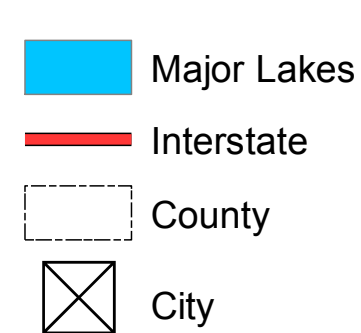
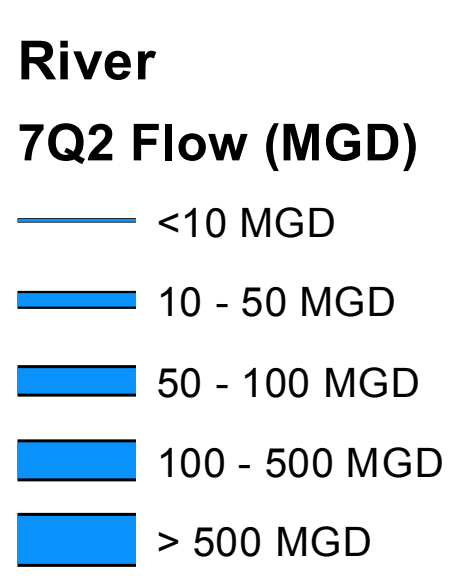
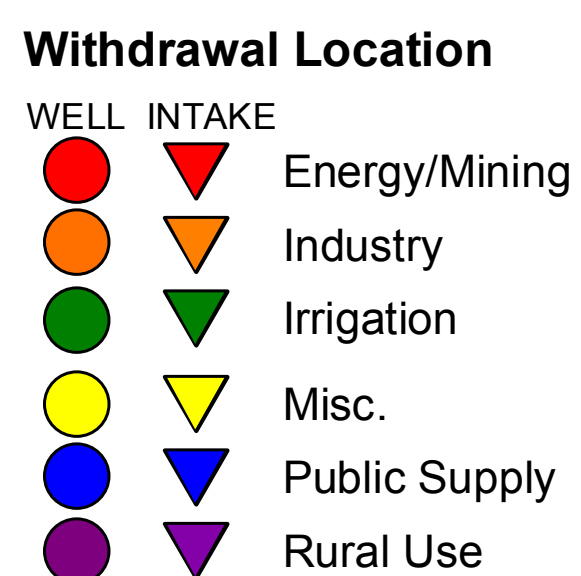


Water Resources and Use in Putnam County

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



INTERA
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BEDROCK AQUIFER SYSTEMS OF PUTNAM COUNTY, INDIANA

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

Bedrock aquifer systems in Putnam County are overlain by unconsolidated deposits of varying thickness ranging from outcropping to over 250 feet. Bedrock, in places, is at or near the surface along many 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 aquiclads, restricting recharge to underlying bedrock aquifers. However, fracturing and/or jointing may occur in aquiclads 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.

Four bedrock aquifer systems are identified within Putnam County. They are, from youngest to oldest: the Racoon Creek Group of Pennsylvanian age; the Buffalo Wallaw, Stephensport and West Baden Groups, the Blue River and Sanders Groups, and the Borden Group of Mississippian age. Approximately 72 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.

Pennsylvanian - Racoon Creek Group Aquifer System

The Racoon Creek Group Aquifer System outcrops/subcrops throughout the majority of the western and southwestern portions of Putnam County. The group consists in ascending order of the Mansfield, Brazil and Saunton Formations. The basal formation of the group, the Mansfield Formation, rests unconformably on Mississippian rocks. Bedrock consists mostly of shale, mudstone, and siltstone with minor amounts of coal, sandstone and limestone. The Racoon Creek Group in Putnam County ranges from exposure at the ground surface to being overlain by up to approximately 140 feet of unconsolidated deposits.

Wells completed in the Racoon Creek Group Aquifer System are generally capable of meeting the needs of most domestic users in this county. Wells in this system are completed at depths ranging from 40 to 400 feet. Yields for domestic wells range from 1 to 50 gallons per minute (gpm) with some dry holes reported. Static water levels range from flowing to 195 feet below the land surface. There are no registered significant groundwater withdrawal facilities in this system.

In the majority of Putnam County, the Racoon Creek Group Aquifer System has a low susceptibility to surface contamination where thick clay deposits overlie the system. However, areas are at moderate to high risk to contamination where overlying clays are thin or absent, or where bedrock outcrops.

Mississippian - Buffalo Wallaw, Stephensport, and West Baden Groups Aquifer System

This Upper Mississippian bedrock aquifer system consists of three groups, from oldest to youngest: West Baden, Stephensport, and Buffalo Wallaw. However, strata of the Stephensport and Buffalo Wallaw groups are not present in Putnam County. The West Baden Group consists primarily of sandstone and limestone with minor amounts of shale, mudstone and siltstone. Many of the individual rock units of the West Baden Group are laterally discontinuous.

