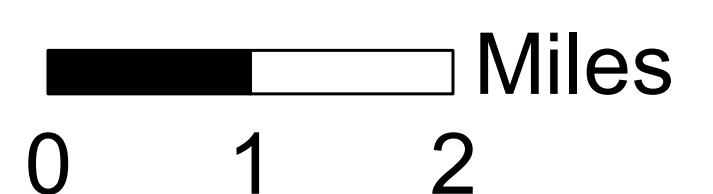
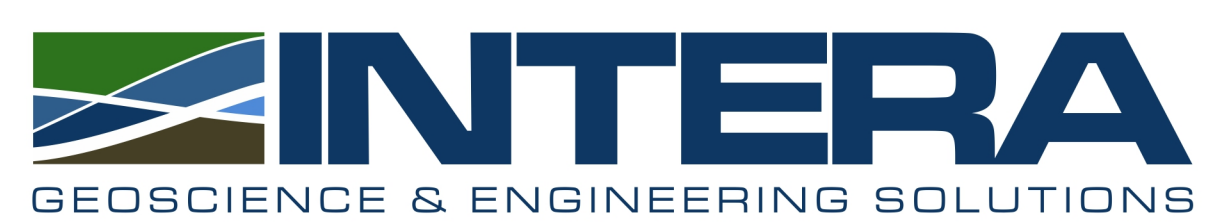
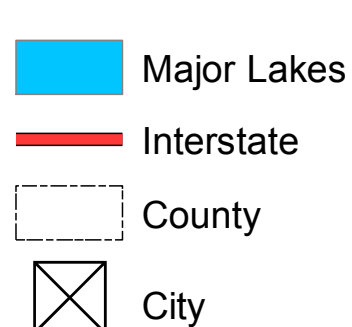
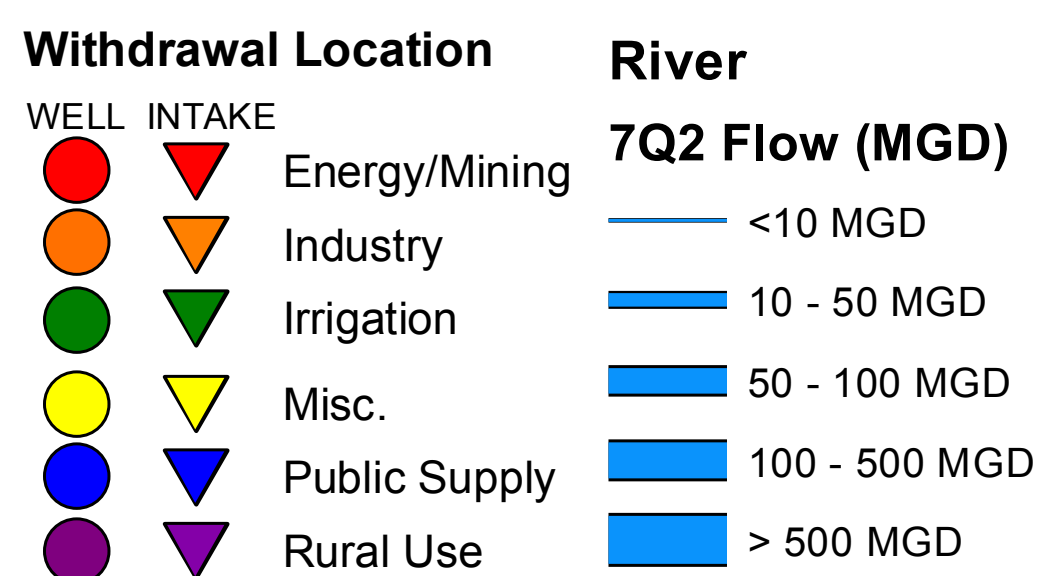
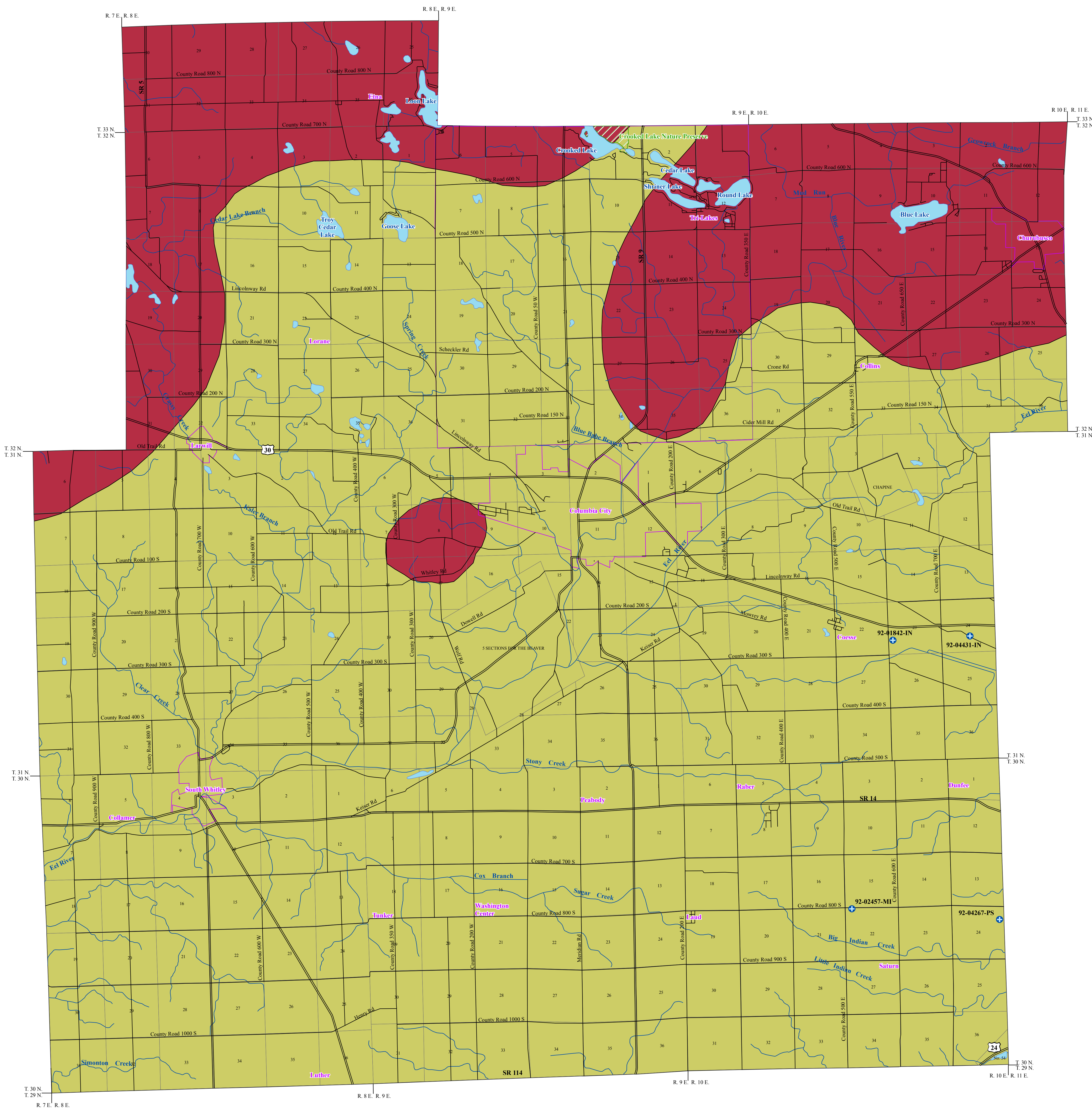


