing system.

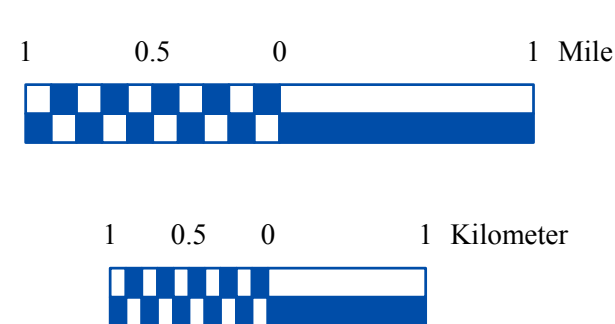
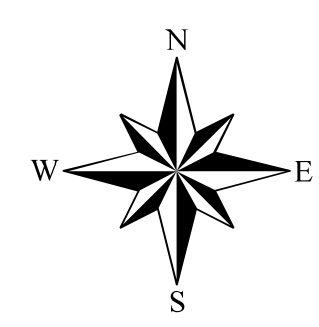
The Muscatatuck Group in Johnson County is up to 125 feet thick and generally increases in thickness as it dips to the southwest beneath younger rock formations. The underlying Silurian carbonates are 125 to 175 feet thick and also thicken as they dip to the southwest. The combined thickness, therefore, is up to 300 feet with depth to bedrock ranging from 80 to 250 feet below surface.

Few water wells are completed in the Silurian and Devonian Carbonates Aquifer System in Johnson County. Proliferous unconsolidated aquifer materials overlie the carbonate bedrock aquifer system and are used as the primary source of water. However, a few wells penetrate 10 to 25 feet of the carbonate bedrock with completed well depths that range from 225 to 265 feet.

The Silurian and Devonian Carbonates Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields are 10 gpm or greater with static water levels commonly reported from 60 to 90 feet below surface. One registered significant water withdrawal facility (one well) has a reported yield 80 gpm. However, this well is located outside the outcrop area at a depth of 500 feet. Also, this well penetrates through the Mississippian Borden Group and Devonian New Albany Shale Aquifer Systems. It is likely that there is some contribution from the overlying bedrock aquifer systems.

Most of the Silurian and Devonian Carbonates Aquifer System is overlain by thick clay deposits. Therefore, most of the aquifer system is considered at low risk to contamination. However, in some areas the aquifer system is overlain by unconsolidated deposits composed primarily of sand and gravel outwash materials. In such areas, the aquifer system is considered at moderate to high risk.

Location Map



EXPLANATION

- Registered Significant Ground-water Withdrawal Facility
- County Road
- State Roads & US Highways
- Interstate
- Stream
- Lake & River
- U.S. Military Reservation Camp Atterbury
- State Managed Property
- Municipal Boundary



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Bedrock Aquifer Systems of Johnson County, Indiana

by
Randall D. Maier
Division of Water, Resource Assessment Section
September 2005

POTENTIOMETRIC SURFACE MAP OF THE BEDROCK AQUIFERS OF JOHNSON COUNTY, INDIANA

Johnson County, Indiana is located in the central portion of the state and is situated within two major drainage basins, the White and West Fork White River Basin to the west and the East Fork White River Basin to the east.

The generalized potentiometric surface map (PSM) contour elevations represent lines of equal elevation relative to the measured groundwater levels in wells. Static water level measurements in individual wells used to construct the potentiometric surface map are indicative of the water level at the time of well completion. Therefore, current site specific conditions may differ due to local or seasonal variations in measured static water levels.

