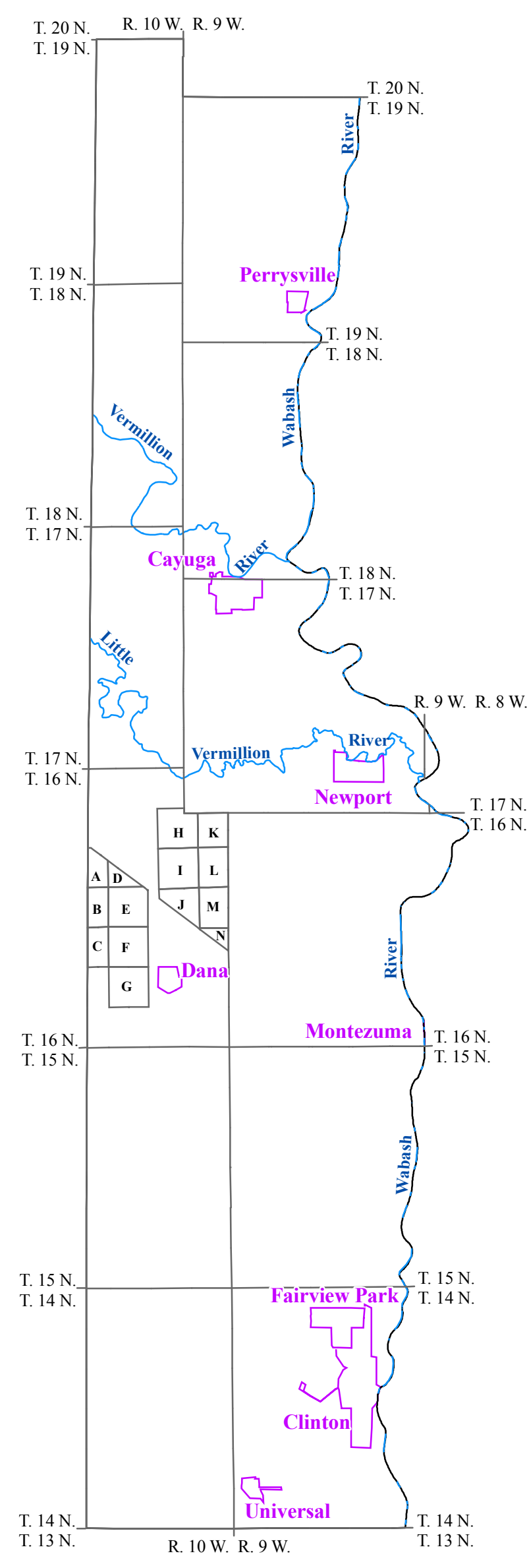
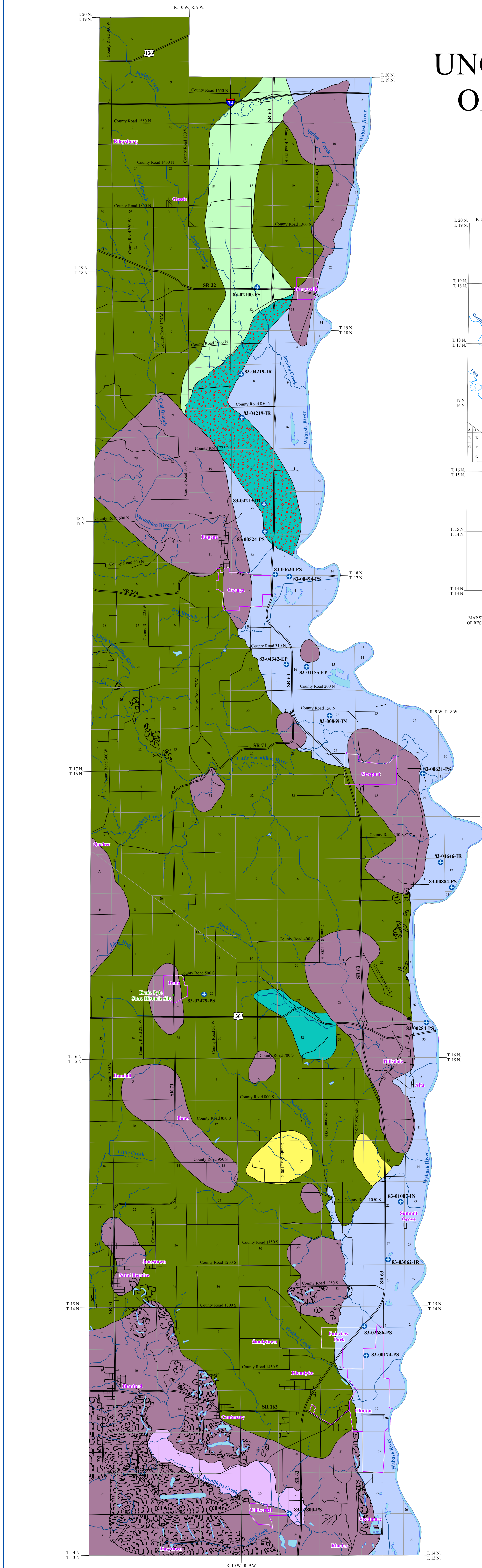
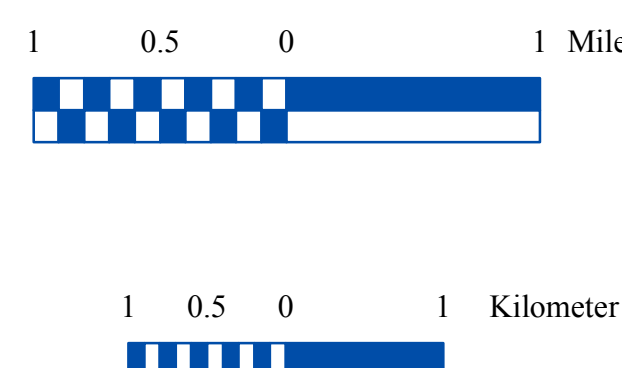
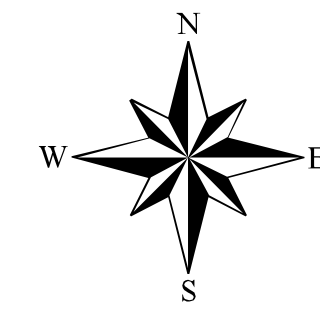


