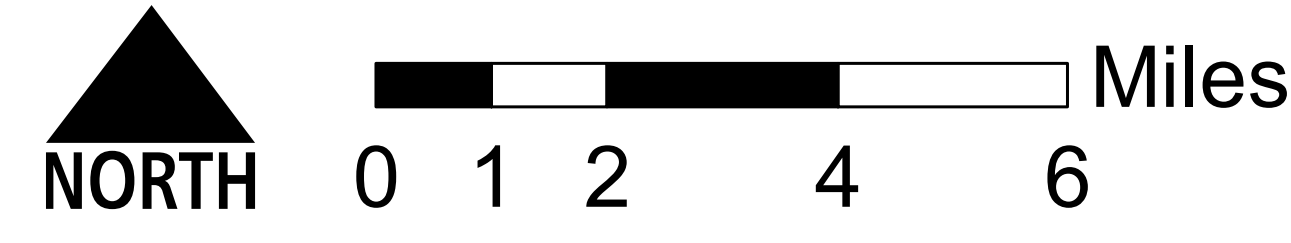
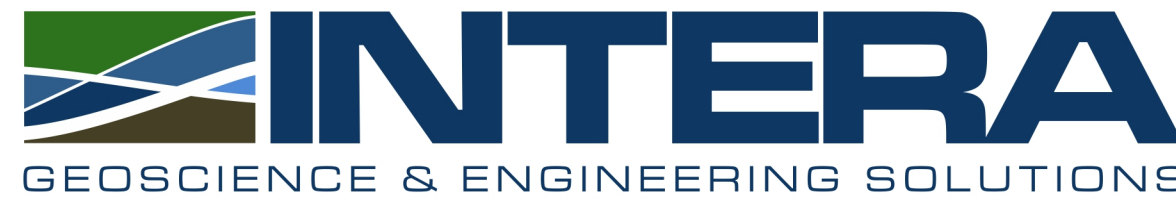


Water Resources and Use in Lake County

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

Major Lakes
Interstate
County
City



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

BEDROCK AQUIFER SYSTEMS OF LAKE 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.

Two bedrock aquifer systems are identified for Lake County: the Devonian and Mississippian age Coldwater, Ellsworth and Antrim Shales, and the Silurian and Devonian Carbonates. Moderately productive limestone subgroups throughout the northern, western, and southern portions of the county, and unproductive shales subgroups over the east-central section of the county. Bedrock aquifer systems in Lake County are overlain by unconsolidated deposits of varying thickness ranging from about 50 to over 200 feet throughout the county. Major sand and gravel aquifers occur in these thick unconsolidated deposits overlying the bedrock.

The yield of a bedrock aquifer depends on its hydraulic characteristics and the nature of the overlying deposits. Shale and glacial fill act as aquitards, restricting recharge to underlying bedrock aquifers. However, fracturing and jointing may occur in aquitards, which can increase recharge to the underlying aquifers. Hydraulic properties of the bedrock aquifers are highly variable. Most of the bedrock aquifers in the county are under confined conditions. In other words, the potentiometric surface (water level) in most wells completed in bedrock rises above the top of the water-bearing zone.

The 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.

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

The Coldwater, Ellsworth and Antrim Shales Aquifer System is present at the bedrock surface in the east-central portion of Lake County. This system is generally not utilized as a source of water in the county because of the typically low permeability of shale, and unconsolidated aquifers are commonly abundant in the overlying deposits. However, the Coldwater, Ellsworth and Antrim Shales is used as the primary source of water in a few isolated areas in Lake County. These locations lie to the immediate north and north-east of the town of Crown Point, where the unconsolidated deposits do not contain any significant aquifers. In some instances, wells are completed in the underlying carbonate rocks in areas where the thickness of the shales are relatively thin. However, the water may be of poor quality.

Water wells utilizing the Coldwater, Ellsworth and Antrim Shales Aquifer System penetrate approximately 100 to 150 feet of unconsolidated material, and are completed into more than 50 feet of shale. However, only the upper 25 feet of the shale has typically been made permeable due to post-Devonian weathering, jointing and fracturing. Static water levels in the shale range from 40 to 90 feet below the surface. The Coldwater, Ellsworth and Antrim Shales Aquifer System is capable of supplying some domestic users requiring less than 10 gallons per minute (gpm). There are no registered significant groundwater withdrawal facilities in this system.

Since the permeability of shale materials is considered low and the overlying unconsolidated deposits are relatively thick, this bedrock system is not very susceptible to contamination introduced at or near the surface.