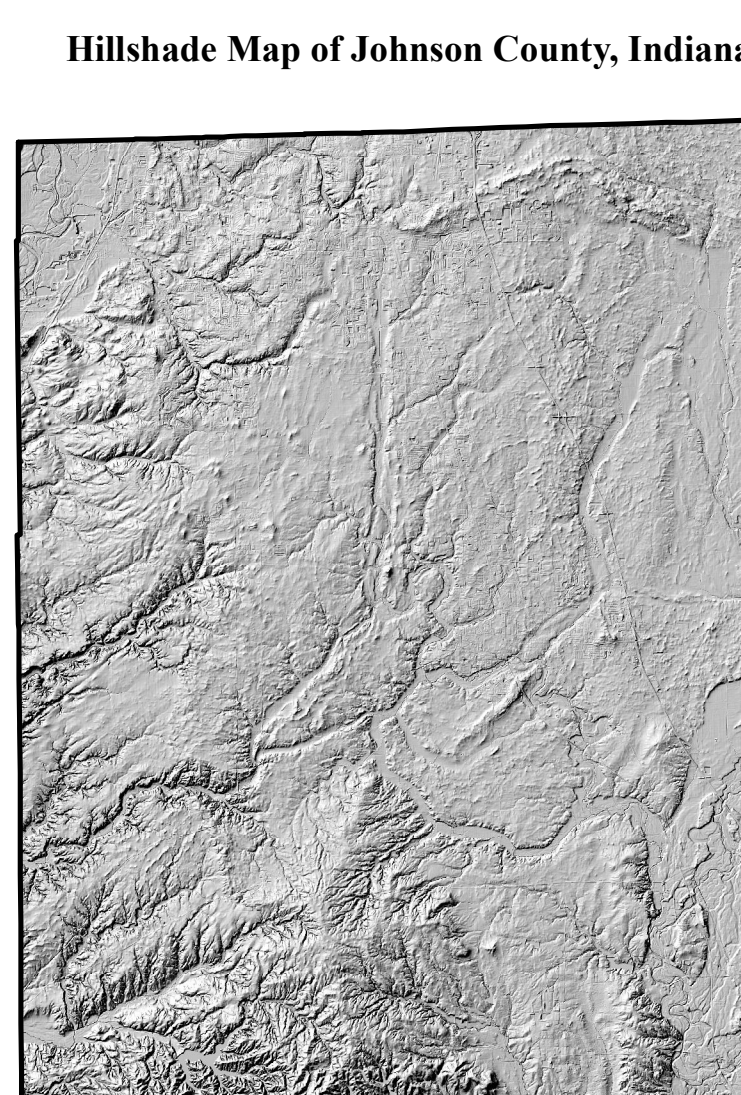
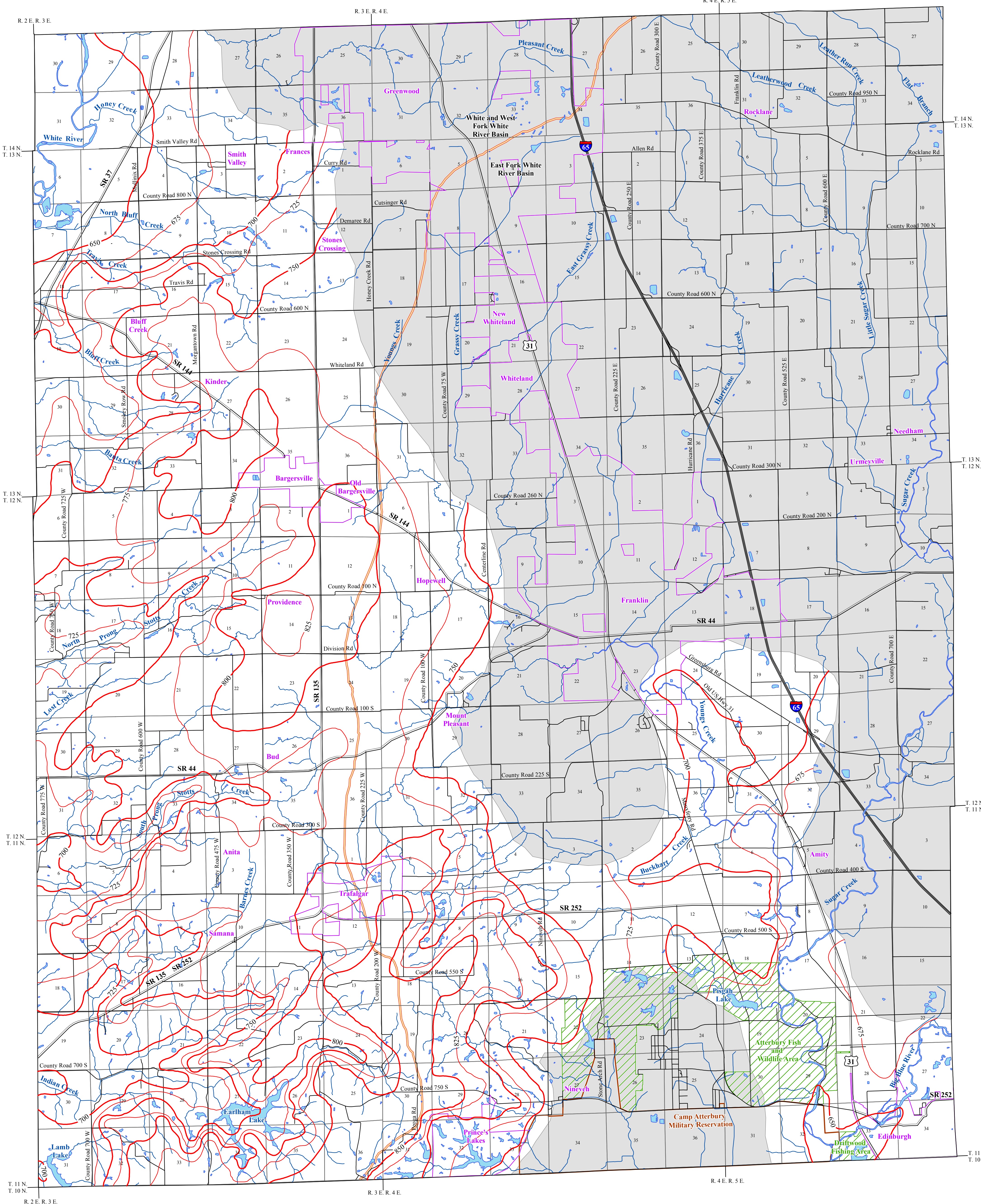
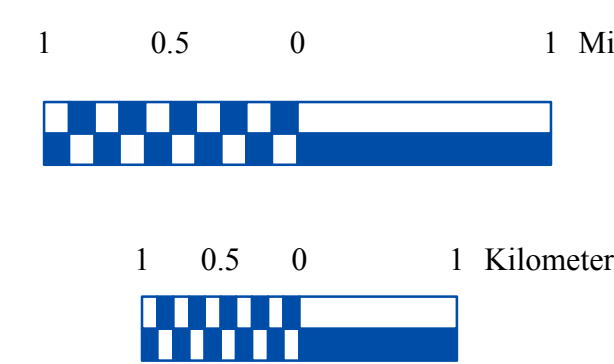
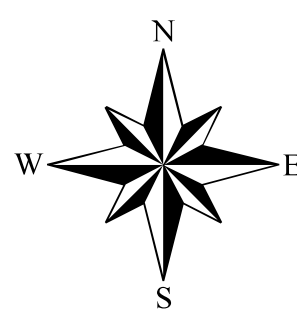
Coordinate locations of water well records were physically obtained in the field, determined through address geocoding, or reported on water well records. Elevation data were either obtained from topographic maps or a digital elevation model (DEM). Elevation and location quality control/quality assurance procedures were utilized to refine or remove data where errors were readily apparent.