# UNCONSOLIDATED AQUIFER SYSTEMS OF VERMILION COUNTY, INDIANA



- A. 9 South of the Ten O'Clock Line
- B. 16 South of the Ten O'Clock Line
- C. 21 South of the Ten O'Clock Line
- D. 10 South of the Ten O'Clock Line
- E. 15 South of the Ten O'Clock Line
- F. 22 South of the Ten O'Clock Line
- G. 27 South of the Ten O'Clock Line
- H. 9 North of the Ten O'Clock Line
- I. 16 North of the Ten O'Clock Line
- J. 21 North of the Ten O'Clock Line
- K. 10 North of the Ten O'Clock Line
- L. 15 North of the Ten O'Clock Line
- M. 22 North of the Ten O'Clock Line
- N. 27 North of the Ten O'Clock Line

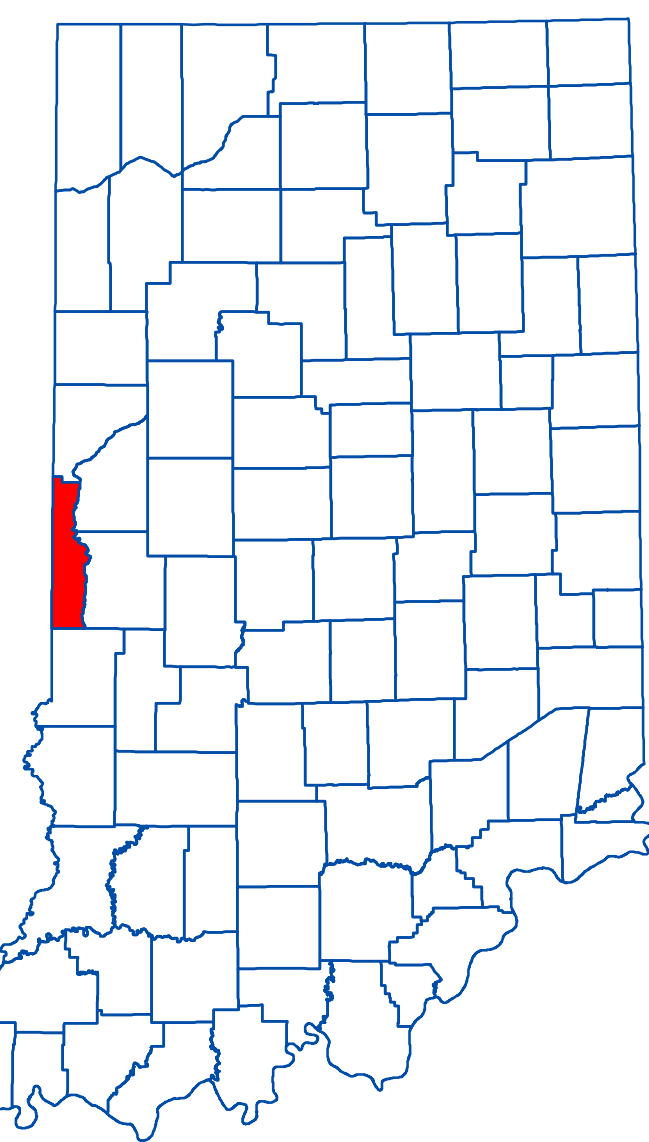
MAP SHOWING NAME AND LOCATION OF RESERVES IN VERMILION COUNTY



### EXPLANATION

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

### Location Map



Eight unconsolidated aquifer systems have been mapped in Vermillion County: Till Veneer; the Central Wabash Valley Till; the Central Wabash Valley Till Subsystem; the Buried Valley; the Central Wabash Valley Complex; the Wabash River and Tributaries Outwash; the Wabash River and Tributaries Outwash Subsystem; and the Coal Mine Spoil. Boundaries of all aquifer systems described are commonly gradational, and individual aquifers may extend across aquifer system boundaries.

The thickness of unconsolidated deposits in Vermillion County is quite variable because glacial material has been deposited over an uneven bedrock surface. Unconsolidated materials range from less than 50 feet thick in the eastern and southern portions of the county to more than 250 feet in the central portion of Vermillion County. However, throughout much of Vermillion County unconsolidated deposits are commonly 50 to 100 feet thick.

Regional estimates of potential contamination to aquifer systems from the surface can differ considerably by location. Variations within geologic environments can result in a wide range of susceptibility to these systems. 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 Aquifer System

The Till Veneer Aquifer System is mapped mostly along sections of the Wabash River, an unnamed tributary of Norton Creek, and Brouillets Creek. The system consists of thin till, generally less than 50 feet thick, which directly overlies an uneven bedrock surface. Potential aquifers within this system can include thin isolated sand and/or gravel layers. Along some of the major streams this system may include thin alluvium and surficial sands and gravels that directly overlie the bedrock surface. It is the most limited aquifer system mapped in Vermillion County.

There is little potential for groundwater production in this system in Vermillion County. Few wells have been completed in the Till Veneer Aquifer System because most wells have been completed in the underlying bedrock. Potential aquifer deposits would include thin, isolated sands and/or gravels with yields less than 5 gallons per minute (gpm). There are no registered significant groundwater withdrawal facilities utilizing this system.

This aquifer system is generally not very susceptible to surface contamination because intratill sand and gravel units are overlain by till deposits. However, some areas have surface sands and gravels, or thin to no clay deposits above the aquifer resource. These areas are considered at moderate to high risk to contamination.

#### Central Wabash Valley Till Aquifer System

The Central Wabash Valley Till Aquifer System primarily consists of thick clay with thin intratill sand and gravel layers. Wells completed in this system are capable of meeting the needs of most domestic users in Vermillion County. Saturated aquifer materials include sand and/or gravel deposits that are commonly 4 to 18 feet thick and are generally overlain by 75 to 135 feet of till.