Silurian and Devonian Carbonates Aquifer System

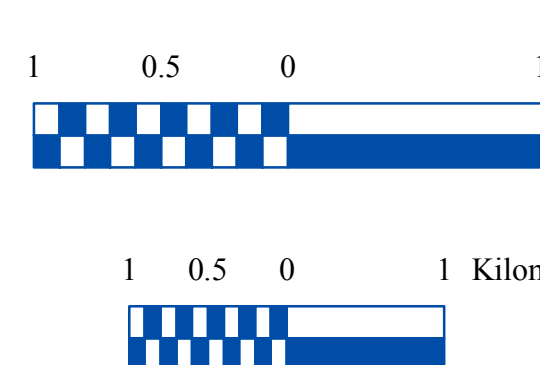
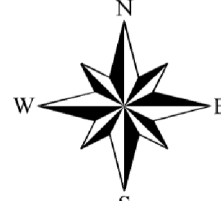
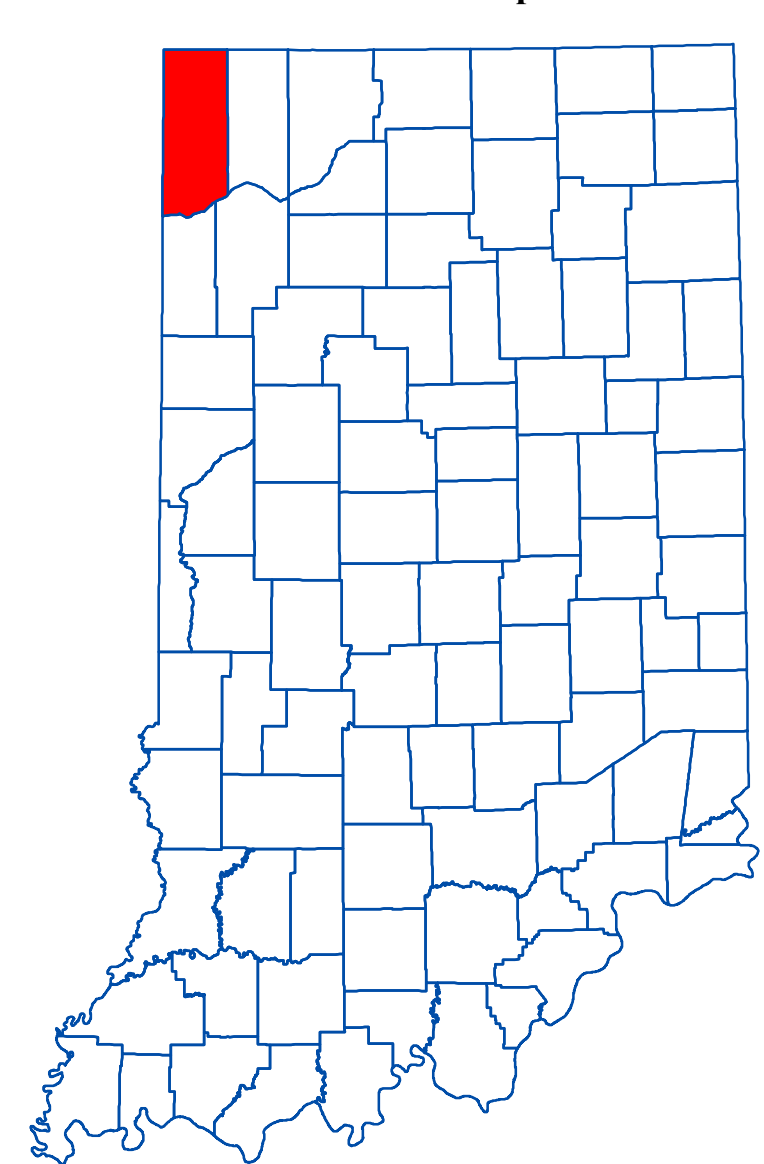
The Silurian and Devonian Carbonates Aquifer System subgroups throughout Lake County except in the east-central portion of the county. It is the principle bedrock aquifer and the only one capable of supporting high-capacity pumpage in the county.

In Lake County the Silurian and Devonian Carbonates Aquifer System is overlain in most places by about 50 to more than 200 feet of unconsolidated material. The majority of domestic water wells that penetrate the system are completed in the upper 15 to 100 feet of bedrock. Deep high-capacity wells commonly penetrate 200 to 450 feet of carbonate rock, and some wells have been reported to penetrate up to 550 feet of bedrock. In some areas near the contact between the Coldwater, Ellsworth and Antrim Shales Aquifer System, and the Silurian and Devonian carbonates, wells are drilled through the shales and into the more productive underlying carbonate rocks. Because the overlying shales inhibit recharge, these wells are less productive than wells completed in carbonates not overlain by shale.

Water wells are drilled to an average depth of about 230 feet and static water levels range from flowing to 117 feet below the surface; however, water levels usually are between 10 to 40 feet. Only a few dry holes have been reported in this aquifer system. Most domestic wells can be expected to produce between 10 and 30 gpm with yields ranging from 8 to 200 gpm. There are 22 registered significant groundwater withdrawal facilities (16 wells) in this system. Reported yields range from 37 to 1700 gpm. Uses for these facilities are public supply and irrigation.

