

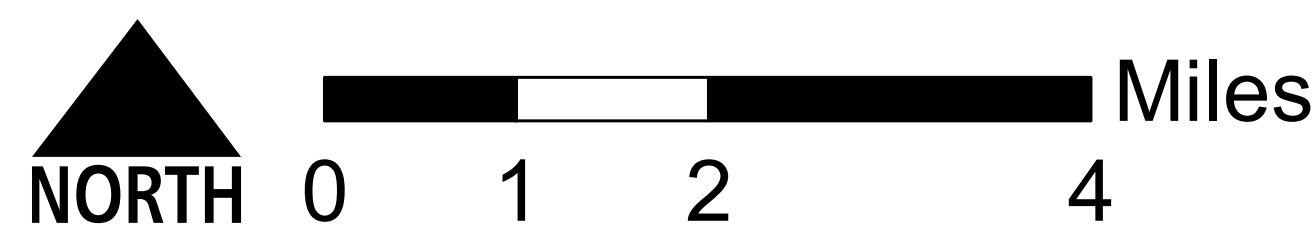
# Water Resources and Use in Marion County

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



# BEDROCK AQUIFER SYSTEMS OF MARION COUNTY, INDIANA

The occurrence of bedrock aquifers depends on the original composition of the geologic material 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.

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 bedrock aquifers are highly variable.

Most bedrock aquifers are under confined conditions, mainly a result of low vertical hydraulic conductivity clay-rich materials, such as glacial till, overlying the bedrock. Therefore, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing zone.

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 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 within Marion County. They are, from youngest to oldest and from west to east: the Borden Group of Mississippian age, the New Albany Shale of Devonian and Mississippian age, and the Silurian and Devonian Carbonates.

Depth to bedrock ranges from outcropping along a relatively small area of the White River in the north-central section of Marion County, to being overlain by unconsolidated deposits up to about 305 feet thick in the northeast. Approximately 19 percent of all wells in this county are completed in bedrock.

## Mississippian – Borden Group Aquifer System

The Borden Group subgroups in the southwest area of Marion County, and in a relatively small area of the northwestern corner of the county. This bedrock aquifer system is composed mostly of sandstone, siltstone, mudstone and shale. Although carbonates are somewhat rare, discontinuous interbedded limestone lenses are present. The Borden Group in Marion County is overlain by unconsolidated deposits up to approximately 230 feet in thickness.

The Borden Group is composed primarily of fine-grained materials that limit the movement of groundwater to fractures, joints, and along the bedrock surface. This aquifer system is often described as an aquitard, and yields of wells completed in it are typically quite limited. Because the Borden Group is generally not very productive, most wells produce either from the overlying unconsolidated deposits or penetrate through the sandstone, siltstone, mudstone and shale in favor of the underlying carbonates.

Wells started in this system are completed at depths ranging from approximately 35 to 400 feet. Domestic well yields range from 2 to 20 gallons per minute (gpm) with static water levels from about 5 to 250 feet below surface. There are no registered significant groundwater withdrawal facilities using the Borden Group Aquifer System.

Where bedrock is shallow, risk to contamination from the surface or near surface sources is high. Where the overlying sediments consist of thick fine-grained clay materials, the Borden Group Aquifer System is 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 high risk.

## Devonian and Mississippian – New Albany Shale Aquifer System

The New Albany Shale subgroups in a northwest to southeast trend in Marion County and consists mostly of brownish-black carbonaceous shale, greenish-gray shale, and minor amounts of dolomite and dolomitic quartz sandstone. The New Albany Shale is often described as an aquitard, and yields of wells completed in it are typically quite limited. Therefore, most wells either produce from the overlying unconsolidated deposits or penetrate through the shale in favor of the underlying Silurian and Devonian Carbonates.

The depths of the relatively few wells reported in the New Albany Shale Aquifer System range from approximately 30 to 415 feet deep, and the amount of rock penetrated in this system is generally about 10 to 240 feet. Domestic water well yields are typically less than 5 gpm with many dry holes having been reported in this system. There are no registered significant groundwater withdrawal facilities using the New Albany Shale Aquifer System.

The permeability of shale materials is considered low, therefore, the New Albany Shale Aquifer System is considered to have a low susceptibility to contamination introduced at or near the surface.

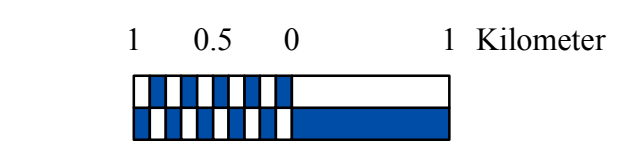
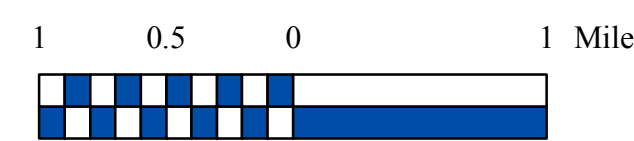
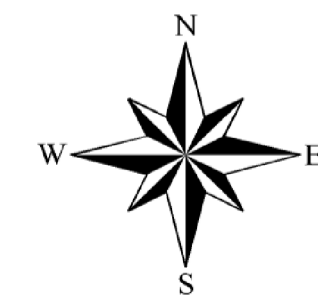
## Silurian and Devonian Carbonates Aquifer System

In Marion County, the outcrop/subcrop area of the Silurian and Devonian Carbonates Aquifer System is present in the central and eastern portions of the county. This system includes middle-Devonian age carbonates (finesandstone 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 Silurian and Devonian Carbonates Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Wells in the system penetrate up to 400 feet into the carbonate bedrock with completed well depths ranging from 30 to 485 feet. Typical domestic yields are 10 gpm or greater with static water levels reported from flowing to 227 feet below surface.

