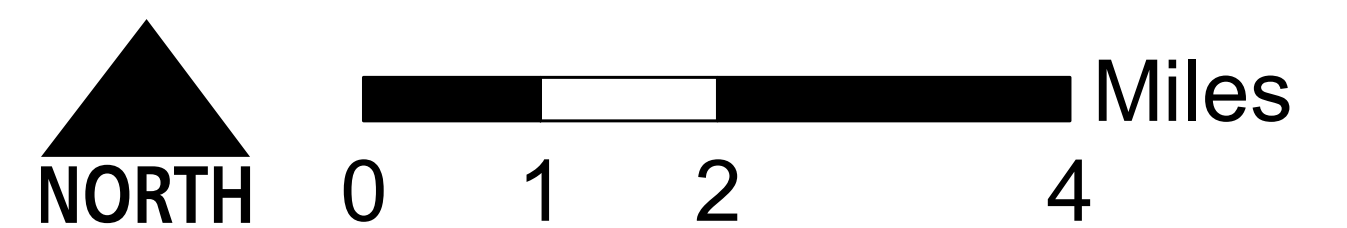
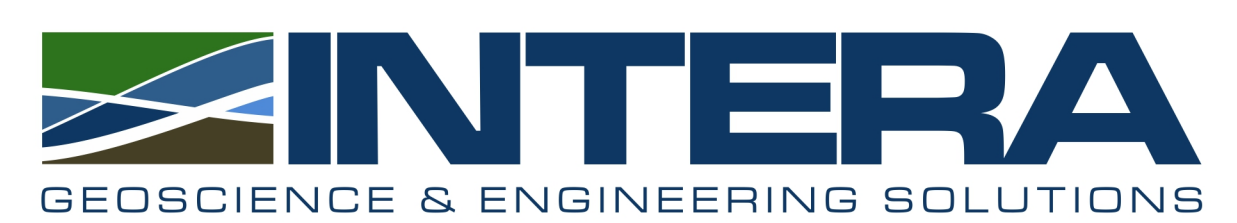
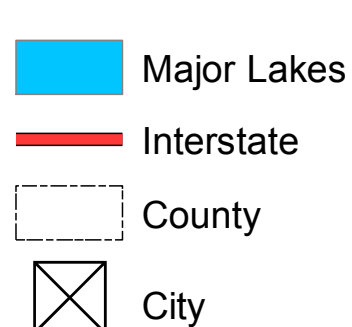
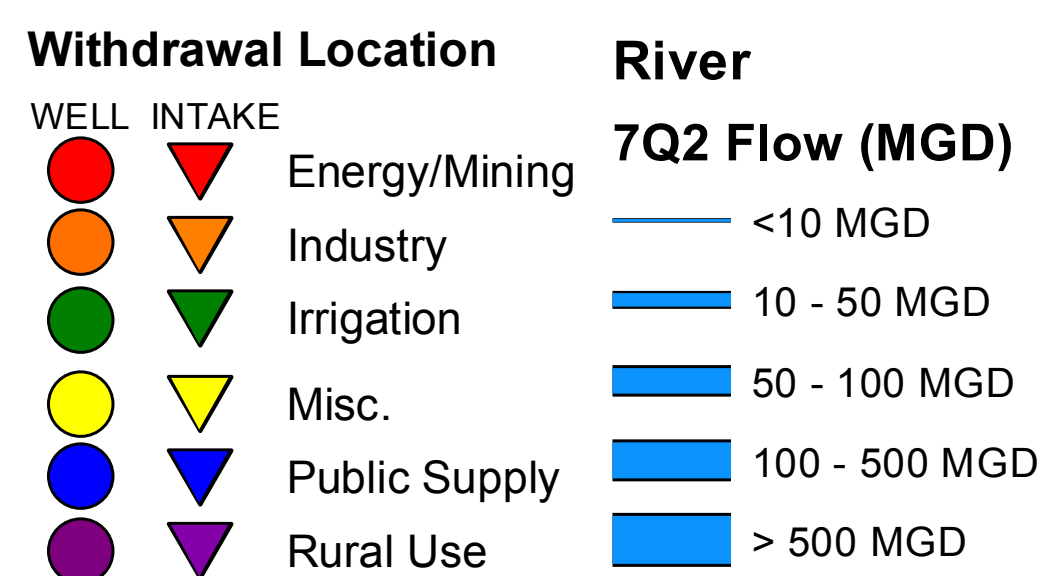


# Water Resources and Use in Wells County

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



# BEDROCK AQUIFER SYSTEMS OF WELLS 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.

One bedrock aquifer system is identified for Wells County - the Silurian and Devonian Carbonates. Rock types exposed at the bedrock surface include moderately productive to prolific limestones and dolomites with varying amounts of interbedded shale. Bedrock wells represent about 90 percent of all wells completed in this county. Most of the bedrock aquifers in Wells 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 bedrock aquifer system in Wells County is overlain by unconsolidated deposits of varying thickness, ranging from less than one foot to approximately 170 feet. However, for about one-half of the county the depth to bedrock is 50 feet or less. This shallow area of bedrock primarily trends northwest to southeast across the county from just south of Zanesville to near Liberty Center.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and clay 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 extremely variable.

The susceptibility of bedrock aquifer systems to surface contamination is largely dependent on the type and thickness of the overlying sediments. However, 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.