In Johnson County depth to bedrock varies ranging from less than 5 feet in the southwest up to 250 feet to the northeast. There are approximately 493 located wells that are completed in bedrock. Wells are generally completed in shale and siltstone bedrock deposits of the Mississippian Borden Group or the Devonian and Mississippian New Albany Shale. However, much of the eastern part of Johnson County is lacking in data and/or covered by more prolific unconsolidated deposits that limit the necessity to complete wells in bedrock. Therefore, potentiometric surface elevations have not been extended through these areas.

Potentiometric surface elevations range from a high of 850 feet mean sea level (msl) in the south-central region of the county near the basin divide, to a low of 650 feet msl in the northwest and southeast parts of the county. Generalized groundwater flow direction for Johnson County is towards major drainage relevant to the basin. Therefore, in the White and West Fork White River Basin, groundwater flow is west towards the White River, and to the east-southeast towards Sugar Creek and the Big Blue River for the East Fork White River Basin.

EXPLANATION

- Line of equal elevation, in feet above mean sea level. Potentiometric Contour interval 10 feet
- Stream
- County Road
- State Road & US Highway
- Interstate
- Basin Boundary
- Municipal Boundary
- Camp Atterbury Military Reservation
- State Managed Property
- Lake & River
- No Aquifer Material or Limited Data



