

Unconsolidated Aquifer Systems of Rush County, Indiana

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February 2008

The unconsolidated aquifer systems of Rush County are a result of many geologic factors, including the county's position along the broad top of the north end of the Cincinnati Arch, a major geologic structure in the Midwest. The county's resistant Silurian limestone forms the backslope of a regional escarpment that provides some of the highest bedrock elevations in the state. Drift is thin, and outcrops of the underlying bedrock are abundant along the east side of the regional slope and along some of the major drainageways; but glacial deposits increase to the west and north. There is also a northward trending belt of fairly rugged morainic topography that lies over the escarpment in Rush County. Portions of three end morainic systems having a general northeast/southwest orientation provide the structure for the subparallel pattern of northeast/southwest draining streams in the county. Many of the streams follow inherited valleys formerly occupied by glacial drainage during the Pleistocene. Present-day aquifer systems are also affected by the preglacial drainage divides and bedrock valleys. Because of these prominent geologic features, Rush County's unconsolidated aquifer systems are transitional with its neighbors. As such, the aquifer systems have characteristics of individual systems in each county without being identical.

Five unconsolidated aquifer systems have been mapped in Rush County: the **Dissected Till and Residuum / Till Veneer**; the **New Castle Till**; the **New Castle Till Subsystem**; the **New Castle Complex**; and the **White River and Tributaries Outwash Subsystem**. The first system includes relatively thin deposits left by continental ice sheets as well as eroded residuum (a product of bedrock weathering). The next four systems comprise sediments deposited by, or resulting from glaciers, glacial meltwater, and post-glacial events. Due to the area's complex glacial history, the boundaries between the systems are gradational and may include some small areas of other aquifer systems.

In places, four of these aquifer systems overlie deep buried bedrock valleys. The major valley outlines are provided on the accompanying map. During valley development, bedrock was eroded to create valleys that were then filled with unconsolidated sediment that was subsequently capped with glacial drift or in places, by late Pleistocene outwash. Because adequate yields are generally found in shallower aquifers, there is little known about the deposits in the deeper portions of the bedrock valleys. The deepest wells drilled into the bedrock valley deposits are approximately 100 to 170 feet deep and do not provide much information regarding potential ground water availability. In nearby Henry County additional information is available to suggest there is little evidence for ground water potential in most of these buried bedrock valleys.

The thickness of unconsolidated sediments in Rush County is variable, from less than 50 feet in much of the southern part of the county and along major drainageways, to in excess of 350 feet

in a bedrock valley in northeastern Rush County near the Henry County line. Elsewhere in Rush County, unconsolidated deposits are commonly greater than 50 feet thick.

In general, there is little potential for significant ground-water production from the unconsolidated aquifer systems in much of the southern part of the county. Some areas in the county's midsection also have limited potential. However, much of the northern part of the county has good ground water availability, including the capability of supporting high-capacity use in some places.

Variations within geologic environments can cause variation in susceptibility of an aquifer system to surface contamination, therefore, regional estimates of aquifer susceptibility to contamination from the surface can differ considerably from local reality. 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.

Dissected Till and Residuum Aquifer System / Till Veneer Aquifer System

In Rush 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/or Wisconsin till is thin and dissected due to deep down-cutting by streams and other areas 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, chiefly the product of the deposition of glacial till over an uneven, eroded bedrock surface rather than erosion of till by younger streams. Also included in this aquifer system are relatively thin deposits of alluvium and colluvium in many stream valleys.

Much of southern Rush County is mapped as Dissected Till and Residuum, especially the southwestern part of the county and along the Rush/Decatur county line. Thin till over a bedrock high, west and northwest of Rushville, is mapped as the Till Veneer Aquifer System. Isolated patches located along the Big Blue River in northwestern Rush County are also mapped in this system. Areas along the Flat Rock River near Rushville and the southern part of the town itself are also mapped within this system. Similarly, isolated areas are mapped along the Little Blue River, southwest of Arlington to the Shelby County line.

There is little potential for ground-water production in the Dissected Till and Residuum Aquifer System or the Till Veneer Aquifer System in Rush County. Because the bedrock underlying this system is generally a more reliable source of water, very few wells are completed in unconsolidated materials. The total thickness of these systems is less than 50 feet, and static water levels commonly range from 10 to 30 feet below the surface. Where present, sand and gravel units are typically less than 3 feet thick. Large-diameter bored (bucket-rig) wells are typically used in this county to produce and store water from thin sands within the predominantly clay and silt materials of this aquifer system.

Together, the Dissected Till and Residuum Aquifer System and the Till Veneer Aquifer System have the most limited ground-water resources of the unconsolidated aquifer systems in the county. Because of the generally low permeability of the near-surface materials, these systems are not very susceptible to contamination from surface sources.

