GROUND WATER POLLUTION POTENTIAL
OF HURON COUNTY, OHIO

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ABSTRACT

A ground water pollution potential map of Huron County has been prepared using the DRASTIC mapping process. The DRASTIC system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system for pollution potential.

Hydrogeologic settings incorporate hydrogeologic factors that control ground water movement and occurrence including depth to water, net recharge, aquifer media, soil media, topography, impact of the vadose zone media, and hydraulic conductivity of the aquifer. These factors, which form the acronym DRASTIC, are incorporated into a relative ranking scheme that uses a combination of weights and ratings to produce a numerical value called the ground water pollution potential index. Hydrogeologic settings are combined with the pollution potential indexes to create units that can be graphically displayed on a map.

Ground water pollution potential analysis in Huron County resulted in a map with symbols and colors, which illustrate areas of varying ground water pollution potential indexes ranging from 80 to 217.

Huron County lies entirely within the Glaciated Central hydrogeologic setting. A buried valley lies roughly just east of the modern Huron River and extends southwestward from Norwalk. From Norwalk northward, this valley contains fairly coarse, thick sand and gravel outwash deposits that can have maximum yields up to 500 gallons per minute (gpm). Farther southwest, these coarse deposits may be interbedded with finer-grained alluvial or lacustrine deposits or glacial till. Yields from these finer-grained materials occupying buried valleys seldom exceed 100 gpm. High-yielding sand and gravel deposits are also found in the area just southeast of Willard. Yields of less than 5 gpm up to 25 gpm are obtained from thin lenses of sand and gravel interbedded with glacial till, and from lacustrine sediments in upland areas containing moderately thick drift, particularly end moraines.

Bedrock aquifers vary considerably across Huron County. In the far northwest corner of Huron County, limestones and dolomites of the Devonian Columbus Limestone and Delaware Limestone form the uppermost aquifer and yield from 25 to 100 gpm. Higher yields may be obtained from limestones and dolomites of the underlying Silurian Salina Dolomite, Tymochtee Dolomite, and Greenfield Dolomite. From the southwest corner of the county extending northeastward, the Devonian Ohio Shale forms a broad band across western Huron County. For roughly a mile or two past the contact between the shale and carbonate units, the underlying limestone and dolomite remain the aquifer. To the east and south, the shale becomes too thick and the ground water quality becomes marginal to further utilize the limestone. The Ohio Shale is a poor aquifer, commonly yielding less than 5 gpm. The Mississippian Bedford Shale extends in a narrow southwest to northeast belt across central Huron County. This unit is also a very poor aquifer. The Mississippian Berea Sandstone is

the predominant bedrock aquifer in the eastern half of Huron County. Yields from the Berea average from 5 to 25 gpm. Across the southern edge of the county, the Mississippian Sunbury Shale overlies the Berea Sandstone. This unit is very similar to the Ohio Shale and is a poor aquifer. Wells are commonly drilled through this formation and into the underlying Berea Sandstone where possible. Thin interbedded sandstones, shales, and siltstones of the Mississippian Cuyahoga Formation are found occupying bedrock highs across eastern Huron County. The units of the Cuyahoga Formation are usually too thin or too shaley to be used as an aquifer, wells are completed in the underlying Berea Sandstone. Locally the Cuyahoga Formation becomes sufficiently thick and coarse enough to yield 5 to 25 gpm in southeastern Greenwich Township.

The ground water pollution potential mapping program optimizes the use of existing data to rank areas with respect to relative vulnerability to contamination. The ground water pollution potential map of Huron County has been prepared to assist planners, managers, and local officials in evaluating the potential for contamination from various sources of pollution. This information can be used to help direct resources and land use activities to appropriate area, or to assist in protection, monitoring, and clean-up efforts.

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INTRODUCTION

The need for protection and management of ground water resources in Ohio has been clearly recognized. Approximately 42 percent of Ohio citizens rely on ground water for drinking and household use from both municipal and private wells. Industry and agriculture also utilize significant quantities of ground water for processing and irrigation. In Ohio, approximately 750,000 rural households depend on private wells; 5,000 of these wells exist in Huron County.