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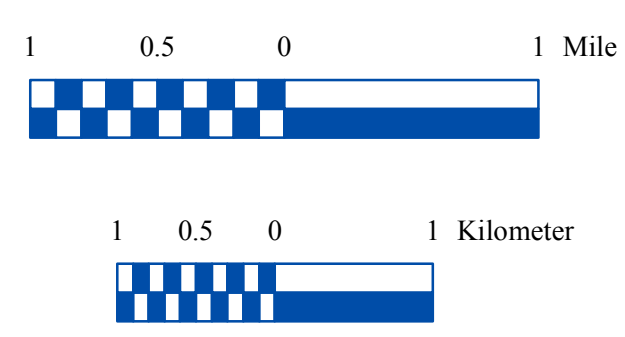
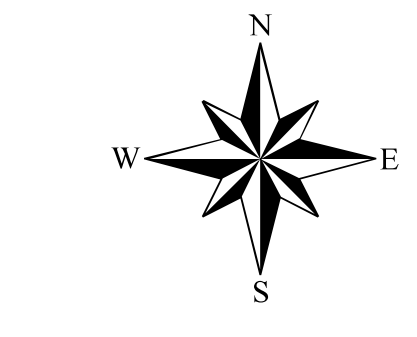
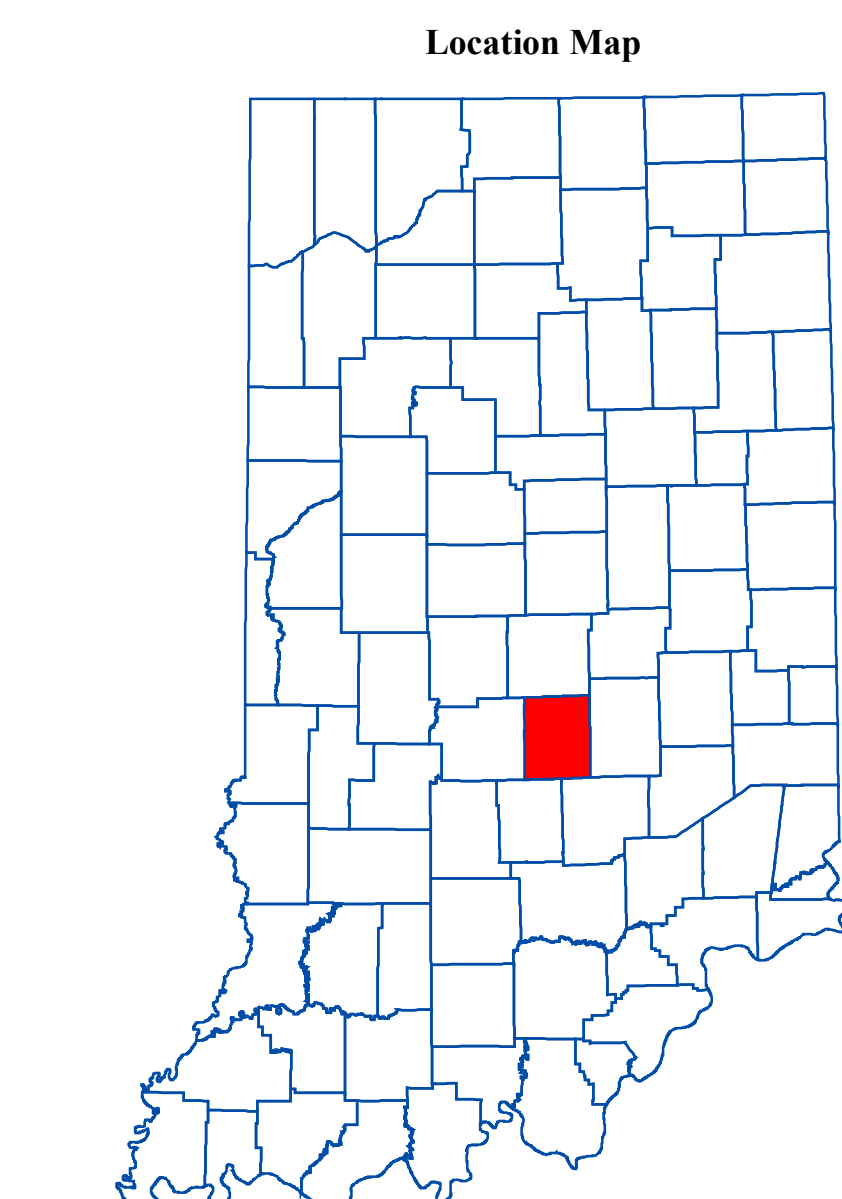
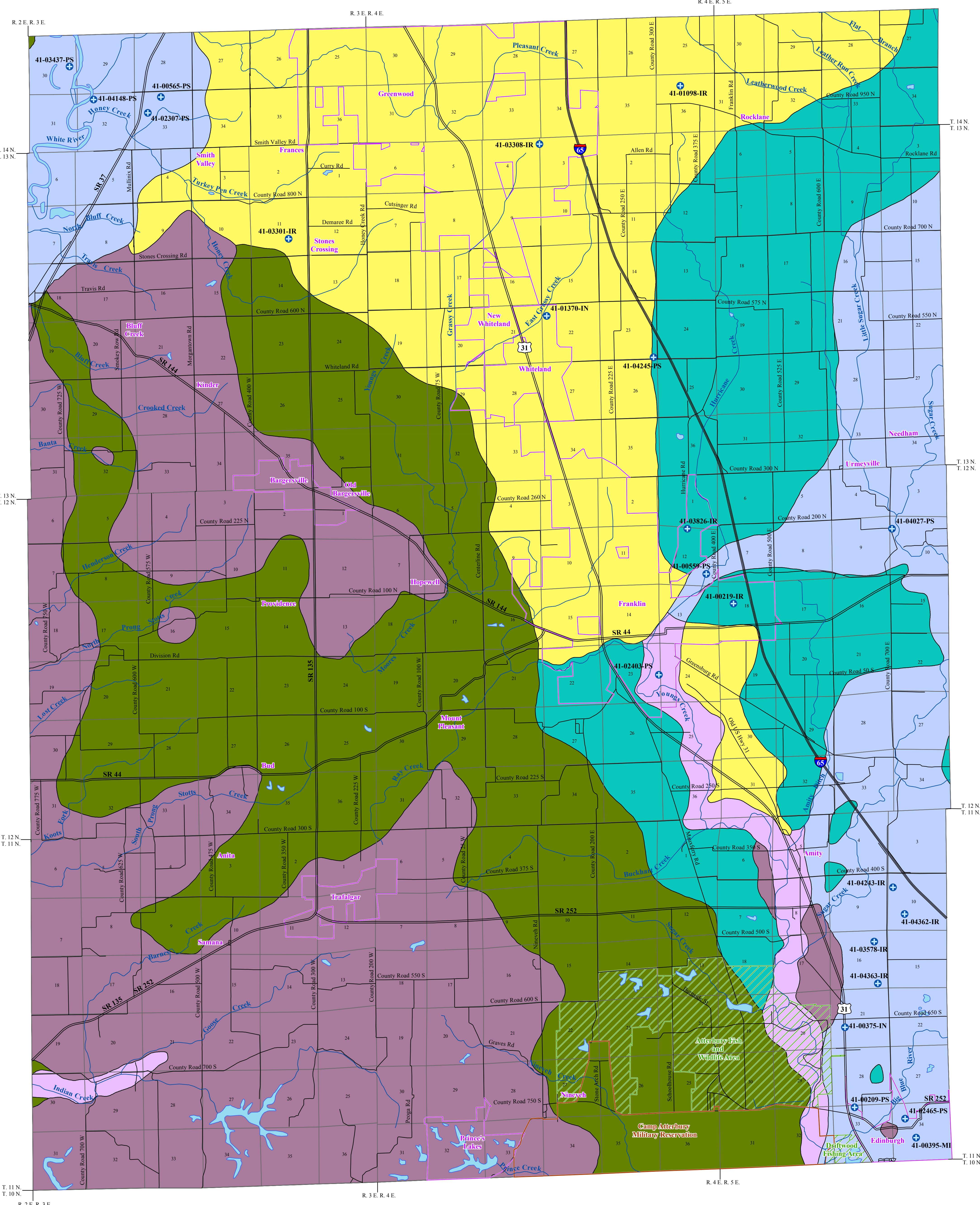
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Potentiometric Surface Map of the Bedrock Aquifers of Johnson County, Indiana

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

September 2012

UNCONSOLIDATED AQUIFER SYSTEMS OF JOHNSON COUNTY, INDIANA



EXPLANATION

- Registered Significant Ground-water Withdrawal Facility
- County Road
- State Roads & US Highways
- Interstate
- Stream
- Municipal Boundary
- U.S. Military Reservation Camp Atterbury
- State Managed Property
- Lake & River

Six unconsolidated aquifer systems have been mapped in Johnson County: the Till Veneer / Dissected Till and Residuum; the New Castle Till; the New Castle Till Subsystem; the New Castle Complex; the White River and Tributaries Outwash; and the White River and Tributaries Outwash Subsystem. Boundaries of these aquifer systems are commonly gradational, and individual aquifers may extend across aquifer system boundaries.