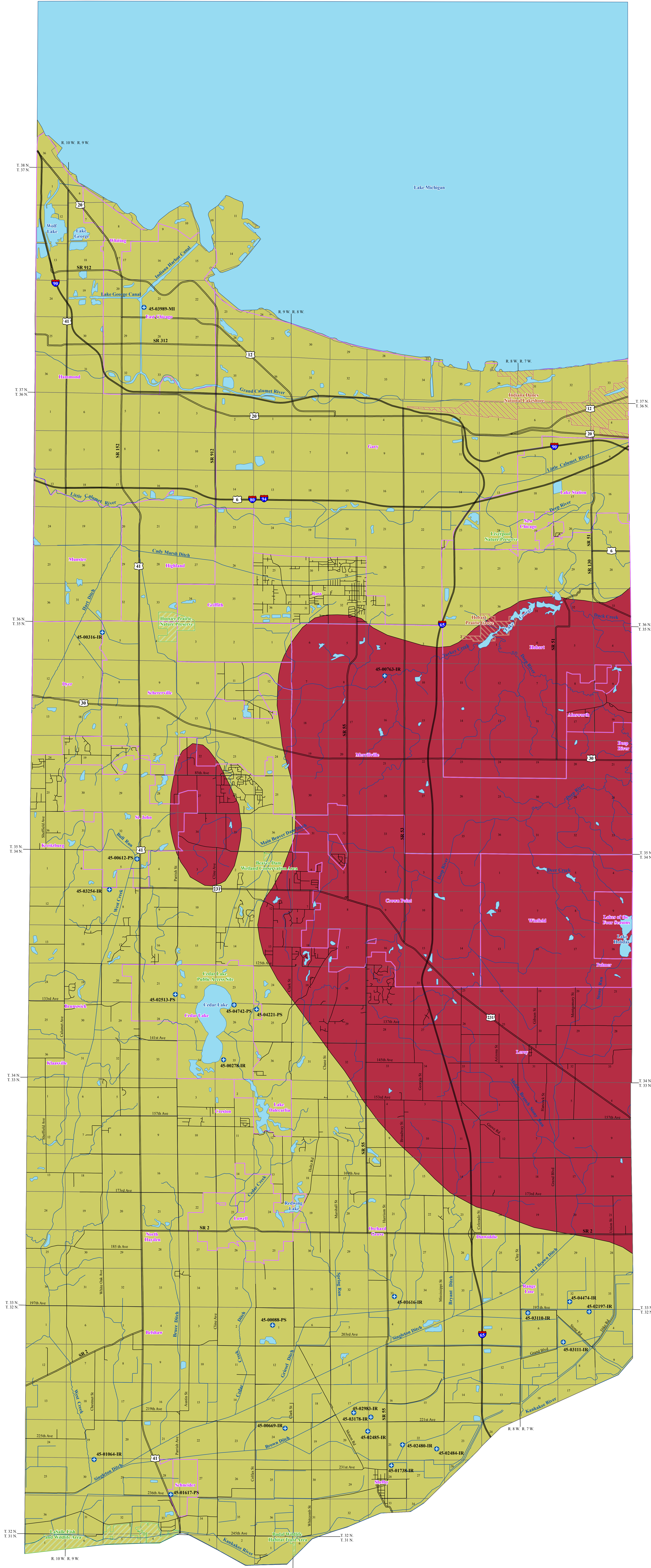
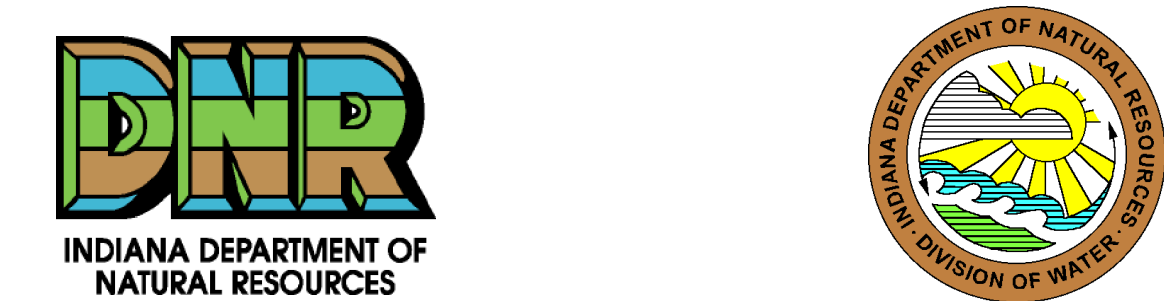
The Silurian and Devonian Carbonates Aquifer System has a low susceptibility to surface contamination because the overlying unconsolidated deposits are relatively thick.

Location Map



EXPLANATION

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



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Bedrock Aquifer Systems of Lake County, Indiana

by
 INDR Division of Water

1990, 1994

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

Lake County, Indiana is located in the northeastern corner of the state and is bounded by the state of Illinois along its western border, Lake Michigan to the north, Porter, Jasper and Newton counties to the east and south. The county is situated within two major drainage basins of which the northern portion is located within the Lake Michigan Region, with the southern section of the county within the Kankakee River Basin.

The Bedrock Potentiometric Surface Map (PSM) of Lake County was mapped by contouring the elevations of over 500 static water-levels reported on well records received 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 or 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 groundwater 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.

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 not field verified. 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 Lake County range from a high of approximately 710 feet mean sea level (msl) in the east-central section of the county, to a low of about 590 feet msl in the northern portion. Generalized groundwater flow direction appears to emanate from the central portion of the county towards Lake Michigan to the north, and to the Kankakee River to the south.

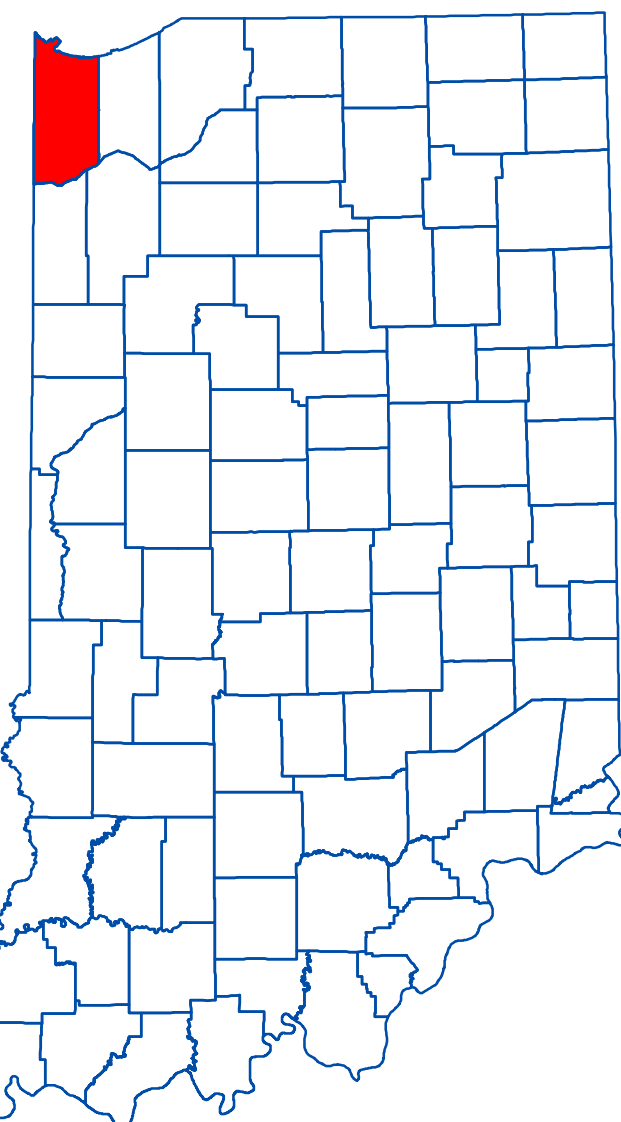
The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. County PSM's represent overall regional characteristics and are not intended to be a substitute for site-specific studies.