Water Resources and Use in Whitley County

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



BEDROCK AQUIFER SYSTEMS OF WHITLEY 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.

Unconsolidated deposits of varying thickness overlie bedrock aquifer systems in Whitley County. Most of the bedrock aquifers, therefore, are under confined conditions. In other words, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing formation. Thickness of unconsolidated deposits in Whitley County ranges from approximately 70 feet in the southern half of the county to as much as 385 feet to the north.

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 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.

Two bedrock aquifer systems are identified for Whitley County. They are the Devonian and Mississippian Coldwater, Elsworth and Antrim Shales, and the Silurian and Devonian Carbonates.

Devonian and Mississippian – Coldwater, Elsworth and Antrim Shales Aquifer System

In Whitley County only the Antrim Shale subcrop in the Coldwater, Elsworth and Antrim Shales Aquifer System. The subcrop area for the Antrim Shale is present along portions of the northern third and a small area of central Whitley County. Shale is commonly described as an aquitard and, therefore, the system is an extremely limited ground-water resource.

The Antrim Shale in Whitley County is up to 85 feet thick and generally increases in thickness to the north. This aquifer system consists mostly of brownish-black to greenish carbon-rich shale. Depth to bedrock is up to 360 feet.

Due to the availability of the overlying unconsolidated resources no known wells have been completed in the Coldwater, Elsworth and Antrim Shales Aquifer System in Whitley County. However, a few domestic wells have been completed in equivalent deposits (New Albany Shale Aquifer System) in southern portions of Indiana. Typical yields are 5 gallons per minute (gpm) or less with some dry holes reported.

Because the permeability of shale materials is considered low and the overlying unconsolidated deposits are thick, susceptibility to contamination introduced at or near the surface is low.

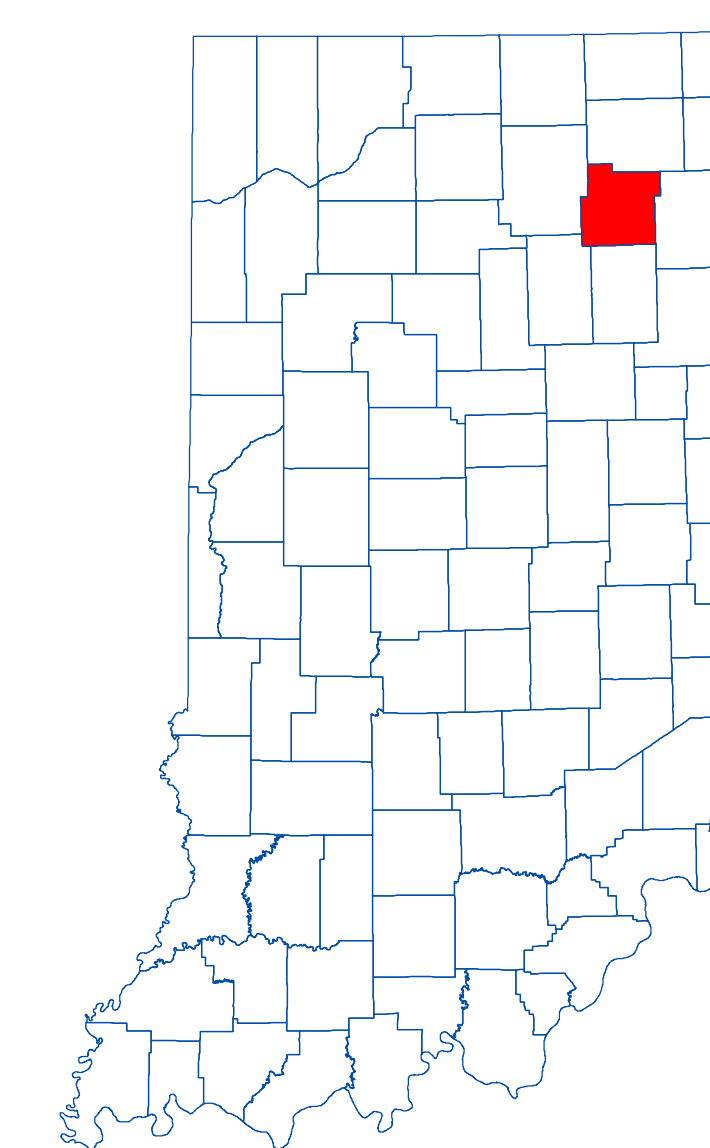
Silurian and Devonian Carbonates Aquifer System

The Silurian and Devonian Carbonates Aquifer System is extensive throughout nearly all of Whitley County. The system includes Silurian and Devonian age carbonate rock units (limestone and dolomite) with some interbedded shale units. Total thickness of the Silurian bedrock is up to 550 feet. Total thickness of Devonian bedrock is up to 125 feet. Depth to the bedrock surface ranges from about 70 to 385 feet but is commonly 165 to 230 feet. Total well depths range from 115 to 520 feet but are typically 210 to 290 feet with penetration into bedrock commonly 25 to 75 feet.

This system in Whitley County is capable of meeting the needs of domestic and some high-capacity users. Typical domestic yields range from 15 to 25 gpm. Static water levels range from 15 to 220 feet but are commonly 35 to 60 feet. There are 4 registered significant ground-water withdrawal facilities (9 wells) with yields that range from 80 to 1940 gpm.

