

# Water Resources and Use in Madison County

- |                            |                       |
|----------------------------|-----------------------|
| <b>Withdrawal Location</b> | <b>River</b>          |
| WELL INTAKE                | <b>7Q2 Flow (MGD)</b> |
| ● 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

**INTERA**  
 GEOSCIENCE & ENGINEERING SOLUTIONS

NORTH  
 0 1 2 4 Miles

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

# BEDROCK AQUIFER SYSTEMS OF MADISON COUNTY, INDIANA

The occurrence of bedrock aquifers depends on the original composition of the rocks and subsequent changes, which influence the hydraulic properties. Post-depositional processes, which promote jointing, fracturing, and solution activity of exposed bedrock, generally increase the hydraulic conductivity (permeability) of the upper portion of bedrock aquifer systems. Because permeability in many places is greatest near the bedrock surface, bedrock units within the upper 100 feet are commonly the most productive aquifers.

Bedrock aquifer systems in Madison County are overlain by unconsolidated deposits of varying thickness ranging from bedrock exposure in Fall Creek at Pendleton to over 250 feet in a buried bedrock valley located south of Chesterfield. Bedrock, in places, is at or near the surface along several streams in the county.

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 in the county 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.

Two bedrock aquifer systems are identified for Madison County. They are, from west to east and younger to older: the Silurian and Devonian Carbonates, and the Maquoketa Group of Ordovician age. Approximately 49 percent of all wells in this county are completed in bedrock.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. Because the bedrock aquifer systems have complex fracturing systems, once a contaminant has been introduced into a bedrock aquifer system, it will be difficult to track and remediate.

## Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System subcrop throughout nearly all of Madison County. Wells penetrating the Silurian and Devonian Carbonates Aquifer System have reported depths ranging from 25 to 480 feet, but are commonly 90 to 220 feet deep. The amount of rock penetrated in this system typically ranges from 30 to 132 feet.

Wells utilizing the Silurian and Devonian Carbonates Aquifer System are generally capable of meeting the needs of domestic and some high-capacity users in this county. Domestic well yields commonly range from 8 to 26 gallons per minute (gpm). Static water levels typically range from 15 to 36 feet below the land surface. A few flowing wells have been reported for this bedrock aquifer system in the county. There are 12 registered significant groundwater withdrawal facilities (34 wells) utilizing the Silurian and Devonian Carbonates Aquifer System in Madison County. High-capacity well depths range from approximately 100 to 400 feet below the land surface. Reported high-capacity well yields range from 90 gpm to nearly 500 gpm.

This aquifer system is generally not very susceptible to surface contamination due to thick clay deposits over most of the county. However, there are localized areas, especially near the White River, where the bedrock surface is shallow. These areas, therefore, are at moderate to high risk to contamination.

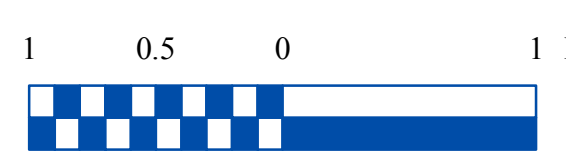
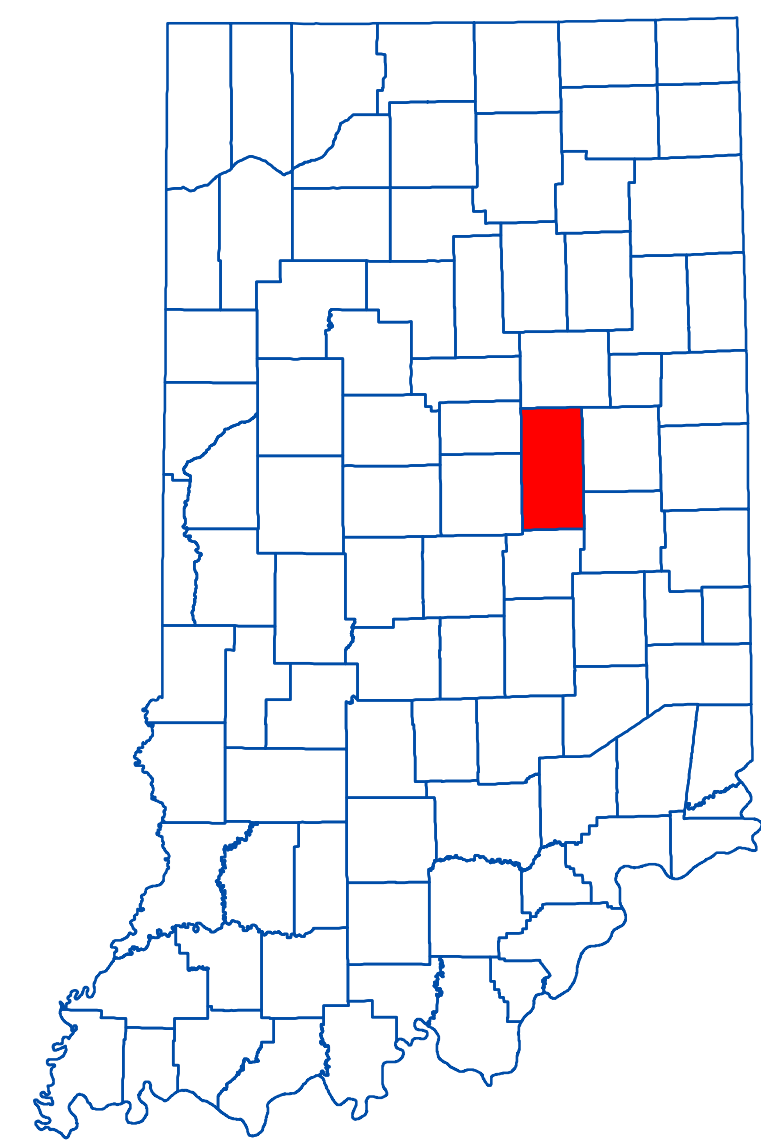
## Ordovician - Maquoketa Group Aquifer System

The extent of the Maquoketa Group Aquifer System subcrop area is limited to a buried pre-glacial bedrock valley located in central Madison County. The Maquoketa Group consists mostly of shale with interbedded limestone units.

Few wells have been reported in this system in Madison County mostly due to the availability of overlying unconsolidated sand and gravel aquifer resources. However, wells completed in the Maquoketa Group Aquifer System are generally capable of meeting the needs of domestic users in this county. Reported depths of the few wells utilizing this system range from 170 to 270 feet with the amount of rock penetration typically 5 to 85 feet. Reported well yields range from 6 to 28 gpm with static water levels ranging from 22 to 42 feet. There are no registered significant groundwater withdrawal facilities utilizing the Maquoketa Group Aquifer System in Madison County.