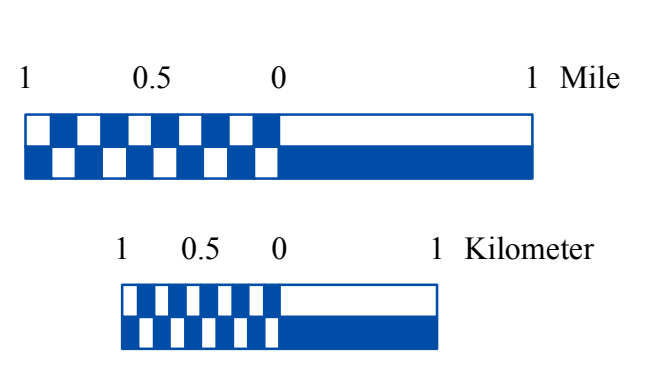
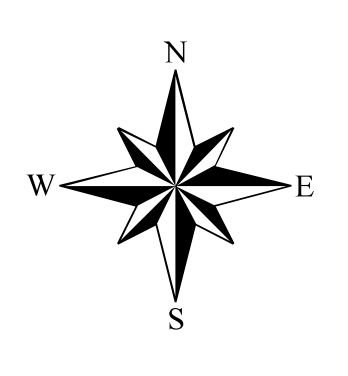
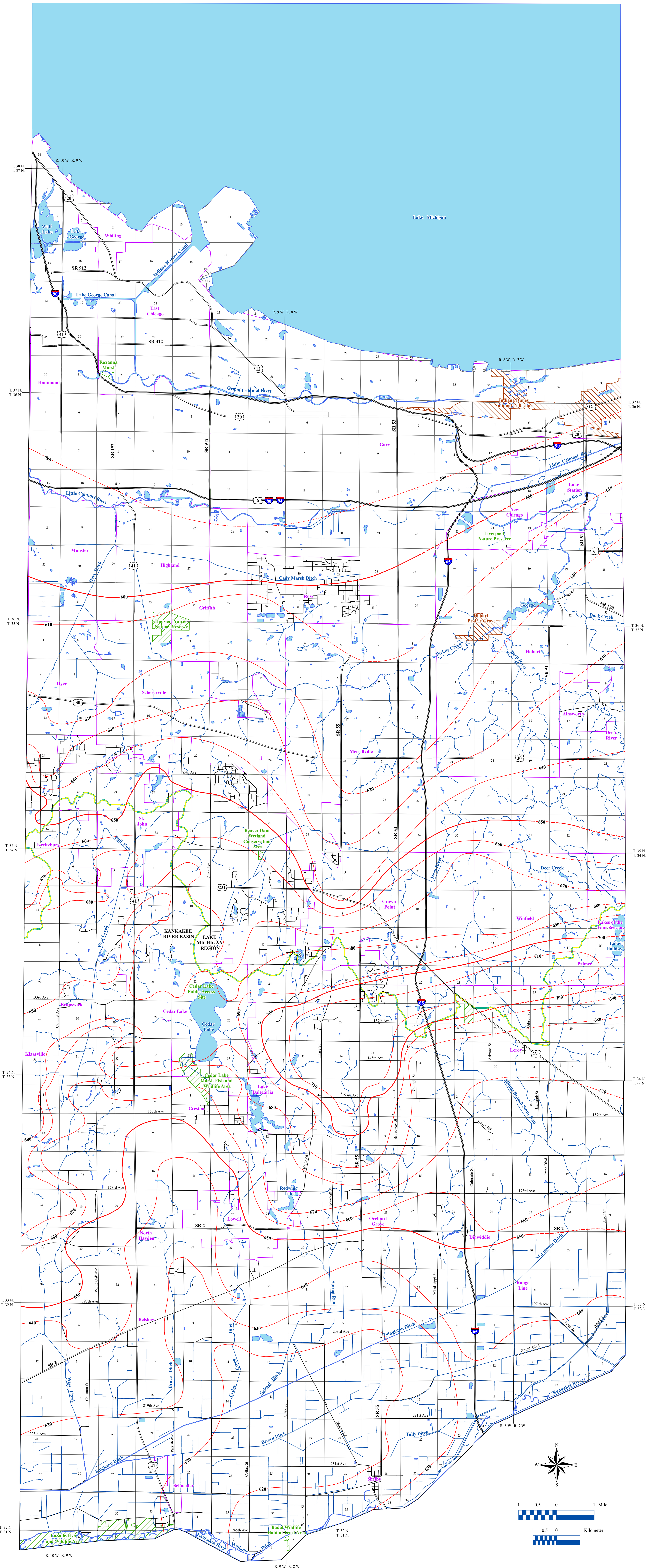
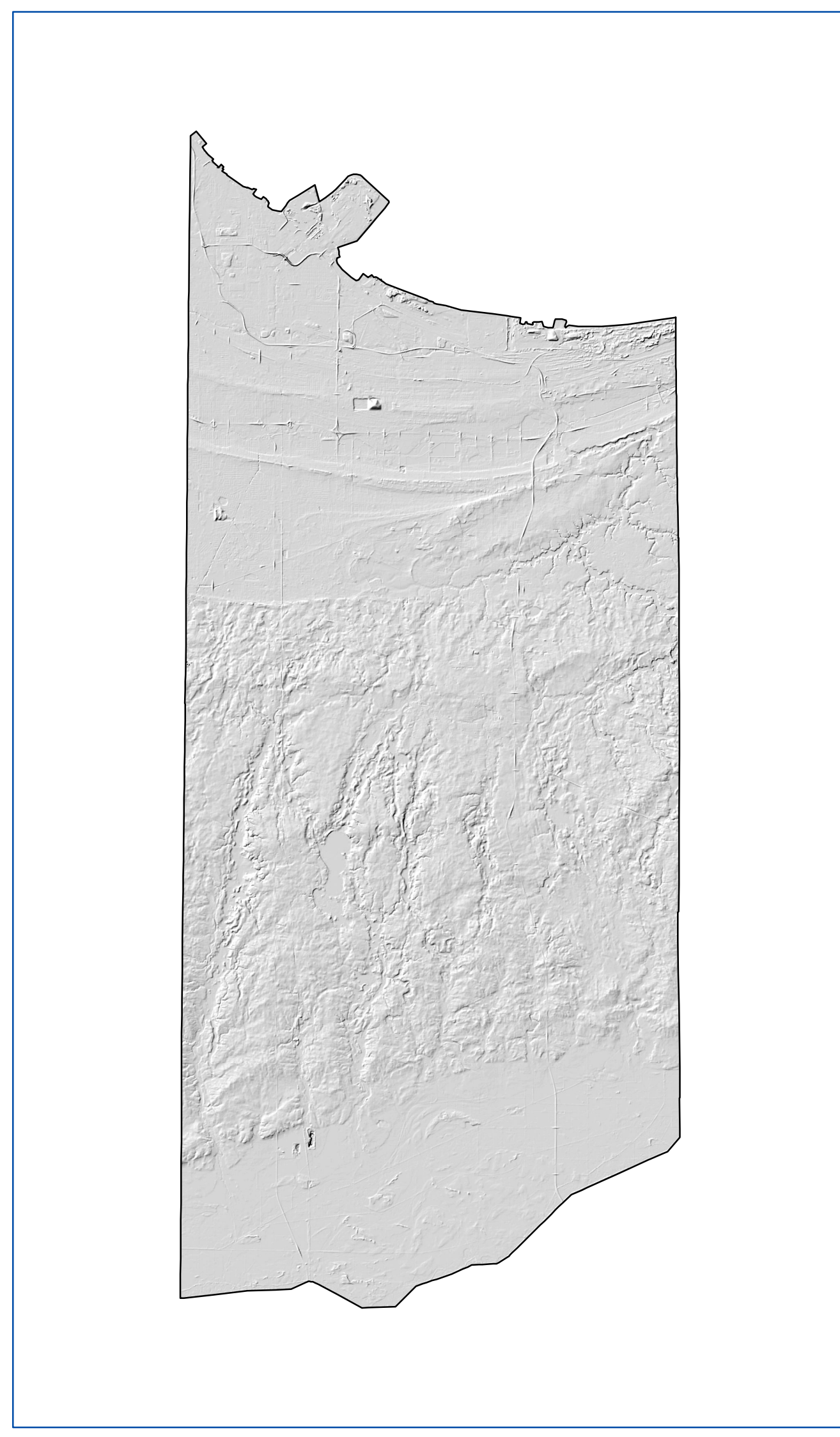
EXPLANATION