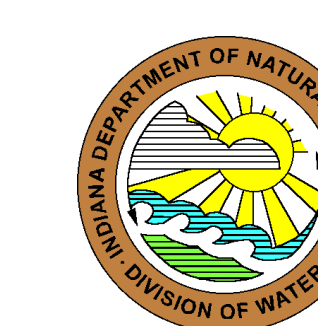
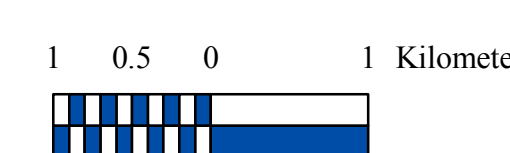
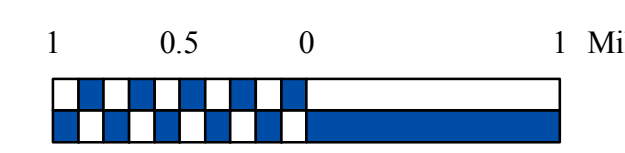
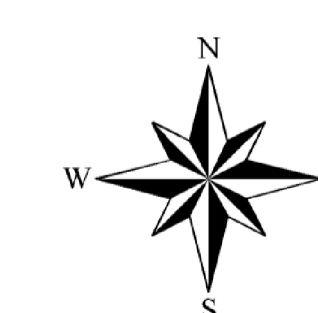
Most of the Silurian and Devonian Carbonates Aquifer System in Whitley County is overlain by thick clay deposits. This aquifer system is generally considered at low risk to contamination. However, near the El River, bedrock is overlain by alluvial and outwash deposits with intermittent clay. These areas, therefore, are at moderate to high risk to contamination.

Location Map



EXPLANATION

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



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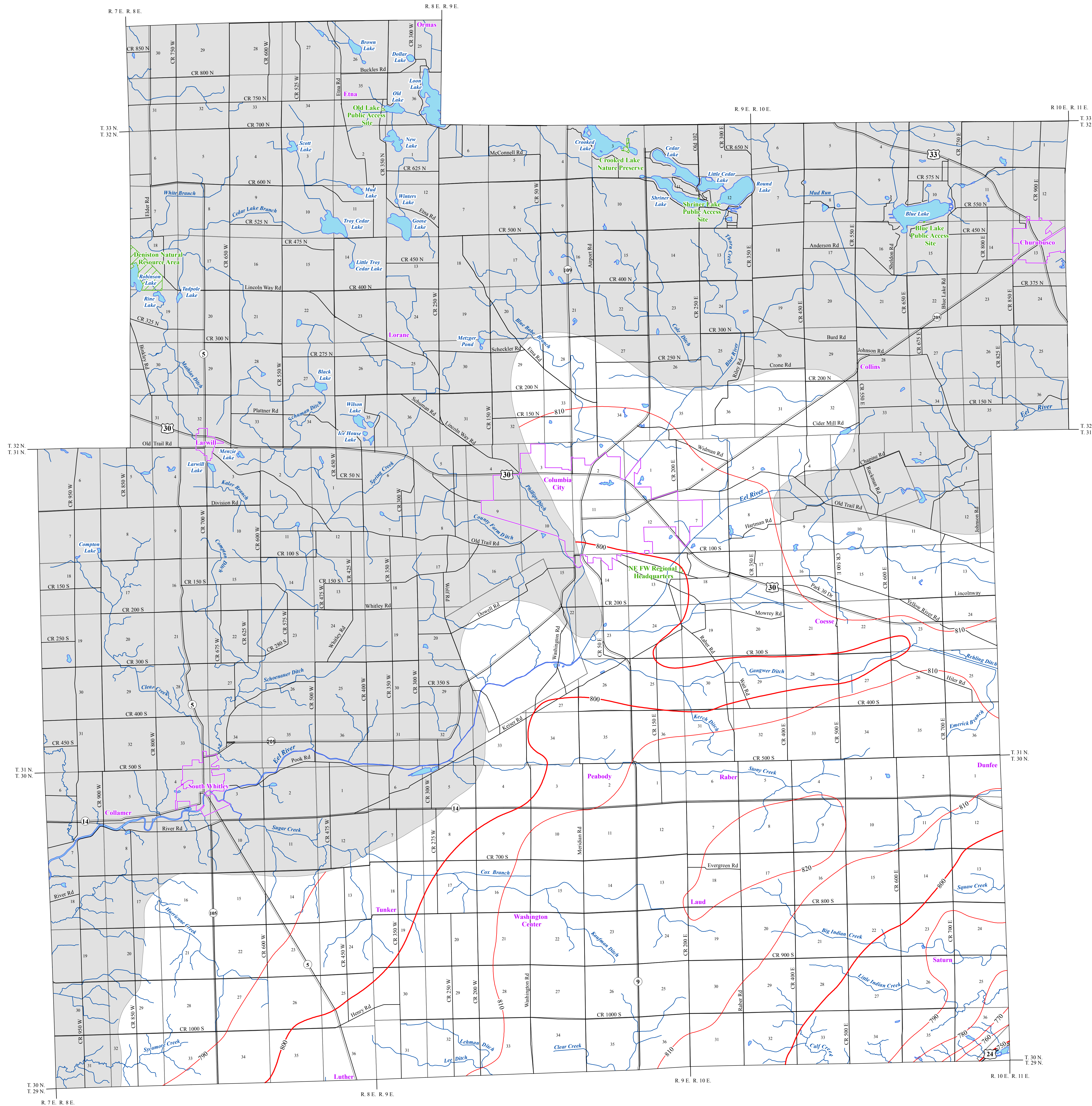
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Bedrock Aquifer Systems of Whitley County, Indiana

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

July 2007

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



Whitley County, Indiana is located in the northeast portion of the state bounded by Kosciusko, Noble, Allen, Huntington, and Wabash counties in the west, north, east, south and southwest, respectively. Whitley County is situated within the Upper Wabash River Basin.

The Bedrock Potentiometric Surface Map (PSM) of Whitley County was mapped by contouring the elevations of 370 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. Groundwater levels in an unconfined aquifer system are at atmospheric pressure and will not rise in a well above the top of the water bearing formation. The potentiometric surface in most wells completed in bedrock within Whitley County rises above the top of the bedrock water bearing formation due to the confining nature of the system. Depth to bedrock in Whitley County ranges from approximately 70 feet in the southern half of the county to as much as 385 feet to the north.