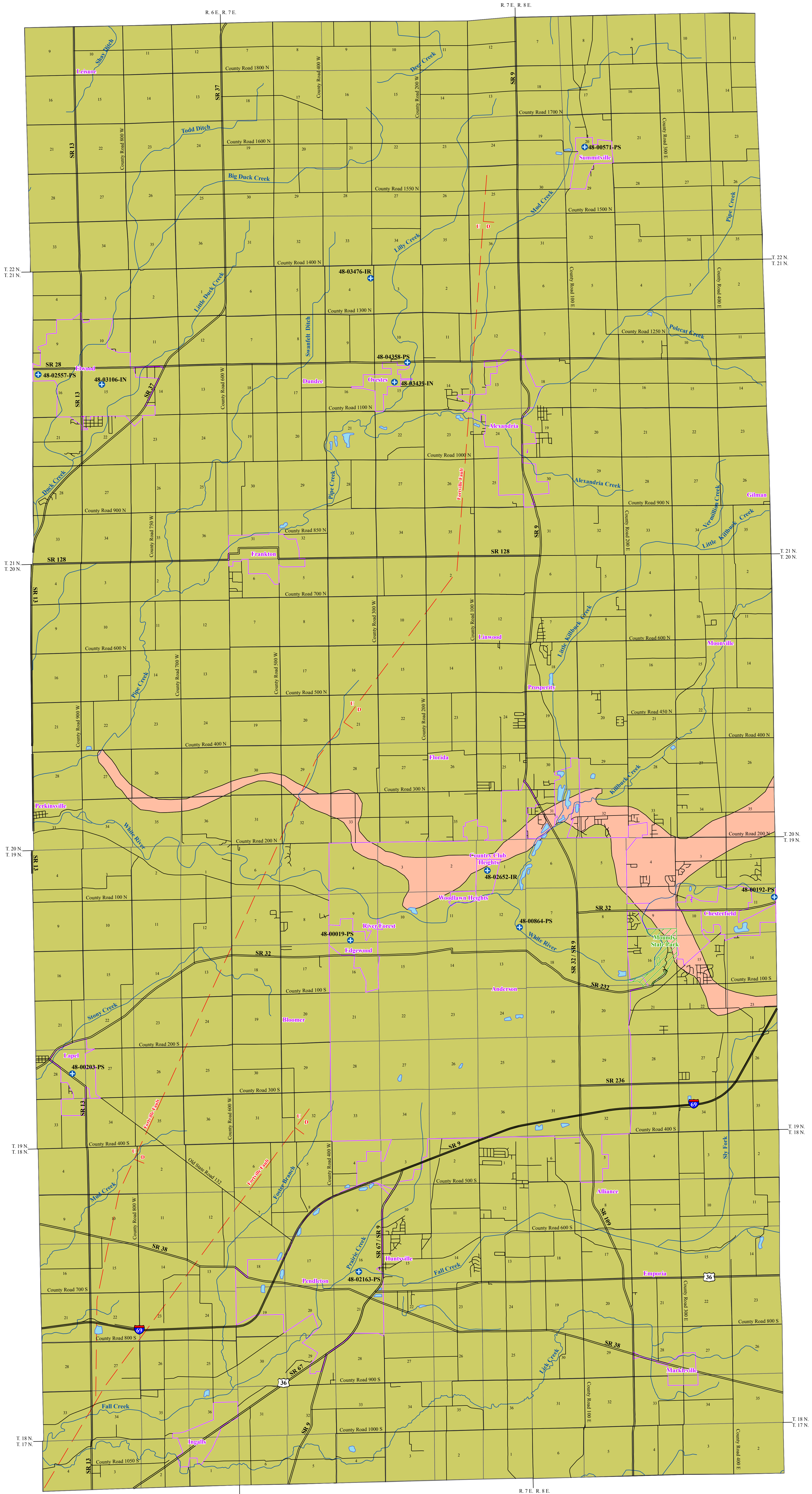
The Maquoketa Group Aquifer System is generally not very susceptible to contamination from the land surface because thick layers of clay-rich material overlie the bedrock.

### Location Map



### EXPLANATION

- Registered Significant Groundwater Withdrawal Facility
- Fault
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- State Managed Property
- Lake & River



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### Bedrock Aquifer Systems of Madison County, Indiana

by  
Robert A. Scott  
Division of Water, Resource Assessment Section

August 2010

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

Madison County, Indiana is located in the north-central section of the state and lies primarily within the White and West Fork White River Basin; however, the northern portion lies within the Upper Wabash River Basin and the southeast section lies within the East Fork White River Basin.

The Potentiometric Surface Map (PSM) of the bedrock aquifers of Madison County was mapped by contouring the elevations of 2438 static water-levels reported on well records received primarily over a 50 year period. These wells are completed in 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.

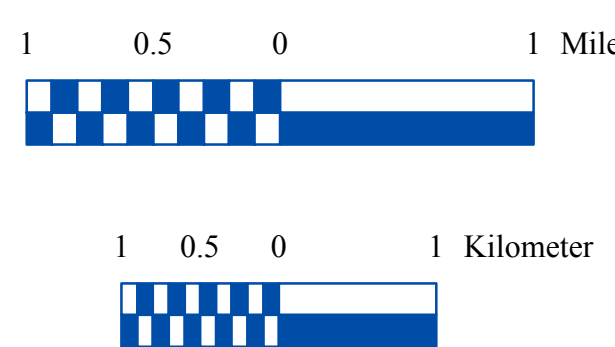
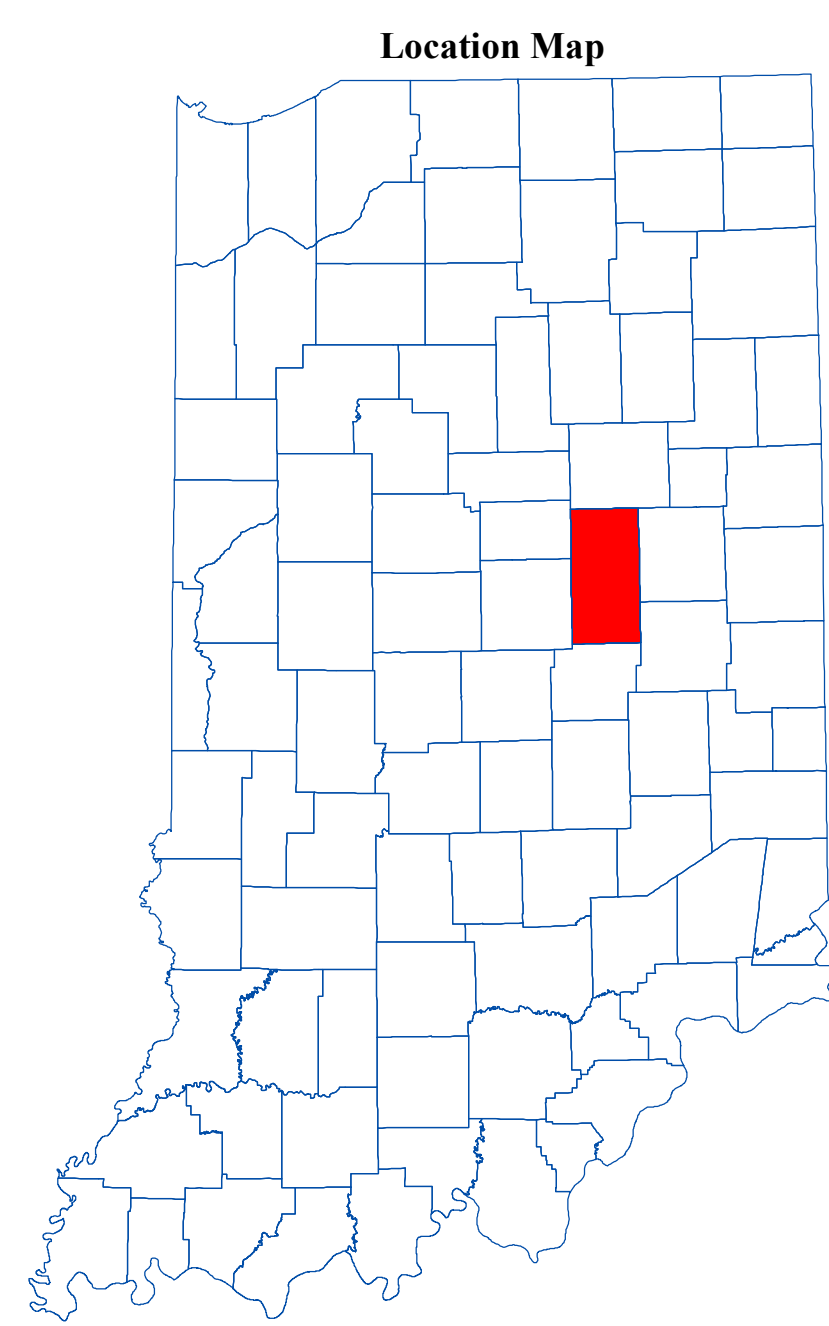
The potentiometric surface is a measure of the pressure on water in a water bearing formation. Water in an unconfined aquifer is at atmospheric pressure and will not rise in a well above the top of the aquifer, in contrast to groundwater in a confined aquifer which is under hydrostatic pressure and will 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, measured static water-levels in an area may differ due to local or seasonal variations. Because fluctuations in groundwater are typically small, static water-levels can be used to construct a generalized PSM. As a general rule, but certainly not always, groundwater flow approximates the overlying topography and intersects the land surface at major streams.