The Buffalo Wallaw, Stephensport, and West Baden Groups Aquifer System is not regarded as a major groundwater resource in Putnam County. However, most attempts to drill a domestic well into it are successful. Well depths in the West Baden Group range from 10 to 620 feet with most wells completed between 50 to 70 feet. The depth to the bedrock surface is generally less than 65 feet. Static water level depths range from 10 to 200 feet, and domestic wells completed in the system are commonly tested at 15 gpm or less. There are no registered significant groundwater withdrawal facilities in this system.

This aquifer system in Putnam County is considered moderately susceptible to contamination from the land surface because of the shallow rock. Where the unconsolidated deposits consist of thick fine-grained clay materials, the susceptibility to contamination is lower.

Mississippian - Blue River and Sanders Groups Aquifer System

The Blue River and Sanders Groups Aquifer System is commonly present throughout most of the central portion of the county, generally trending from the northwest to the southeast. This Middle Mississippian age aquifer system encompasses two groups: the Blue River Group and the underlying Sanders Group. In Putnam County, the Sanders Group includes the Ramp Creek, Haroldsburg and Salem Formations, which are mostly limestone with some dolomitic content. The overlying Blue River Group consists of the St. Louis, Ste. Genevieve and Paoli Formations. The formations are composed mostly of limestone, but also include gypsum, anthracite, shale, and calcareous sandstone. The formations thicken as they dip to the west-southwest.

Depth to bedrock ranges from outcropping to about 190 feet below land surface. Limestones of the Blue River Group are noted for development of karst features, particularly in southern Indiana; however, only a few wells in Putnam County suggest any minor karst features are present.

This aquifer system is capable of meeting the needs of some domestic and high-capacity users in Putnam County. Reported yields are typically from 1 to 60 gpm with some dry holes noted. Static water levels range from flowing to 230 feet below surface. There are three registered significant groundwater withdrawal facilities (5 wells) using the Blue River and Sanders Groups Aquifer System. Reported capacities of the wells are 100 and 110 gpm. These facilities are used for public water supply.