Bedrock potentiometric surface elevation contours have not been extended through the northern and western portions of Whitley 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 wells in these areas are mainly finished in the thick unconsolidated material overlying the Coldwater, Ellsworth, and Antrim Shales along with the Silurian and Devonian Carbonates. Shale is commonly described as an aquitard and, therefore, the system is an extremely limited groundwater resource. However, in the southeastern portion of Whitley County and in nearby Allen and Huntington Counties, the Silurian and Devonian Carbonates Aquifer System is capable of supporting domestic and some high-capacity users.

Static water-level measurements in individual wells used to construct county PSM's are indicative of the water-level near 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 contours were determined based on the amount of data and the degree of change in water levels between wells in each mapped area.

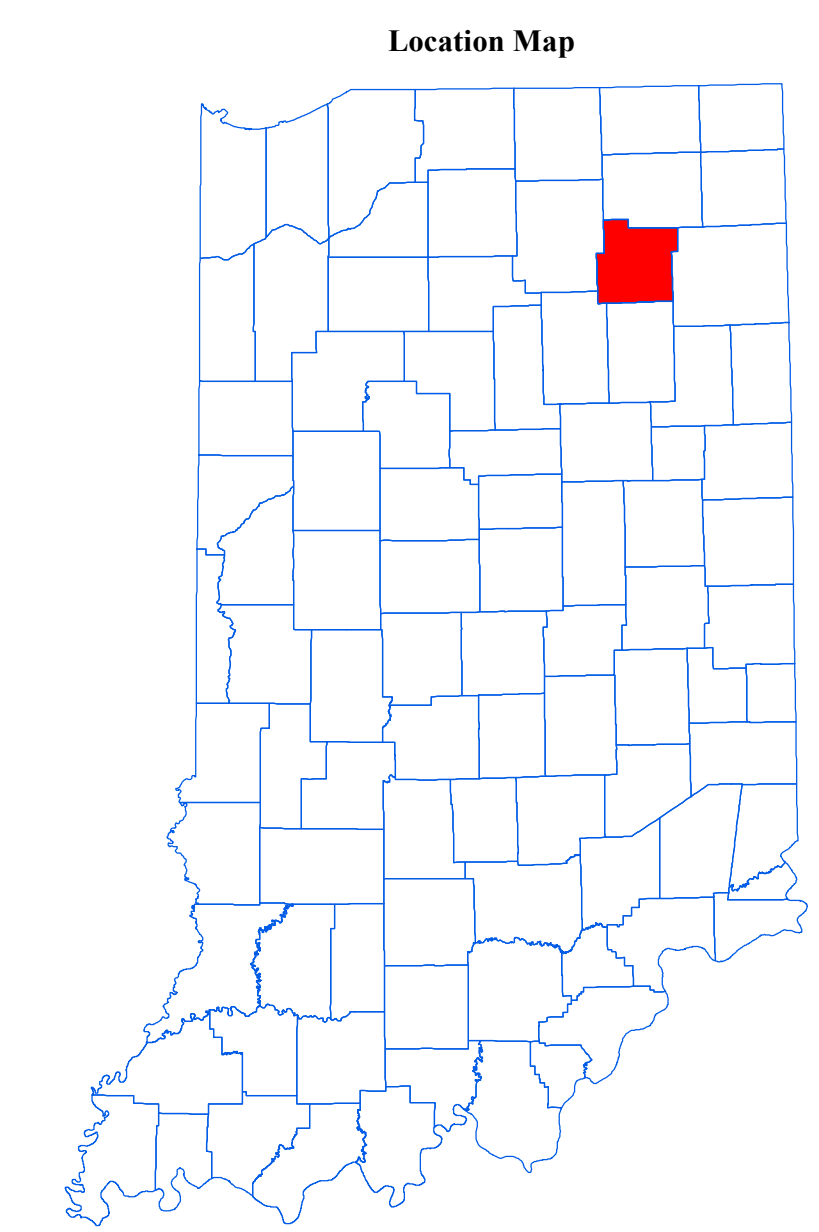
Data collected to generate PSM were standardized and validated for competency. Universal Transverse Mercator (UTM) coordinates for the water wells were either physically obtained in the field, determined through address geocoding, or determined based on water well records; however, the location of many of the water well records used to make the PSM were not field verified. Elevation data were derived from LIDAR based 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 Whitley County range from a high of approximately 820 feet mean sea level (msl) in the southeast region of the county, to a low of about 750 feet msl in the far southeast corner of the county. Groundwater flow within Whitley County takes two directions, towards Aboto Creek-Little River in adjacent Allen and Huntington Counties to the southeast, and towards Eel River in the south central and west central parts of the county.

