

# **Unconsolidated Aquifer Systems of Greene County, Indiana**

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The unconsolidated aquifer systems of Greene County are composed of sediments deposited by, or resulting from, a complex sequence of glaciers, glacial meltwaters, and post-glacial precipitation events. Six unconsolidated aquifer systems have been mapped in Greene County: the Till Veneer / Unglaciaded Southern Hills and Lowlands; the Alluvial, Lacustrine and Backwater Deposits; the Wabash Lowland / Crawford Upland Till Subsystem; the White River and Tributaries Outwash; the White River and Tributaries Outwash Subsystem; and the Coal Mine Spoil. Because of the complicated glacial geology in most of the county, boundaries of the aquifer systems are commonly gradational and individual aquifers may extend across aquifer system boundaries.

The thickness of unconsolidated deposits in Greene County is quite variable due to the deposition of glacial material over an uneven bedrock surface. Unconsolidated deposits range from less than one foot in the southeastern corner of the county to over 195 feet thick southwest of an area known as the American Bottoms (Malott, 1919) in central Greene County. Approximately 5 percent of all wells in this county are completed in unconsolidated deposits.

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, unplugged or improperly abandoned wells, and open excavations can provide contaminant pathways that bypass the naturally protective clays.

## **Till Veneer / Unglaciaded Southern Hills and Lowlands Aquifer System**

The Till Veneer / Unglaciaded Southern Hills and Lowlands Aquifer System occurs in areas where the unconsolidated material is predominantly thin till overlying bedrock. This system has the most limited groundwater resources of all the unconsolidated aquifer systems in Greene County. The unconsolidated materials of this aquifer system consist primarily of pre-Wisconsin glacial till, some lacustrine deposits, and some eroded bedrock residuum. The total thickness of this system in Greene County is generally less than 50 feet thick. Most of Greene County is mapped as Till Veneer / Unglaciaded Southern Hills and Lowlands Aquifer System.

There is little potential for groundwater production in this system in Greene County. All reported wells started in the Till Veneer / Unglaciaded Southern Hills and Lowlands Aquifer System have been completed in the underlying bedrock. However, potential aquifer deposits may include thin, isolated sands and/or gravels with expected yields less than a few gallons per minute (gpm).

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.

### **Alluvial, Lacustrine, and Backwater Deposits Aquifer System**

The Alluvial, Lacustrine, and Backwater Deposits Aquifer System in Greene County is mapped within several wide floodplains along tributaries of the White River. This system consists of deposits resulting from glacial meltwater drainage, fine-grained glaciolacustrine deposits formed in relatively stagnant water, or colluvium from the surrounding upland areas.

The Alluvial, Lacustrine, and Backwater Deposits Aquifer System is capable of meeting the needs of domestic users in Greene County. However, about 85 percent of wells started in this system in Greene County are completed in the underlying bedrock aquifer system. Individual sand and gravel units range from 5 to 15 feet thick with well depths ranging from 50 to 80 feet. Domestic well yields range from 5 to 10 gpm with static water levels ranging from 5 to 30 feet below the surface. The wells with reported capacities in the upper limits of this system have noted significant drawdowns. There is one registered significant groundwater withdrawal facility (one well) using the Alluvial, Lacustrine, and Backwater Deposits Aquifer System in Greene County with a reported capacity of 100 gpm.

Thick deposits of clay that have a low susceptibility to surface contamination commonly characterize this aquifer system. However, the susceptibility is greater in areas where surficial clay deposits are thin and directly overlie sand and gravel deposits.

### **Wabash Lowland / Crawford Upland Till Aquifer Subsystem**

The Wabash Lowland / Crawford Upland Till Aquifer Subsystem is found in portions of south-central and east-central Greene County. This aquifer system is up to 195 feet in thickness, and consists primarily of glacial till with intertill sand and gravel layers. However, the sand and gravel aquifers in this system tend to be relatively discontinuous.