There are 14 registered significant groundwater withdrawal facilities (39 wells) using the Silurian and Devonian Carbonates Aquifer System. These facilities are used for public supply, industry, irrigation, and energy production. The reported yields for these wells range from 59 to 1,200 gpm.

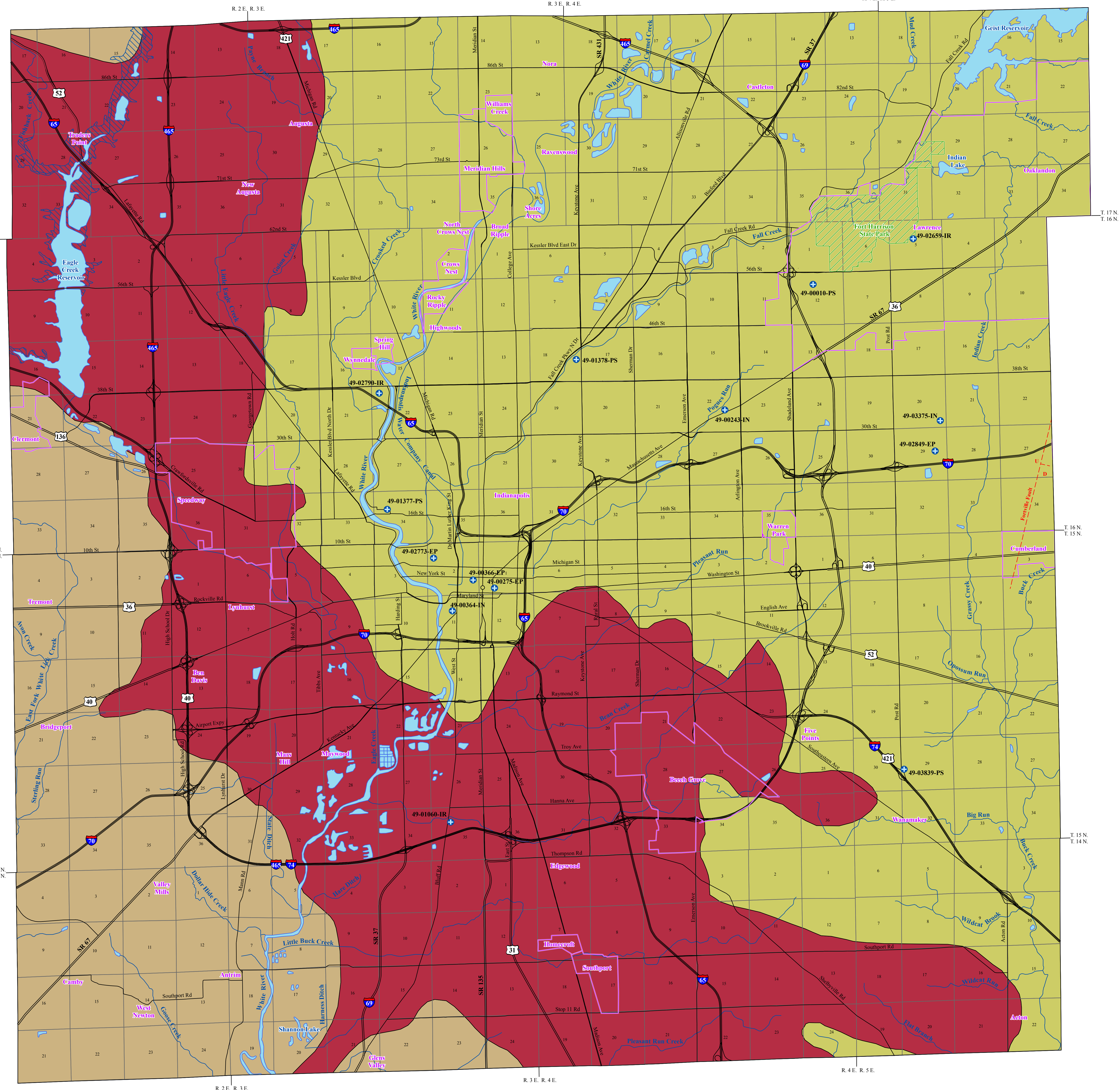
Most of the Silurian and Devonian Carbonates Aquifer System is overlain by thick clay deposits. Therefore, most of the aquifer system is considered at low risk to contamination. However, in some areas the aquifer system is overlain by unconsolidated deposits composed primarily of sand and gravel outwash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