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. The location of the majority of the water well records used to make the PSM were field verified. Elevation data were obtained from a digital elevation model. Quality control/quality assurance procedures were utilized to refine or remove data where errors were readily apparent.

Potentiometric surface elevations range from a high of 970 feet mean sea level (msl) in the southeastern corner of the county, to a low of 790 feet msl in the west-central section. Groundwater flow direction throughout the majority of the county is generally to the west-southwest towards Pipe Creek and the White River, with a subcomponent flowing to the southwest toward Fall Creek. However, in the northeastern portion of the county, approximately north of the boundary between the White and West Fork White River, and Upper Wabash River Basins, groundwater flow is to the north. Bedrock potentiometric surface elevation contours have not been extended through portions of the county. These areas are lacking in data and/or covered by more prolific unconsolidated deposits that limit the necessity to complete wells in bedrock.

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.

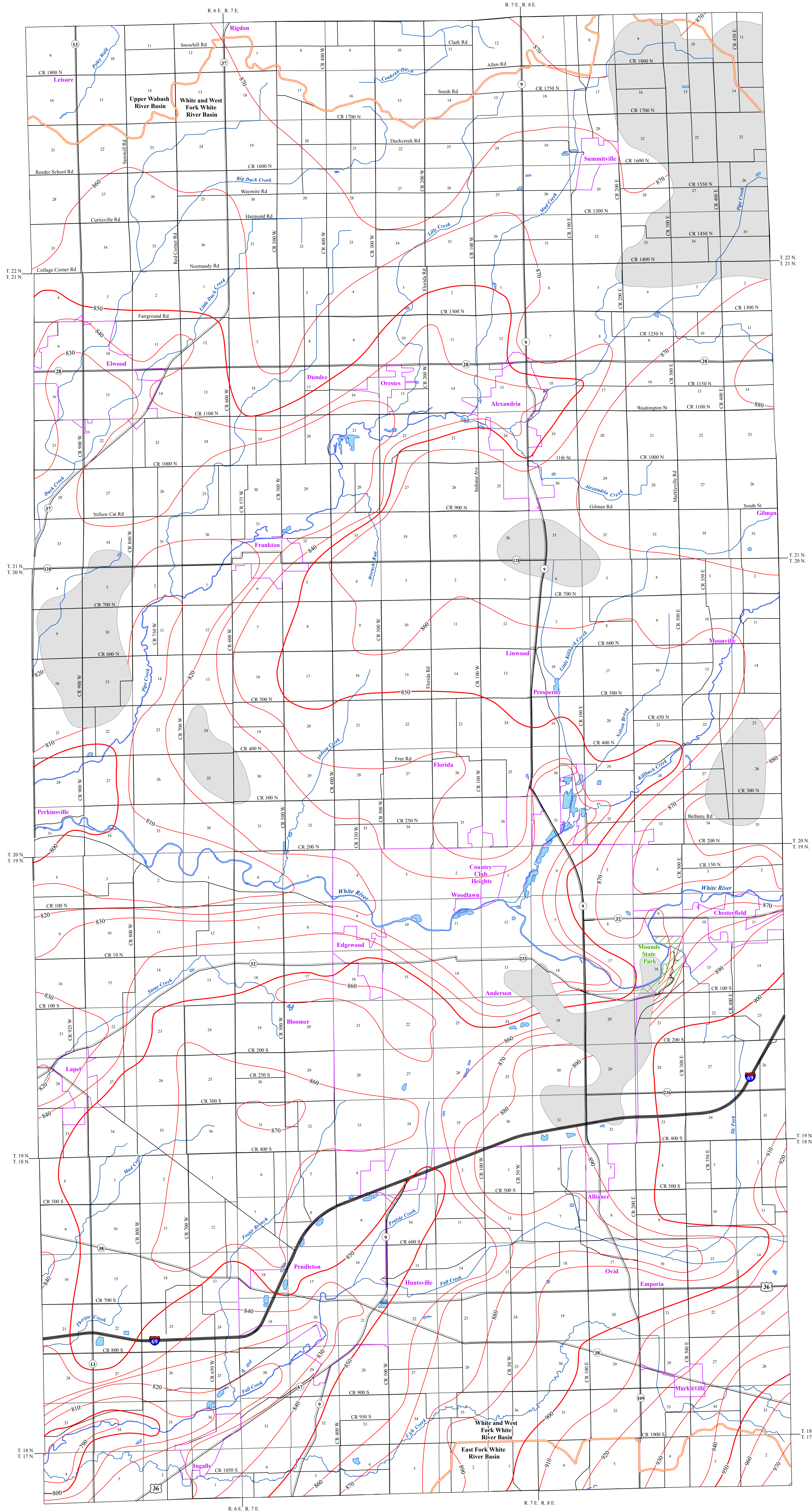
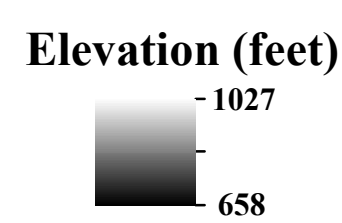
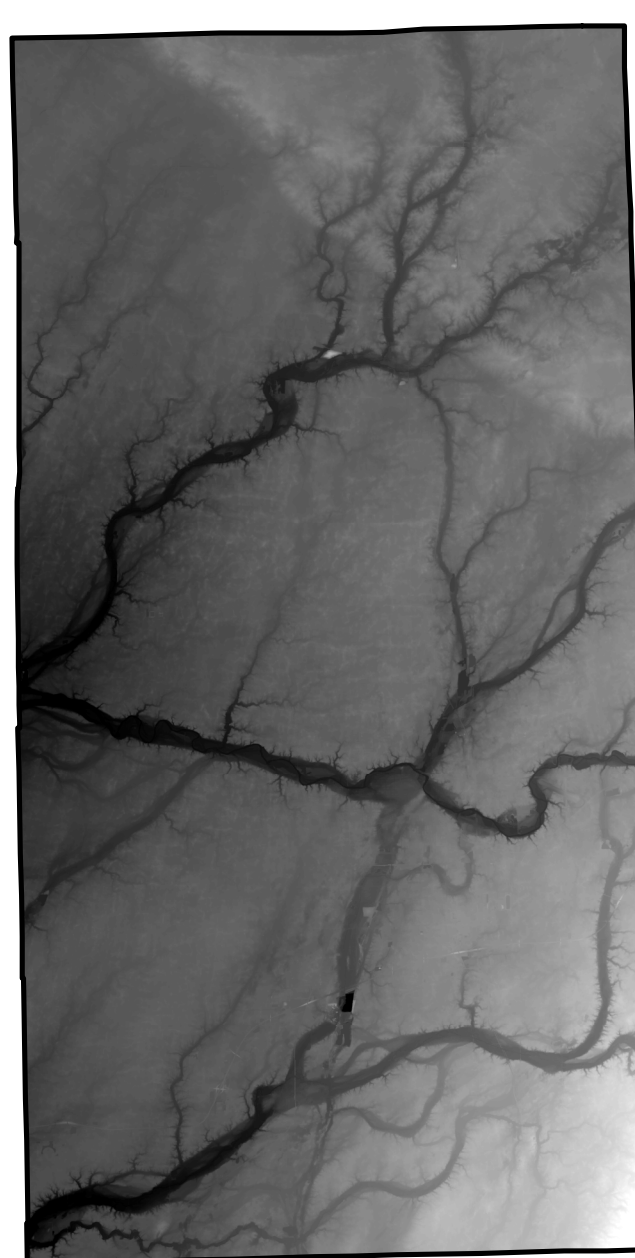