The characteristics of the many aquifer systems in the state make ground water highly vulnerable to contamination. Measures to protect ground water from contamination usually cost less and create less impact on ground water users than remediation of a polluted aquifer. Based on these concerns for protection of the resource, staff of the Division of Water conducted a review of various mapping strategies useful for identifying vulnerable aquifer areas. They placed particular emphasis on reviewing mapping systems that would assist in state and local protection and management programs. Based on these factors and the quantity and quality of available data on ground water resources, the DRASTIC mapping process (Aller et al., 1987) was selected for application in the program.

Considerable interest in the mapping program followed successful production of a demonstration county map and led to the inclusion of the program as a recommended initiative in the Ohio Ground Water Protection and Management Strategy (Ohio EPA, 1986). Based on this recommendation, the Ohio General Assembly funded the mapping program. A dedicated mapping unit has been established in the Division of Water, Water Resources Section to implement the ground water pollution potential mapping program on a countywide basis in Ohio.

The purpose of this report and map is to aid in the protection of our ground water resources. This protection can be enhanced by understanding and implementing the results of this study, which utilizes the DRASTIC system of evaluating an area's potential for ground water pollution. The mapping program identifies areas that are vulnerable to contamination and displays this information graphically on maps. The system was not designed or intended to replace site-specific investigations, but rather to be used as a planning and management tool. The map and report can be combined with other information to assist in prioritizing local resources and in making land use decisions.

APPLICATIONS OF POLLUTION POTENTIAL MAPS

The pollution potential mapping program offers a wide variety of applications in many counties. The ground water pollution potential map of Huron County has been prepared to assist planners, managers, and state and local officials in evaluating the relative vulnerability of areas to ground water contamination from various sources of pollution. This information can be used to help direct resources and land use activities to appropriate areas, or to assist in protection, monitoring, and clean-up efforts.

An important application of the pollution potential maps for many areas will be assisting in county land use planning and resource expenditures related to solid waste disposal. A county may use the map to help identify areas that are suitable for disposal activities. Once these areas have been identified, a county can collect more site-specific information and combine this with other local factors to determine site suitability.

Pollution potential maps may be applied successfully where non-point source contamination is a concern. Non-point source contamination occurs where land use activities over large areas impact water quality. Maps providing information on relative vulnerability can be used to guide the selection and implementation of appropriate best management practices in different areas. Best management practices should be chosen based upon consideration of the chemical and physical processes that occur from the practice, and the effect these processes may have in areas of moderate to high vulnerability to contamination. For example, the use of agricultural best management practices that limit the infiltration of nitrates, or promote denitrification above the water table, would be beneficial to implement in areas of relatively high vulnerability to contamination.

A pollution potential map can assist in developing ground water protection strategies. By identifying areas more vulnerable to contamination, officials can direct resources to areas where special attention or protection efforts might be warranted. This information can be utilized effectively at the local level for integration into land use decisions and as an educational tool to promote public awareness of ground water resources. Pollution potential maps may be used to prioritize ground water monitoring and/or contamination clean-up efforts. Areas that are identified as being vulnerable to contamination may benefit from increased ground water monitoring for pollutants or from additional efforts to clean up an aquifer.

Individuals in the county who are familiar with specific land use and management problems will recognize other beneficial uses of the pollution potential maps. Planning commissions and zoning boards can use these maps to help make informed decisions about the development of areas within their jurisdiction. Developers proposing projects within ground water sensitive areas may be required to show how ground water will be protected.

Regardless of the application, emphasis must be placed on the fact that the system is not designed to replace a site-specific investigation. The strength of the system lies in its ability to make a "first-cut approximation" by identifying areas that are vulnerable to contamination. Any potential applications of the system should also recognize the assumptions inherent in the system.

SUMMARY OF THE DRASTIC MAPPING PROCESS

DRASTIC was developed by the National Ground Water Association for the United States Environmental Protection Agency. This system was chosen for implementation of a ground water pollution potential mapping program in Ohio. A detailed discussion of this system can be found in Aller et al. (1987).

The DRASTIC mapping system allows the pollution potential of any area to be evaluated systematically using existing information. Vulnerability to contamination is a combination of hydrogeologic factors, anthropogenic influences, and sources of contamination in any given area. The DRASTIC system focuses only on those hydrogeologic factors that influence ground water pollution potential. The system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and the superposition of a relative rating system to determine pollution potential.

The application of DRASTIC to an area requires the recognition of a set of assumptions made in the development of the system. DRASTIC evaluates the pollution potential of an area under the assumption that a contaminant with the mobility of water is introduced at the surface and flushed into the ground water by precipitation. Most important, DRASTIC cannot be applied to areas smaller than 100 acres in size and is not intended or designed to replace site-specific investigations.