- 600 Line of equal elevation, in feet above mean sea level. Potentiometric Contour interval 10 feet.
- 690 Approximate 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
- National Park Service Managed Property
- Lake & River

Location Map



Hillshade Map of Lake County, Indiana



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

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

March, 2012

UNCONSOLIDATED AQUIFER SYSTEMS OF LAKE COUNTY, INDIANA

The following is a summary of the availability of groundwater to Lake County and was derived from the Indiana Department of Natural Resources 1990 publication Water Resource Availability in the Kankakee River Basin, Indiana, and the Indiana Department of Natural Resources 1994 publication Water Resource Availability in the Lake Michigan Region, Indiana. Each report describes the availability, distribution, quality, and use of groundwater and surface water in the Kankakee River Basin and the Lake Michigan Region. The full reports can be viewed and downloaded at <http://www.in.gov/dnr/water>.

Unconsolidated deposits of glacial sands and gravels are the principle source of groundwater in Lake County. Five unconsolidated aquifer systems have been mapped in Lake County and defined on the basis of geologic environments and aquifer characteristics: the Calumet, the Kankakee, the Lacustrine Plain, the Valparaiso Moraine, and the Valparaiso Outwash Apron. Due to the availability of prolific unconsolidated aquifer systems and the extreme limitations of shale materials, the underlying bedrock is generally not used as an aquifer resource.

Calumet Aquifer System

The Calumet Aquifer System consists of fine-to-medium-grained sand with dispersed lenses of gravel. Beds of interlaminated silt and clay, and deposits of peat and muck confine the aquifer in small areas across the county. This system is underlain by a relatively impermeable clay and till unit that in places exceeds 100 feet in thickness. Areas of subdued relief in the northern portion of the county have static water levels that are frequently less than 15 feet below the surface. Saturation thickness of the Calumet Aquifer System ranges from less than 5 feet along its southern extent to about 40 feet in areas containing broad water-table mounds.