### EXPLANATION

- Registered Significant Groundwater Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Interstate
- Fortville Fault
- Municipal Boundary
- State Managed Property
- Inundation Area of Eagle Creek Reservoir
- Lake & River

### Location Map



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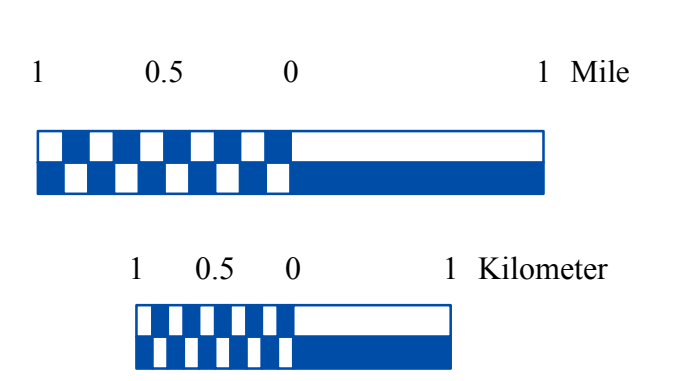
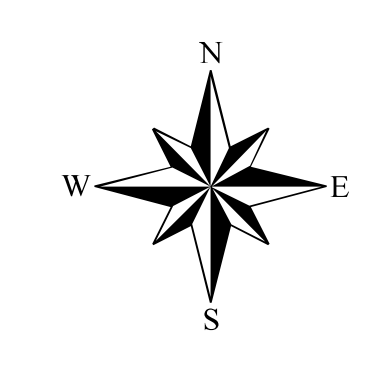
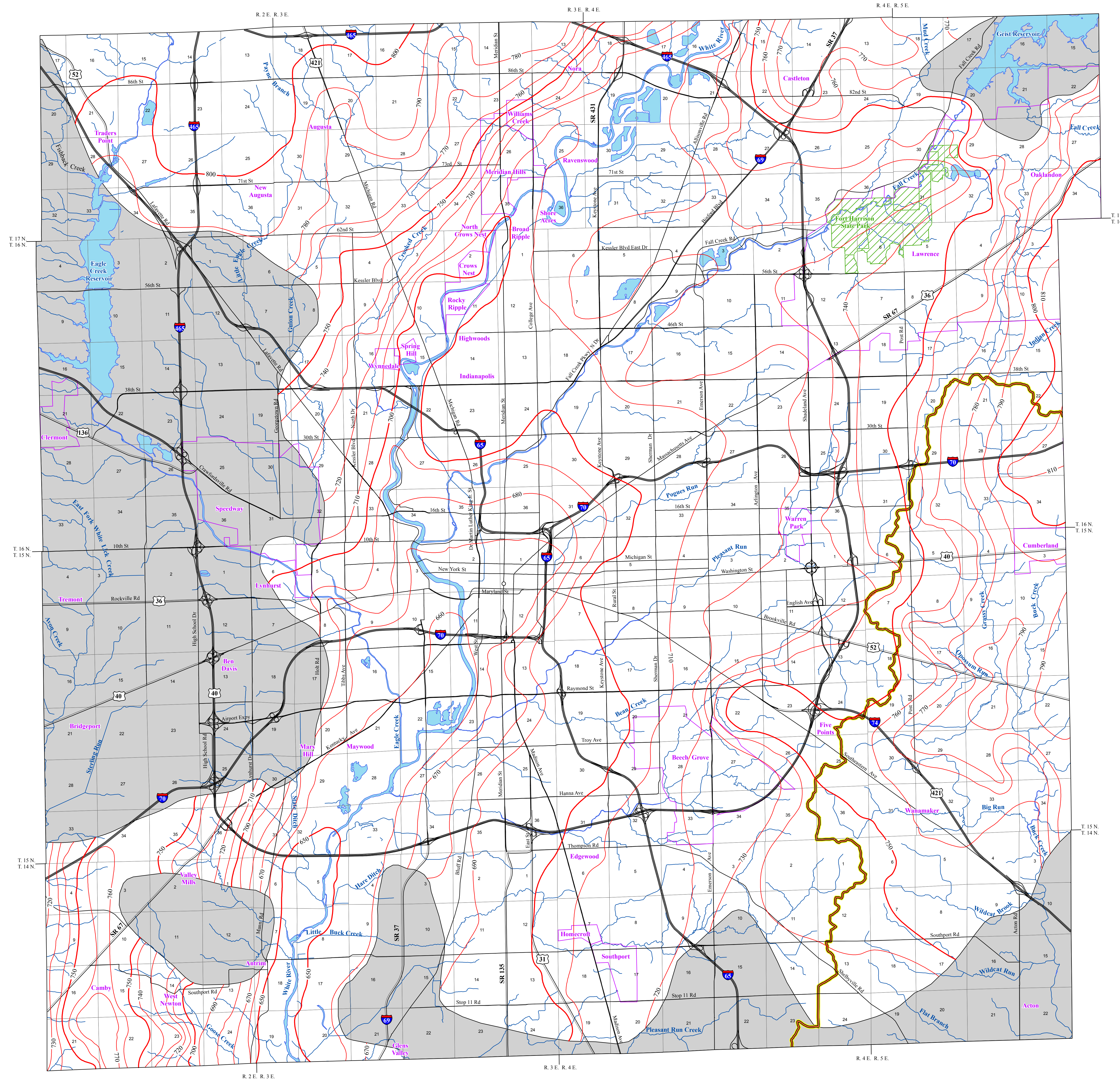
This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) and County Boundaries of Indiana (polygon shapefile, 20020621) were all from the Indiana Geological Survey and based on a 1:24,000 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. Structural Features of Indiana (line shapefile, 20020718) was from the Indiana Geological Survey and based on various scales. Managed Areas 96 (polygon shapefile, various dates) was from HDNR.