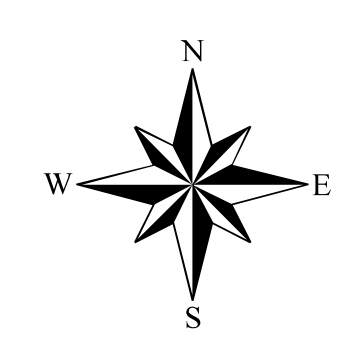
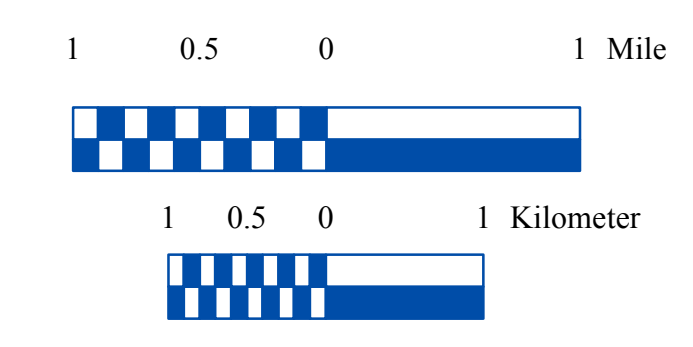
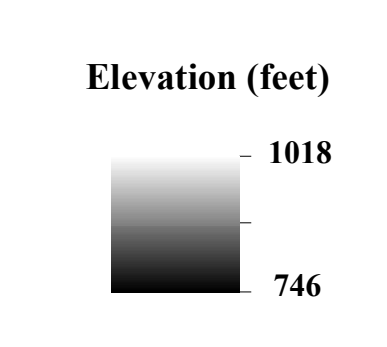
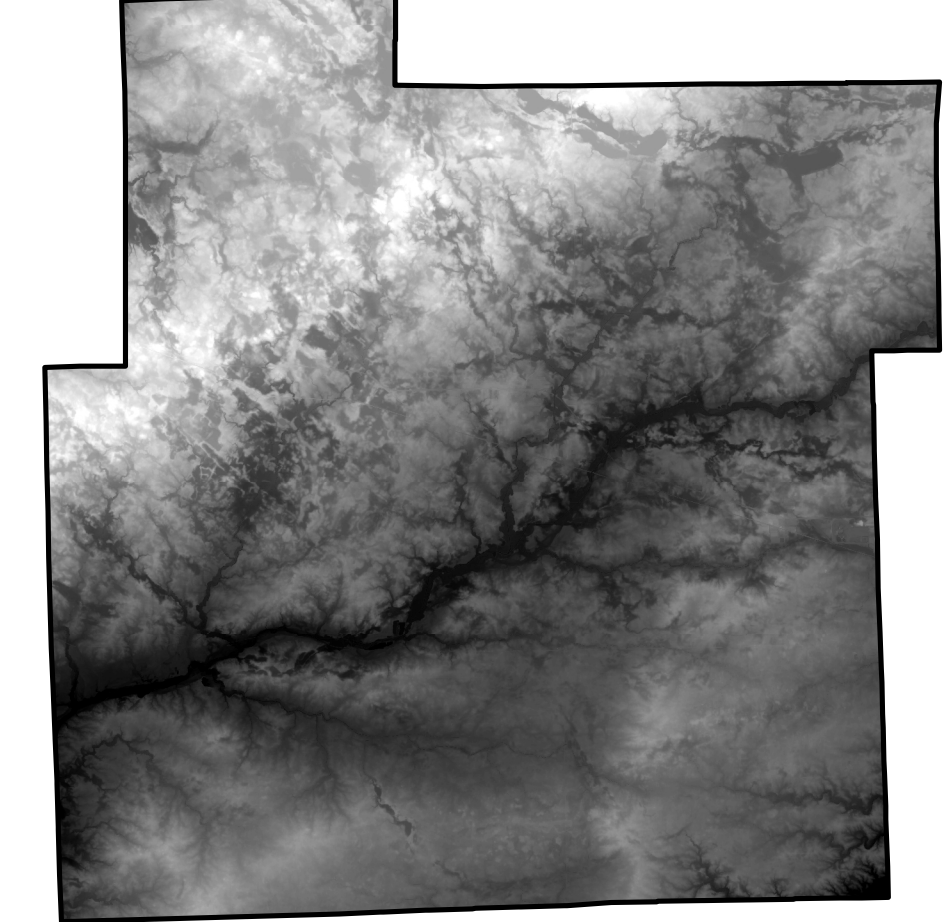
The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. County PSM's represent overall regional characteristics and are not intended to be a substitute for site-specific studies.

EXPLANATION

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



Digital Elevation Model of Whitley County, Indiana



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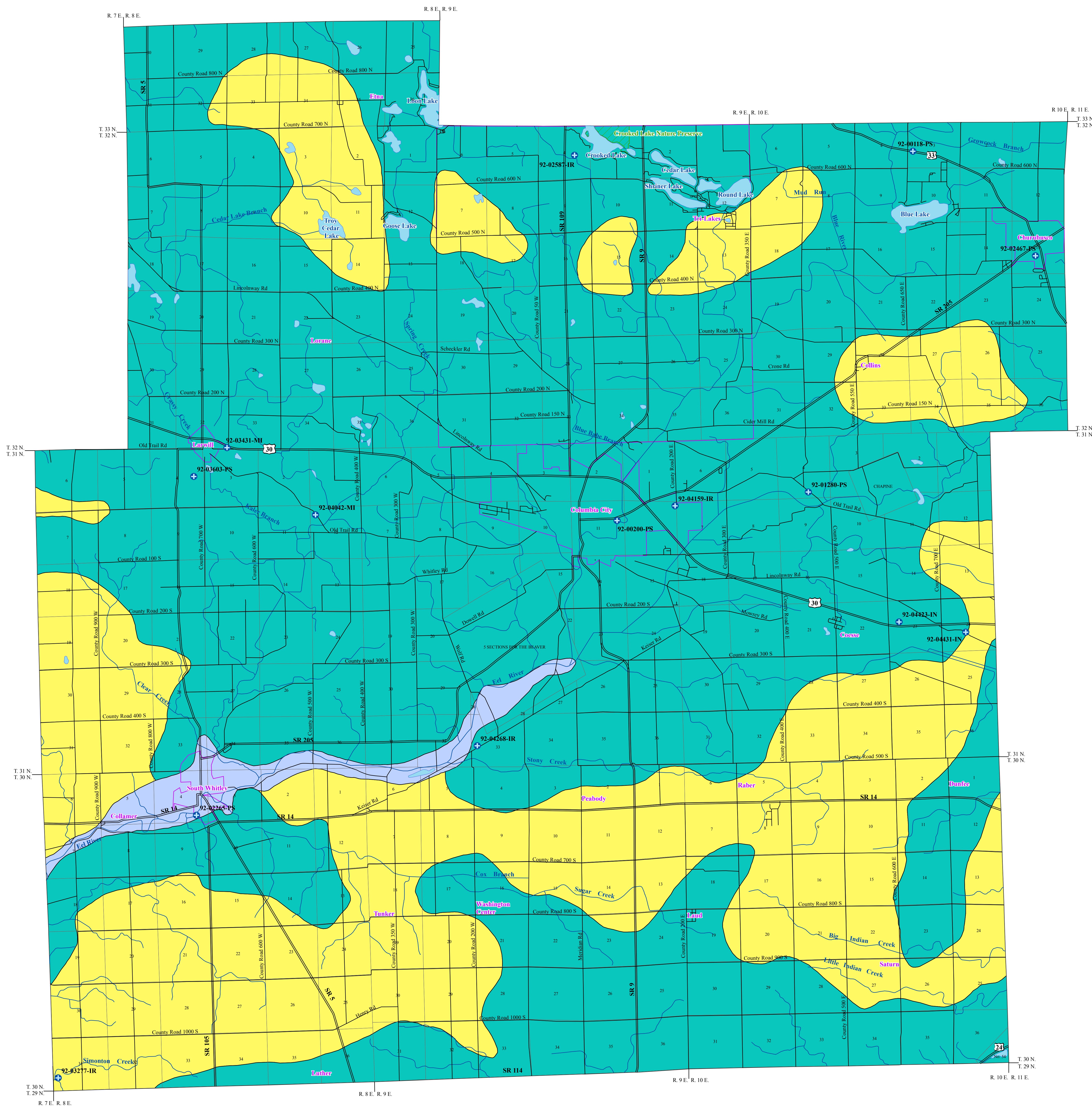
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Potentiometric Surface Map of the Bedrock Aquifers of Whitley County, Indiana

by
Ginger Korinek
Division of Water, Resource Assessment Section
June 2013

Map generated by Joel Sanderson
IDNR, Division of Water, Resource Assessment Section

UNCONSOLIDATED AQUIFER SYSTEMS OF WHITLEY COUNTY, INDIANA



Five unconsolidated aquifer systems have been mapped in Whitley County: the Bluffton/Auburn Till, the Bluffton/Auburn Complex, and the Wabash River and Tributaries Outwash System. Boundaries of these aquifer systems are commonly gradational, and individual aquifers may extend across aquifer system boundaries.