The Calumet Aquifer has not been developed significantly because of its proximity to Lake Michigan, an abundant surface-water source. However, the aquifer system is utilized as a source of water by a few domestic and small commercial facilities. Domestic wells typically produce about 5 to 20 gallons per minute (gpm). There are 4 registered significant groundwater withdrawal facilities (13 wells) with yields ranging from 7 to 1130 gpm. The primary usage for these facilities is industrial. The aquifer is highly susceptible to surface contamination because there is no clay cap across most of the aquifer and a lack of clay separator beds.

Lacustrine Plain Aquifer System

The Lacustrine Plain Aquifer System consists of a series of aquifers present beneath the Calumet Lacustrine Plain. The individual aquifers consist of fine-to-medium-grained glaucoconcretine and coarsel sands capped by lacustrine clays or till. Thickness of individual aquifers frequently ranges from 7 to 90 feet, and averages about 24 feet. Depths to static water levels are highly variable in the many aquifers of the Lacustrine Plain Aquifer System. Domestic water wells in the Lacustrine Plain Aquifer System can typically produce about 5 to 20 gpm. There are 9 registered significant groundwater withdrawal facilities (21 wells) with yields ranging from 39 to 450 gpm. These facilities are used for irrigation, industry, and public supply. This aquifer system's susceptibility to contamination ranges from low to high, depending on the thickness of the surficial lacustrine clays and till.

Valparaiso Moraine Aquifer System

The Valparaiso Moraine Aquifer System consists of a heterogeneous layer of outwash sand and gravel with intermixed clay and silt lenses. The aquifer thickness ranges from about 10 to more than 130 feet, and lies about 10 to 100 feet beneath the surface of the Valparaiso Moraine; however, this aquifer system is unconfined in small isolated areas in the county where surficial tills are absent. Sand- and gravel-filled outwash channels of limited saturated thickness are present in Lake County. These coarse-grained and poorly-sorted outwash channel deposits have an average thickness of about 26 feet and directly overlie the major aquifer body. However, the channel deposits may be separated from the major aquifer by a 10- to 20-foot-thick clay.

In parts of the Valparaiso Moraine Aquifer System, artesian conditions exist because the overlying till behaves as an aquitard. In parts of the county, water levels in the artesian wells completed in the aquifer system sometimes rise to the surface. However, static water levels are relatively deep, ranging from 25 to 80 feet below the surface.

Production from wells completed in the main aquifer body are commonly adequate for domestic use. Yields typically range from 10 to 25 gpm, although yields vary from 5 to 60 gpm. There are 11 registered significant groundwater withdrawal facilities (24 wells) with reported capacities ranging from 55 to 375 gpm. These facilities are used primarily for irrigation and public supply. The Valparaiso Moraine Aquifer System's susceptibility to surface contamination ranges from low to high, depending on the thickness of the till cap and the stratigraphy of the moraine.

Valparaiso Outwash Apron Aquifer System

This aquifer system, which forms the southern slope of the Valparaiso Moraine, is a deposit of fine- to medium-grained sand interbedded with gravel rich zones and clay lenses. The outwash apron is more than 100 feet thick in places.

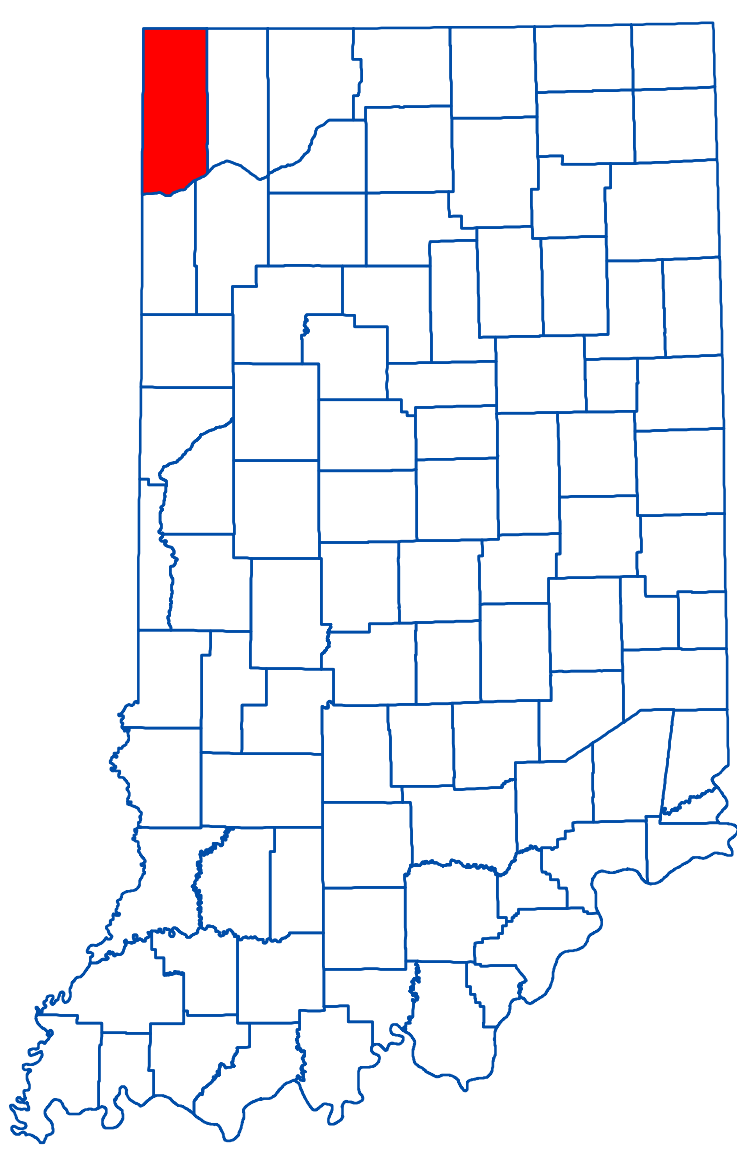
Most wells completed in the upper aquifer unit of the system have depths ranging from 30 to more than 100 feet. The wells completed in the lower aquifer unit of the system typically exceed 50 feet and may be more than 150 feet in depth. Static water levels are typically less than 20 feet deep, but at higher surface elevations, may exceed 40 feet. Yields in the upper and lower aquifer units are similar, ranging from 15 to 60 gpm for domestic wells. There are 4 registered significant groundwater withdrawal facilities (15 wells) with yields ranging from 62 to 1000 gpm. These facilities are used for irrigation and public supply. Because there is no clay rich cap, the aquifer system is highly susceptible to surface contamination.