### EXPLANATION

- 810 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



Digital Elevation Model of Madison County, Indiana



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### Potentiometric Surface Map of the Bedrock Aquifers of Madison County, Indiana

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

February 2014

# UNCONSOLIDATED AQUIFER SYSTEMS OF MADISON COUNTY, INDIANA

The unconsolidated aquifer systems of Madison 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 Madison County: the Till Veneer; the Bluffton / New Castle / Tipton Till; the Bluffton / New Castle / Tipton Till Subsystem; the Bluffton / 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 system boundaries. Approximately 51 percent of all wells in this county are completed in unconsolidated deposits.

The thickness of unconsolidated deposits in Madison County is quite variable, due to the deposition of glacial material over an uneven bedrock surface. Unconsolidated deposits in the county range from no cover at the falls of Fall Creek at Pendleton to over 350 feet thick in a buried bedrock valley located south of Chesterfield.

Regional estimates of aquifer susceptibility to contamination from the surface can differ considerably due to a wide range of variations within geologic environments. In addition, man-made structures such as poorly constructed water wells, unshaded or improperly abandoned wells, and open excavations can provide contaminant pathways that bypass the naturally protective clays.

## Till Veneer Aquifer System

In Madison County, the Till Veneer Aquifer System occurs in areas where the unconsolidated material is predominantly thin till overlying bedrock. This system is chiefly the product of the deposition of glacial till over an uneven, eroded bedrock surface, and is generally less than 50 feet thick. Portions of northern and southwestern Madison County are mapped as Till Veneer.

The Till Veneer Aquifer System has the most limited groundwater resources of the unconsolidated aquifer systems. Approximately 99 percent of the wells in this system are completed in the underlying bedrock; however, some wells do utilize this aquifer system. Potential aquifers within this system include thin isolated sand and gravel layers, and surficial sand and gravel outwash or alluvium. Wells are completed at depths ranging from 24 to 45 feet with sand and gravel aquifer materials commonly 4 to 10 feet thick. Most of the wells in this system have reported capacities of 5 gallons per minute (gpm) or less with some wells being reported as "dry". Static water levels range between 16 and 32 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, areas where protective clay layers are thin or absent are very susceptible to contamination.

## Bluffton / New Castle / Tipton Till Aquifer System

The Bluffton / New Castle / Tipton Till Aquifer System is mapped throughout portions of Madison County. This aquifer system is up to about 170 feet in thickness, and consists primarily of glacial till with interill sand and gravel layers. However, the sand and gravel aquifers in this system tend to be relatively thin and discontinuous.

This aquifer system is capable of meeting the needs of most domestic and some high-capacity users in Madison County. The wells utilizing this aquifer system are completed at depths ranging from 50 to 105 feet with sand and gravel aquifer materials commonly 4 to 24 feet thick. Domestic well yields are typically 10 to 40 gpm and static water levels range from flowing to 32 feet below the land surface. There are 5 registered significant groundwater withdrawal facilities (11 wells) using the Bluffton / New Castle / Tipton Till Aquifer System. The reported yields for the high-capacity wells range from 250 to 1,000 gpm.

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

## Bluffton / New Castle / Tipton Till Aquifer Subsystem

The Bluffton / New Castle / Tipton Till Aquifer Subsystem is mapped in several areas throughout Madison County. The subsystem is mapped similar to the Bluffton / New Castle / Tipton Till Aquifer System; however, potential aquifer materials are generally thinner and potential yields are less in the subsystem.

About 81 percent of wells started in this subsystem in Madison County are completed in the underlying bedrock aquifer system. However, the Bluffton / New Castle / Tipton Till Aquifer Subsystem is capable of meeting the needs of some domestic users in the county. Potential aquifer materials include relatively thin, discontinuous interill sand and gravel deposits. These interill 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 45 to 85 feet. Domestic well yields are generally 5 to 10 gpm and static water levels range from 10 to 30 feet below the surface. There are no registered significant groundwater withdrawal facilities using the Bluffton / New Castle / Tipton Till Aquifer Subsystem.

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

## Bluffton / New Castle / Tipton Complex Aquifer System

The Bluffton / New Castle / Tipton Complex Aquifer System is mapped throughout the central and southern areas of Madison County. Multiple glacial advances resulted in sequences of interill sand and gravel layers, typically overlain by thick clay, resulting in aquifers that are highly variable in depth, thickness, and lateral extent. The total combined thickness of the unconsolidated deposits is up to 240 feet.