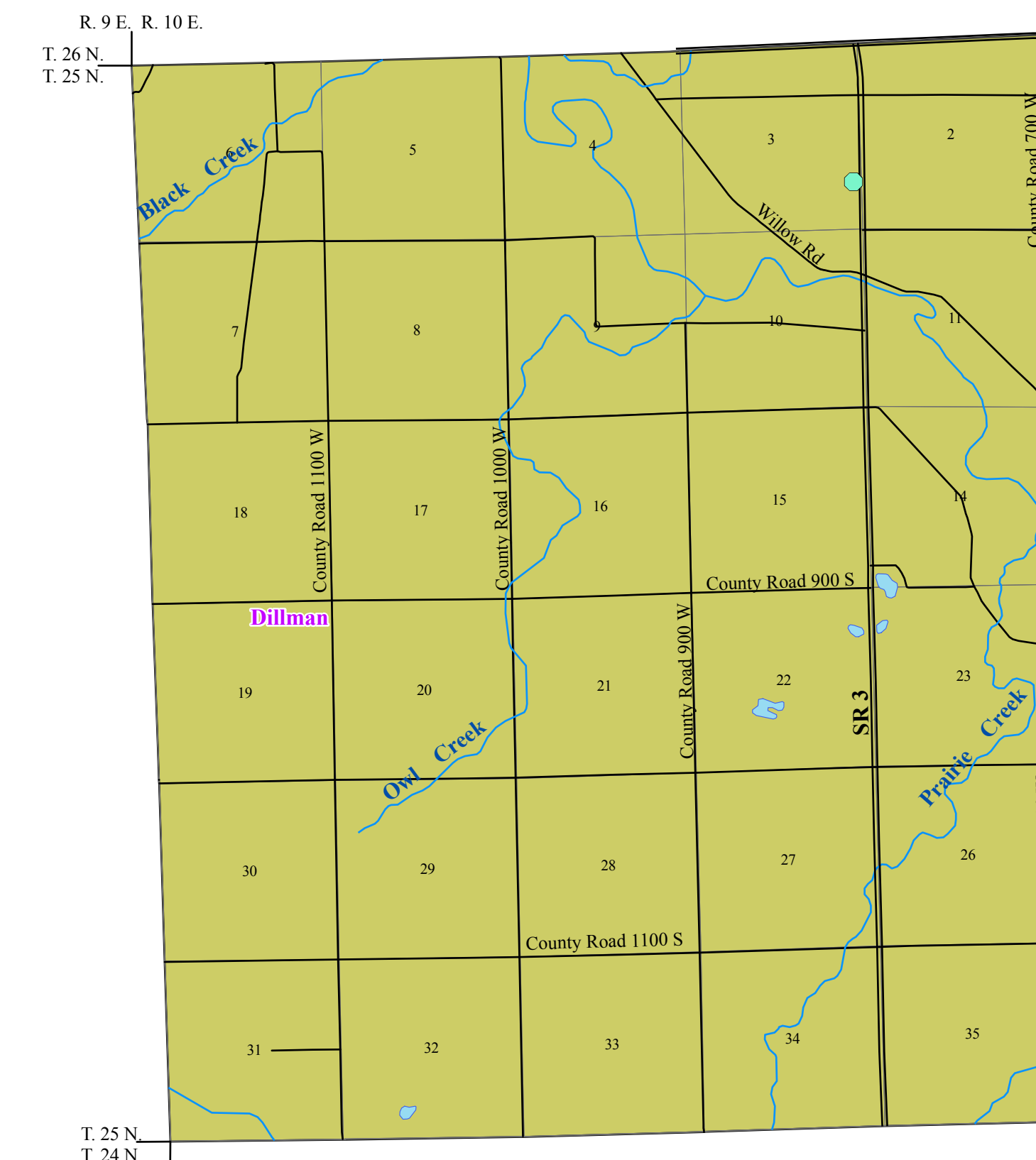
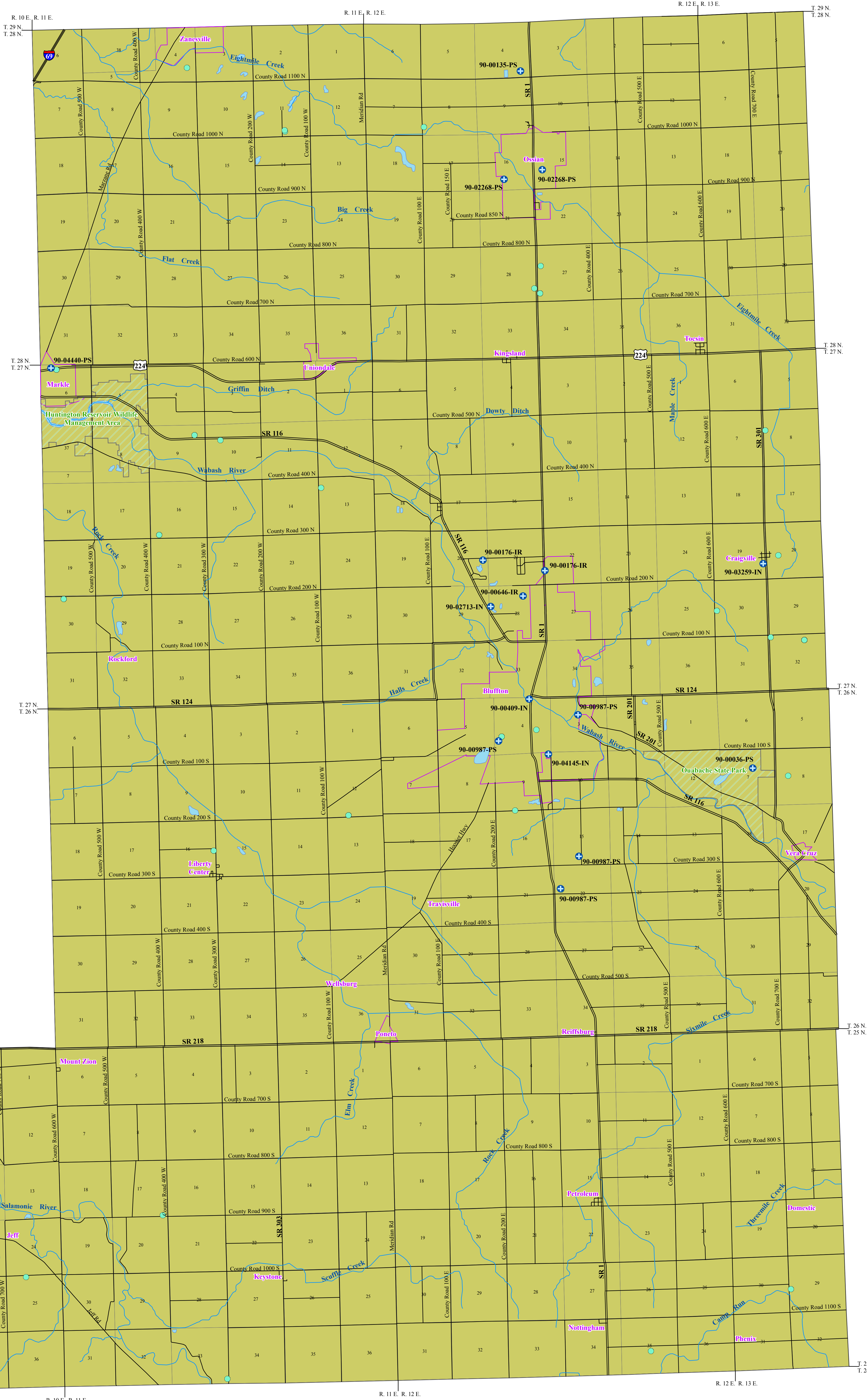
## Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System outcrops/subcrops throughout all of Wells County. The system includes Silurian age carbonate rock units (limestone and dolomite) with some interbedded shale units. The total thickness of this system in the county ranges from about 200 feet to 500 feet.

Wells penetrating the Silurian and Devonian Carbonates Aquifer System in this county have reported depths ranging from 35 to 450 feet, but are commonly 75 to 180 feet deep. The amount of rock penetrated in this system typically ranges from 30 to 120 feet. Some well records describe cavities or solution channels up to 15 feet in height (see map). These karst features are produced by the action of ground water dissolving the limestone, primarily along fractures or zones of weakness such as bedding planes.

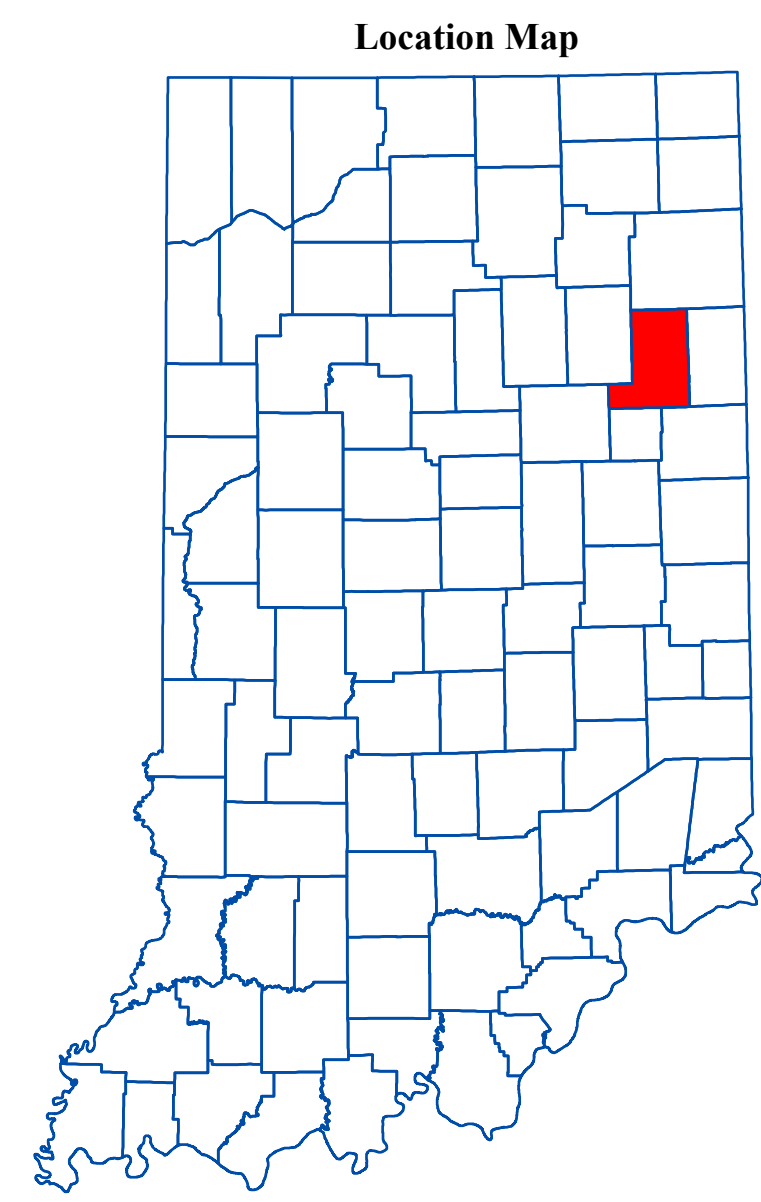
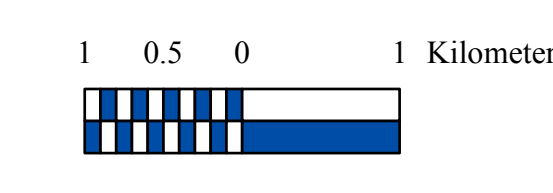
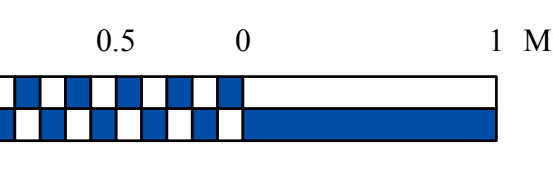
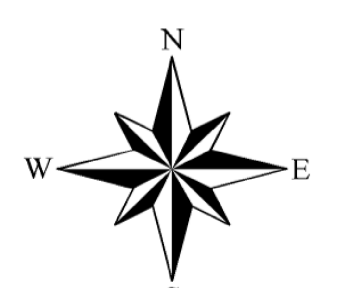
Wells completed in the Silurian and Devonian Carbonates Aquifer System are capable of meeting the needs of domestic and some high-capacity users in this county. Domestic well yields commonly range from 15 to 40 gallons per minute (gpm). Static water levels typically range from 15 to 40 feet below the land surface. There are 11 registered significant ground-water withdrawal facilities (32 wells) utilizing the Silurian and Devonian Carbonates Aquifer System in Wells County. Reported high-capacity well yields range from 108 to 600 gpm.