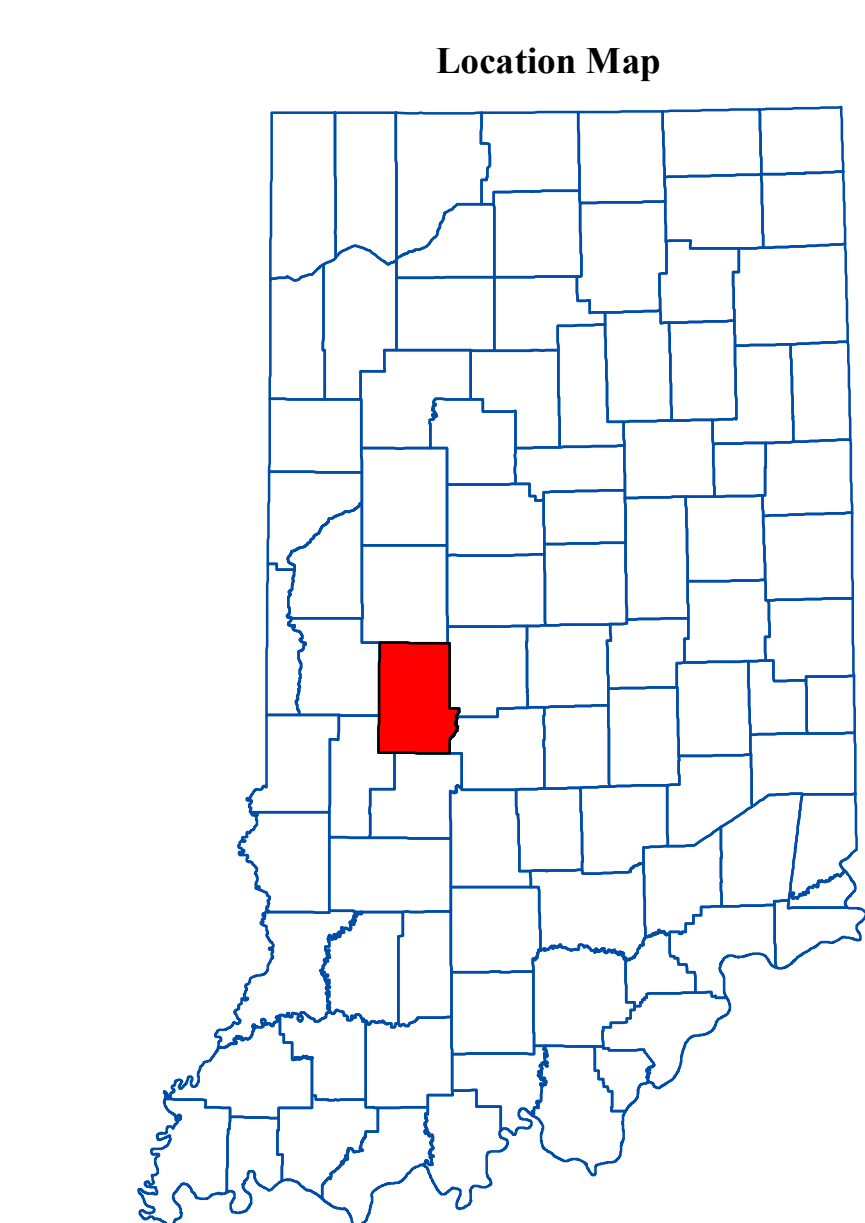
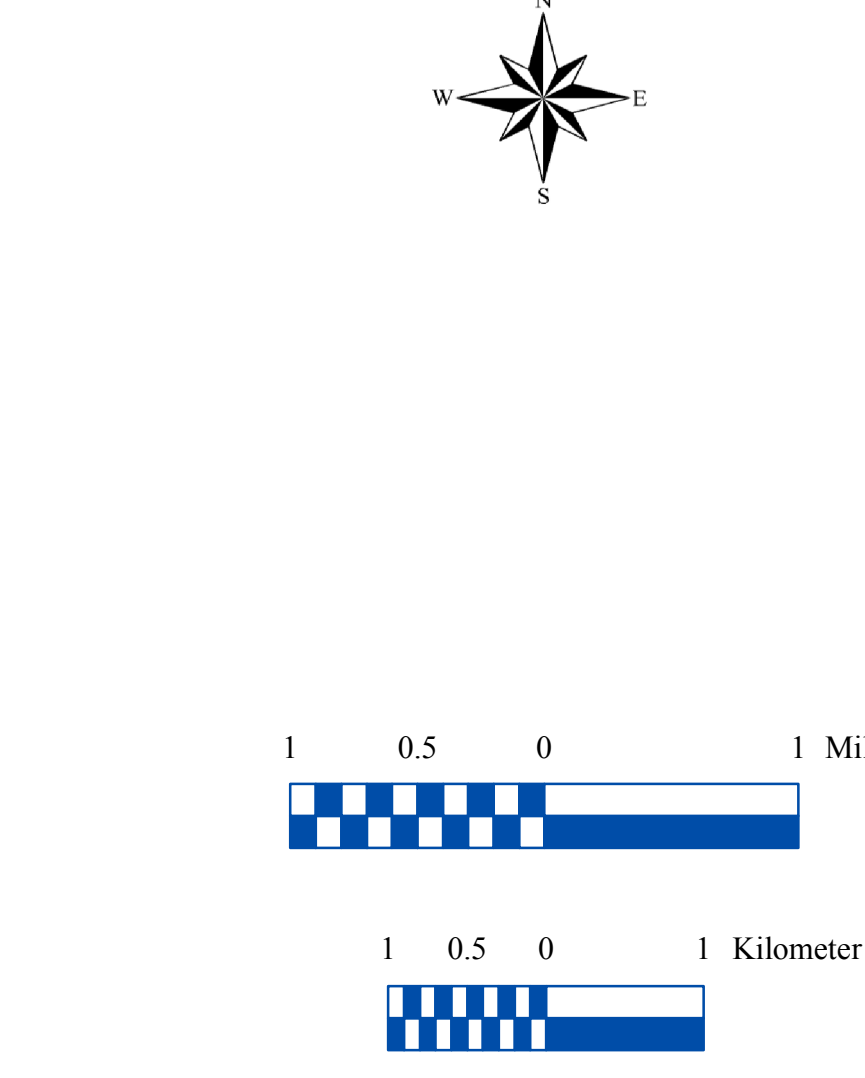
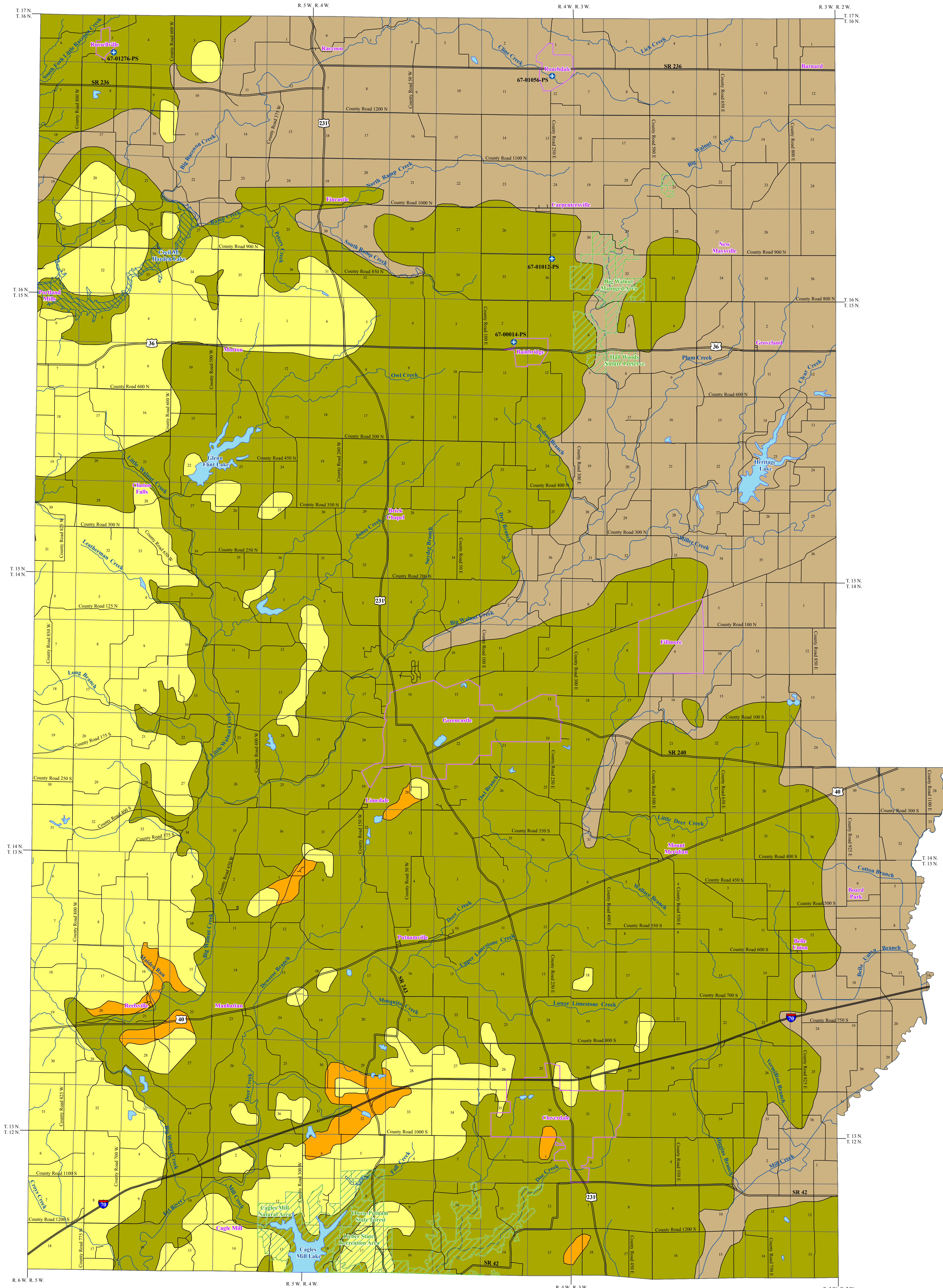
Clay materials of varying thickness overlie the Blue River and Sanders Group Aquifer System. Where the clay materials are thin the aquifer system has a moderate to high risk to contamination. However, where overlying sediments consist of thick fine-grained clay materials, the risk is low.