The deeper more prolific aquifers of this system are capable of meeting the needs of domestic and some high-capacity users in Madison County. Saturated aquifer materials in the Bluffton / New Castle / Tipton Complex Aquifer System range from about 5 to 25 feet thick, and wells in this system are generally completed at depths from about 70 feet to 125 feet. Domestic well yields range up to 50 gpm and static water levels are about 15 to 40 feet below the surface. There are 14 registered significant groundwater withdrawal facilities (34 wells) using this system. The reported yields for the high-capacity wells range from 75 to 2,947 gpm.

The New Castle Complex Aquifer System overlies a buried bedrock valley located in the east-central portion of the county. The total unconsolidated thickness is up to 350 feet in this area. Only a few reported wells utilize the deeper aquifer within the buried bedrock valley. The aquifer utilized by these wells is up to 22 feet thick, and the reported yields range from 10 to 30 gpm. There is 1 registered significant groundwater withdrawal facility (1 well) using this system. The reported yield for the high-capacity well is 400 gpm.

The Bluffton / 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 in the central portion of Madison County along the White River. The system includes thick glacial outwash sands and gravels that are generally capped by a layer of clay and silt deposits.

The White River and Tributaries Outwash Aquifer System is capable of meeting the needs of both domestic and high-capacity users in Madison County. The wells utilizing this aquifer system are completed at depths ranging from 15 to 165 feet with sand and gravel aquifer materials commonly 4 to 22 feet thick. Domestic well yields are typically 10 to 50 gpm with static water levels ranging from 12 to 36 feet below the surface. In the White River and Tributaries Outwash Aquifer System there are 2 registered significant groundwater withdrawal facilities (3 wells). Reported production for these high-capacity wells range from 512 to 1,319 gpm.

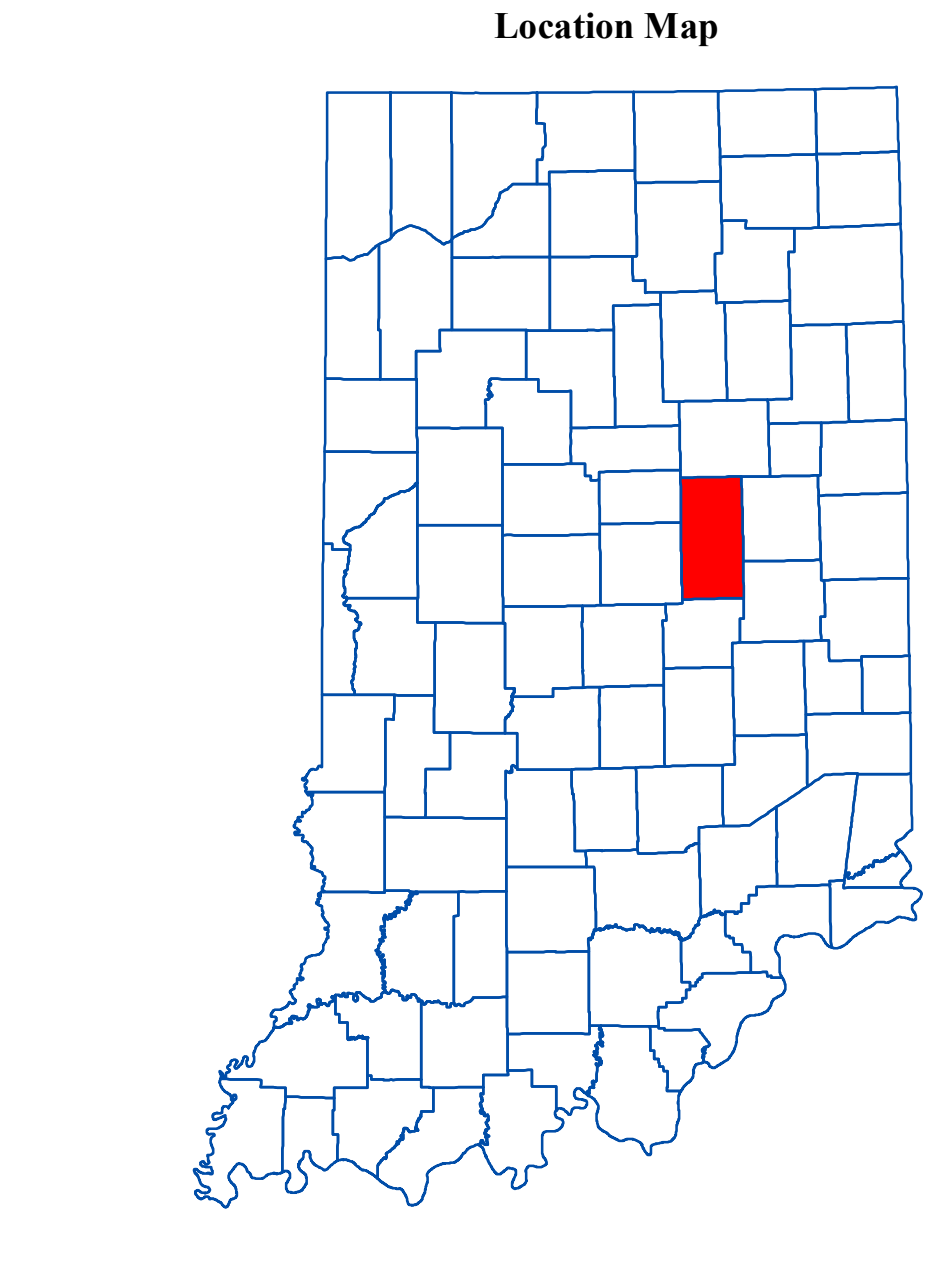
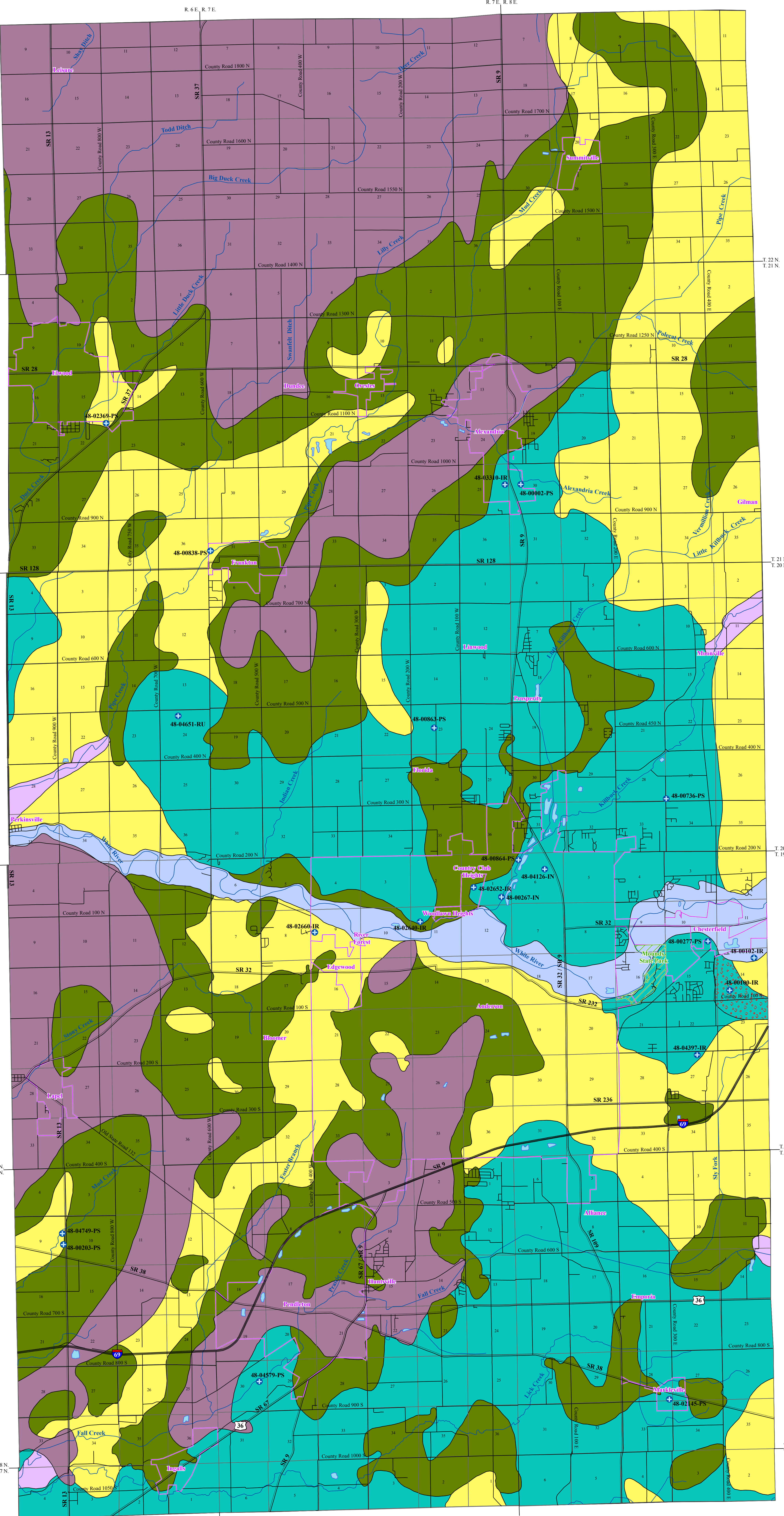
The White River and Tributaries Outwash Aquifer System is highly susceptible to surface contamination where sand and gravel deposits are near the surface and have little or no clay deposits. However, areas with relatively thick clays overlying the sand and gravel deposits are moderately susceptible to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