The thickness of unconsolidated sediments in Johnson County is quite variable. Pre-Wisconsin glacial sediments have completely covered the entire county followed by Wisconsin glacial sediments that covered nearly all but the extreme southwest area. Sediments that overlie bedrock range from 5 feet, in areas where only residuum or thin drift is present, to as much as 250 feet.

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.

Till Veneer / Dissected Till and Residuum Aquifer System

The Till Veneer / Dissected Till and Residuum Aquifer System is mapped along portions of the western half of Johnson County, along a portion of Sugar Creek northwest of Edinburgh and in a small area of Edinburgh. The systems are mapped together because they are similar in composition and aquifer characteristics. It is the most limited ground water resource of the unconsolidated aquifer systems in Johnson County.

Unconsolidated deposits of this aquifer system consist mostly of fill with thin layers of stratified drift and, in some areas along the southwestern portion of the county, thin, eroded bedrock residuum. The thickness of these sediments typically range from less than 5 feet (where only residuum is present) to 50 feet. However, there are a few isolated areas where glacial deposits have filled small bedrock valleys and the thickness of sediments is greater.

Because this aquifer system is generally thin and not very productive, most drillers prefer to complete wells in the underlying bedrock aquifer. However, many large diameter bucket or cable tool type wells are successful in meeting the needs of domestic users. Total well depths are commonly 45 to 50 feet. Aquifer materials consist of thin sand and gravel deposits that are typically less than 5 feet in thickness. Well capacities are less than 5 gallons per minute (gpm) with static water levels commonly 8 to 30 feet below surface.

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

New Castle Till Aquifer System

The New Castle Till Aquifer System in Johnson County is mapped mostly in the central and north-central portion of the county. Unconsolidated deposits range from 40 feet (where bedrock is near the surface) to 250 feet (where thick glacial deposits have filled bedrock valleys). Potential aquifer materials include outwash sands and/or gravels that typically range from 10 to 15 feet thick and are generally overlain by 65 to 135 feet of clay.

The New Castle Till Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Well depths generally range from 75 to 150 feet below surface. Domestic well capacities are typically 10 to 15 gpm. There are four registered significant water withdrawal facilities (6 wells) that report well capacities ranging from 70 gpm to 250 gpm. Static water levels range from 10 to 80 feet below surface with some reports of flowing wells.

The New Castle Till Aquifer System is generally not very susceptible to surface contamination because its intertill sand and gravel units are overlain by thick till deposits.

New Castle Till Aquifer Subsystem

The New Castle Till Aquifer Subsystem is mapped mostly in the central portion of Johnson County and southeast to the county boundary. The characteristics of the New Castle Till Aquifer Subsystem are similar to that of the New Castle Till Aquifer System. However, thickness of potential aquifer materials and potential yield is significantly less. Typical well depths range from 50 feet to 90 feet. Potential outwash aquifer materials include thin, intertill sand and gravel deposits that range from 1 to 5 feet in thickness. The outwash aquifer deposits are capped by till generally 45 to 80 feet thick. Also, a few abandoned water wells at Camp Atterbury Military Reservation, along with some seismic data, indicate thickness of unconsolidated materials up to 130 feet.

The New Castle Till Aquifer Subsystem is capable of meeting the needs of some domestic users. However, in some cases it is necessary for drillers to continue below the aquifer bearing zone into underlying clay deposits. This increases well capacity by allowing for extra borehole storage. Typical well yields range from 4 to 10 gpm. Static water levels are generally 10 to 35 feet below land surface. Abandoned test wells located at Atterbury Military Reserve report well yields of 15 to 40 gpm with static water levels that range from 20 to 70 feet below land surface. However, significant drawdown is reported on some well records indicating limited yield in isolated areas.

The New Castle Till Aquifer Subsystem is generally not very susceptible to surface contamination because its intertill sand and gravel units are overlain by thick till deposits.

New Castle Complex Aquifer System

The New Castle Complex Aquifer System is mapped in portions of the eastern half of Johnson County. The system is commonly mapped adjacent to outwash aquifer systems. The New Castle Complex Aquifer System is characterized by unconsolidated deposits that are quite variable in materials and thickness. Sand and gravel aquifer deposits vary from thin to massive and are typically overlain by a thick till. However, the system also exhibits multiple layers of outwash and till of variable thickness above the aquifer resource. Total thickness of unconsolidated deposits can be as much as 250 feet.

Typical well depths range from 60 to 125 feet. Outwash aquifer materials range from 1 to 105 feet in thickness but are typically 5 to 30 feet thick. The aquifer deposits can be overlain by till up to 215 feet thick. However, the till cap is generally 35 to 90 feet. In some areas the outwash aquifer materials are separated from upper sand and gravel deposits (not typically used as a resource) by till that commonly ranges from 10 to 40 feet thick. The upper sands and gravels are typically 2 to 20 feet thick.

The New Castle Complex is capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields range from 15 to 20 gpm. Three registered significant water withdrawal facilities (3 wells) report pumping capacities that range from 70 gpm to 700 gpm. Typical static water levels range from 15 to 40 feet below surface.

The New Castle Complex Aquifer System is not very susceptible to contamination where thick clay materials overlie. However, in some areas where outwash is present at or near the surface and clay deposits are thin, the system is at moderate to high risk.

White River and Tributaries Outwash Aquifer System

The White River and Tributaries Outwash Aquifer System in Johnson County is mapped in the northwest corner along the White River and along most of the eastern third of the county along Hurricane Creek, Sugar Creek and the Big Blue River. This system contains large volumes of outwash and alluvial deposits that filled the river valleys of the 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.