This aquifer system is generally not very susceptible to surface contamination due to thick clay deposits over most of the county. However, in many places the bedrock surface is quite shallow. In addition, solution features such as caves are described in several well records suggesting some karst development in places. Therefore, these areas are at moderate to high risk to contamination.



### EXPLANATION

- Registered Significant Ground-Water Withdrawal Facility
- Cave or Crevice Described on Water Well Record
- Stream
- County Road
- State Road & US Highway
- Interstate
- State Managed Property
- Municipal Boundary
- Lake & River



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### Bedrock Aquifer Systems of Wells County, Indiana

by  
 Gerald A. Unterreiner  
 Division of Water, Resource Assessment Section  
 May 2007

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

Wells County, Indiana is located in the northeast portion of the state and is situated within two major drainage basins. Most of the county is within the Upper Wabash River Basin, but the east-central and northeast corner is within the Maumee River Basin.

The generalized bedrock potentiometric surface map contour elevations represent lines of equal elevation to which groundwater levels will rise 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.

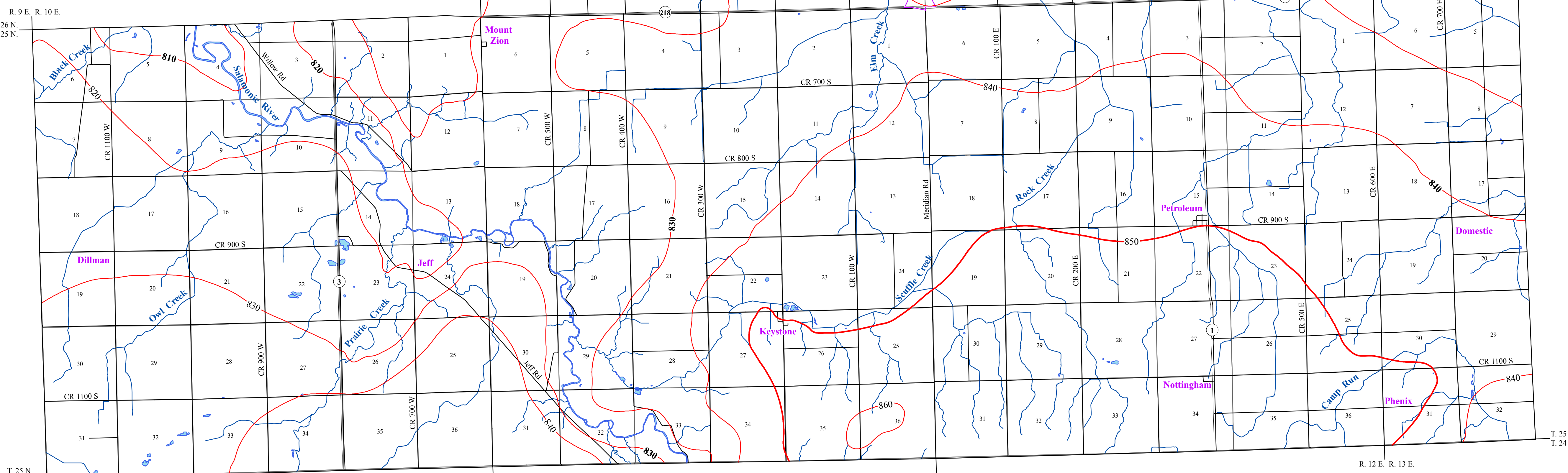
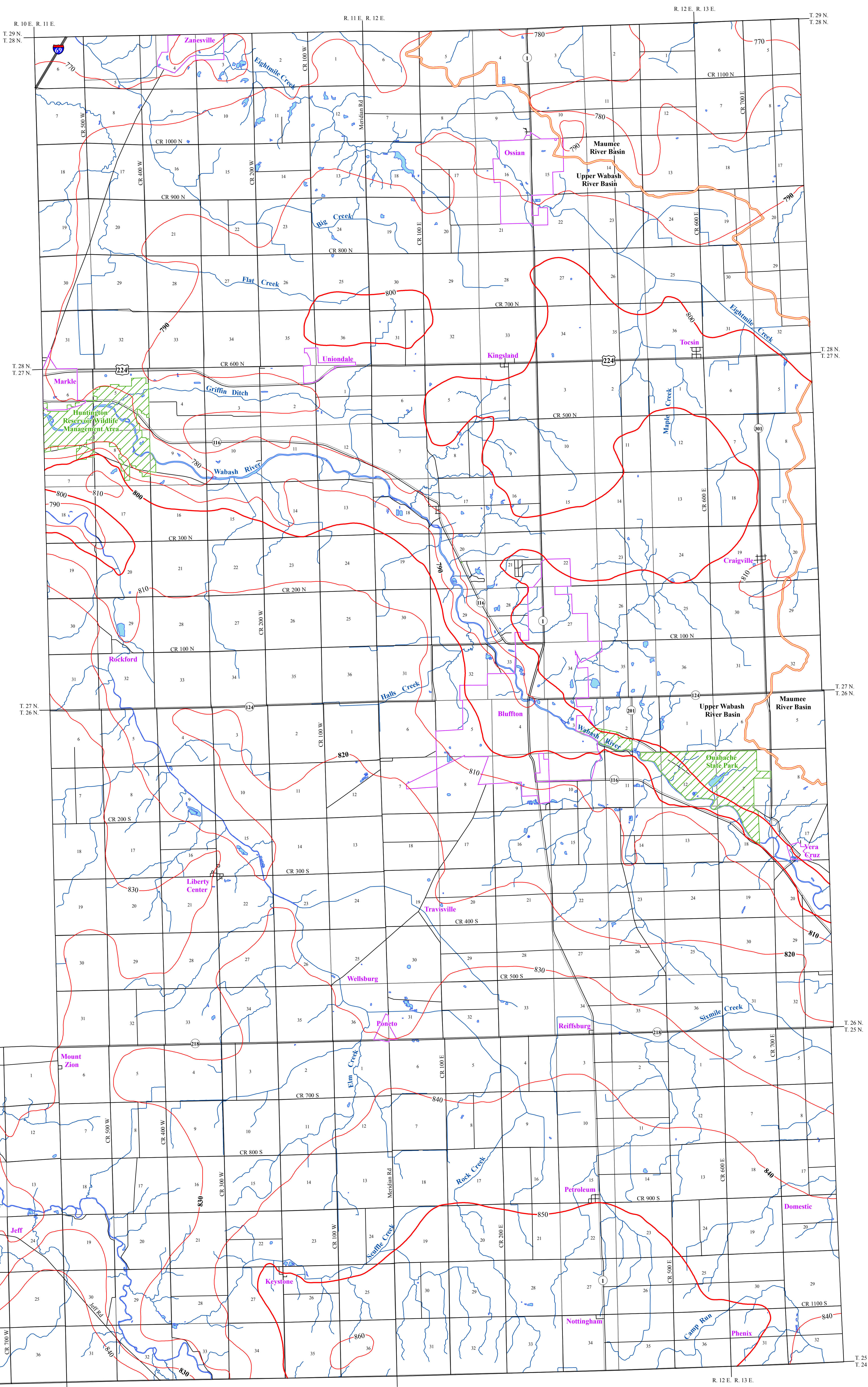
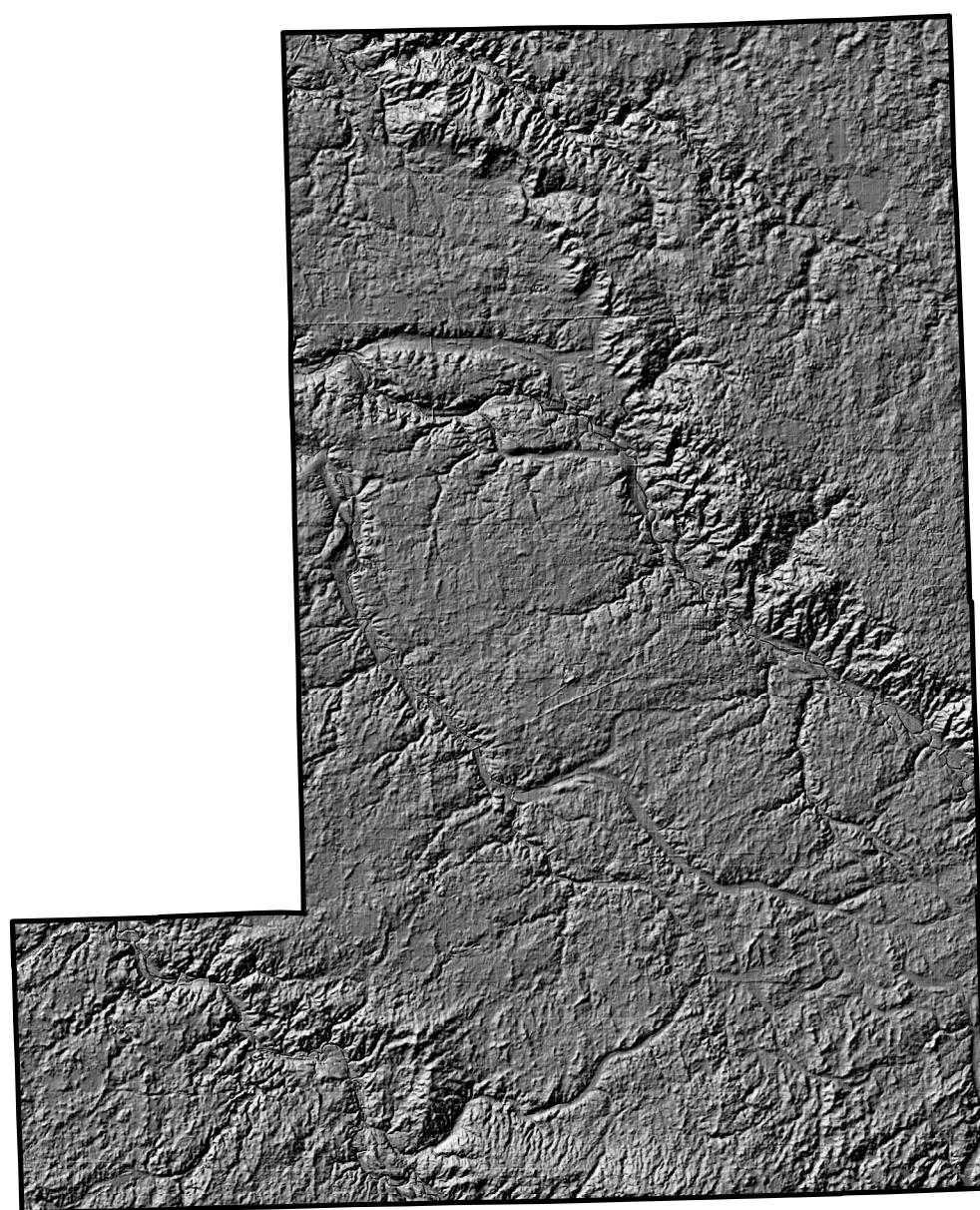
In Wells County there are approximately 1,793 water well records. Nearly all wells are completed in bedrock of which approximately 969 (54%) are located. These wells are finished in limestone and dolomite materials of the Silurian and Devonian Carbonates Aquifer System. Total well depths for located wells range from 37 to 450 feet with static water levels that are between 4 to 125 feet below surface.