### Bedrock Aquifer Systems of Marion County, Indiana

by  
 Robert K. Schmidt  
 Division of Water, Resource Assessment Section

May 2011

# POTENTIOMETRIC SURFACE MAP OF THE BEDROCK AQUIFERS OF MARION COUNTY, INDIANA



**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
- State Managed Property
- Lake & River
- No Aquifer Material or Limited Data

Marion County, Indiana is located in the central portion of the state. Nearly the entire county is situated within the White and West Fork White River Basin, with the exception of the southeastern portion which is located in the East Fork White River Basin.

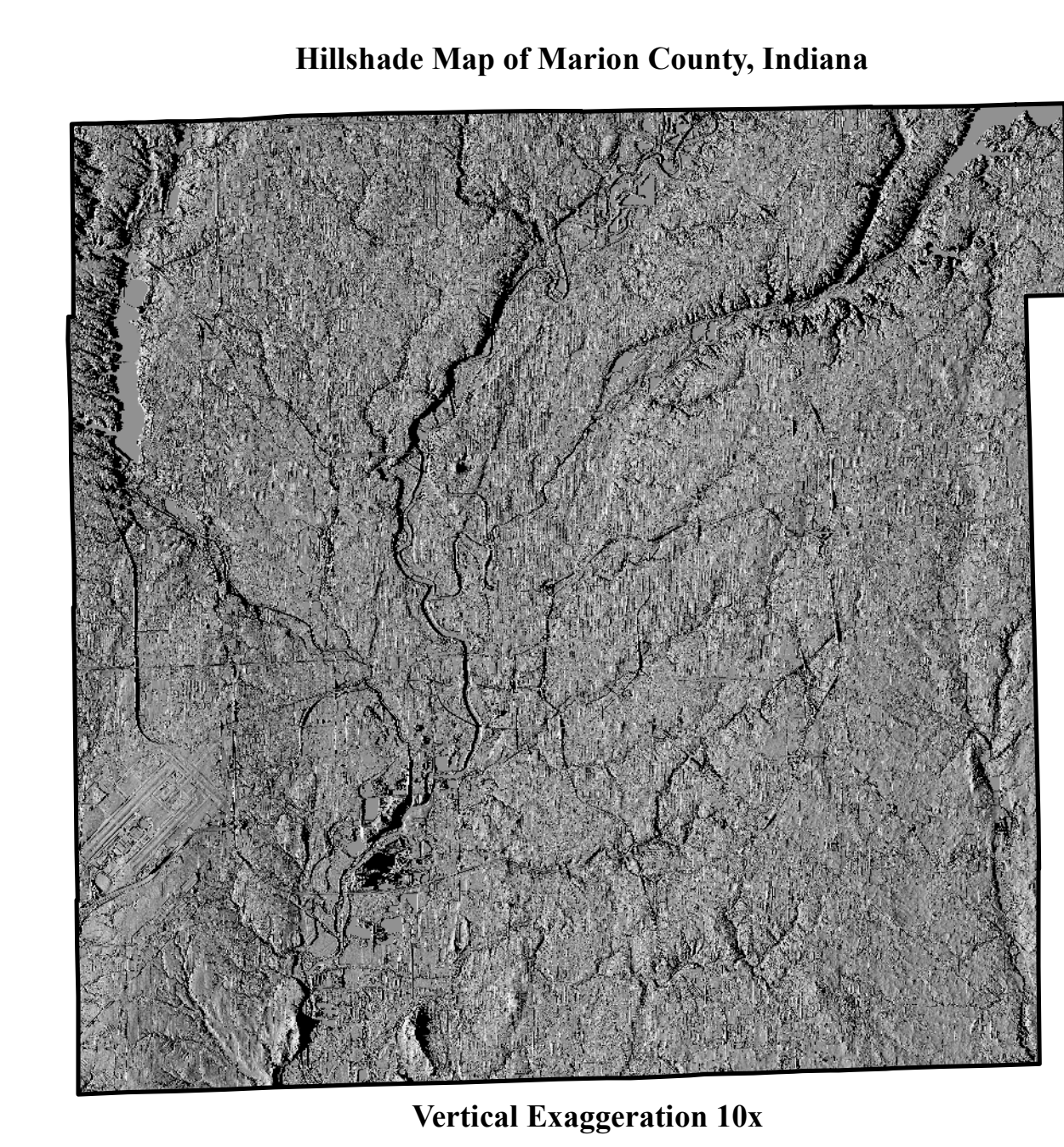
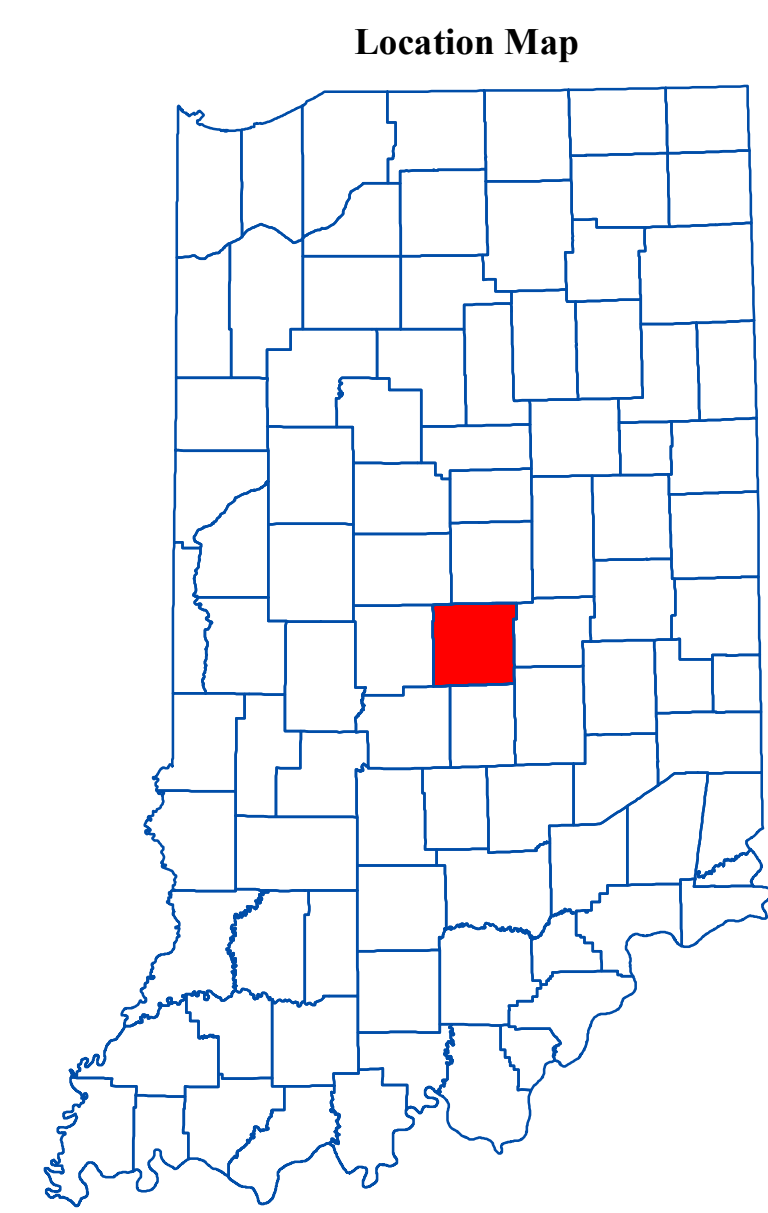
The Potentiometric Surface Map (PSM) of the bedrock aquifers of Marion County was mapped by contouring the elevations of over 1100 static water-levels reported on well records received primarily over a 50 year period. These wells are completed in bedrock aquifers at various depths, and typically, under confined conditions (bounded by impermeable layers above and below the water bearing formation). However, some wells were completed under unconfined (not bounded by impermeable layers) settings. The potentiometric surface is a measure of the pressure on water in a water bearing formation. Water in an unconfined aquifer (water table) is at atmospheric pressure and will not rise in a well above the top of the water bearing formation, in contrast to water in a confined aquifer which is under hydrostatic pressure and will rise in a well above the top of the water bearing formation.