New Castle Till Aquifer System

The New Castle Till Aquifer System is composed primarily of glacial deposits that are generally thicker than 50 feet and are made up of till separated by intratill sand and gravel aquifers that, in general, have limited thickness and extent. Unconsolidated deposits within the boundaries of this system typically range in thickness from 50 feet to 150 feet; however, a small part of the system lying north of Rushville overlies a buried bedrock valley where it has a thickness in excess of 150 feet.

Geographically, the New Castle Till Aquifer System is comprised of large and small fragments scattered throughout the county. The largest contiguous areas mapped within this system lie east of Rushville near the Fayette County line, along State Road 3 north of Rushville, and south of Knightstown near the Henry County line.

Of special note are small isolated areas in the southwestern part of the county that are mapped as New Castle Till Aquifer System. These “pods” differ from most areas mapped within this system, but are so mapped because they differ significantly from the aquifer systems surrounding them. These “pods” occur primarily along or adjacent to narrow drainageways where accumulations of sand and/or gravel have been deposited. Little is known about how areally extensive the coarse deposits extend; therefore they are mapped as small pods with alignments primarily from northeast to southwest, following previous and present drainage.

Potential aquifer materials include outwash sands and/or gravels that commonly range from 5 to 10 feet in thickness. However, thicknesses greater than 10 feet are not uncommon, especially in the area of this aquifer system located south of Knightstown near the Henry County line. Reported well depths are generally 40 to 90 feet; however, south of Knightstown, well depths in this system exceed 100 feet. Some flowing wells are reported, but static water levels generally range from 6 to 40 feet below the surface. In the area south of Knightstown however, static levels are generally 50 to 60 feet below the surface.

This system is capable of meeting the needs of domestic and some high-capacity users. Domestic well capacities are typically 10 to 25 gallons per minute (gpm). There are two registered significant ground-water withdrawal facilities in the New Castle Till Aquifer System in Rush County. One registered facility (2 wells), located in the part of the system lying south of Knightstown, reports individual well capacities of 250 gpm and 400 gpm. Another is located east of Rushville near the Fayette County line to supply the town of Glenwood (approximately 200 gpm). Other wells located in the area between Mauzy and Glenwood appear to have good potential for high-capacity usage. There are also discontinued registered facilities that are located in this aquifer system north of Rushville having reported capacities up to 500 gpm.

The New Castle Till Aquifer System is generally not susceptible to surface contamination because productive sands and gravels are generally overlain by thick low-permeability glacial till.

New Castle Till Aquifer Subsystem

Areas in Rush County where unconsolidated materials generally exceed 50 feet in thickness, yet have little aquifer potential, are mapped as New Castle Till Aquifer Subsystem. Unconsolidated materials in this system are typically 50 to 100 feet thick. Much of Rush County's northwest/southeast trending midsection is mapped as New Castle Till Aquifer Subsystem. In addition, there are a few isolated areas near the southern county line and in uplands on either side of Flat Rock River valley that are also included in this system.

Wells completed in this system in Rush County are typically 40 to 60 feet deep with static water levels commonly 15 to 25 feet below the surface. Potential aquifer materials include thin, intratill sand and gravel deposits that are typically less than 4 feet thick. Any aquifer material present is overlain by a till cap that is highly variable in thickness.

The New Castle Till Aquifer Subsystem is capable of meeting the needs of some domestic users in the county. However, most wells constructed in this system bypass the unconsolidated materials and use the generally more dependable underlying bedrock aquifer. Well yields from this system are commonly less than 10 gpm.

The New Castle Till Aquifer Subsystem is generally not very susceptible to surface contamination because its intratill sand and gravel units are generally overlain by thick till deposits.

New Castle Complex Aquifer System

The New Castle Complex Aquifer System is characterized by unconsolidated deposits that are highly variable in material and thickness. In general, this system may be thought of as a series of stacked, complex sequences of surficial and/or intratill sand and/or gravel deposits and inter-layered till deposits. In Rush County, this system typically has a thickness greater than 100 feet. However, in places the system overlies deep buried bedrock valleys where it reaches a maximum thickness of more than 350 feet in the northeast part of the county near the Henry County line. Sand and gravel aquifer deposits in the system vary from thin to massive and are in places, overlain by thick till. Water-bearing sand and/or gravel deposits in excess of 10 feet are common in this system.

The New Castle Complex Aquifer System is mapped in a large area of the northern part of Rush County, including areas near the Henry County line and the Hancock/Shelby county boundaries. This system also includes much of the area overlying a prominent bedrock valley in the

northeastern part of the county and areas near the headwaters of bedrock valleys along the county's western boundary.

The system displays differing characteristics across the county. The primary aquifers within the system in the northwestern part of the county are generally thick intratill sands and/or gravels. These aquifers are highly variable in depth and lateral extent and are in places confined by variably thick clay or till sequences. The water-bearing deposits are generally deeper and have deeper static water levels than the recent surficial outwash deposits found in the northeastern part of this system in the county.