Mississippian - Borden Group Aquifer System

The Borden Group outcrops/subcrops primarily in the northern and eastern portions of Putnam County. This bedrock aquifer system is composed of sandstone, siltstone, mudstone and shale. Although carbonates are somewhat rare, discontinuous interbedded limestone lenses are present. The Borden Group in Putnam County is overlain by unconsolidated deposits up to 200 feet in thickness; however, there are areas where the bedrock is exposed at the surface.

Wells in this system are commonly completed at depths ranging from 35 to 490 feet. Domestic well yields typically range from 2 to 60 gpm with some dry holes reported. Static water levels commonly range from flowing to 110 feet below surface. There is one registered significant groundwater withdrawal facility (5 wells) using the Borden Group Aquifer System. Reported capacities of the wells are 100, 130 and 150 gpm. This facility is used for public water supply.

Where bedrock is shallow, risk to contamination from the surface or near surface sources is high. Where the overlying sediment consists of thick fine-grained clay materials, the Borden Group Aquifer System in Putnam County is at low risk to contamination from the surface or near surface sources.



EXPLANATION

- Registered Significant Groundwater Withdrawal Facility
- Stream
- County Road
- State Road & US Highway
- Interstate
- Municipal Boundary
- Inundation Area of Cecil M. Harden Lake
- State Managed Property
- Lake & River

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This map was created from several existing shapefiles. Township and Range Lines of Indiana (line shapefile, 20020621), Land Survey Lines of Indiana (polygon shapefile, 20020621) and County Boundaries of Indiana (polygon shapefile, 20020621), were all from the Indiana Geological Survey and based on a 1:24,000 scale, except the Bedrock Geology of Indiana (polygon shapefile, 20020318), which was at a 1:500,000 scale. Drain road shapefiles, System and System's (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Managed Areas96 (polygon shapefile, various dates) was from IDNR. Populated Areas in Indiana 2000 (polygon shapefile, 20021000) was from the U.S. Census Bureau and based on a 1:100,000 scale. Streams27 (line shapefile, 20000420) was from the Center for Advanced Applications in GIS at Purdue University.