Static water-level measurements in individual wells used to construct county PSM's are indicative of the water-level at the time of well completion. The groundwater level within an aquifer constantly fluctuates in response to rainfall, evapotranspiration, groundwater movement, and pumping. Therefore, current site specific conditions may differ due to local or seasonal variations in measured static water levels. Because fluctuations in groundwater are typically small, static water-levels can be used to construct a generalized PSM. Groundwater flow is naturally from areas of recharge toward areas of discharge. As a general rule, but certainly not always, groundwater flow approximates the overlying topography and intersects the land surface at major streams. The contour type was determined based on the amount of data and the degree of change in water levels between wells in each mapped area. However, portions of the 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.

Universal Transverse Mercator (UTM) coordinates for the water wells were either physically obtained in the field, determined through address geocoding or reported on water well records; however, the location of the majority of the water well records used to make the PSM were address geocoded. Elevation data were either obtained from topographic maps or a digital elevation model. Quality control/quality assurance procedures were utilized to refine or remove data where errors were readily apparent.

Bedrock potentiometric surface elevations in Marion County range from a high of 810 feet mean sea level (msl) along the east-central border with Hancock County, to a low of 650 feet msl in the south-central portion. Groundwater flow direction within the White and West Fork White River Basins is generally towards the White River. Within a small area in the southwest corner of the county groundwater flows to the west-southwest towards East Fork White Lick Creek in Hendricks County.