Pre-Wisconsin and Wisconsin glacial sediments completely cover Whitley County. However, the thickness of unconsolidated sediments is quite variable. Thickness of unconsolidated sediments that overlie bedrock ranges from approximately 70 feet in the southern half of the county to as much as 385 feet to the north.

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.

Bluffton/Auburn Till Aquifer System

In Whitley County, the Bluffton/Auburn Till Aquifer System is mapped throughout portions of the southern half of the county and, to a lesser extent, the northern half. The system typically consists of thick clay with intermittent sands and gravels that in places are up to 360 feet in total thickness. Well depths generally range from 80 to 170 feet below surface. Potential aquifer materials include sands and/or gravels that typically range from 4 to 12 feet thick. Aquifer materials are generally overlain by 70 to 170 feet of clay that include intermittent sand and gravel deposits that are commonly 3 to 9 feet thick.

The Bluffton/Auburn Till Aquifer System is capable of meeting the needs of domestic and some high-capacity users. Domestic well capacities are generally 10 to 20 gallons per minute (gpm). Static water levels are commonly 30 to 75 feet below surface with a few flowing wells reported. There is one registered significant ground-water withdrawal facility (2 wells) with reported yields of 75 gpm. This aquifer system is generally not very susceptible to surface contamination because intertilt sand and gravel units are overlain by thick till deposits.

Bluffton/Auburn Complex Aquifer System

The Bluffton/Auburn Complex Aquifer System is mapped throughout most of Whitley County. This system includes unconsolidated deposits that are quite variable in materials and thickness. Multiple sand and gravel aquifer deposits vary from thin to massive and are typically overlain by a thick till. Also, in places the system exhibits multiple sand and gravel deposits above the primary aquifer resource that are also a potential source of ground-water.

Well depths range from 30 to 315 feet but are commonly 70 to 155 feet. Typical aquifer thicknesses are 10 to 35 feet. However, aquifer materials up to 160 feet thick have been reported. The deeper, more productive aquifer deposits are commonly overlain by till with multiple discontinuous sands and gravels that range from 10 to 240 feet thick but are generally 55 to 130 feet thick. The multiple discontinuous sands and gravels range from 2 to 120 feet thick but are typically 5 to 20 feet thick.

The Bluffton/Auburn Complex Aquifer System is capable of meeting the needs of domestic and high-capacity users. Typical domestic yields range from 10 to 30 gpm. Static water levels commonly range from 25 to 65 feet below surface. There are 12 registered significant ground-water withdrawal facilities (19 wells) with reported yields that range from 80 to 2600 gpm. This aquifer system is not very susceptible to contamination because thick clay deposits overlie aquifer materials.

Wabash River and Tributaries Outwash Aquifer System

The Wabash River and Tributaries Outwash Aquifer System is mapped in the west-central portion of Whitley County along a section of the Ellettsville River. There are very few wells completed in this system. However, production wells for the Towns of South Whitley indicate adequate potential for domestic and some high-capacity users.

Well depths generally range from 30 to 250 feet below surface with up to 160 feet of continuous sand and gravel. Aquifer materials are generally capped by silt, sandy clay, or clay ranging from 10 to 15 feet thick. Also, in places aquifer sand and gravel deposits include discontinuous clay or gravelly clay deposits 10 to 30 feet thick. There is one registered significant ground-water withdrawal facility (2 wells) in the outwash system in Whitley County. Reported test yields for each well are up to 1000 gpm and static water levels range from 3 to 20 feet below surface.

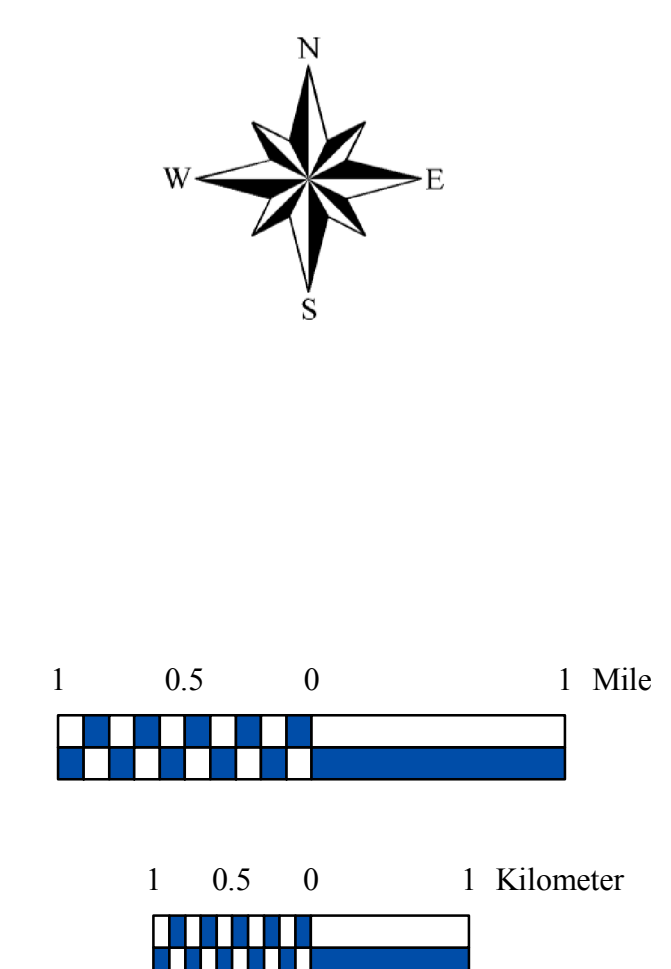
Areas that lack overlying clay or silt deposits are highly susceptible to contamination. However, where overlying clay or silt deposits are present the system is moderately susceptible to surface contamination.