Kankakee Aquifer System

The Kankakee Aquifer System is an unconfined deposit of fine-to-medium-grained sand, which is interbedded with gravel lenses in the tributary valleys. The aquifer system thickness ranges from less than 20 feet where the unit overlies bedrock highs to more than 150 feet in tributary valleys. However, the thickness is about 30 feet in most areas.

Static water levels are shallow in the Kankakee River floodplain, and are typically less than 20 feet deep. Wells typically are shallow, and few exceed depths of 50 feet. However, in the tributary valleys, the depth to the water table may exceed 50 feet and well depths may exceed 150 feet. Domestic wells commonly produce from 15 to 50 gpm. There are 1 registered significant groundwater withdrawal facilities (14 wells) with yields ranging from 200 to 650 gpm. These facilities are used for irrigation. Because of the absence of clay deposits, the aquifer system is highly susceptible to surface contamination.

Location Map



EXPLANATION

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



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Unconsolidated Aquifer Systems of Lake County, Indiana

by
Division of Water
1990, 1994

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

Lake County, Indiana is located in the northwestern corner of the state and is bounded by the state of Illinois along its western border, Lake Michigan to the north, and Porter, Jasper and Newton counties to the east and south. The county is situated within two major drainage basins of which the northern portion is located within the Lake Michigan Region, with the southern sectors of the county within the Kankakee River Basin.

The Unconsolidated Potentiometric Surface Map (PSM) of Lake County was mapped by contouring the elevations of approximately 3450 static water-levels reported on well records received over a 30 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 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 groundwater 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 objective in creating county PSM's is to map static water-levels in the upper 100 feet of unconsolidated materials. If a section of a county has few located wells in the zero to 100 feet interval, then the static water-levels in wells completed between 100 to 200 feet, if available, are used to complement the area.

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 wells used to make the PSM were not field verified. 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.

Unconsolidated potentiometric surface elevations in Lake County range from a high of approximately 720 feet mean sea level (msl) in the east-central section of the county, to a low of about 590 feet msl in the northern portion. Generalized groundwater flow direction appears to emanate from the central part of the county and flows in a northerly direction in the upper half of the county, parallel to Lake Michigan, and in a southerly direction in the lower half of the county, towards the Kankakee River.

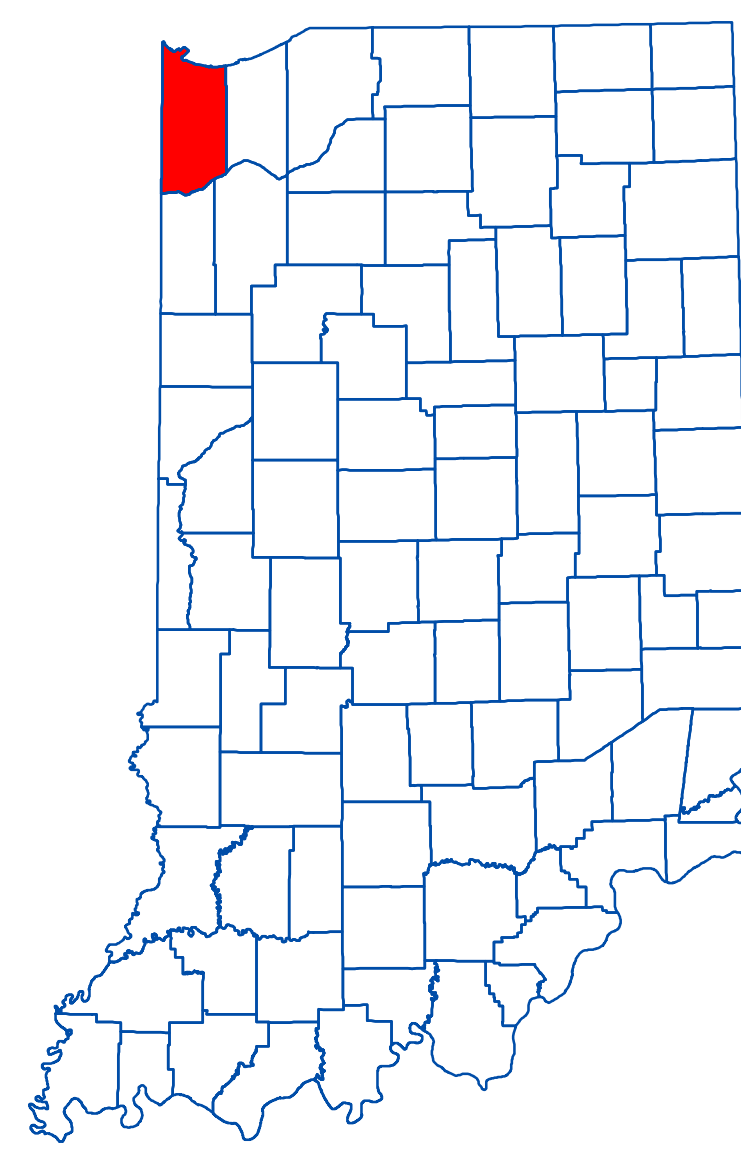
The county PSM can be used to define the regional groundwater flow path and to identify significant areas of groundwater recharge and discharge. County PSM's represent overall regional characteristics and are not intended to be a substitute for site-specific studies.