The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. County PSM's represent overall regional characteristics and are not intended to be a substitute for site-specific studies.



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**Potentiometric Surface Map of the  
Bedrock Aquifers of Marion County, Indiana**  
by  
Glenn E. Grove  
Division of Water, Resource Assessment Section  
September 2012

Map generated by Scott H. Dean  
DNR, Division of Water, Resource Assessment Section

# UNCONSOLIDATED AQUIFER SYSTEMS OF MARION COUNTY, INDIANA

The unconsolidated aquifer systems of Marion County are composed of sediments deposited by, or resulting from, a complex sequence of glacial, glacial meltwaters, and post-glacial precipitation events. Six unconsolidated aquifer systems have been mapped in Marion County: the Till Veneer, the New Castle / Tipton Till, the New Castle / Tipton Till Subsystem, the New Castle / Tipton Complex, the White River and Tributaries Outwash, and the White River and Tributaries Outwash Subsystem. Because of the complicated glacial geology, boundaries of the aquifer systems in this county are commonly gradational and individual aquifers may extend across aquifer system boundaries. Approximately 81 percent of all wells in this county are completed in unconsolidated deposits.

The thickness of unconsolidated deposits in Marion County is quite variable, due to the deposition of glacial material over an uneven bedrock surface. Unconsolidated deposits in the county typically range from bedrock exposure along the White River in the north-central portion of Marion County, to about 305 feet thick in the northeastern section of the county.

Regional estimates of aquifer susceptibility to contamination from the surface can differ considerably due to a wide range of variation within geologic environments. 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 Aquifer System

The Till Veneer Aquifer System is mapped primarily in southwestern Marion County, and along the western edge of the White River in the central and northern portions of the county. This system is the product of the deposition of glacial till over an uneven, eroded bedrock surface, and is generally less than 50 feet thick.

In the Till Veneer Aquifer System, potential aquifers include thin isolated sand and/or gravel layers, and surficial sand and gravel over alluvium; however, this system has the most limited groundwater resources of the unconsolidated aquifer systems with most wells being completed in the underlying bedrock.

Most of the wells in this system have reported capacities of 5 gallons per minute (gpm) or less, with static water levels ranging from flowing to about 50 feet below the surface. There are no registered significant groundwater withdrawal facilities utilizing this system.

This system is generally not very susceptible to contamination from surface sources because of the low permeability of the near-surface materials. However, there are areas where protective clay layers are thin or absent. These areas are very susceptible to contamination.

## New Castle / Tipton Till Aquifer System

The New Castle / Tipton Till Aquifer System is mapped throughout Marion County. This aquifer system is up to about 305 feet in thickness, and consists primarily of glacial till with intertill sand and gravel layers.

This aquifer system is capable of meeting the needs of most domestic and some high-capacity users in Marion County. Individual sand and gravel units are commonly 5 to 15 feet thick with well depths ranging from 25 to 300 feet. Domestic well yields are typically 10 to 50 gpm and static water levels range from flowing to 185 feet below the land surface. There are 17 registered significant groundwater withdrawal facilities (38 wells) using the New Castle / Tipton Till Aquifer System. These facilities are used for public water supply, irrigation, industrial and energy production. The reported high-capacity yields for the wells range from 70 to 430 gpm.

The New Castle / Tipton Till Aquifer System typically has a low susceptibility to surface contamination because intertill sand and gravel units are commonly overlain by thick glacial till. However, shallow wells completed in this system are moderately susceptible to contamination.

## New Castle / Tipton Till Aquifer Subsystem

The New Castle / Tipton Till Aquifer Subsystem is generally found throughout Marion County. The subsystem is mapped similar to the New Castle / Tipton Till Aquifer System, but, potential aquifer materials are generally thinner and potential yields are less in the subsystem.

In Marion County, the New Castle / Tipton Till Aquifer Subsystem is capable of meeting the needs of most domestic users; however, about 35 percent of the wells started in this subsystem are completed in the underlying bedrock aquifer system.

Potential aquifer materials include relatively thin, discontinuous intertill sand and gravel deposits. These intertill sand and gravel aquifer materials are commonly less than 10 feet thick. The wells producing from this subsystem are typically completed at depths ranging from about 30 to 230 feet. Domestic well yields are generally 5 to 10 gpm, and static water levels range from flowing to 180 feet below the surface. There are no registered significant groundwater withdrawal facilities utilizing this subsystem.

This subsystem is generally not very susceptible to surface contamination because intertill sand and gravel units are overlain by thick till deposits. Wells producing from shallow aquifers are moderately susceptible to contamination.

## New Castle / Tipton Complex Aquifer System

The New Castle / Tipton Complex Aquifer System is mapped primarily in the east, and in several relatively small areas in the western half of Marion County. Multiple glacial advances have resulted in complex sequences of thick clays with intertill sand and gravel aquifers that are highly variable in depth, thickness, and lateral extent. The total thickness of the combined unconsolidated deposits is up to about 280 feet in this system.