Potentiometric surface elevations range from a high of 860 feet mean sea level (msl) in the south-central region of the county, to a low of 770 feet msl in the northwest and northeast areas of the county. Generalized groundwater flow direction for most of Wells County is towards major drainage relevant to the basin. Therefore, groundwater flow is towards the Wabash River. However, the northeast and east-central edge of the county is within the Maumee River Basin and general groundwater flow is northeast out of the county towards the St. Mary's River.

Much of the Wells County bedrock surface is overlain by unconsolidated deposits that range from less than one foot, to 170 feet in thickness (Interreiner, 2007). Where bedrock is shallow, the potentiometric surface is generally under unconfined or semi-confined conditions. However, most of Wells County is covered by thicker sediments overlying bedrock. Therefore, the potentiometric surface for most of the county is considered under confined conditions.

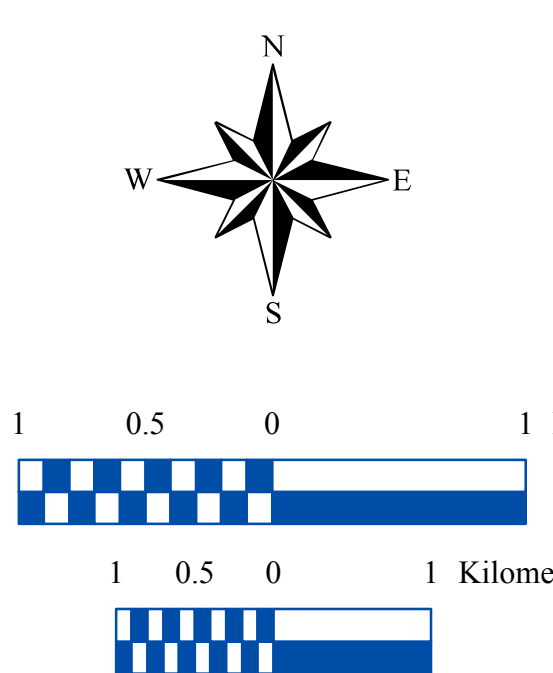
Interreiner, 2007. Bedrock Aquifer Systems of Wells County, Indiana. Indiana Department of Natural Resources, Division of Water, Aquifer System Map 19-0.

Hillshade Map of Wells County, Indiana



### EXPLANATION

- 850 — Line of equal elevation, in feet above mean sea level
- Potentiometric Contour interval 10 feet
- Stream
- County Road
- State Road
- 224 — US Highway
- Interstate
- Basin Boundary
- Municipal Boundary
- State Managed Property
- Lake & River



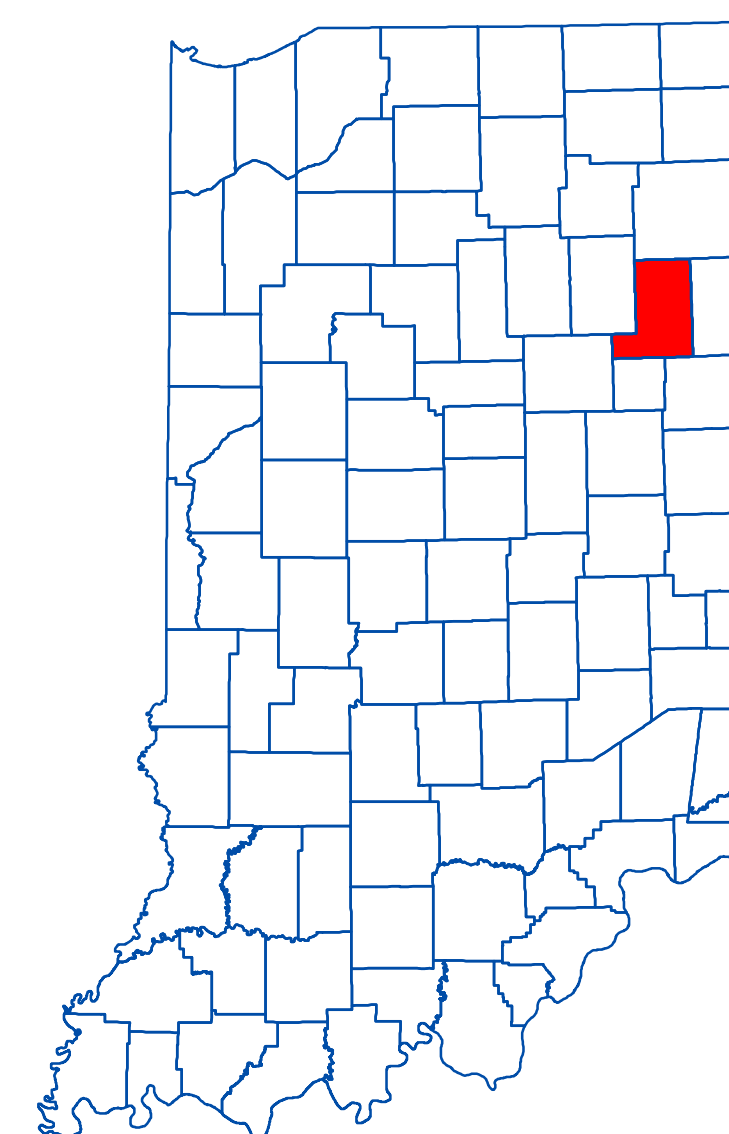
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Location Map



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

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

June 2012

# UNCONSOLIDATED AQUIFER SYSTEMS OF WELLS COUNTY, INDIANA

Six unconsolidated aquifer systems have been mapped in Wells County: the Till Veneer, the Hessen Cassel, the Bluffton Till, the Bluffton Till Subsystem, the Bluffton Complex, and the Wabash River and Tributaries Outwash Subsystem. These systems comprise sediments deposited by or resulting from glacial, glacial meltwaters, and post-glacial precipitation events. Characteristics of the Hessen Cassel Aquifer System have been described and mapped as part of the basin study report: "Water Resource Availability in the Maumee River Basin, Indiana, IDNR, 1996." The description of the regional Hessen Cassel Aquifer System has been modified here to include details specific to Wells County. Boundaries of all aquifer systems are commonly gradational and individual aquifers may extend across aquifer system boundaries.