Hydrogeologic Settings and Factors

To facilitate the designation of mappable units, the DRASTIC system used the framework of an existing classification system developed by Heath (1984), which divides the United States into 15 ground water regions based on the factors in a ground water system that affect occurrence and availability.

Within each major hydrogeologic region, smaller units representing specific hydrogeologic settings are identified. Hydrogeologic settings form the basis of the system and represent a composite description of the major geologic and hydrogeologic factors that control ground water movement into, through, and out of an area. A hydrogeologic setting represents a mappable unit with common hydrogeologic characteristics and, as a consequence, common vulnerability to contamination (Aller et al., 1987).

Figure 1 illustrates the format and description of a typical hydrogeologic setting found within Huron County. Inherent within each hydrogeologic setting are the physical characteristics that affect the ground water pollution potential. These characteristics or factors identified during the development of the DRASTIC system include:

D – Depth to Water

R – Net Recharge

A – Aquifer Media

S – Soil Media

T – Topography

I – Impact of the Vadose Zone Media

C – Conductivity (Hydraulic) of the Aquifer

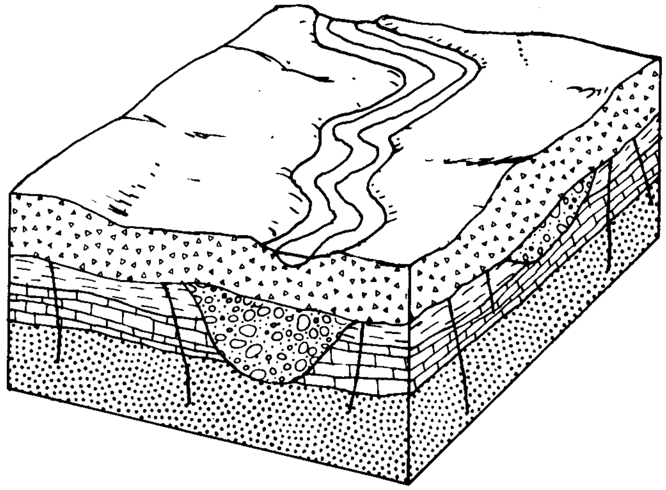
These factors incorporate concepts and mechanisms such as attenuation, retardation, and time or distance of travel of a contaminant with respect to the physical characteristics of the hydrogeologic setting. Broad consideration of these factors and mechanisms coupled with existing conditions in a setting provide a basis for determination of the area's relative vulnerability to contamination.

Depth to water is considered to be the depth from the ground surface to the water table in unconfined aquifer conditions or the depth to the top of the aquifer under confined aquifer conditions. The depth to water determines the distance a contaminant would have to travel before reaching the aquifer. The greater the distance the contaminant has to travel, the greater the opportunity for attenuation to occur or restriction of movement by relatively impermeable layers.

Net recharge is the total amount of water reaching the land surface that infiltrates the aquifer measured in inches per year. Recharge water is available to transport a contaminant from the surface into the aquifer and affects the quantity of water available for dilution and dispersion of a contaminant. Factors to be included in the determination of net recharge include contributions due to infiltration of precipitation, in addition to infiltration from rivers, streams and lakes, irrigation, and artificial recharge.

Aquifer media represents consolidated or unconsolidated rock material capable of yielding sufficient quantities of water for use. Aquifer media accounts for the various physical characteristics of the rock that provide mechanisms of attenuation, retardation, and flow pathways that affect a contaminant reaching and moving through an aquifer.

Soil media refers to the upper six feet of the unsaturated zone that is characterized by significant biological activity. The type of soil media influences the amount of recharge that can move through the soil column due to variations in soil permeability. Various soil types also have the ability to attenuate or retard a contaminant as it moves throughout the soil profile. Soil media is based on textural classifications of soils and considers relative thicknesses and attenuation characteristics of each profile within the soil.