Total thickness of unconsolidated deposits can be as much as 165 feet with up to 110 feet of continuous sand and gravel. In some areas, however, strings of silt, clay-sand or clay-gravel mixtures, generally 5 to 30 feet thick, disrupt the continuity of the sands and gravels. Well depths are typically 45 to 85 feet. Aquifer materials are commonly 10 to 45 feet thick and may be capped by 5 to 25 feet of clay or silt.

This system has the greatest potential of any aquifer system in Johnson County and can meet the needs of domestic and high-capacity users. Domestic well yields commonly range from 10 to 25 gpm. There are fourteen registered significant water withdrawal facilities (45 wells) in this system. Reported well capacities are up to 2700 gpm but are typically 500 to 1500 gpm. Static water levels range from 10 to 25 feet below surface with some reports of flowing wells.

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.

White River and Tributaries Outwash Aquifer Subsystem

In Johnson County the White River and Tributaries Outwash Aquifer Subsystem is mapped in the southwest corner along Indian Creek and to the east of Franklin from the confluence of Hurricane Creek and Youngs Creek continuing south to the Bartholomew County line.

There are few wells available in the White River and Tributaries Outwash Aquifer Subsystem. Well depths typically range from 35 to 40 feet below surface. Sand and gravel aquifer deposits are generally 10 to 35 feet thick. The sands and gravels may also be capped by a silt or clay 5 to 20 feet thick. In a few isolated areas bedrock is shallow; some drillers bypass the unconsolidated sediments and continue to bedrock allowing for extra borehole storage. However, typical penetration of the bedrock is less than 10 feet and it is likely that the overlying sands and gravels contribute significantly to the well yield.

This aquifer system has the potential to meet the needs of domestic and some high-capacity users. Domestic well yields are typically from 10 to 25 gpm with static water levels 5 to 20 feet below surface. There is one registered significant water withdrawal facility (3 wells) in the outwash subsystem in Johnson County with reported capacities that range from 100 gpm to 450 gpm.

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

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Unconsolidated Aquifer Systems of Johnson County, Indiana

by
Randall D. Maier
Division of Water, Resource Assessment Section
September 2005

POTENTIOMETRIC SURFACE MAP OF THE UNCONSOLIDATED AQUIFERS OF JOHNSON COUNTY, INDIANA

Johnson County, Indiana is located in the central portion of the state and is situated within two major drainage basins, the White and West Fork White River Basin to the west and the East Fork White River Basin to the east.

The generalized potentiometric surface map (PSM) contour elevations represent lines of equal elevation relative to the measured groundwater levels in wells. Static water level measurements in individual wells used to construct the potentiometric surface map are indicative of the water level at the time of well completion. Therefore, current site specific conditions may differ due to local or seasonal variations in measured static water levels.