## White River and Tributaries Outwash Aquifer Subsystem

The White River and Tributaries Outwash Aquifer Subsystem is mapped in several areas of Madison County along portions of Fall Creek, Pipe Creek, and Killbuck Creek. This subsystem is mapped similar to the White River and Tributaries Outwash Aquifer System; however, aquifer materials in the White River and Tributaries Outwash Aquifer Subsystem are generally thinner, overlying silt and clay materials are thicker, and potential yields are less in the subsystem.

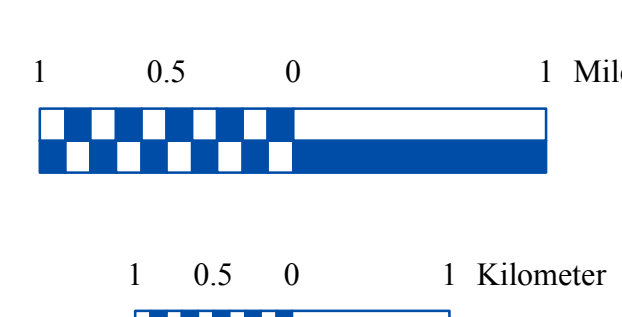
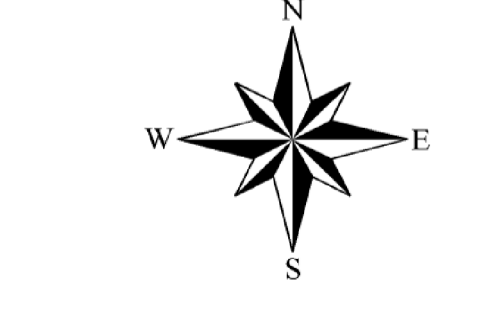
The White River and Tributaries Outwash Aquifer Subsystem has the potential to meet the needs of domestic and some high-capacity users. The wells in this subsystem are completed at depths commonly ranging from 50 to 90 feet. Saturated aquifer materials include sand and gravel deposits that are typically 1.5 to 50 feet thick. Domestic well yields are generally 10 gpm with static water levels ranging from 8 to 28 feet below the surface. There are no registered significant groundwater withdrawal facilities in the White River and Tributaries Outwash Aquifer Subsystem.

Areas within the White River and Tributaries Outwash Aquifer Subsystem that have 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
- Lake & River



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### Unconsolidated Aquifer Systems of Madison County, Indiana

by  
 Robert A. Scott  
 Division of Water, Resource Assessment Section  
 August 2010

# POTENTIOMETRIC SURFACE MAP OF THE UNCONSOLIDATED AQUIFERS OF MADISON COUNTY, INDIANA

Madison County, Indiana is located in the north-central section of the state and lies primarily within the White and West Fork White River Basin; however, the northern portion lies within the Upper Wabash River Basin and the southeast section lies within the East Fork White River Basin.

The Potentiometric Surface Map (PSM) of the unconsolidated aquifers of Madison County was mapped by contouring the elevations of 2881 static water-levels reported on well records received primarily over a 50 year period. These wells are completed in 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 mapped potentiometric surface contours are primarily for the upper 100 feet of the unconsolidated materials and utilize data for wells 100 feet or less in depth. If the shallow data was sparse or unavailable in an area, deeper wells were used to complement the mapping.