7D Buried Valley

This hydrogeologic setting is limited to north central Huron County. The buried valley lies slightly east of the modern Huron River. The setting is characterized by flat to gently rolling topography and low relief. The buried valley is not obvious on the ground surface. Depth to water is moderate, averaging about 40 feet. The aquifer consists of sand and gravel lenses interbedded with finer-grained till, alluvial, or lacustrine deposits. If a sufficient thickness of sand and gravel is not encountered, wells are completed in the underlying sandstone or shale bedrock. Soils are extremely variable due to the high variability of parent materials including till, alluvium, lacustrine, beach, or outwash deposits. The vadose zone is commonly fractured till and was denoted as sand and gravel with significant silt and clay or as silt and clay depending upon the texture of the till and how it weathers. The till may be fractured or jointed, particularly in areas where it is predominantly thin and weathered. Recharge is moderate to low depending upon the thickness and permeability of the overlying drift.

GWPP index values for the hydrogeologic setting of Buried Valley range from 81 to 131, with the total number of GWPP index calculations equaling 23.

Figure 1. Format and description of the hydrogeologic setting - 7D Buried Valley.

Topography refers to the slope of the land expressed as percent slope. The slope of an area affects the likelihood that a contaminant will infiltrate into the subsurface. Topography also affects soil development and often can be used to help determine the direction and gradient of ground water flow under water table conditions.

The impact of the vadose zone media refers to the attenuation and retardation processes that can occur as a contaminant moves through the unsaturated zone above the aquifer. The vadose zone represents that area below the soil horizon and above the aquifer that is unsaturated or discontinuously saturated. Various attenuation, travel time, and distance mechanisms related to the types of geologic materials present can affect the movement of contaminants in the vadose zone. Where an aquifer is unconfined, the vadose zone media represents the materials below the soil horizon and above the water table. Under confined aquifer conditions, the vadose zone is simply referred to as a confining layer. The presence of the confining layer in the unsaturated zone has a significant impact on the pollution potential of the ground water in an area.

Hydraulic conductivity of an aquifer is a measure of the ability of the aquifer to transmit water, and is also related to ground water velocity and gradient. Hydraulic conductivity is dependent upon the amount and interconnectivity of void spaces and fractures within a consolidated or unconsolidated rock unit. Higher hydraulic conductivity typically corresponds to higher vulnerability to contamination. Hydraulic conductivity considers the capability for a contaminant that reaches an aquifer to be transported throughout that aquifer over time.

Weighting and Rating System

DRASTIC uses a numerical weighting and rating system that is combined with the DRASTIC factors to calculate a ground water pollution potential index or relative measure of vulnerability to contamination. The DRASTIC factors are weighted from 1 to 5 according to their relative importance to each other with regard to contamination potential (Table 1). Each factor is then divided into ranges or media types and assigned a rating from 1 to 10 based on their significance to pollution potential (Tables 2-8). The rating for each factor is selected based on available information and professional judgment. The selected rating for each factor is multiplied by the assigned weight for each factor. These numbers are summed to calculate the DRASTIC or pollution potential index.

Once a DRASTIC index has been calculated, it is possible to identify areas that are more likely to be susceptible to ground water contamination relative to other areas. The higher the DRASTIC index, the greater the vulnerability to contamination. The index generated provides only a relative evaluation tool and is not designed to produce absolute answers or to represent units of vulnerability. Pollution potential indexes of various settings should be compared to each other only with consideration of the factors that were evaluated in determining the vulnerability of the area.

Pesticide DRASTIC

A special version of DRASTIC was developed for use where the application of pesticides is a concern. The weights assigned to the DRASTIC factors were changed to reflect the processes that affect pesticide movement into the subsurface with particular emphasis on soils. Where other agricultural practices, such as the application of fertilizers, are a concern, general DRASTIC should be used to evaluate relative vulnerability to contamination. The process for calculating the Pesticide DRASTIC index is identical to the process used for calculating the general DRASTIC index. However, general DRASTIC and Pesticide DRASTIC numbers should not be compared because the conceptual basis in factor weighting and evaluation differs significantly. Table 1 lists the weights used for general and pesticide DRASTIC.