### Till Veneer Aquifer System

The Till Veneer Aquifer System has the most limited ground-water resources of the unconsolidated aquifer systems in the county. This system is mapped over about 50 percent of Wells County, generally in areas where the depth to the bedrock surface is less than 50 feet.

There is little potential for ground water production in the Till Veneer Aquifer System in Wells County. Nearly all wells started in this system are completed in the underlying bedrock. Unconsolidated deposits consist primarily of clay. Where present, sand and gravel units are generally less than 5 feet thick. The few wells completed in the Till Veneer Aquifer System in this county range from 30 to 56 feet deep.

This system is not very susceptible to contamination from surface sources because of the low permeability of the near-surface materials. However, there are areas where bedrock is extremely shallow. These areas are moderately susceptible to contamination.

### Hessen Cassel Aquifer System

The Hessen Cassel Aquifer System contains a few thin sand and gravel lenses occurring amidst thick sequences of tills and some fine-grained glaciolacustrine deposits. The sand and gravel lenses within the system are either confined within glacial till or are directly overlying bedrock. In Wells County, about 90 percent of the wells started in this system are completed in the underlying bedrock aquifer system. However, the Hessen Cassel Aquifer System is capable of meeting the needs of some domestic users in the county. The few wells completed in this system are 80 to 90 feet deep and produce from sand and gravel aquifers about 10 feet thick. Reported yields for these domestic wells are 12 to 50 gallons per minute (gpm) with static water levels of 36 to 50 feet below the ground surface. In general, this system has a low susceptibility to surface contamination because intratill sand and gravel units are commonly overlain by thick glacial till.

### Bluffton Till Aquifer System

The Bluffton Till Aquifer System primarily consists of glacial till separated by thin intratill sand and gravel layers. In Wells County, this aquifer system ranges in thickness from 50 feet to 130 feet. Saturated aquifer materials include sand and/or gravel deposits that are commonly 5 to 15 feet thick and typically overlain by 45 to 75 feet of till.

Wells completed in the Bluffton Till Aquifer System are capable of meeting the needs of most domestic and some high-capacity users in Wells County. However, approximately 45 percent of wells started in this system utilize the underlying bedrock aquifer. Wells producing from the Bluffton Till Aquifer System are typically 60 to 90 feet deep. Domestic well capacities are commonly 15 to 60 gpm. Static water levels generally range from 20 to 40 feet below the surface.

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

### Bluffton Till Aquifer Subsystem

Areas where unconsolidated materials are generally greater than 50 feet in thickness, yet have little aquifer potential, are mapped as the Bluffton Till Aquifer Subsystem in Wells County. This subsystem is mapped on about 30 percent of the county. The Bluffton Till Aquifer Subsystem ranges from about 45 feet to 145 feet thick in Wells County. However, the system is typically less than 100 feet deep. Potential aquifer materials include thin, intratill sand and gravel deposits. Where present, aquifer materials are capped by till that is generally 50 to 70 feet thick.

More than 90 percent of wells started in the Bluffton Till Aquifer Subsystem in Wells County are completed in the underlying bedrock aquifer system. However, this subsystem is capable of meeting the needs of some domestic users in the county. The few wells producing from the Bluffton Till Aquifer Subsystem are completed at depths of 45 to 145 feet.

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

### Bluffton Complex Aquifer System

This system is mapped in portions of southwestern Wells County. The Bluffton Complex Aquifer System is characterized by unconsolidated deposits that are quite variable in materials and thickness. Aquifers within the system range from thin to thick and include single or multiple intratill sands and gravels. The aquifers are highly variable in depth and lateral extent and are typically confined by clay layers. The total thickness of unconsolidated deposits is in excess of 170 feet in places.

Well depths in the Bluffton Complex Aquifer System range from 60 to 160 feet although wells are typically completed at depths ranging from 60 to 110 feet. Most wells are completed below the shallow aquifer (if present), which generally ranges in thickness from 1 to 10 feet. A till cap of variable thickness commonly separates upper and lower aquifers, and ranges in thickness from 5 to 60 feet. Wells completed in the Bluffton Complex Aquifer System produce from saturated aquifer materials that range in thickness from 4 to 120 feet but are typically 10 to 30 feet thick.

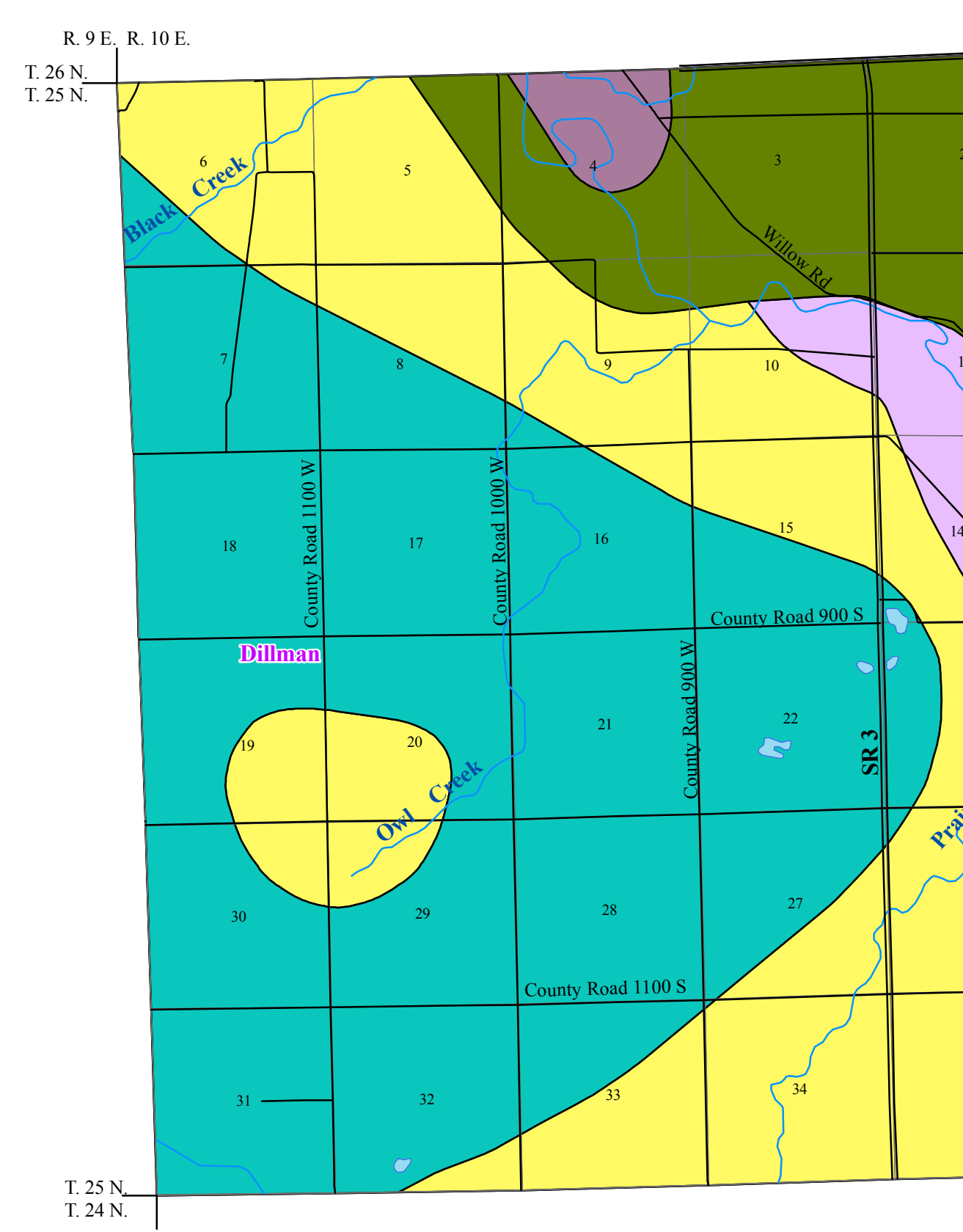
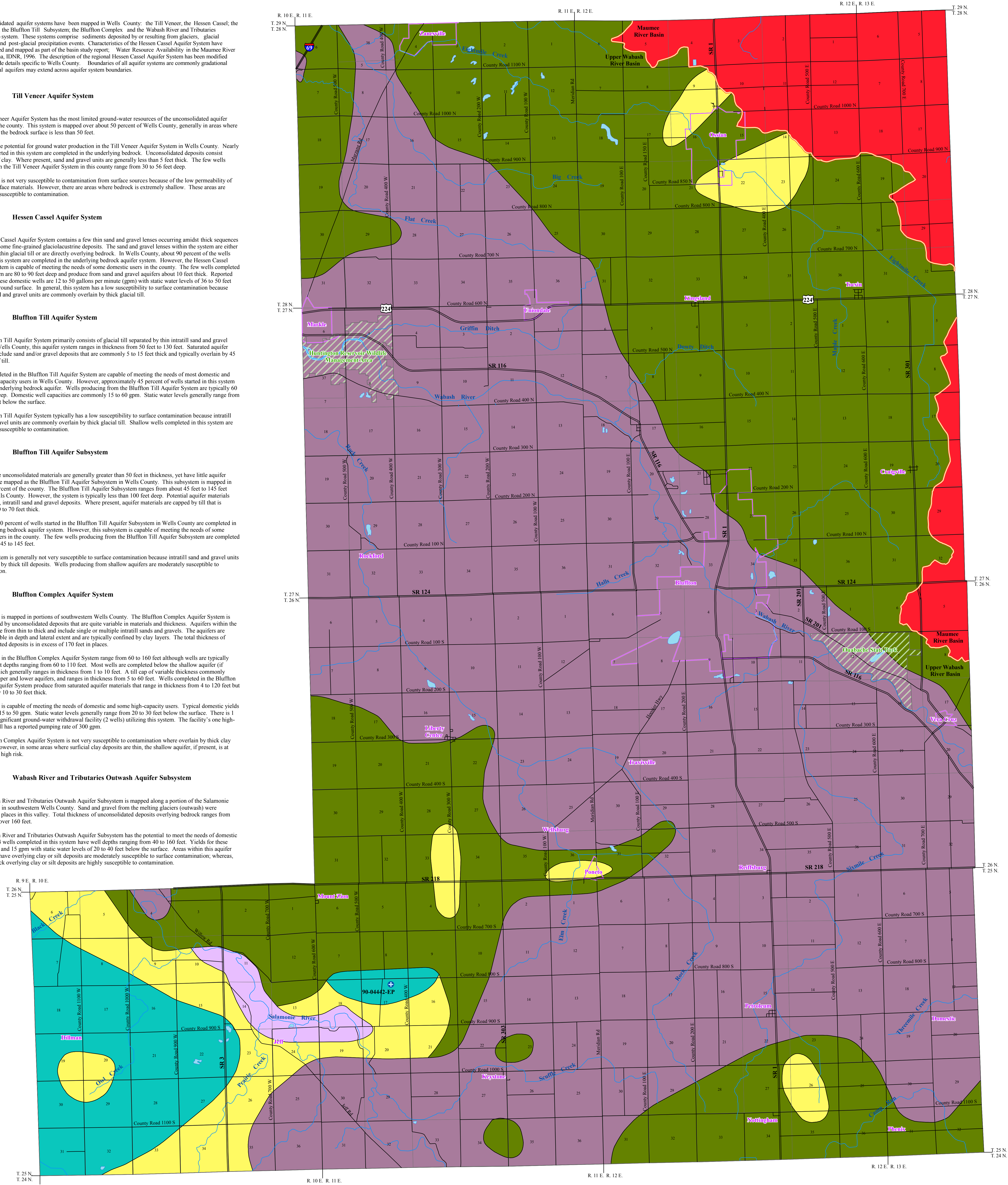
This system is capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields range from 15 to 50 gpm. Static water levels generally range from 20 to 30 feet below the surface. There is 1 registered significant ground-water withdrawal facility (2 wells) utilizing this system. The facility's one high-capacity well has a reported pumping rate of 300 gpm.