Bedrock Aquifer Systems of Putnam County, Indiana
by
Robert K. Schmidt
Division of Water, Resource Assessment Section
May 2010

UNCONSOLIDATED AQUIFER SYSTEMS OF PUTNAM COUNTY, INDIANA

The unconsolidated aquifer systems of Putnam County are composed of sediments deposited by, or resulting from, a complicated sequence of glacial, glacial meltwaters, and post-glacial precipitation events. Eight unconsolidated aquifer systems have been mapped in Putnam County: the Dissected Till and Residuum / Till Veneer, the Tipton Till, the Martinsville Hills / Tipton / Wabash Lowland Till Subsystem, the Tipton Complex, the Wabash River and Tributaries Outwash, the Wabash River and Tributaries Outwash Subsystem, 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 gradual and individual aquifers may extend across aquifer system boundaries. Approximately 28 percent of all wells in this county are completed in unconsolidated deposits.

The thickness of unconsolidated deposits in Putnam County is quite variable, due to the deposition of glacial material over an uneven bedrock surface. Unconsolidated deposits in the county typically range from bedrock exposure at the surface to about 250 feet thick in the buried valleys.

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

Dissected Till and Residuum / Till Veneer Aquifer System

In Putnam County, the Dissected Till and Residuum Aquifer System, and the Till Veneer Aquifer System, are mapped as one system because they are similar in composition and in aquifer characteristics. As in counties to the south, the Dissected Till and Residuum Aquifer System includes areas where pre-Wisconsin and Wisconsin till is thin and dissected due to deep down-cutting by streams or where soils have formed directly from bedrock due to weathering. The Till Veneer Aquifer System encompasses 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 bedrock surface rather than erosion of till by younger streams. Also included in this aquifer system are relatively thin deposits of alluvium, colluvium and gravel outwash overlying shallow bedrock in many stream valleys.

Much of west-central and southern Putnam County is mapped as Dissected Till and Residuum, especially along Big Walnut Creek where the tributary streams are deeply incised. In most of the northern and eastern portions of the county thin till over bedrock is mapped as the Till Veneer Aquifer System. Total thickness of this system generally ranges from about 20 to 50 feet.

The Dissected Till and Residuum / Till Veneer Aquifer System has the most limited groundwater resources of the unconsolidated aquifer systems. There is little potential for groundwater production in this system in Putnam County, and most wells are completed in the underlying bedrock. Potential aquifers within this system include thin sand and gravel layers, and surficial sand and gravel outwash or alluvium. The total thickness of the Dissected Till and Residuum / Till Veneer Aquifer System is typically less than 50 feet, with static water levels ranging from 5 and 15 feet below the surface. Most of the wells have reported capacities of 5 gallons per minute (gpm) or less with some borings being reported as dry. There are no registered significant groundwater withdrawal facilities utilizing this system.

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

Tipton Till Aquifer System

The Tipton Till Aquifer System is mapped primarily in the north and northeastern portions, with a few isolated areas in the central section of Putnam County. This aquifer system ranges in thickness from about 50 feet to more than 150 feet, and consists primarily of glacial till with intertil sand and gravel layers. However, the sand and gravel aquifers in this system tend to be relatively thin and discontinuous.

This aquifer system is generally capable of meeting the needs of most domestic and some high-capacity users in Putnam County. However, approximately 60 percent of wells started in this system utilize the underlying bedrock aquifer. Individual sand and gravel units are commonly 5 to 15 feet thick with well depths ranging from about 50 to 190 feet. Domestic well yields are typically 10 to 50 gpm and static water levels range from flowing to about 150 feet below the land surface. There are no registered significant groundwater withdrawal facilities using the Tipton Till Aquifer System.

A small area of the Tipton Till Aquifer System overlies a buried bedrock valley in the northeastern portion of the county. The total unconsolidated thickness generally exceeds 200 feet in this area. Only one reported well utilizes the deeper aquifer within the buried bedrock valley. The sand and gravel of the aquifer utilized by this well is reported to be 20 feet thick, and the reported yield is 100 gpm.

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

Martinsville Hills / Tipton / Wabash Lowland Till Aquifer Subsystem

The Martinsville Hills / Tipton / Wabash Lowland Till Aquifer Subsystem is found throughout Putnam County; however, this system is predominantly mapped in the northern half of the county. The subsystem is mapped similar to that of the Tipton Till Aquifer System. However, potential aquifer materials are generally thinner and potential yields are less in the subsystem.