Location Map



EXPLANATION

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



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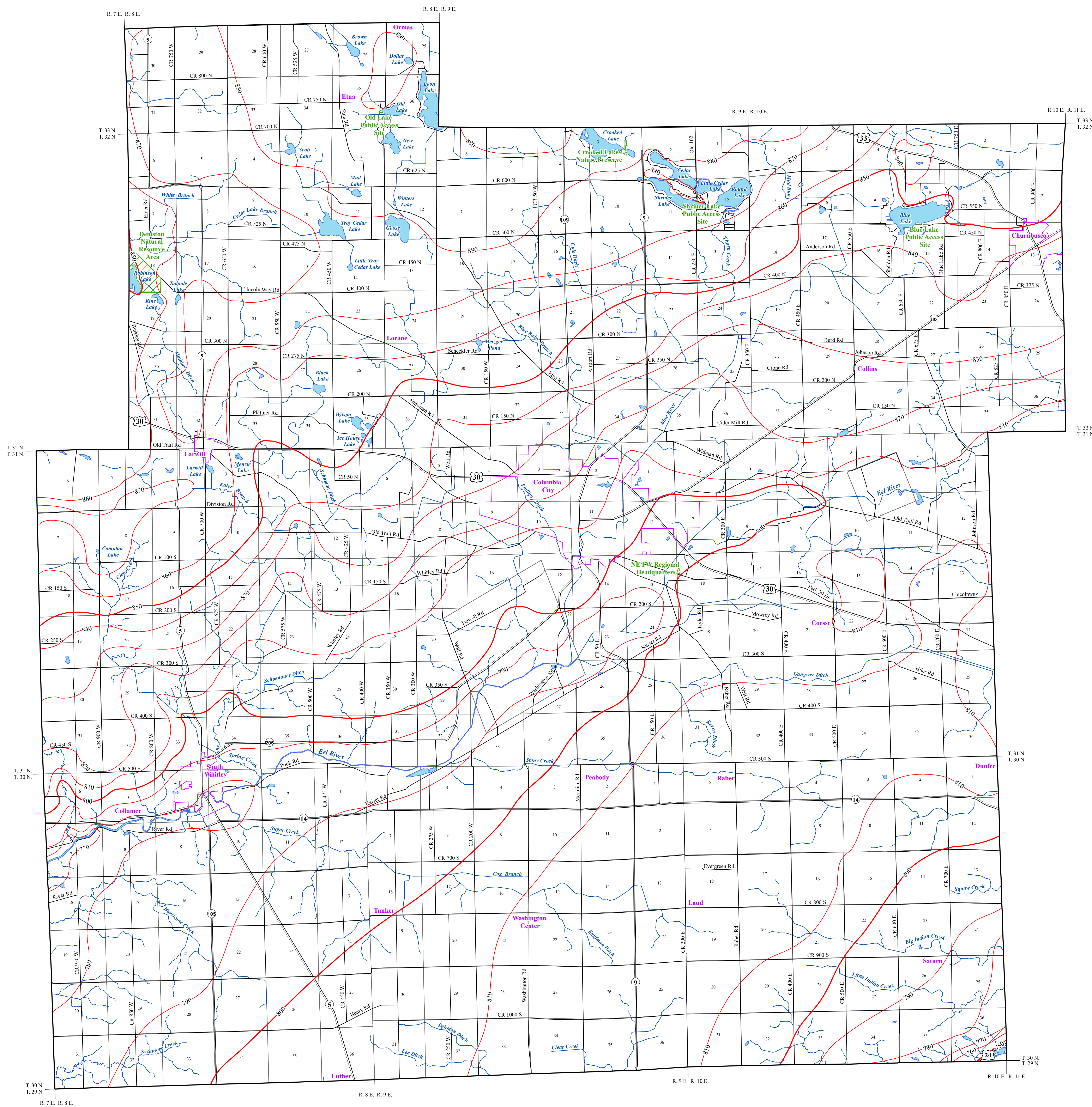
Unconsolidated Aquifer Systems of Whitley County, Indiana

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

July 2007



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



Whitley County, Indiana is located in the northeast portion of the state bounded by Kosciusko, Noble, Allen, Huntington, and Wabash counties in the west, north, east, south and southwest, respectively. Whitley County is situated within the Upper Wabash River Basin.

The Potentiometric Surface Map (PSM) of the unconsolidated aquifers of Whitley County was mapped by contouring the elevations of 2051 static water-levels reported on well records received primarily over a 50 year period. These wells are completed in unconsolidated 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 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. Artesian wells from the unconsolidated aquifers have been located along an unnamed tributary of Eel River on the Western border of Whitley County.

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 contours were determined based on the amount of data and the degree of change in water levels between wells in each mapped area.

Data collected to generate PSM were standardized and validated for competency. Universal Transverse Mercator (UTM) coordinates for the water wells were either physically obtained in the field, determined through address geocoding, or determined based 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 derived from LIDAR based digital elevation model. Quality control/quality assurance procedures were utilized to refine or remove data where errors were readily apparent.