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

### Wabash River and Tributaries Outwash Aquifer Subsystem

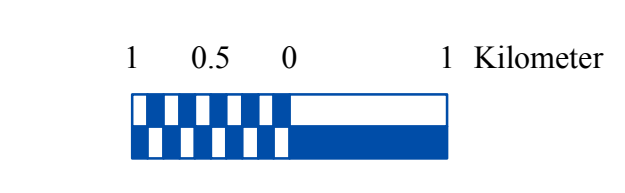
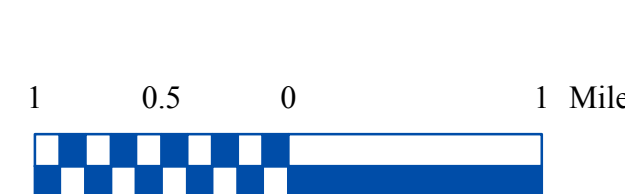
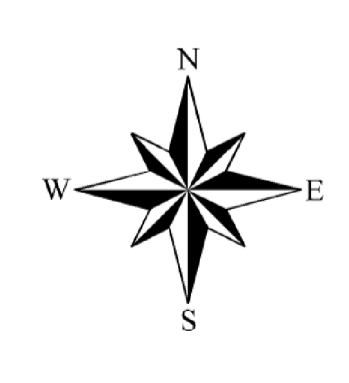
The Wabash River and Tributaries Outwash Aquifer Subsystem is mapped along a portion of the Salamonie River valley in southwestern Wells County. Sand and gravel from the melting glaciers (counties) were deposited in places in this valley. Total thickness of unconsolidated deposits overlying bedrock ranges from about 70 to over 160 feet.

The Wabash River and Tributaries Outwash Aquifer Subsystem has the potential to meet the needs of domestic users. The 4 wells completed in this system have well depths ranging from 40 to 160 feet. Yields for these wells are 10 and 15 gpm with static water levels of 20 to 40 feet below the surface. Areas within this aquifer system that have overlying clay or silt deposits are moderately susceptible to surface contamination; whereas, areas that lack overlying clay or silt deposits are highly susceptible to contamination.



### EXPLANATION

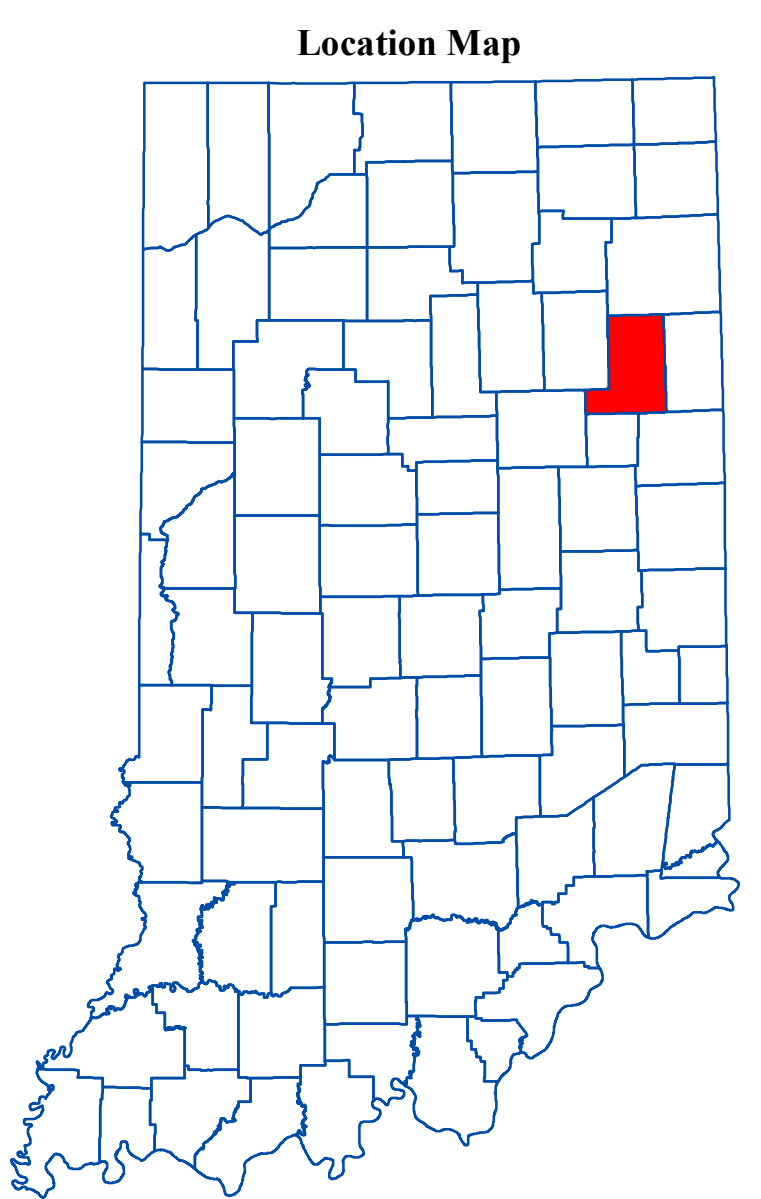
- Registered Significant Ground-Water Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Interstate
- Basin Boundary
- State Managed Property
- Municipal Boundary
- Lake & River



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### Unconsolidated Aquifer Systems of Wells County, Indiana

by  
Gerald A. Unterreiner  
Division of Water, Resource Assessment Section  
May 2007

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

Wells County is located in northeastern Indiana and is situated within two major drainage basins. The majority of the county lies in the Upper Wabash River Basin, while the east-central and northeast corner are situated in the Maumee River Basin.