The Wabash Lowland / Crawford Upland Till Aquifer Subsystem is capable of meeting the needs of some domestic users in the county. However, nearly all wells started in this subsystem in Greene County are completed in the underlying bedrock aquifer system. Potential aquifer materials include relatively thin, discontinuous intertill sand and gravel deposits. These intertill sand and gravel aquifer materials are generally 5 to 10 feet thick with well depths ranging from 40 to 50 feet. Domestic well yields for this system are typically less than 10 gpm with static water levels ranging from 10 to 25 feet below the surface. The higher yields are commonly associated with significant drawdowns. There are no registered significant groundwater withdrawal facilities utilizing this subsystem.

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

### **White River and Tributaries Outwash Aquifer System**

The White River and Tributaries Outwash Aquifer System is located within the floodplains of the White River and its major tributaries. This system includes thick glacial outwash sands and gravels, that are (in some areas) capped by a thin layer of clay and/or silt deposits.

The White River and Tributaries Outwash Aquifer System is capable of meeting the needs of both domestic and high-capacity users in Greene County. The wells utilizing this aquifer system are completed at depths ranging from 50 to 100 feet with sand and gravel aquifer materials commonly 20 to 70 feet thick. Domestic well yields are typically 10 to 40 gpm with static water levels ranging from 8 to 15 feet below the surface. In the White River and Tributaries Outwash Aquifer System there are 11 registered significant groundwater withdrawal facilities (24 wells) with yields that range from 100 to 1,500 gpm.

This aquifer system is highly susceptible to surface contamination where sand and gravel deposits are near the surface and have little or no overlying clay deposits.

### **White River and Tributaries Outwash Aquifer Subsystem**

The White River and Tributaries Outwash Aquifer Subsystem is mapped primarily along the Eel River in the northern section of the county, and adjacent to the White River and Tributaries Outwash Aquifer System in the southern portion of the county. This system generally occupies a higher topographic position and has considerably thinner (typically 8 to 36 feet thick) sand and gravel units than the main outwash aquifer system. Also, outwash deposits are commonly covered by a thicker layer of clay, till, lacustrine, or loess deposits ranging from 10 to 35 feet in thickness.

The White River and Tributaries Outwash Aquifer Subsystem is capable of meeting the needs of both domestic and some high-capacity users in Greene County. The wells utilizing this aquifer system are completed at depths ranging from 45 to 80 feet. Although not nearly as productive as the outwash system, domestic wells completed in this subsystem typically yield 10 to 30 gpm with static water levels ranging from 5 to 20 feet below the surface. There is one significant groundwater withdrawal facility (2 wells) using this subsystem in Greene County. Each of the high-capacity wells in this aquifer subsystem have reported rates of 150 gpm.

In general, these subsystems are moderately to highly susceptible to surface contamination. Although the overlying clay or till may provide some protection to the confined portions of these subsystems, in places such protection does not exist.

### **Coal Mine Spoil Aquifer System**

The Coal Mine Spoil Aquifer System is present in the western portion, and to a lesser degree southeastern Greene County, and covers about 10 percent of the county. The coal seams occur within the Carbondale Group and the Raccoon Creek Group of Pennsylvanian age. This aquifer system was formed during the process of coal surface-mining methods. The overburden was typically broken up by blasting and moved aside to uncover the desired coal seam. The overburden, most of which was originally solid rock, became a heterogeneous mixture of particles ranging in size from clay to boulders. Where extensive, these spoil areas may contain considerable amounts of groundwater.

In Greene County, there are no reported wells producing from the Coal Mine Spoil Aquifer System. Wells started in this system are usually completed in bedrock. Information from surface coal mine areas in other counties indicate the quality of groundwater in this system is probably much poorer than in the overburden before mining took place. Typically, a significant increase in total dissolved solids, especially calcium, magnesium, bicarbonate, and sulfate occurs. High iron, and in places low pH, can severely limit potential uses of groundwater from this system.

Generally, it is expected that aquifers in coal mine spoil not graded and capped with compacted soil are highly susceptible to contaminants introduced at the surface. However, spoil aquifers in areas benefiting from modern reclamation methods are likely to be only moderately susceptible.

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