About 90 percent of wells started in this subsystem in Putnam County are completed in the underlying bedrock aquifer system. However, the Martinsville Hills / Tipton / Wabash Lowland Till Aquifer Subsystem is capable of meeting the needs of most domestic users in the county. Potential aquifer materials include relatively thin, discontinuous intertil sand and gravel deposits. These intertil 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 25 to 125 feet. Domestic well yields are generally 5 to 10 gpm and static water levels range from 10 to 100 feet below the surface. There is one registered significant groundwater withdrawal facility (two wells) utilizing this subsystem. These wells are situated at the toe of the dam to Glenn Flint Lake and appear to be under the influence of the lake. The reported capacities are 100 gpm for each well. The use for this facility is public supply.

A small area of the Martinsville Hills / Tipton / Wabash Lowland Till Aquifer Subsystem overlies a buried bedrock valley in the southeastern part of the county along Mill Creek. The total unconsolidated thickness is up to about 180 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 reported to be about 10 feet thick and the reported yield is approximately 10 gpm.

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

Tipton Complex Aquifer System (over buried valley with some potential)

The Tipton Complex Aquifer System is mapped in a relatively small area in the northeast corner of Putnam County. There are few wells in this system in Putnam County; however, as mapped in adjacent Montgomery and Hendricks counties, the system is characterized by unconsolidated deposits that are quite variable in materials and thickness, and typically overlain by thick clay layers. The aquifer is highly variable in depth and lateral extent and generally includes multiple intertil sand and gravel layers. The total unconsolidated thickness is up to about 250 feet.

The deeper more prolific aquifers of this system are capable of meeting the needs of domestic and some high-capacity users in Putnam County. As mapped in Montgomery and Hendricks counties, saturated aquifer materials in the Tipton Complex Aquifer System range from 5 to 15 feet thick, and wells in this system are completed at depths up to about 200 feet. Domestic well yields range up to 15 gpm and static water levels are about 20 to 50 feet below the surface. There is one registered significant groundwater withdrawal facility (2 wells) using this system. This facility is used for irrigation. The reported yields for the wells are 300 and 1,000 gpm.

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

Wabash River and Tributaries Outwash Aquifer System / White River and Tributaries Outwash Aquifer System

The Wabash River and Tributaries Outwash Aquifer System is mapped along Big Raccoon Creek in the northwestern portion of the county, and the White River and Tributaries Outwash Aquifer System is mapped in the southwestern and central portions of Putnam County. Both systems include thick glacial outwash sands and gravels, and are capped by a layer of clay, silt, or loess deposits in a few places. The total thickness of unconsolidated deposits in these systems ranges from about 25 feet up to 140 feet.

Both aquifer systems are capable of meeting the needs of domestic and high-capacity users in Putnam County. The wells utilizing these aquifer systems are completed at depths ranging from 25 to 120 feet with saturated sand and gravel aquifer materials commonly 15 to 50 feet thick. Domestic well yields typically range from 10 to 60 gpm with static water levels ranging from 5 to 15 feet below the surface. In the Wabash River and Tributaries Outwash Aquifer System there are two registered significant groundwater withdrawal facilities (4 wells). Prodominant uses for these facilities are public water supply and industry. Reported production for these high-capacity wells ranges up to 675 gpm. In the White River and Tributaries Outwash Aquifer System there are two registered significant groundwater withdrawal facilities (11 wells). Reported production for these high-capacity wells range between 200 and 1,200 gpm and the use for these facilities is public water supply.

Both the Wabash River and Tributaries Outwash Aquifer System, and the White River and Tributaries Outwash Aquifer System are highly susceptible to surface contamination where sand and gravel deposits are near the surface and have little or no clay deposits. However, areas that have overlying thick clay deposits are moderately susceptible to contamination.