Table 1. Assigned weights for DRASTIC features

Feature	**General DRASTIC Weight**	**Pesticide DRASTIC Weight**
Depth to Water	5	5
Net Recharge	4	4
Aquifer Media	3	3
Soil Media	2	5
Topography	1	3
Impact of the Vadose Zone Media	5	4
Hydraulic Conductivity of the Aquifer	3	2

Table 2. Ranges and ratings for depth to water

Depth to Water (feet)	
Range	**Rating**
0-5	10
5-15	9
15-30	7
30-50	5
50-75	3
75-100	2
100+	1
Weight: 5	Pesticide Weight: 5

Table 3. Ranges and ratings for net recharge

Net Recharge (inches)	
Range	**Rating**
0-2	1
2-4	3
4-7	6
7-10	8
10+	9
Weight: 4	Pesticide Weight: 4

Table 4. Ranges and ratings for aquifer media

Aquifer Media		
Range	**Rating**	**Typical Rating**
Shale	1-3	2
Glacial Till	4-6	5
Sandstone	4-9	6
Limestone	4-9	6
Sand and Gravel	4-9	8
Interbedded Ss/Sh/Ls/Coal	2-10	9
Karst Limestone	9-10	10
Weight: 3	Pesticide Weight: 3	

Table 5. Ranges and ratings for soil media

Soil Media	
Range	**Rating**
Thin or Absent	10
Gravel	10
Sand	9
Peat	8
Shrink/Swell Clay	7
Sandy Loam	6
Loam	5
Silty Loam	4
Clay Loam	3
Muck	2
Clay	1
Weight: 2	Pesticide Weight: 5

Table 6. Ranges and ratings for topography

Topography (percent slope)	
Range	**Rating**
0-2	10
2-6	9
6-12	5
12-18	3
18+	1
Weight: 1	Pesticide Weight: 3

Table 7. Ranges and ratings for impact of the vadose zone media

Impact of the Vadose Zone Media		
Range	**Rating**	**Typical Rating**
Confining Layer	1	1
Silt/Clay	2-6	3
Shale	2-5	3
Limestone	2-7	6
Sandstone	4-8	6
Interbedded Ss/Sh/Ls/Coal	4-8	6
Sand and Gravel with Silt and Clay	4-8	6
Glacial Till	2-6	4
Sand and Gravel	6-9	8
Karst Limestone	8-10	10
Weight: 5	Pesticide Weight: 4	

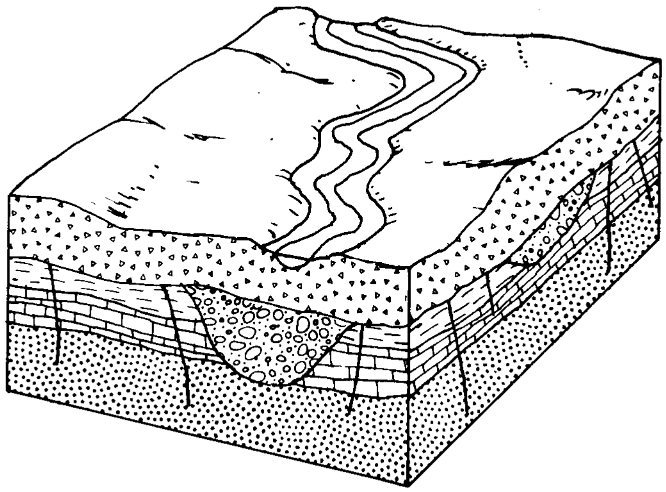
Table 8. Ranges and ratings for hydraulic conductivity

Hydraulic Conductivity (GPD/FT^2)	
Range	**Rating**
1-100	1
100-300	2
300-700	4
700-1000	6
1000-2000	8
2000+	10
Weight: 3	Pesticide Weight: 2

Integration of Hydrogeologic Settings and DRASTIC Factors

Figure 2 illustrates the hydrogeologic setting 7D1, Buried Valley, identified in mapping Huron County, and the pollution potential index calculated for the setting. Based on selected ratings for this setting, the pollution potential index is calculated to be 93. This numerical value has no intrinsic meaning, but can be readily compared to a value obtained for other settings in the county. DRASTIC indexes for typical hydrogeologic settings and values across the United States range from 45 to 223. The diversity of hydrogeologic conditions in Huron County produces settings with a wide range of vulnerability to ground water contamination. Calculated pollution potential indexes for the nine settings identified in the county range from 80 to 217.

Hydrogeologic settings identified in an area are combined with the pollution potential indexes to create units that can be graphically displayed on maps. Pollution potential analysis in Huron County resulted in a map with symbols and colors that illustrate areas of ground water vulnerability. The map describing the ground water pollution potential of Huron County is included with this report.