Wells producing from this system are typically 75 to 175 feet deep. Domestic well capacities are commonly 5 to 15 gpm and static water levels generally range from 30 to 70 feet below the surface. There are no registered significant groundwater withdrawal facilities utilizing this system in Vermillion County.

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

#### Central Wabash Valley Till Aquifer Subsystem

Areas where unconsolidated materials are generally greater than 50 feet in thickness, yet have limited aquifer potential, are mapped as the Central Wabash Valley Till Aquifer Subsystem. The unconsolidated material in this subsystem ranges from about 50 to 250 feet thick in Vermillion County. Potential aquifer materials include intratill sand and gravel deposits. Where present, aquifer materials are capped by till that is commonly 25 to 75 feet thick.

More than 45 percent of wells started in the Central Wabash Valley Till Aquifer Subsystem in this county are completed in the underlying bedrock aquifer system. However, this subsystem is capable of meeting the needs of some domestic users in the county. The wells producing from this subsystem are generally completed at depths of 55 to 120 feet. Intratill sand and gravel aquifer materials are typically 2 to 16 feet thick. Reported well yields generally range from 5 to 10 gpm and static water levels are commonly 20 to 65 feet below the surface. There is 1 registered significant groundwater withdrawal facility (4 wells) with yields from 35 to 50 gpm. However, available drawdown is limited.

This subsystem is generally not very susceptible to surface contamination because intratill sand and gravel units are overlain by thick till deposits. However, in some areas where aquifers are shallow and overlying clay deposits are thin, the system is at moderate risk.

#### Buried Valley Aquifer System

The Buried Valley Aquifer System consists of glacial materials deposited in deep stage bedrock valleys. The system is mapped from the northern county boundary and continues south to southeast for approximately eight miles. Typical deposits include a thick glacial till with isolated sands and gravels ranging from 25 to 125 feet thick that are generally not used as an aquifer resource. Aquifer sands and gravels are typically 120 to 180 feet deep and range from 5 to 25 feet thick. In places, the aquifer sands and gravels may directly overlie the bedrock surface.

Few wells are completed in the Buried Valley Aquifer System in Vermillion County. However, this aquifer system has the potential to meet the needs of domestic and some high-capacity users. Wells are generally 135 to 190 feet deep with yields that range from 8 to 30 gpm. Static water levels range from 85 to 115 feet below the surface. There is 1 registered significant groundwater withdrawal facility (2 wells) with yields of 300 gpm for each well.

This system typically has a low susceptibility to surface contamination because intratill sand and gravel units are commonly overlain by thick glacial till. Shallow wells completed in this system are moderately susceptible to contamination.

#### Central Wabash Valley Complex Aquifer System

The Central Wabash Valley Complex Aquifer System is mapped along a portion of Thick Creek in eastern Vermillion County and is characterized by unconsolidated deposits that are quite variable in materials and thickness. Sand and gravel aquifer deposits are commonly overlain by a thick till. This system generally exhibits alternating layers of outwash and till of variable thickness above the main aquifer. The unconsolidated material in this system ranges from about 100 to 200 feet thick in Vermillion County.

This system is capable of meeting the needs of domestic and some high-capacity users in Vermillion County. The most utilized aquifer layers in the Central Wabash Valley Complex Aquifer System are generally 10 to 55 feet thick sands and/or gravels overlain by a till cap which is commonly 45 to 140 feet thick. Wells in this system are typically completed at depths ranging from 160 to 225 feet. Domestic well yields are commonly 10 to 50 gpm and static water levels are about 100 feet below the surface. There are no registered significant groundwater withdrawal facilities utilizing this system.

The Central Wabash Valley Complex Aquifer System is not very susceptible to contamination where overlain by thick clay deposits.