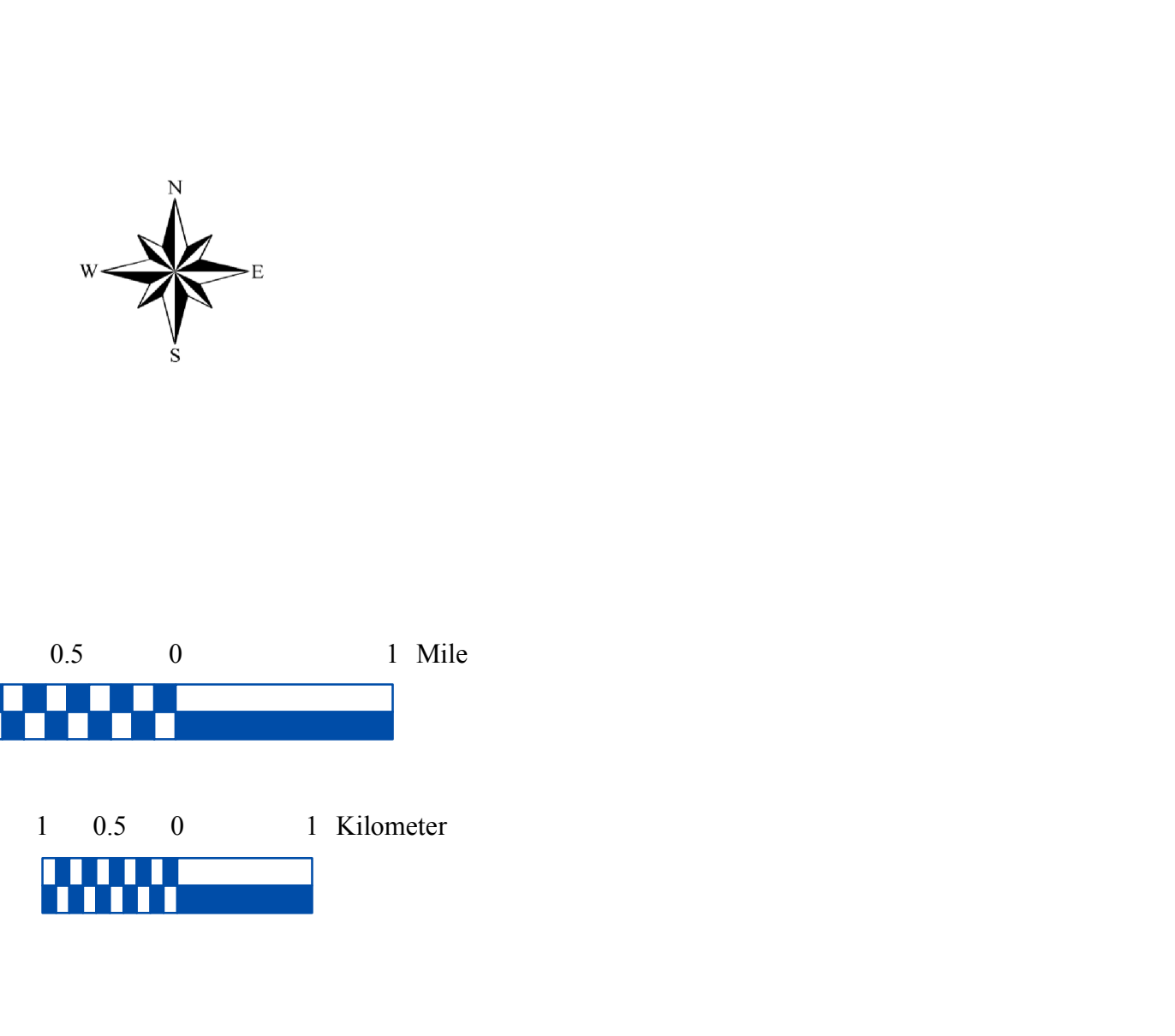
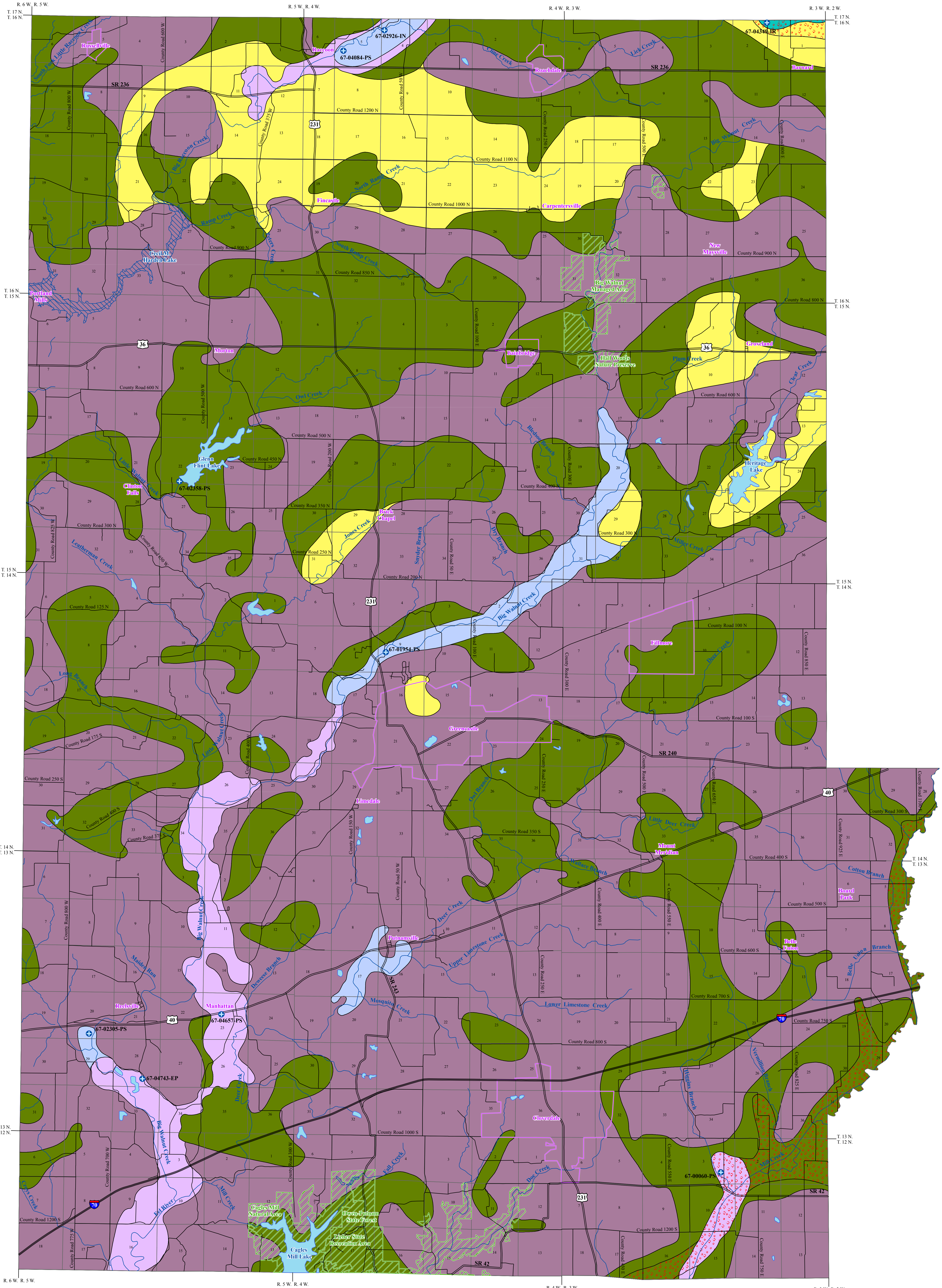
Wabash River and Tributaries Outwash Aquifer Subsystem / White River and Tributaries Outwash Aquifer Subsystem