The deeper more prolific aquifers of this system are capable of meeting the needs of domestic and most high-capacity users in Marion County. Saturated aquifer materials in the New Castle / Tipton Complex Aquifer System range from 10 to 25 feet thick, and wells in this system are completed at depths from about 30 feet up to 260 feet. Domestic well yields range up to 50 gpm with reported static water levels from flowing to 160 feet below the surface. There are six registered significant groundwater withdrawal facilities (11 wells) using this system. These facilities are used for irrigation and industry. The reported high-capacity yields for the wells range from 70 to 1,100 gpm.

The New Castle / Tipton Complex Aquifer System is not very susceptible to contamination where overlain by thick clay deposits. However, in some areas where surficial clay deposits are relatively thin, the shallow aquifer, if present, is at moderate to high risk.

## White River and Tributaries Outwash Aquifer System

The White River and Tributaries Outwash Aquifer System is mapped adjacent to the White River in the central portion of the county, and the three tributaries entering the county from the northwest and northeast. The system includes thick glacial outwash sands and gravels that are generally capped by a layer of clay and silt deposits.

This aquifer system is capable of meeting the needs of both domestic and high-capacity users in Marion County. The wells utilizing this aquifer system are completed at depths ranging from 25 to 277 feet with saturated sand and gravel aquifer materials commonly 10 to 35 feet thick. Domestic well yields are typically up to 50 gpm with static water levels ranging from flowing to about 165 feet below the surface. In the White River and Tributaries Outwash Aquifer System there are 37 registered significant groundwater withdrawal facilities (145 wells). Reported production for these high-capacity wells ranges from 70 to 3040 gpm, and the uses for these facilities are energy production, public supply, industry, irrigation, and miscellaneous.

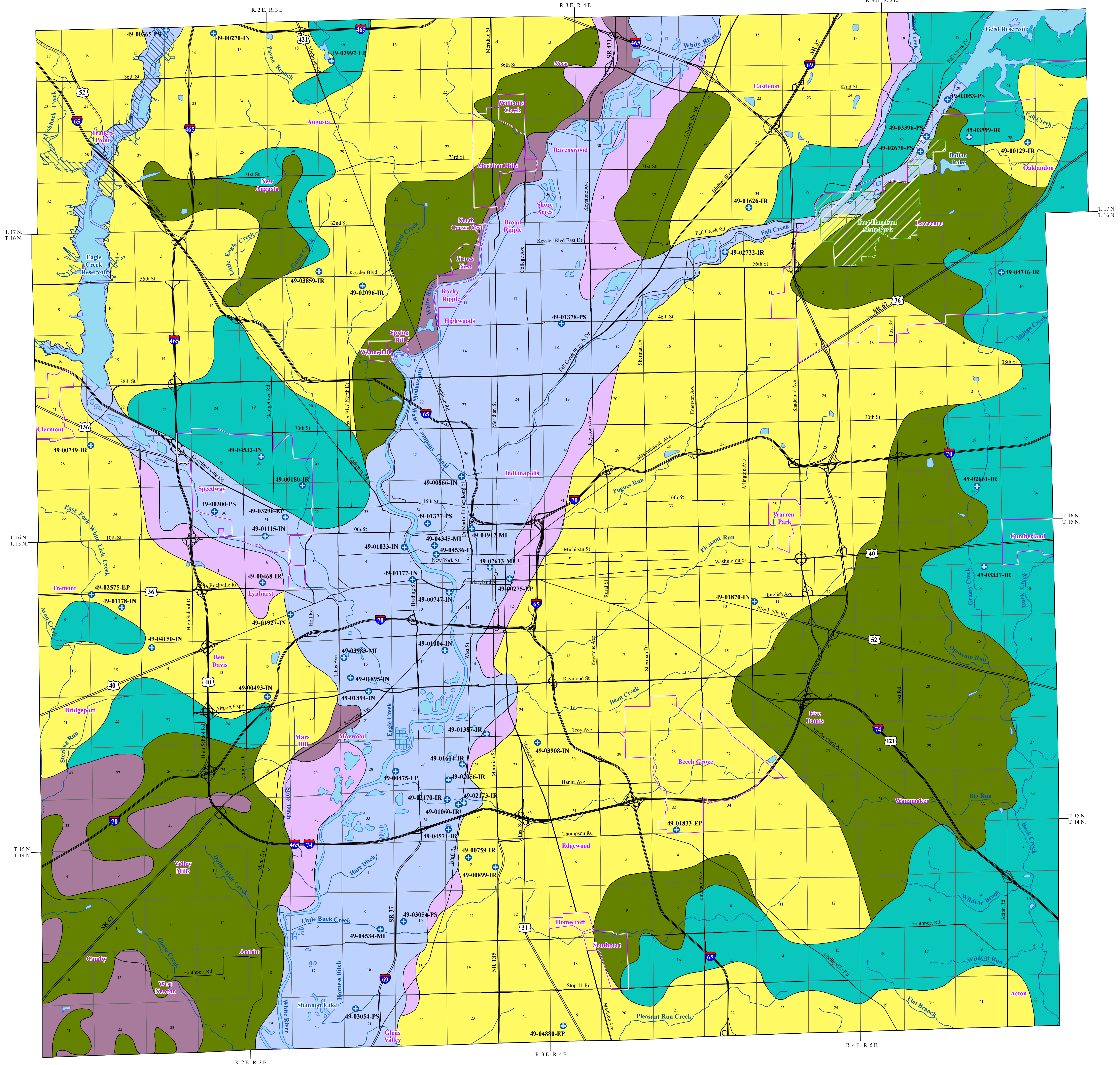
The White River and Tributaries Outwash Aquifer System is highly susceptible to surface contamination where sand and gravel deposits are near the surface and have little or no clay deposits. However, areas having relatively thick clays overlying the sand and gravel deposits are moderately susceptible to contamination.