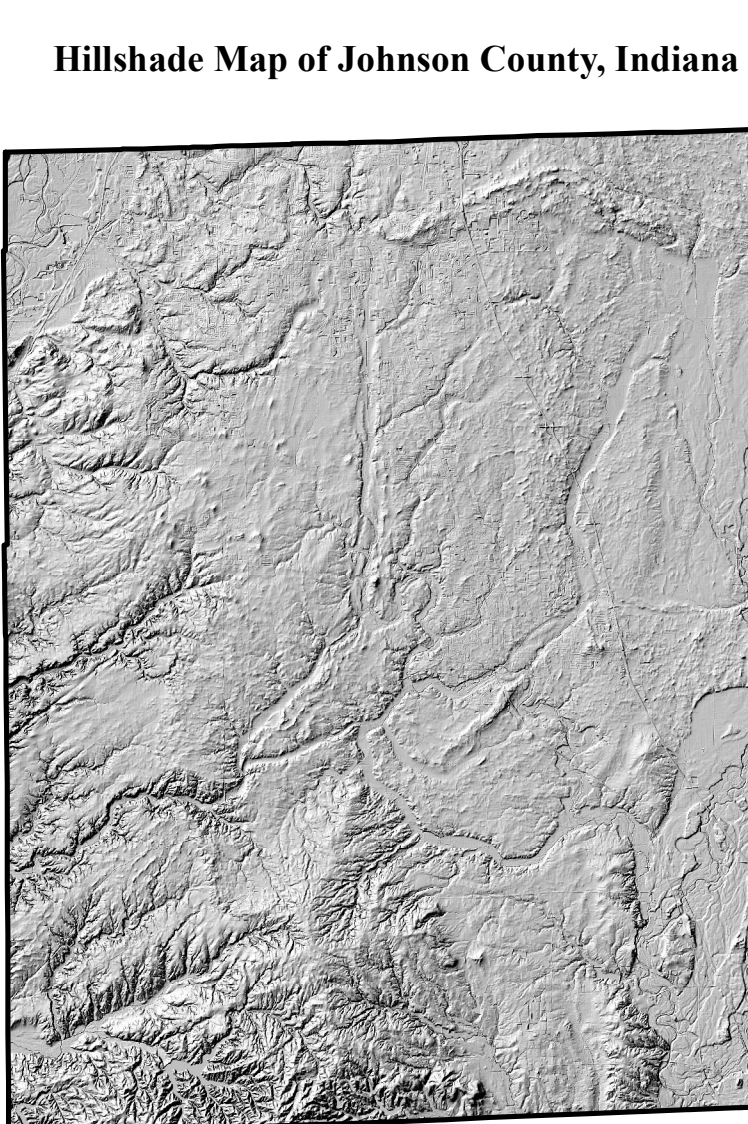
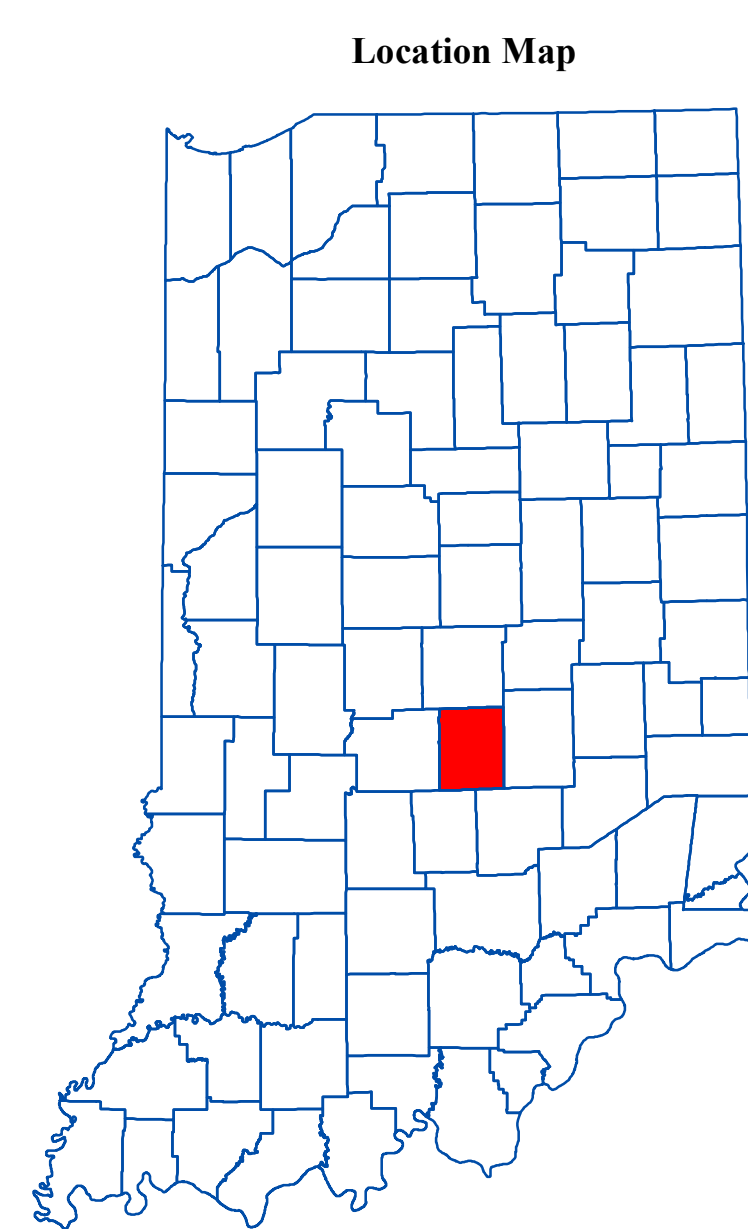
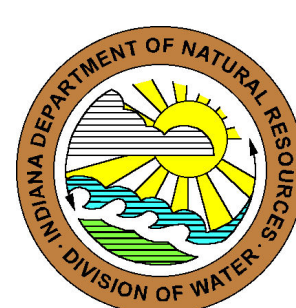
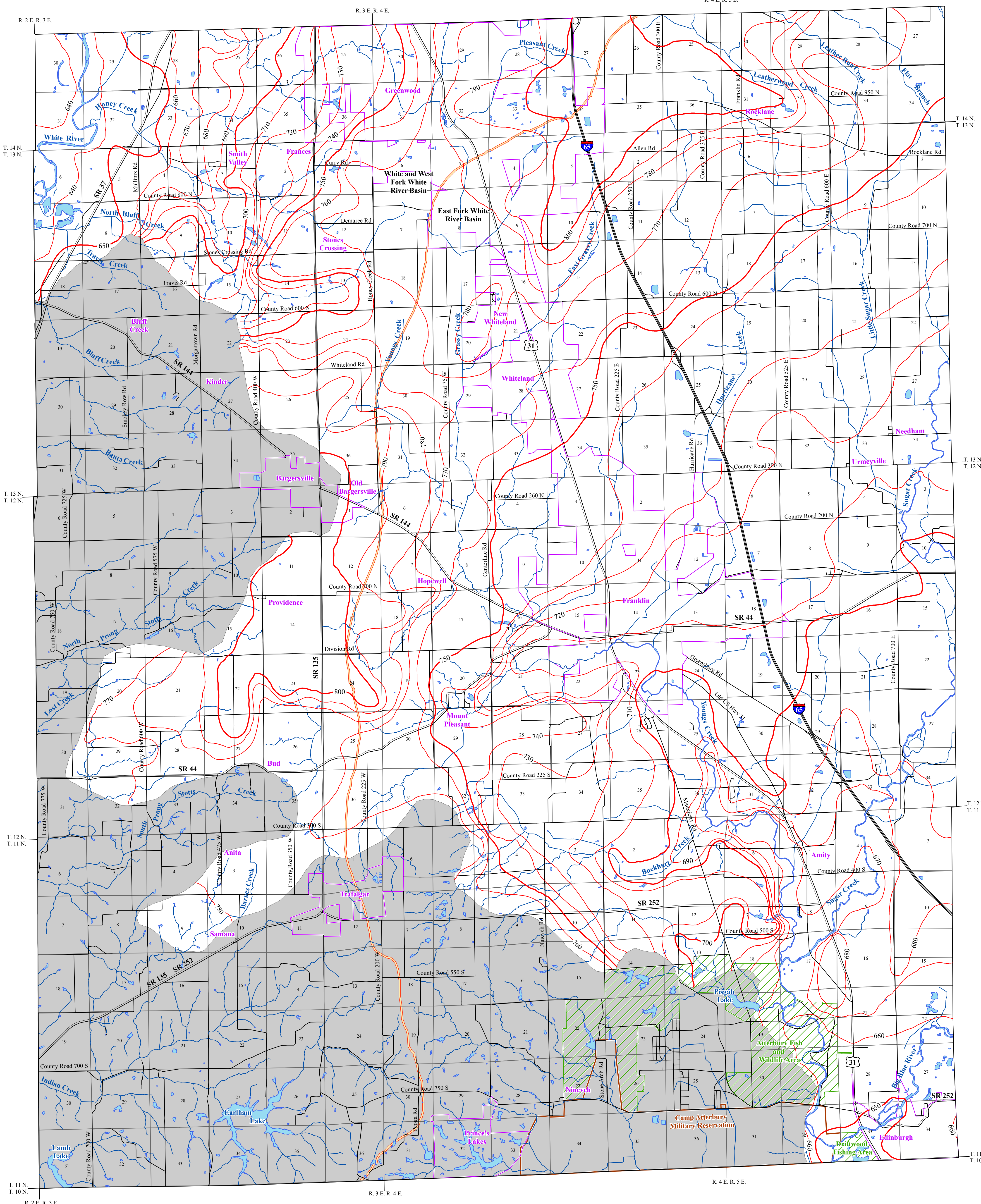
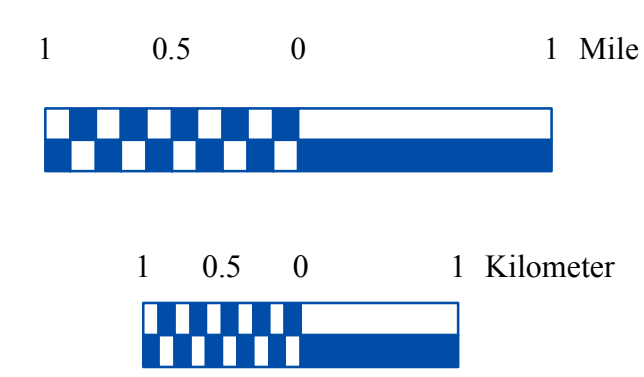
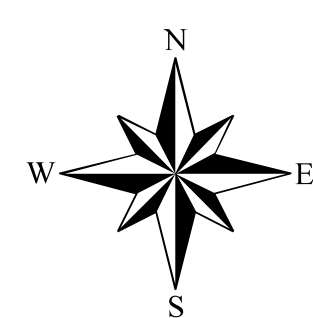
Coordinate locations of water well records were physically obtained in the field, determined through address geocoding, or reported on water well records. Elevation data were either obtained from topographic maps or a digital elevation model (DEM). Elevation and location quality control assurance procedures were utilized to refine or remove data where errors were readily apparent.