The Wabash River and Tributaries Outwash Aquifer Subsystem is mapped along Big Raccoon Creek in the northwestern portion of the county, and the White River and Tributaries Outwash Aquifer Subsystem is mapped along Big Walnut Creek and Deer Creek in southwestern Putnam County. These subsystems are mapped similar to the Wabash River and Tributaries Outwash Aquifer System, and the White River and Tributaries Outwash Aquifer System. However, aquifer materials are generally thinner, overlying silt and/or clay materials are thicker, and potential yields are less in the subsystem.

The Wabash River and Tributaries Outwash Aquifer Subsystem, and the White River and Tributaries Outwash Aquifer Subsystem have the potential to meet the needs of domestic and some high-capacity users. The wells in these subsystems are completed at depths commonly ranging from 30 to 100 feet. Saturated aquifer materials include sand and gravel deposits that are commonly 10 to 30 feet thick. Domestic well yields typically range from 10 to 50 gpm with static water levels ranging from 5 to 25 feet below the surface. There are no registered significant groundwater withdrawal facilities in the Wabash River and Tributaries Outwash Aquifer Subsystem in Putnam County. However, there are two registered significant groundwater withdrawal facilities (7 wells) in the White River and Tributaries Outwash Aquifer Subsystem. The use for these facilities is public water supply and energy production. Reported production for the high-capacity wells are between 400 and 800 gpm.

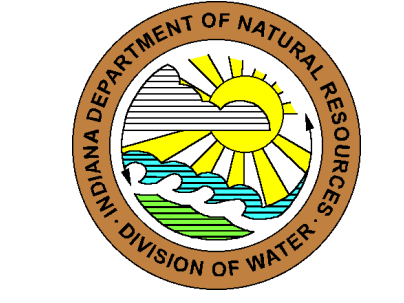
A small area of the White River and Tributaries Outwash Aquifer Subsystem overlies a buried bedrock valley in the southern portion of the county along Mill Creek. The total unconsolidated thickness ranges up to about 150 feet in this area. Only a few reported wells utilize the deeper aquifer within the buried bedrock valley. The aquifer utilized by these wells is reported to be about 10 to 50 feet thick and the reported yield is approximately 10 gpm. There is one registered significant groundwater withdrawal facility (4 wells) using this system. The use for this facility is public water supply, and the reported production for each of the high-capacity wells is 350 gpm.

Areas within the Wabash River and Tributaries Outwash Aquifer Subsystem and 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
- Inundation Area of Cecil M. Harden Lake
- State Managed Property
- Lake & River



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Unconsolidated Aquifer Systems of Putnam County, Indiana

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

Putnam County