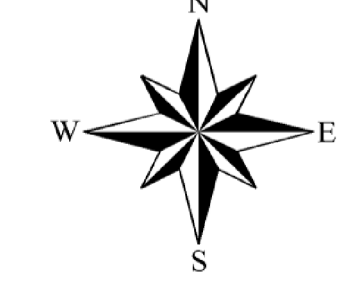
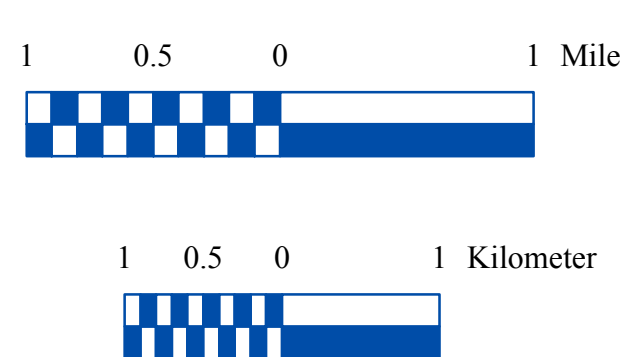
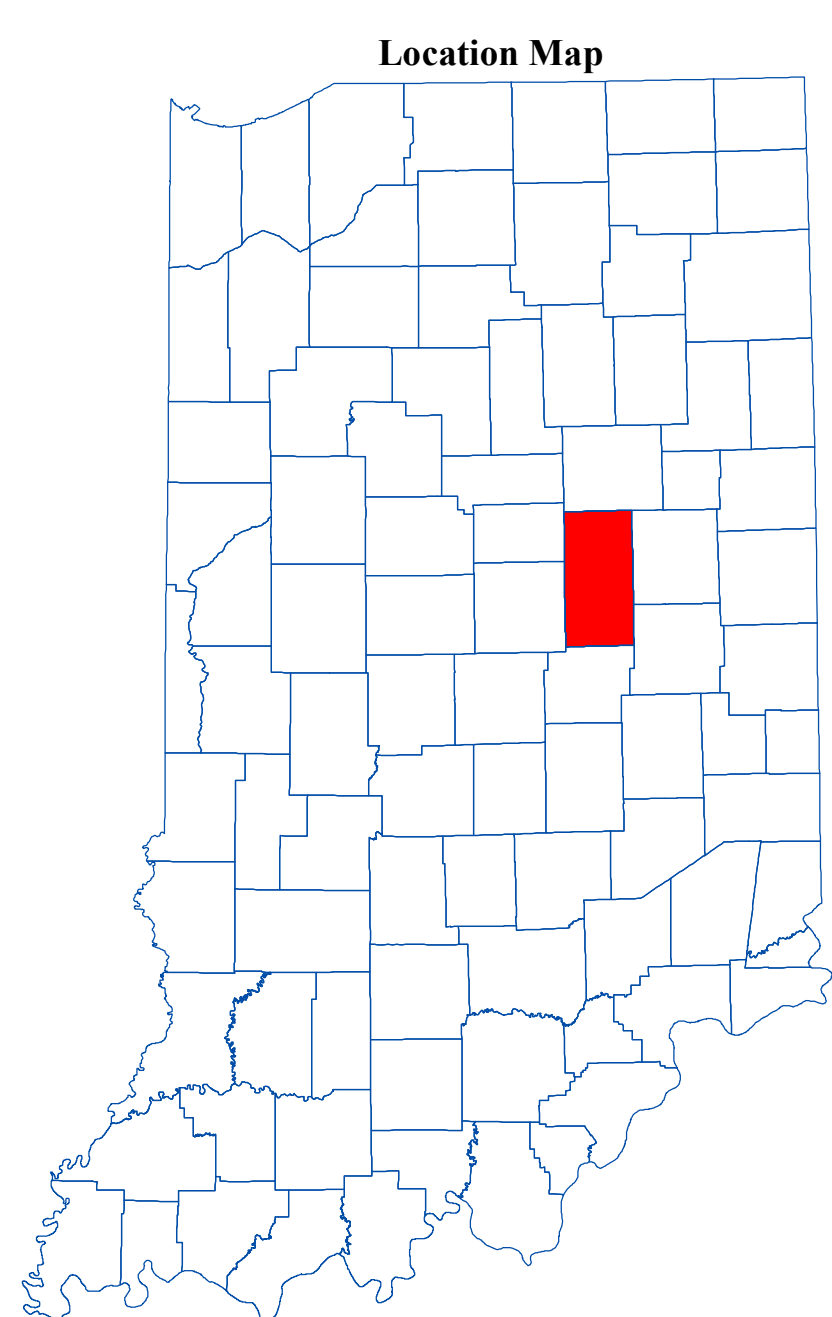
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Static water-level measurements in individual wells used to construct county PSM's are indicative of the water-level at the time of well completion. The groundwater level within an aquifer constantly fluctuates in response to rainfall, evapotranspiration, groundwater movement and pumping. Therefore, measured static water-levels in an area may differ due to local or seasonal variations. Because fluctuations in groundwater are typically small, static water-levels can be used to construct a generalized PSM. As a general rule, but certainly not always, groundwater flow approximates the overlying topography and intersects the land surface at major streams.

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. The location of the majority of the water well records used to make the PSM were field verified. Elevation data were obtained from a digital elevation model. Quality control/assurance procedures were utilized to refine or remove data where errors were readily apparent.

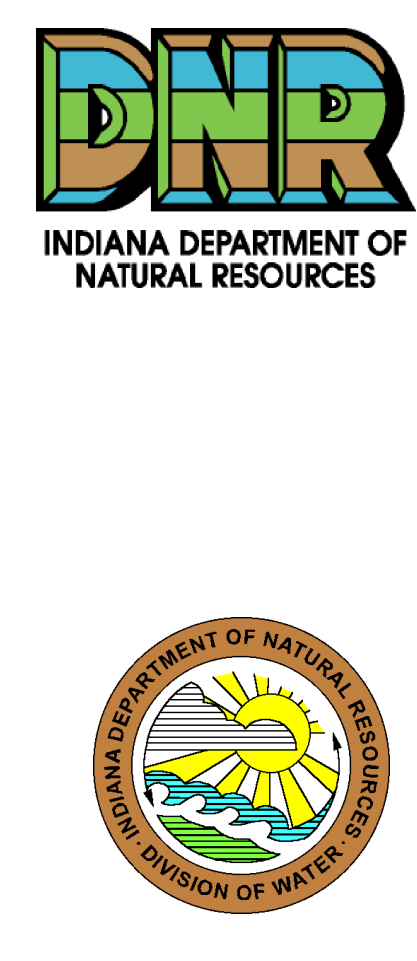
Potentiometric surface elevations range from a high of 980 feet mean sea level (msl) in the southeastern corner of the county, to a low of 790 feet msl in the west-central section. Groundwater flow direction throughout the majority of the county is generally to the west-southwest towards Pipe Creek and the White River, with a subcomponent flowing to the southwest toward Fall Creek. However, in the northeastern portion of the county, approximately north of the boundary between the White and West Fork White River, and Upper Wabash River Basins, groundwater flow is to the north. In portions of the county, where data is lacking and/or covered by thin or unproductive deposits, potentiometric surface elevation contours have not been extended through these areas.

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.