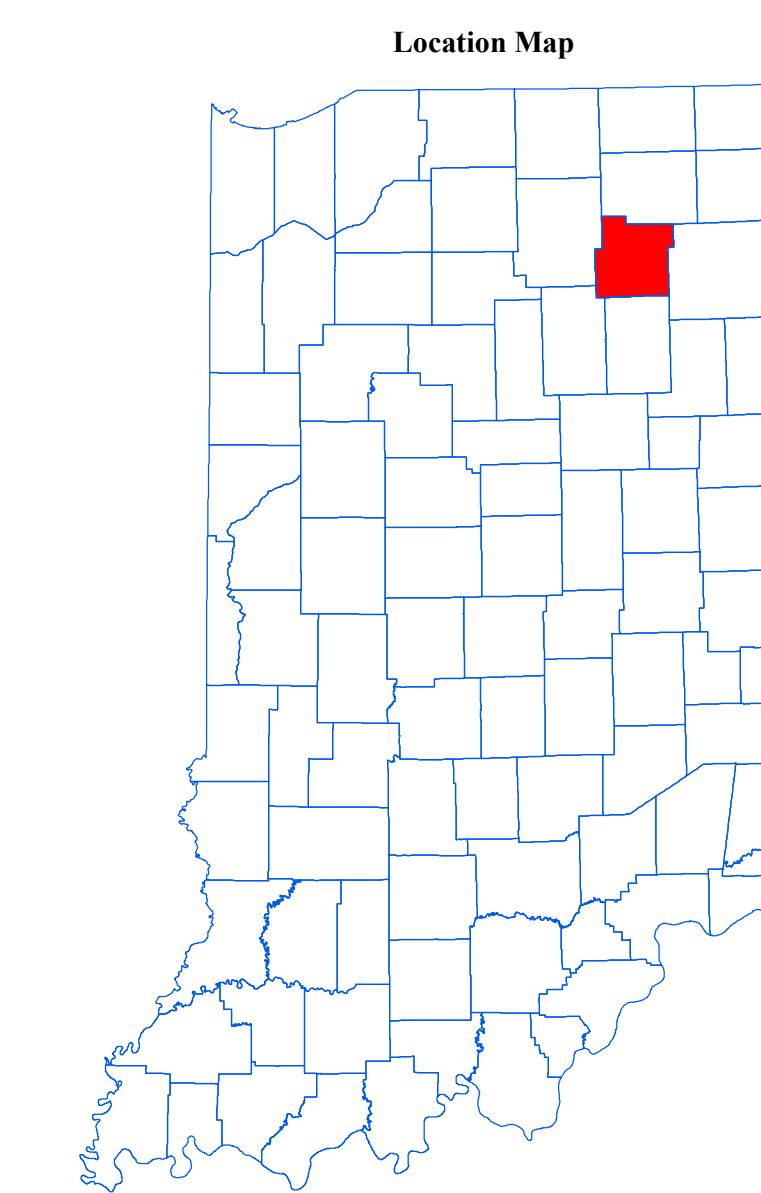
Unconsolidated static water levels in Whitley County range from a high of approximately 890 feet mean sea level (msl) in the northwestern portion of the county, to a low of approximately 750 feet msl near Abote Creek and Little River in the southeastern corner of Whitley County. Groundwater flow direction within Whitley County is generally toward Eel River for most of the county.

In the northwestern portion of the county groundwater flow direction takes more of a westerly direction toward Kosciusko County. In the far southeastern corner of the county groundwater flow direction is southeast towards Abote Creek and Little River in adjacent Allen and Huntington Counties.

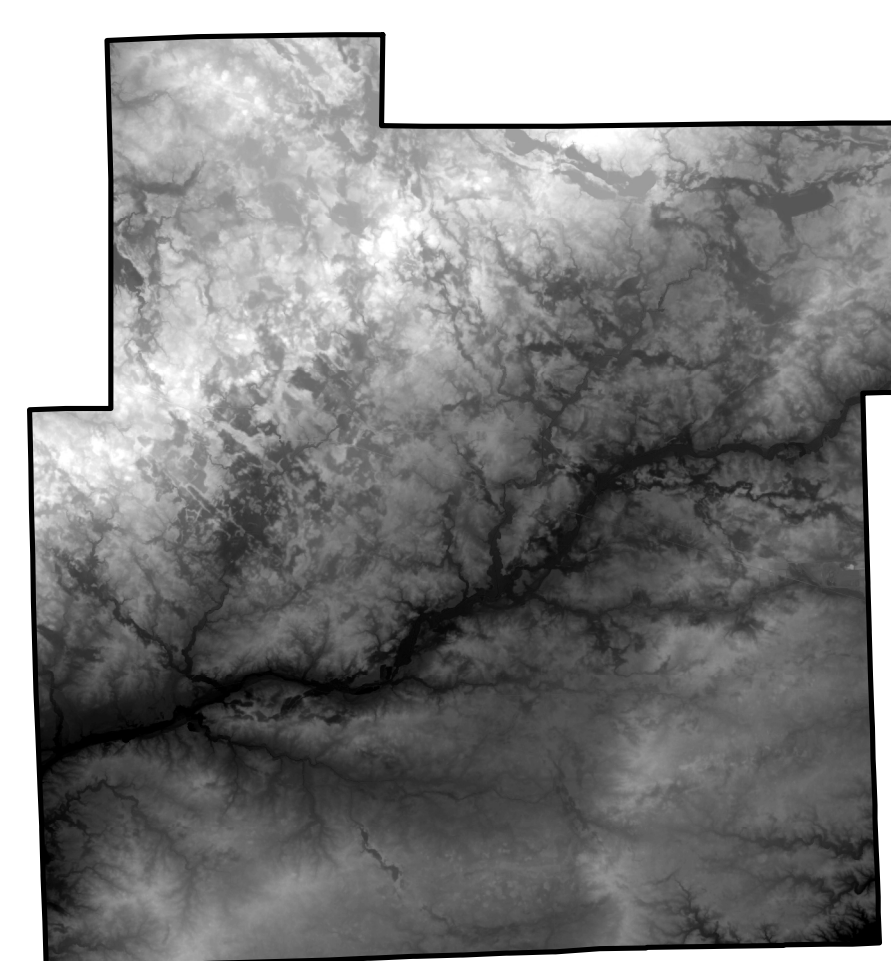
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EXPLANATION

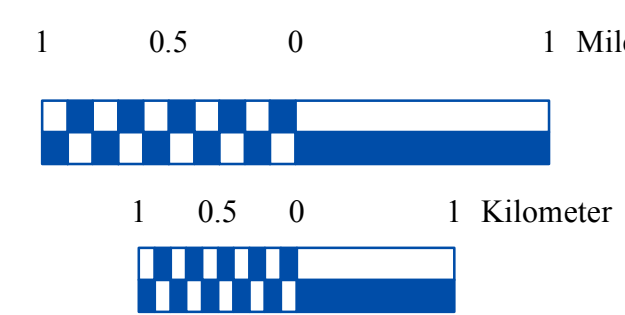
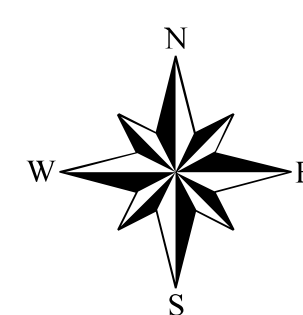
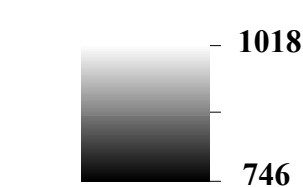
- Line of equal elevation, in feet above mean sea level
Potentiometric Contour interval 10 feet
- Stream
- County Road
- State Road
- US Highway
- Municipal Boundary
- Lake & River
- State Managed Property



Digital Elevation Model of Whitley County, Indiana



Elevation (feet)



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

by
Ginger Kornick
Division of Water, Resource Assessment Section

June 2013

Map generated by Joel Sanderson
IDNR, Division of Water, Resource Assessment Section

Whitley County