The surficial outwash plain deposits that overlie most of the New Castle Complex Aquifer System in northeast Rush County are a result of Pleistocene glaciation in the area. Static water levels are generally less than 20 feet beneath the surface, and water-bearing sands and/or gravels are very near the surface in many places.

Typical well depths range from 35 to 90 feet, but many wells are at a depth in excess of 100 feet. This system is capable of meeting the needs of domestic and some high-capacity users in Rush County. Domestic well yields are commonly 10 to 40 gpm, and static water levels are generally 5 to 40 feet below the surface.

The only registered high-capacity ground-water facility in this aquifer system is located in northwest Rush County. The reported capacity for the registered facility is 2000 gpm. However, 6 water wells that lie elsewhere within this system have reported capacities in excess of 70 gpm. Based on well log descriptions, this system has greater yield potential than is currently being used. In nearby Henry County, high-capacity wells developed in this system report yields up to 1000 gpm. However, such high yields should not be expected in most of Rush County.

The New Castle Complex Aquifer System is not very susceptible to contamination where thick clay materials overlie aquifers, such as in northwest Rush County. However, in some areas where outwash is present at or near the surface and clay deposits are thin (in northeastern Rush County), the system is at moderate to high risk.

White River and Tributaries Outwash Aquifer Subsystem

The White River and Tributaries Outwash Aquifer Subsystem in the Upper East Fork White River Basin has somewhat different characteristics from what is found in many other parts of the state where these systems are mapped. In this watershed, bedrock elevations are among the highest in the state. Most modern streams have cut only a shallow valley or follow inherited glacial drainageways. The glacial valleys carried outwash from the melting glaciers during Wisconsin and pre-Wisconsin glacial periods, but much of the outwash materials have been eroded by subsequent streams such as the Big Blue River, Flatrock River, and Hurricane Creek. Therefore, many outwash deposits in Rush County and the upper East Fork White River watershed are generally thinner than their counterparts in much of the rest of the state.

In Rush County, the White River and Tributaries Outwash Aquifer Subsystem is mapped in the northwest corner of the county near the Hancock County boundary, primarily in the valleys of the Little Blue and Big Blue Rivers. In the town of Rushville and along the Flatrock River valley to the northeast and southwest of the town, this aquifer system is present. However, in places, much of the outwash material has been eroded away by the Flatrock River. Northeast of town, the deposits still occur on the eastern side of valley, but consist of thin outwash over shallow bedrock having some potential, but probably limited. The same is true for the area mapped to the far southwest of town.

In the northeastern part of the county, a large area of contiguous outwash plain deposits is mapped as two different aquifer systems. The area northeast of the town of Mays mapped as White River and Tributaries Outwash Aquifer Subsystem lies on a bedrock high that has unconsolidated deposits with a thickness of less than 100 feet. The area mapped as New Castle Complex has thick deposits as much as 350 feet that fill a bedrock valley.

Total thickness of unconsolidated deposits in the White River and Tributaries Outwash Aquifer Subsystem in Rush County ranges from less than 50 feet along the margins of streams to more than 125 feet along the valley of Sixmile Creek in the northwest corner of the county. Well depths typically range from 25 to 60 feet. Sand and gravel aquifer deposits within this system are generally 5 to 30 feet thick. In a few areas, the bedrock is shallow and some drillers bypass the unconsolidated sediments and complete the wells in bedrock. It is likely that the overlying sands and gravels contribute significantly to the well yield.

The White River and Tributaries Aquifer Subsystem in Rush County has the potential to meet the needs of domestic and some high-capacity users. Domestic well yields are typically 10 to 25 gpm with static water levels 10 to 30 feet below surface. There are 2 registered high-capacity ground-water withdrawal facilities in the county, Rushville (5 wells) and Carthage (2 wells). The town of Rushville has a reported total capacity of 1850 gpm. Carthage has a reported total capacity of 560 gpm. Although not a registered facility, a water well located in northwest Rush County south of Charlottesville has a reported deep, 40-foot sand and gravel deposit.

In general, the White River and Tributaries Aquifer Subsystem in Rush County is highly susceptible to surface contamination because most of the water bearing materials are close to the surface and are not overlain by significant clay or silt deposits.

Registered Significant Ground-water Withdrawal Facilities

There are 5 registered significant ground-water withdrawal facilities (total of 12 wells) using unconsolidated aquifers in the county. Most of these facilities produce from the White River and Tributaries Aquifer System (2 facilities, 7 wells) or the New Castle Till Aquifer System (2 facilities, 4 wells). However, one facility uses the New Castle Complex Aquifer System (1 facility, 1 well). Public water supply and irrigation are the type of water use for these registered facilities. Refer to the accompanying table for some details on the wells and to the map for facility locations.

Map Use and Disclaimer Statement

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