SETTING 7D1		GENERAL		
FEATURE	**RANGE**	**WEIGHT**	**RATING**	**NUMBER**
Depth to Water	30-50	5	5	25
Net Recharge	2-4	4	3	12
Aquifer Media	Sandstone	3	5	15
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	100-300	3	2	6
		DRASTIC	INDEX	93

Figure 2. Description of the hydrogeologic setting - 7D1 Buried Valley.

INTERPRETATION AND USE OF GROUND WATER POLLUTION POTENTIAL MAPS

The application of the DRASTIC system to evaluate an area's vulnerability to contamination produces hydrogeologic settings with corresponding pollution potential indexes. The susceptibility to contamination becomes greater as the pollution potential index increases. This numeric value determined for one area can be compared to the pollution potential index calculated for another area.

The map accompanying this report displays both the hydrogeologic settings identified in the county and the associated pollution potential indexes calculated in those hydrogeologic settings. The symbols on the map represent the following information:

7D1 - defines the hydrogeologic region and setting
93 - defines the relative pollution potential

Here the first number (**7**) refers to the major hydrogeologic region and the upper case letter (**D**) refers to a specific hydrogeologic setting. The following number (**1**) references a certain set of DRASTIC parameters that are unique to this setting and are described in the corresponding setting chart. The second number (**93**) is the calculated pollution potential index for this unique setting. The charts for each setting provide a reference to show how the pollution potential index was derived.

The maps are color-coded using ranges depicted on the map legend. The color codes used are part of a national color-coding scheme developed to assist the user in gaining a general insight into the vulnerability of the ground water in the area. The color codes were chosen to represent the colors of the spectrum, with warm colors (red, orange, and yellow) representing areas of higher vulnerability (higher pollution potential indexes), and cool colors (greens, blues, and violet) representing areas of lower vulnerability to contamination. The maps also delineate large man-made and natural features such as lakes, landfills, quarries, and strip mines, but these areas are not rated and therefore are not color-coded.

GENERAL INFORMATION ABOUT HURON COUNTY

Demographics

Huron County occupies approximately 496 square miles in north central Ohio (Figure 3). It is bounded to the west by Seneca County, to the northwest by Sandusky County, to the north by Erie County, to the east by Lorain County, to the southeast by Ashland County, to the south by Richland County, and to the southwest by Crawford County.

The approximate population of Huron County, based upon year 2000 census estimates, is 59,487 (Department of Development, Ohio County Profiles, 2003). Norwalk is the largest community and the county seat. Agriculture accounts for roughly 78 percent of the land usage in Huron County. Huron County is one of the largest counties in vegetable crop production. Woodlands, primarily in the southern part of the county, account for approximately 18 percent of the land usage. Urban, industrial, and residential are the other major land uses in the county. More specific information on land usage can be obtained from the Ohio Department of Natural Resources, Division of Real Estate and Land Management (REALM), Resource Analysis Program (formerly OCAP).

Climate

The *Hydrologic Atlas for Ohio* (Harstine, 1991) reports an average annual temperature of approximately 50 degrees Fahrenheit for Huron County. The average temperatures decrease towards the south and east. Harstine (1991) shows that the average precipitation ranges from approximately 35 to 36 inches per year for the county with rainfall increasing towards the southeast. The normal annual precipitation at Norwalk is 36.95 inches per year based upon a thirty-year (1971-2000) period (National Oceanic and Atmospheric Administration (NOAA), 2002). The mean annual temperature at Norwalk for the same thirty-year period is 49.3 degrees Fahrenheit (NOAA, 2002).

Physiography and Topography

Huron County lies at the junction of multiple physiographic provinces. Northern Huron County lies within the Eastern Lake Section of the Central Lowlands Province (Frost, 1931; Fenneman, 1938; Bier, 1956; and Totten, 1985), the southwestern portion of the county lies within the Central Till Plains Lowland Province (Frost, 1931; Fenneman, 1938; Bier, 1956; and Totten, 1985) and the eastern portion of the county lies within the Glaciated (Low)