The Potentiometric Surface Map (PSM) of the unconsolidated aquifers of Wells County was mapped by contouring the elevations of about 100 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.

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.

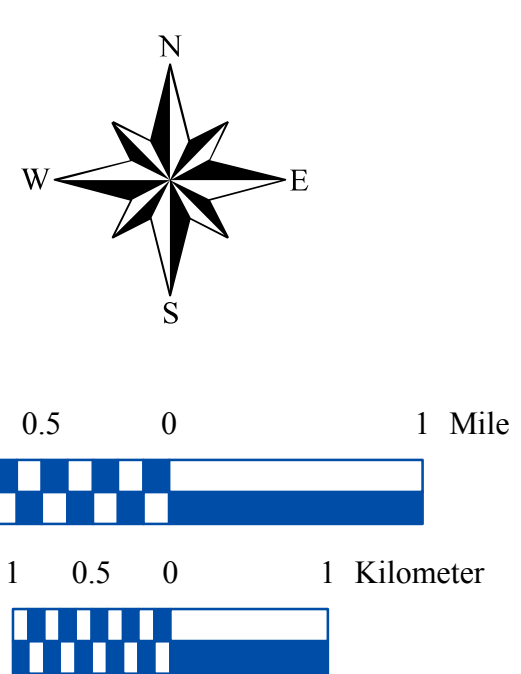
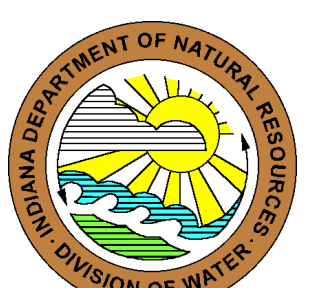
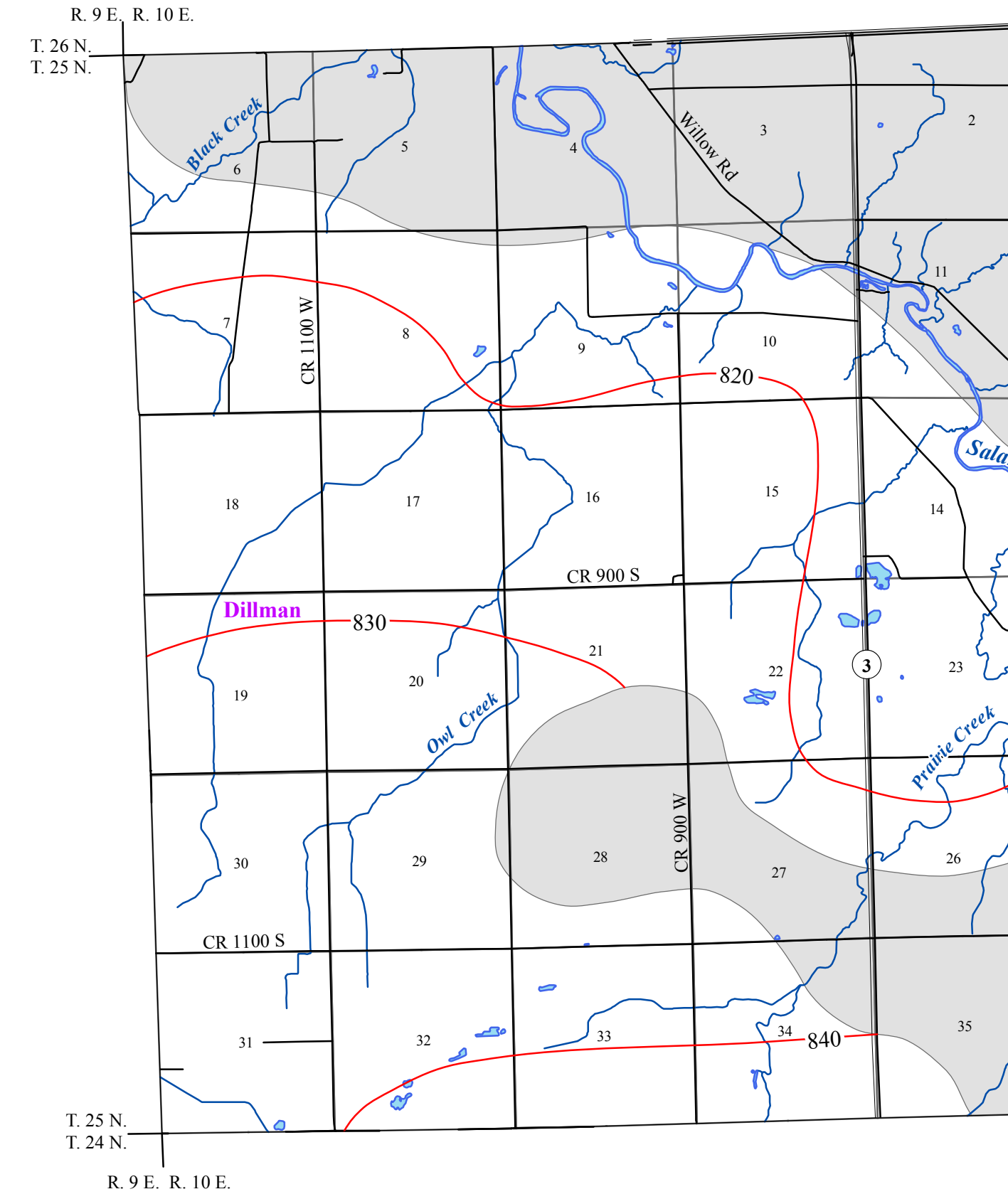
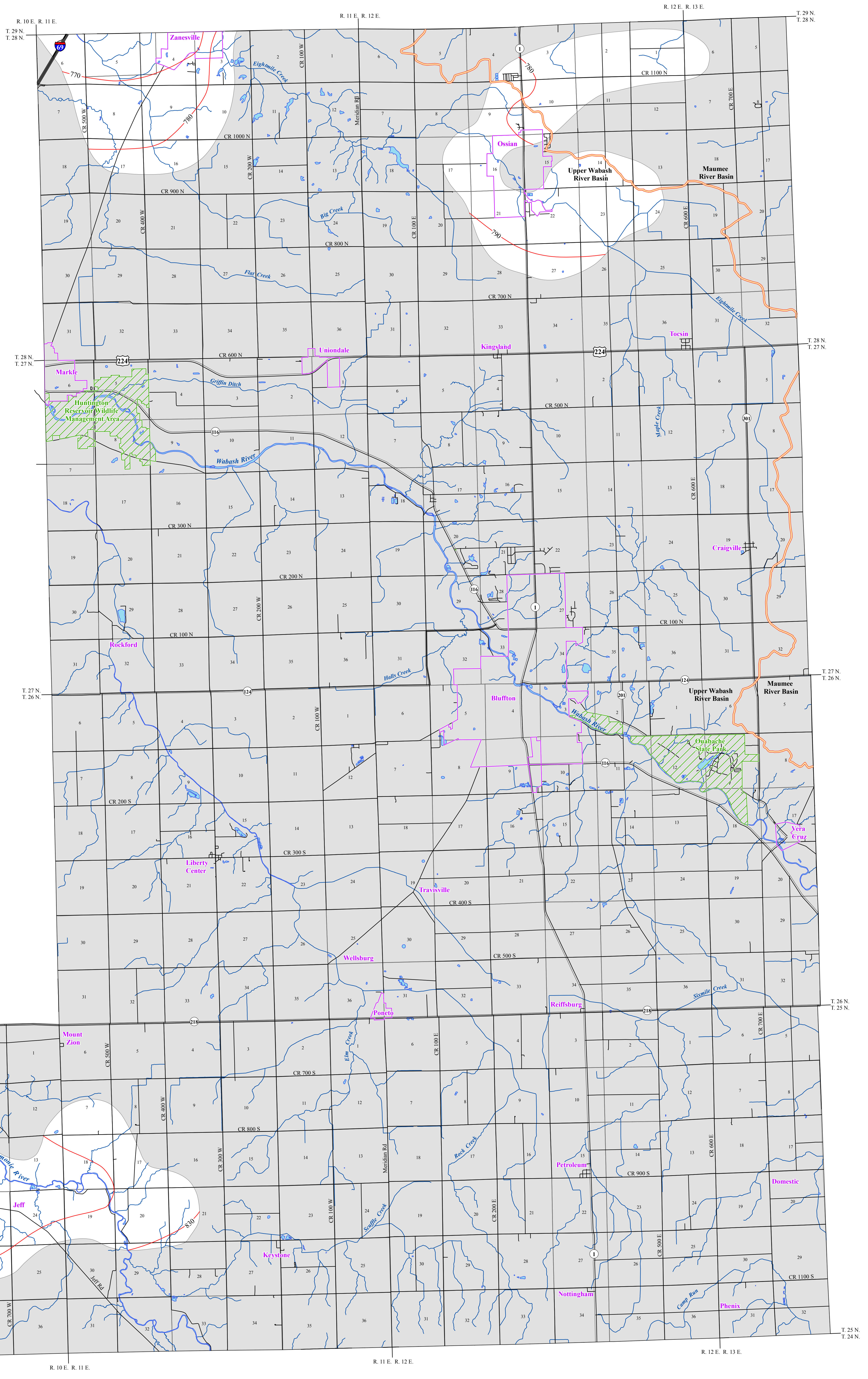
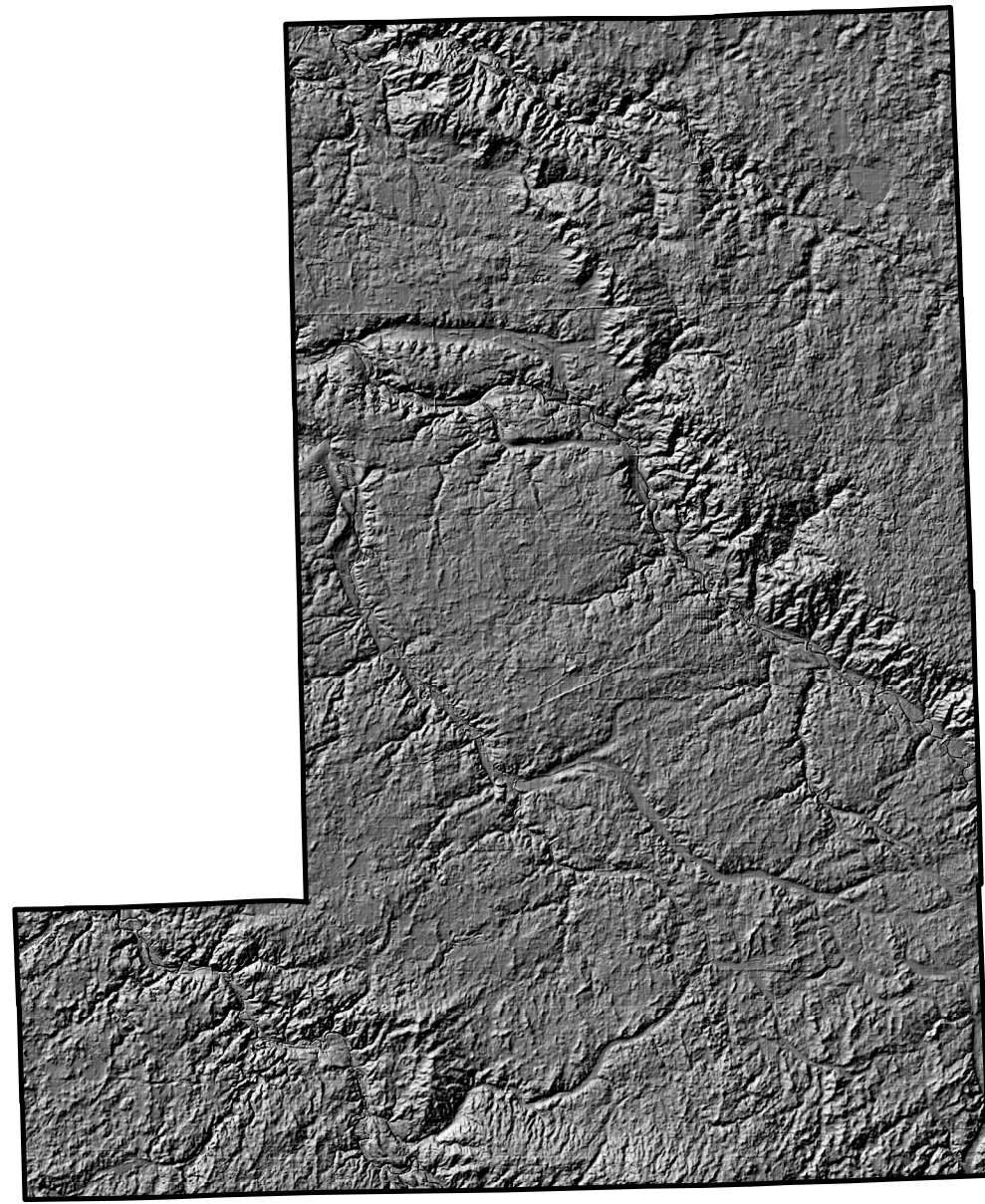
Static water-level measurements in individual wells used to construct county PSM's are indicative of the water-level at the time of well completion. The groundwater level within an aquifer constantly fluctuates in response to rainfall, evapotranspiration, groundwater movement and pumping. Therefore, 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 840 feet mean sea level (msl) in the southwestern section of the county, to a low of 770 feet msl in the northwest. Groundwater flow direction in the northwestern portion of the county is generally towards the northwest, and to the northeast in the northeast part of the county. In the southwestern section of the county, groundwater flow direction trends to the north northwest towards the Salamonie River. Unconsolidated potentiometric surface elevation contours have not been extended throughout much of the county. These areas are either lacking data or unconsolidated deposits are thin or unproductive.