## White River and Tributaries Outwash Aquifer Subsystem

The White River and Tributaries Outwash Aquifer Subsystem is mapped along portions of the White River and its tributaries in Marion County. This subsystem is mapped similar to the White River and Tributaries Outwash Aquifer System, however, the aquifer materials are generally thinner, overlying silt and/or clay materials are thicker, and potential yields are less.

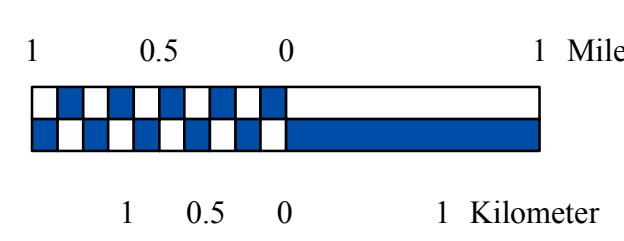
The White River and Tributaries Outwash Aquifer Subsystem has the potential to meet the needs of domestic and some high-capacity users. The wells in this subsystem are completed at depths ranging from 35 to 245 feet. Saturated aquifer materials include sand and gravel deposits that are commonly 5 to 20 feet thick. Domestic well yields are generally 50 gpm or less with static water levels ranging from 4 to 138 feet below the surface. There are two registered significant groundwater withdrawal facilities (3 wells) in the White River and Tributaries Outwash Aquifer Subsystem. The use for these facilities is irrigation. Reported production for the high-capacity wells are up to 300 gpm.

Areas within the White River and Tributaries Outwash Aquifer Subsystem having overlying clay deposits are moderately susceptible to surface contamination, however, areas lacking overlying clay deposits are highly susceptible to contamination.

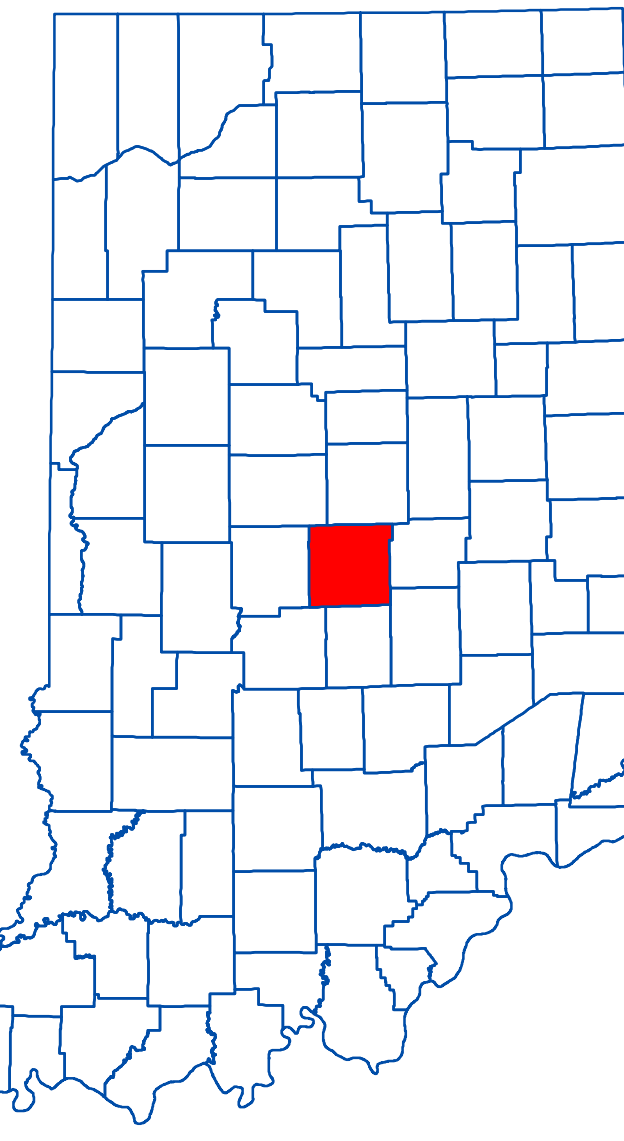


## EXPLANATION

- Registered Significant Groundwater Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- State Managed Property
- Inundation Area of Eagle Creek Reservoir
- Lake & River



## Location Map



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## Unconsolidated Aquifer Systems of Marion County, Indiana

by  
 Robert K. Schmidt  
 Division of Water, Resource Assessment Section

May 2011



# Marion County