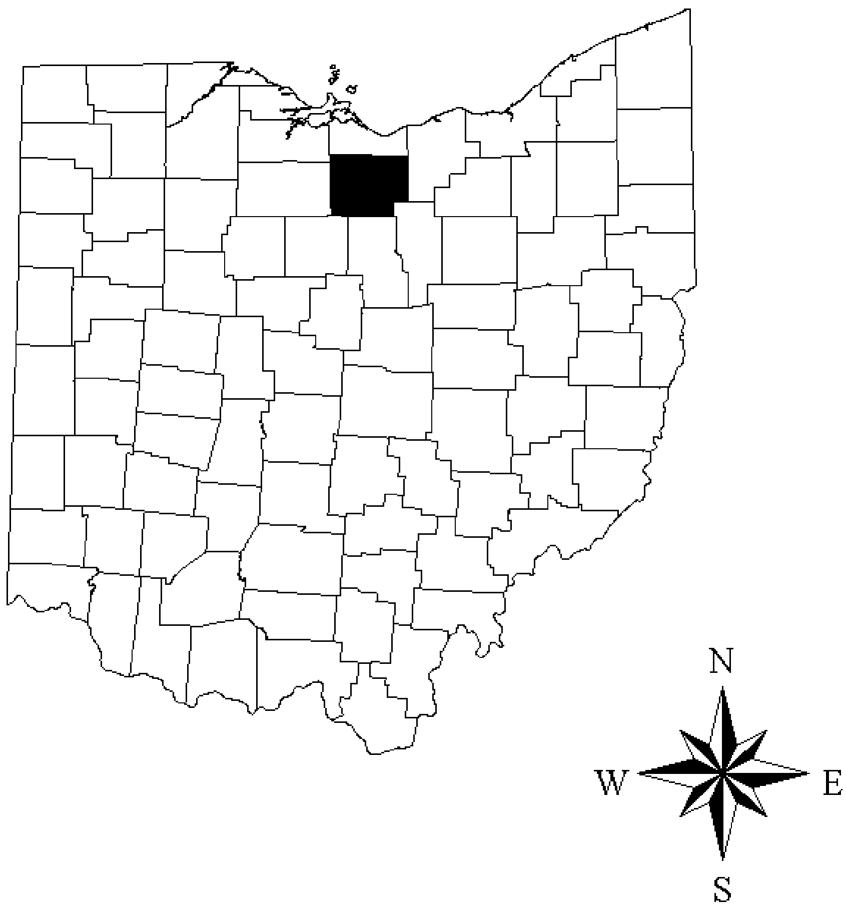


Figure 3. Location of Huron County, Ohio.

Allegheny Plateau Section of the Appalachian Plateau Province (Frost, 1931; Fenneman, 1938; Bier, 1956; and Totten, 1985). Brockman (1987) and Schiefer (2002) recently revaluated the physiography of the entire state and have further subdivided Huron County. Brockman (1998) and Schiefer (2002) indicate that the northwestern corner of Lyme Township is part of the Bellevue-Castalia Karst Plain, an area featuring sinkholes and solution limestone at the surface. The Erie Lake Plain dips southward in the vicinity of Norwalk. Northeastern Huron County is part of the Berea Headlands of the Central Ohio Clayey Till Plain. Southwestern Huron County belongs to the Central Ohio Clayey Till Plain. The southeastern part of the county is part of the Galion Glaciated Low Plateau. The Berea Escarpment, a relatively steep rise caused by the presence of the underlying, erosion-resistant Berea Sandstone, separates the Berea Headlands and the Galion Glaciated Low Plateau from the flatter, lower-lying regions to the north and west. Highly variable topography and relief are found in Richland County. The southern and eastern portions of the county feature rolling to moderately steep, bedrock-controlled ridges due to the nature of the underlying, erosion-resistant, Berea Sandstone. End moraines and stream dissection help make the uplands relatively hummocky through the majority of the county. Very flat, low-relief areas characterize the areas of Lake plain.

Modern Drainage

All but the extreme southwestern corner of Huron County drains into the Lake Erie Basin. The Vermillion River and its tributaries drain the eastern third of the county. The western two thirds of the county is drained by the multiple tributaries and forks of the Huron River. The southwestern corner of the county is drained by the headwaters of Honey Creek, an easterly tributary of the Sandusky River. Tributaries of the Black River drain small portions of southeastern Huron County. Small portions of northwestern Lyme Township drain internally into sinkholes associated with the karst limestone terrain.

Pre- and Inter-Glacial Drainage Changes

The drainage patterns of Huron County have changed as a result of the multiple glaciations. Stout et al. (1943) and Totten (1985) have identified two buried valley systems that represent earlier drainage. Stout et al. (1943) proposed that these drainages were preglacial in origin, whereas Totten (1985) suggested that they might have been interglacial in origin or perhaps a combination. Figures 4 and 5 show the pre-glacial drainage of the Huron County area. The drainage changes are complex and not yet fully understood. More research and data are necessary in both Huron County and adjacent counties. Particularly, well log data for deeper wells that penetrate the entire drift thickness would be helpful in making interpretations.