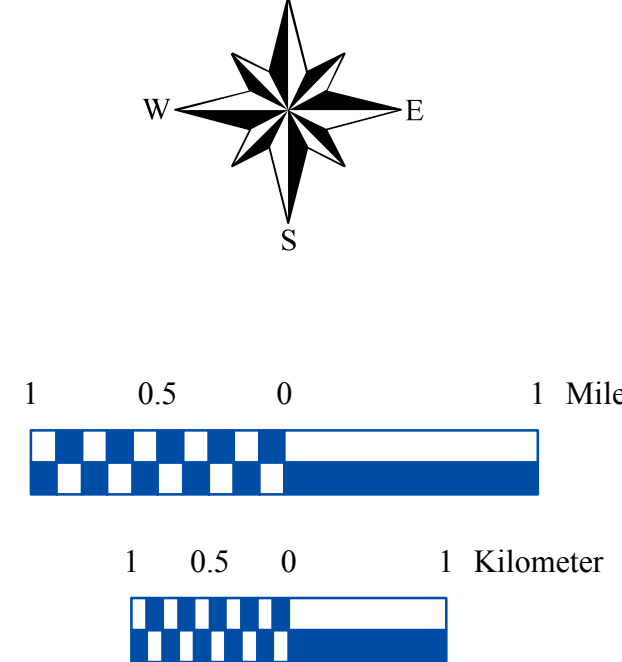
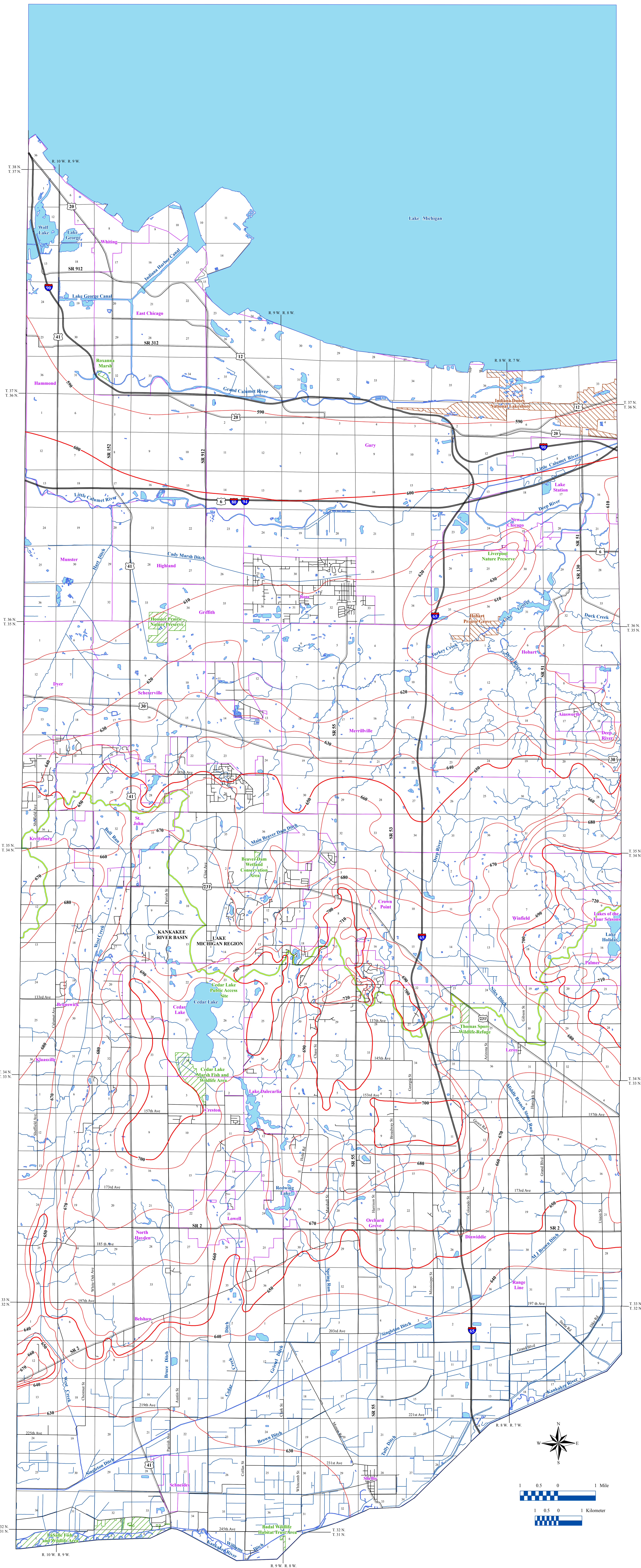
EXPLANATION

- 600 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
- National Park Service Managed Property
- Lake & River

Location Map



Hillshade Map of Lake County, Indiana



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

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

March 2012

Lake County

