

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

by

Glenn E. Grove

Division of Water, Resource Assessment Section

March 2006

Six unconsolidated aquifer systems have been mapped in Clark County: the Unglaciated Southern Hills and Lowlands / Dissected Till and Residuum; the Alluvial, Lacustrine, and Backwater Deposits; the Scottsburg Lowland / Muscatatuck Plateau Till; the Scottsburg Lowland / Muscatatuck Plateau Till Subsystem; the Ohio River Outwash; and the Ohio River Outwash Subsystem. The Unglaciated Southern Hills and Lowlands Aquifer System consists of eroded residuum (a product of bedrock weathering) and colluvium. The Dissected Till and Residuum Aquifer System is the same as the Unglaciated Southern Hills and Lowlands except it also includes relatively thin deposits left by continental ice sheets. The other aquifer systems comprise sediments deposited by, or resulting from, glaciers, glacial meltwaters, and post-glacial precipitation events. Boundaries of these aquifer systems are commonly gradational and individual aquifers may extend across aquifer system boundaries. However, a relatively distinct boundary occurs where the Ohio River Outwash Aquifer System or the Ohio River Outwash Subsystem abuts the steep rocky hillsides of the Dissected Till and Residuum Aquifer System along the Ohio River valley in the eastern portion of the county.

Outside of the main valley of the Ohio River, nearly the entire county has less than 25 feet of unconsolidated materials overlying the bedrock. Bedrock outcrops are especially common in the western half of the county. However, a few scattered areas in north-central Clark County (primarily east of Marysville) contain unconsolidated deposits exceeding 50 feet in thickness. However, only within the main valley of the Ohio River are the sand and gravel deposits of sufficient thickness and extent to constitute major groundwater resources capable of supplying large municipal, industrial, and irrigation needs.

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.

### **Unglaciated Southern Hills and Lowlands / Dissected Till and Residuum Aquifer System**

In Clark County, the Unglaciated Southern Hills and Lowlands Aquifer System and the Dissected Till and Residuum Aquifer System are mapped as one aquifer system because they are similar in composition and in aquifer characteristics. The Unglaciated Southern Hills and Lowlands Aquifer System consists primarily of eroded bedrock residuum in the unglaciated western uplands of Clark County, whereas the Dissected Till and Residuum Aquifer System is primarily composed of eroded bedrock residuum along with thin pre-Wisconsin till in the rest of the county. Relatively thin deposits of alluvium, colluvium, and lacustrine materials are included

in the Dissected Till and Residuum Aquifer System, particularly along Silver Creek, Fourteenmile Creek, and near the Falls of the Ohio. Together the Unglaciated Southern Hills and Lowlands Aquifer System and the Dissected Till and Residuum Aquifer Systems cover over 90 percent of Clark County and have the most limited groundwater resources of all the unconsolidated aquifer systems in the county.

There is little potential for groundwater production in the Unglaciated Southern Hills and Lowlands / Dissected Till and Residuum Aquifer System in Clark County. Only a few of the wells that have been reported to penetrate this aquifer system are completed in unconsolidated materials and most are completed in the underlying bedrock. The total thickness of this system commonly ranges from 5 to 35 feet. Because of the low permeability of the surface materials, this aquifer system is not very susceptible to contamination from surface sources.

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

The Alluvial, Lacustrine, and Backwater Deposits Aquifer System is made up of heterogeneous bodies of alluvial, colluvial, and lacustrine materials within valley bottoms and terraces of some larger streams tributary to the Ohio River. The unconsolidated deposits primarily come from two sources. One source is alluvium, and perhaps some glacial outwash, deposited by the streams along with colluvium eroded from the valley walls and upland areas. The second major source is glaciolacustrine deposits that were formed in bodies of relatively stagnant lake water and are marked by soft silt and clay. These lake deposits were formed when the Ohio River valley was choked with coarser material carried by glacial meltwater. Thick deposits of this material effectively dammed tributary streams, creating lakes. Thick deposits of silt and clay, sometimes called "slackwater clay," mark the former locations of these glacial lakes.

In Clark County the Alluvial, Lacustrine, and Backwater Deposits Aquifer System is mapped along portions of larger tributaries of the Ohio River that include: Camp Creek in northeastern Clark County, and Fourteenmile Creek and Silver Creek in the south-central portion of the county. In places, particularly in downstream areas where the Alluvial, Lacustrine, and Backwater Deposits Aquifer System is near the Ohio River, this system exceeds 50 feet in thickness. Farther upstream, the thickness rapidly decreases to about 25 feet and the sediments become fine-grained sand and silt. Although wells constructed in this system in Clark County would not typically support high-capacity usage, there is one registered significant groundwater withdrawal facility (Essroc Cement Corp.) which has one well with a reported yield of 119 gpm from this aquifer system.

This aquifer system is generally marked by thick surface deposits of soft silt and clay that have low susceptibility to surface contamination. However, the aquifer system has a high susceptibility to surface contamination in some of the upstream areas where the surface cap of silt and clay is thin.