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.

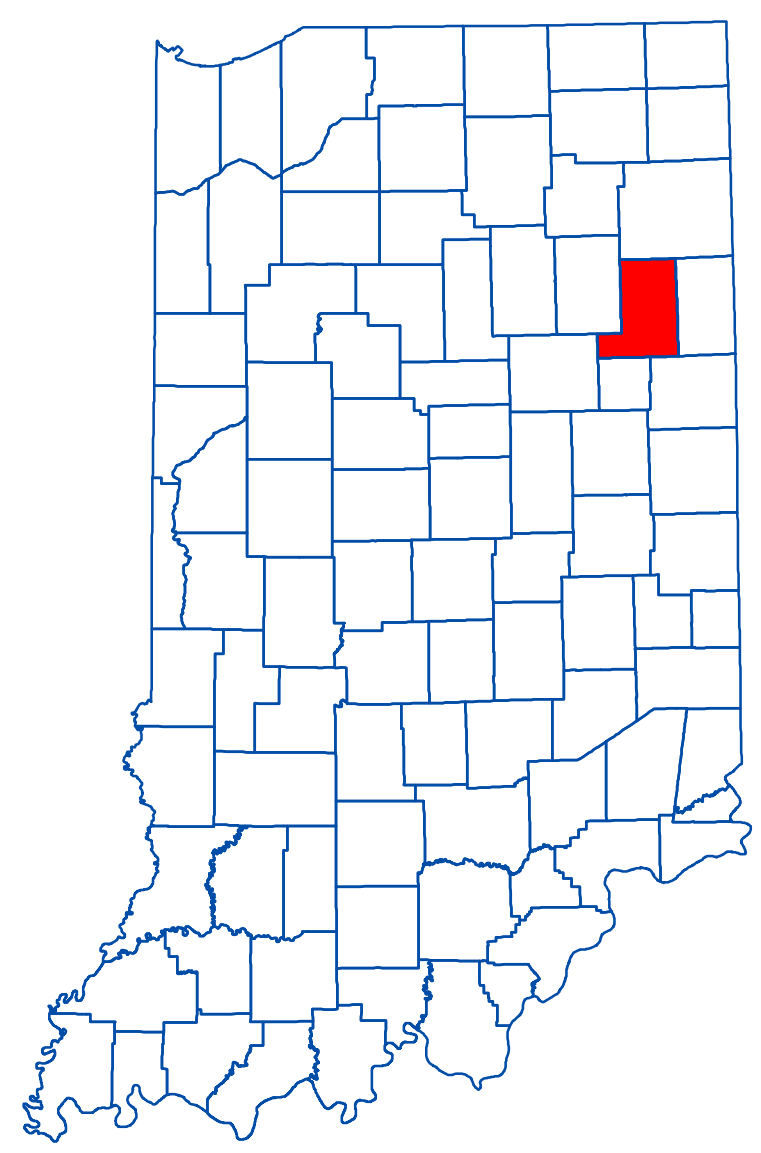
Hillshade Map of Wells County, Indiana



**EXPLANATION**

- 820 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

**Location Map**



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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. System (line shapefile, 2003) is from the Indiana Department of Transportation and based on a 1:24,000 scale. Incorporated Areas in Indiana 2000 (polygon shapefile, 20021000) is from the U.S. Census Bureau and based on a 1:100,000 scale. Hydrography, Streams (NHD) (line shapefile, 20081218), Rivers (NHD) (polygon shapefile, 20081218), and Lakes (NHD) (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. Digital Elevation Model image is derived from the Indiana OrthoLIDAR Statewide Collection Program (2011). Wells County Unconsolidated No Aquifer Material or Limited Data (polygon shapefile, Schmidt, 2013) and Potentiometric Surface Contours of the Unconsolidated Aquifers of Wells County, Indiana (line shapefile, Schmidt, 2014) are based on a 1:24,000 scale.

**Potentiometric Surface Map of the Unconsolidated Aquifers of Wells County, Indiana**

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# Wells County