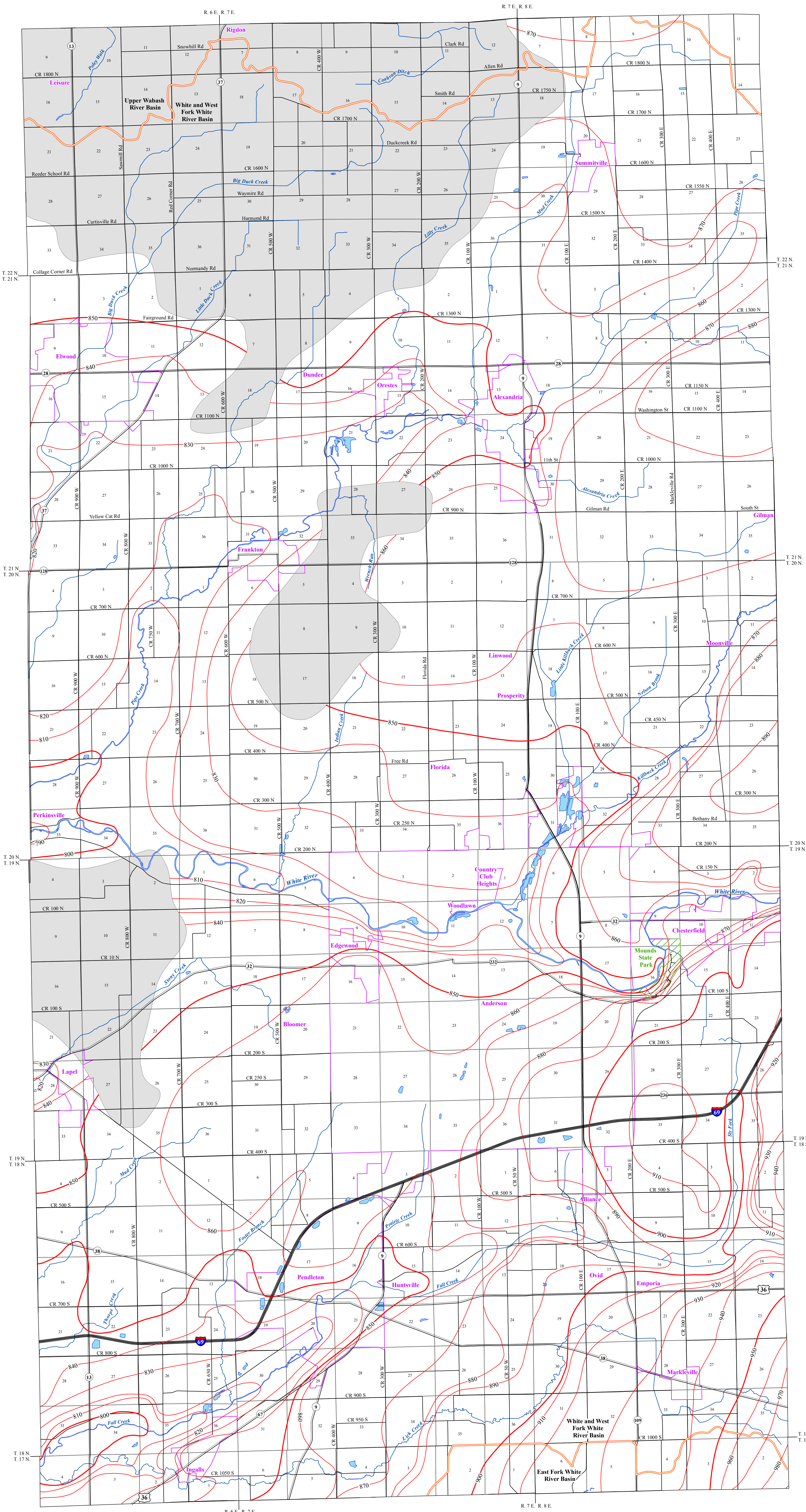
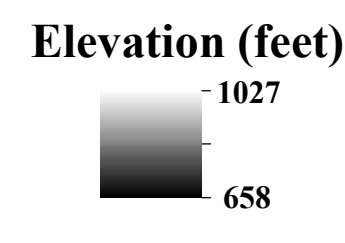
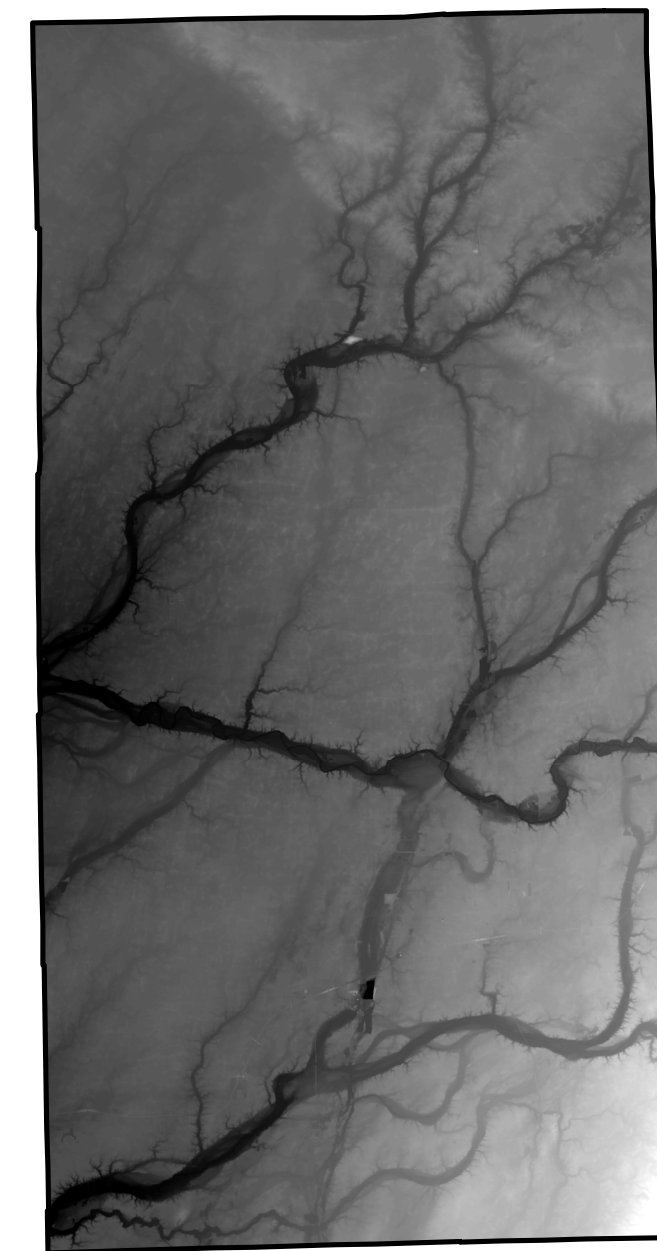


### EXPLANATION

- 810 Line of equal elevation, in feet above mean sea level
- Potentiometric Contour interval 10 feet
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### Digital Elevation Model of Madison County, Indiana



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This map is 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), are all from the Indiana Geological Survey and based on a 1:24,000 scale. Roads (TIGER and INDOT) (line shapefile, 2005) is from the Indiana Department of Transportation and based on a 1:100,000 scale. Systems (line shapefile, 2003) is from the Indiana Department of Transportation and based on a 1:24,000 scale. Incorporated Boundaries in Indiana (polygon shapefile, 20060501) is from the Graphics and Engineering Section, Indiana Department of Transportation. Hydrography, Streams (NHDI) (line shapefile, 20081218), Rivers (NHDI) (polygon shapefile, 20081218), and Lakes (NHDI) (polygon shapefile, 20081218) are from the U.S. Geological Survey and based on a 1:24,000 scale. Basin boundaries are modified from Watershed Boundary Dataset (polygon shapefile, 2008) from the Natural Resource Conservation Service and based on a 1:24,000 scale. Managed Lands (DNR) (polygon shapefile, 20100920) is from the Indiana Department of Natural Resources and based on a 1:24,000 scale. Digital Elevation Model Hillshade image is derived from the Indiana Office of Statewide Collection Program (2012). Madison County Unconsolidated No Aquifer Material or Limited Data (polygon shapefile, Schmidt, 2014) and Potentiometric Surface Contours of the Unconsolidated Aquifers of Madison County, Indiana (line shapefile, Schmidt, 2014) are based on a 1:24,000 scale.

### Potentiometric Surface Map of the Unconsolidated Aquifers of Madison County, Indiana

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February 2014

# Madison County