### **Scottsburg Lowland / Muscatatuck Plateau Till Aquifer System**

The Scottsburg Lowland / Muscatatuck Plateau Till Aquifer System is mapped only in the north-central part of Clark County. The Scottsburg Lowland / Muscatatuck Plateau Till Aquifer System is composed primarily of glacial tills that contain intratill sand and gravel deposits of limited thickness and extent. The grain size of aquifer materials in the intratill deposits varies locally and ranges from fine or muddy sand to coarse gravel. Sand and gravel lenses within the system range in thickness from about 1 to 30 feet, but are commonly less than 10 feet thick. Well depths in this aquifer system are variable and are influenced by the thickness of unconsolidated materials and the depth to productive sand and gravel layers within the thicker tills.

This system has the potential to consistently meet the needs of most domestic and some high-capacity water users. However, no domestic wells have been reported in this system. One registered significant groundwater withdrawal facility (eight wells) currently utilizes this aquifer system in Clark County. The individual wells produce between 75 and 120 gpm.

The Scottsburg Lowland / Muscatatuck Plateau Till Aquifer System has a low susceptibility to surface contamination because intratill sand and gravel units are generally overlain by several feet of low-permeability glacial till.

### **Scottsburg Lowland / Muscatatuck Plateau Till Aquifer Subsystem**

The Scottsburg Lowland / Muscatatuck Plateau Till Aquifer Subsystem is mapped only in a relatively small portion in north-central Clark County. No domestic wells have been reported in this system in Clark County; however, mapping is primarily based on geology, topography, soil types, field observations, and water well data from adjacent counties. Because of the lack of water well data for this aquifer system, the boundary with the Dissected Till and Residuum Aquifer System cannot be defined with a high degree of confidence.

Based on data obtained from Scott County, potential aquifer materials within the glacial till include discontinuous intratill sand and gravel units. Because sand and gravel zones are not expected to be very thick in much of the aquifer system, large diameter bored wells may be needed in places to increase the yield to an acceptable amount for domestic purposes.

The Scottsburg Lowland / Muscatatuck Plateau Till Aquifer Subsystem has a low susceptibility to surface contamination because intratill sand and gravel units are generally separated from the surface by till layers.

### **Ohio River Outwash Aquifer System**

The Ohio River Outwash Aquifer System covers portions of the main valley of the Ohio River. This valley carried great quantities of outwash from the melting glaciers during Wisconsin and pre-Wisconsin glacial periods. Only pre-Wisconsin ice sheets covered large portions of Clark County while the western uplands of Clark County are unglaciated.

This aquifer system contains large volumes of sand and gravel that are contained within the main river valley. As the glaciers melted, sediment was delivered to the Ohio River in quantities too large for the stream to transport. As a result, the increased sediment load was stored in the valley as vertical and lateral accretionary deposits. As long as the retreating glaciers continued to provide sediment in quantities too large for the stream to transport farther downstream, the valley continued to be filled. This valley-filling process formed the most prolific aquifer system in the county.

The Ohio River Outwash Aquifer System in Clark County is about 40 to 130 feet thick. However, not all of these unconsolidated deposits are saturated with water. Actual aquifer thickness (saturated sand and gravel) of the Ohio River Outwash Aquifer System ranges from about 25 to 100 feet, but the typical aquifer thickness is 35 to 85 feet. Static water levels commonly range from about 10 to 35 feet below the land surface.

In Clark County, the Ohio River Outwash Aquifer System is by far the most productive aquifer system and has the potential to consistently meet the needs of high-capacity water users. Well yields of 300 to 2020 gpm have been obtained in this system. Eleven registered significant groundwater withdrawal facilities (total of 49 wells) currently use this aquifer system in Clark County.

This aquifer system is highly susceptible to contamination from surface sources in areas that lack overlying clay layers. The system is only moderately susceptible where it is overlain by thick clay or silt deposits.

### **Ohio River Outwash Aquifer Subsystem**

The Ohio River Outwash Aquifer Subsystem is mapped parallel and adjacent to the Ohio River Outwash Aquifer System where the topographic position is higher and thickness of saturated outwash materials is considerably less than the main outwash system. In addition, aquifer sand and gravels are generally overlain by thicker deposits of silt and clay.

In Clark County, the Ohio River Outwash Aquifer Subsystem has the potential to meet the needs of domestic and some high-capacity users. This system is generally 25 to 70 feet thick, with 50 feet of continuous sand and gravel in places. The few reported wells utilizing this system in the county are 33 to 97 feet deep. Reported well yields range from 5 to 300 gpm, with static water levels between 16 to 35 feet below the surface. Currently, there is one registered significant groundwater withdrawal facility (1 well) that uses this aquifer system in Clark County.

Areas within this aquifer system that have overlying clay or silt deposits are moderately susceptible to surface contamination; whereas, areas that lack overlying clay or silt deposits are highly susceptible to contamination.

## **Registered Significant Groundwater Withdrawal Facilities**

There are 14 registered significant groundwater withdrawal facilities (total of 59 wells) using unconsolidated aquifers in the county. Most of these facilities utilize the Ohio River Outwash Aquifer System (11 facilities, 49 wells). Additionally, facilities use the Ohio River Outwash Aquifer Subsystem (1 facility, 1 well), the Scottsburg Lowland / Muscatatuck Plateau Till Aquifer System (1 facility, 8 wells), and the Alluvial, Lacustrine, and Backwater Deposits Aquifer System (1 facility, 1 well). Reported uses for these facilities are public supply and industry. Refer to Table 1 for some details on the wells and to the map for facility locations.

## **Map Use and Disclaimer Statement**

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