#### Wabash River and Tributaries Outwash Aquifer System

The Wabash River and Tributaries Outwash Aquifer System is mapped along the Wabash River in eastern Vermillion County. The Wabash River and Tributaries Outwash Aquifer System has the potential to meet the needs of domestic and some high-capacity users. However, approximately 15 percent of wells started in this system utilize the underlying bedrock aquifer. The few wells utilizing this system in Vermillion County have been reported at depths of 60 to 115 feet. Saturated aquifer materials include sand and/or gravel deposits that are commonly 30 to 180 feet thick and are overlain by 4 to 22 feet of clay. Yields for these wells are 10 to 35 gpm with static water levels ranging from 25 to 60 feet below the surface. There are 14 registered significant groundwater withdrawal facilities (55 wells) with yields that range from 75 to 2,000 gpm. There is one significant groundwater withdrawal facility with 2 radial collector well systems. The reported capacities for these wells range from 3260 gpm and 9000 gpm.

In northeastern Vermillion County, this system overlies a bedrock valley system, which trends south from the area near Perryville toward the confluence of the Vermilion River with the Wabash River. The total unconsolidated thickness exceeds 200 feet, in places. Only a few wells that utilize the deeper aquifers within the buried bedrock valley have been reported. These wells include the deposits range in thickness from 15 to 105 feet and are overlain by 2 to 22 feet of clay. Reported domestic well yields are up to 50 gpm with static water levels ranging from 45 to 70 feet below the surface. There are 2 registered significant groundwater withdrawal facilities (6 wells) with yields that range from 70 to 1200 gpm.

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

#### Wabash River and Tributaries Outwash Aquifer Subsystem

The Wabash River and Tributaries Outwash Aquifer Subsystem is mapped along Brouillets Creek in Vermillion County. The system is made up of thick, glacially derived outwash deposits.

Few wells have reportedly been completed in the Wabash River and Tributaries Outwash Aquifer Subsystem. The Wabash River and Tributaries Outwash Aquifer Subsystem has the potential to meet the needs of domestic and some high-capacity users. Potential aquifer deposits would include sands and/or gravels ranging in thickness from 5 to 50 feet. There is 1 registered significant groundwater withdrawal facility (2 wells) with yields of 58 and 72 gpm.

Where overlying clay deposits are present the system is moderately susceptible to surface contamination. However, the few areas that lack overlying clay deposits are highly susceptible to contamination.

#### Coal Mine Spoil Aquifer System

The Coal Mine Spoil Aquifer System covers about five percent of Vermillion County. This aquifer system was formed during the process of mining coal by 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, silt, and sand up to gravel, cobbles, and boulders. Where extensive these spoil areas contain considerable amounts of groundwater. Although data are sorely lacking on permeability of these spoil materials, it is generally accepted that the spoil permeability is greater than most of the original rock layers above the coal seam mined.

The quality of groundwater in this system is generally much poorer than that 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 sometimes low pH, can also severely limit potential uses of groundwater from this system.

There are no well records reported in this aquifer system in Vermillion County. Very generally, it is expected that aquifers in old spoil areas that were not graded and capped with compacted soil are highly susceptible to surface contamination, whereas new spoil areas benefiting from modern reclamation methods are likely to be only moderately susceptible.



### Map Use and Disclaimer Statement

We request that the following agency be acknowledged in products derived from this map: Indiana Department of Natural Resources, Division of Water.

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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), Surface Coal Mines (polygon shapefile, 20081231) were all from the Indiana Geological Survey and based on a 1:24,000 scale. Draft road shapefiles, System1 and System2 (line shapefiles, 2003), were from the Indiana Department of Transportation and based on a 1:24,000 scale. Populated Areas in Indiana 2000 (polygon shapefile, 20021000) was from the U.S. Census Bureau and based on a 1:100,000 scale. Sircams27 (line shapefile, 20000420) was from the Center for Advanced Applications in GIS at Purdue University. Managed Areas 96 (polygon shape file, various dates) was from IDNR. Unconsolidated aquifer systems coverage (Scott, 2009) was based on a 1:24,000 scale.

### Unconsolidated Aquifer Systems of Vermillion County, Indiana

by  
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Division of Water, Resource Assessment Section  
September 2009