In Johnson County well depths 100 feet or less were a priority in mapping the potentiometric surface. However, portions of western and southern Johnson County are lacking in data and/or are covered by deposits that have limited to non-existent aquifer potential. Therefore, potentiometric surface elevations contours have not been extended through these areas. There are approximately 1,747 unconsolidated water well records in the county within the priority depth range with approximately 925 (53%) of these wells located.

Potentiometric surface elevations range from a high of 800 feet mean sea level (msl) in the east-central and north-central region of the county near the basin divide, to lows of 640 feet msl in the northwest and 650 feet msl in the southeast part of the county. Generalized groundwater flow direction for Johnson County is towards major drainage relevant to the basin. Therefore, in the White and West Fork White River Basin, groundwater flow is west towards the White River, and to the east-southeast towards Sugar Creek and the Big Blue River for the East Fork White River Basin.

EXPLANATION

- 950 Line of equal elevation, in feet above mean sea level. Potentiometric Contour interval 10 feet
- Stream
- County Road
- State Road & US Highway
- Interstate
- Basin Boundary
- Municipal Boundary
- Camp Atterbury Military Reservation
- State Managed Property
- Lake & River
- No Aquifer Material or Limited Data



Vertical Exaggeration = 10x

Map Use and Disclaimer Statement

We request that the following agency be acknowledged in products derived from this map: Indiana Department of Natural Resources, Division of Water.

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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 Department of Transportation and based on a 1:24,000 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. Hydrography, Streams (NHID) (line shapefile, 20081218), Rivers (NHD) (polygon shapefile, 20081218), Lakes (NHD) (polygon shapefile, 20081218) was from the U.S. Geological Survey and the U.S. Environmental Protection Agency and based on a 1:24,000 scale. Managed Lands IDNR IN (polygon shapefile, 20100920) was from IDNR and based on a 1:24,000 scale. County Hillshade image was from the U.S. Geological Survey National Elevation Dataset (raster image, 20100524). No Aquifer Material and Limited Data (polygon shapefile, 2005) (polygon shapefile) coverage is based on The Unconsolidated Aquifer Systems of Johnson County, Indiana (line shapefile, Maier, 2005). Potentiometric Surface Map of the Unconsolidated Aquifers of Johnson County, Indiana (line shapefile, Maier, 2012) was based on a 1:24,000 scale.

Potentiometric Surface Map of the Unconsolidated Aquifers of Johnson County, Indiana

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Johnson County