Prior to glaciation, the drainage in Ohio is referred to as the Teays Stage (Figure 4). The Teays River drained the southern and western two thirds of the state and was the master stream for what is now the upper Ohio River Valley. Other drainages of that age are referred

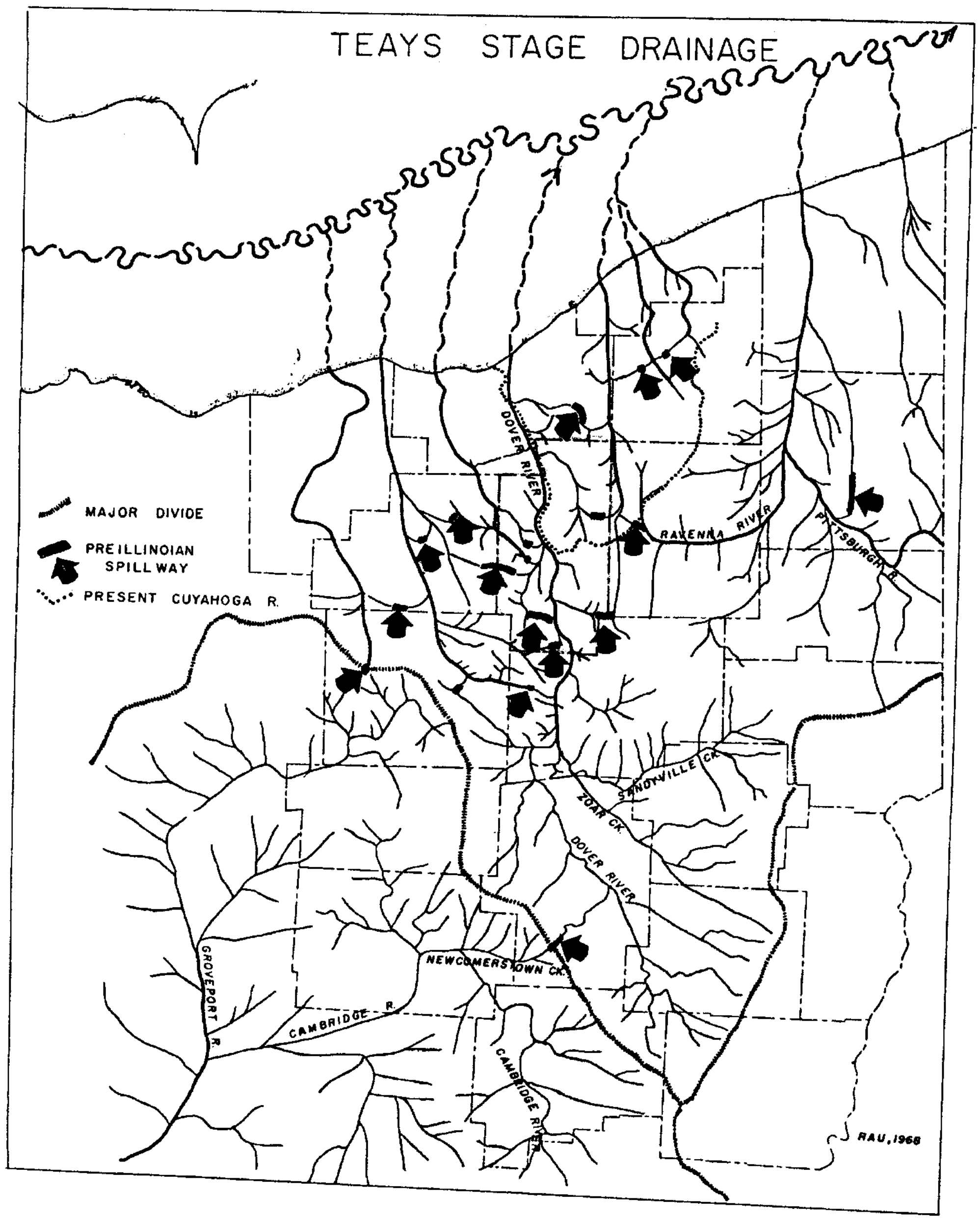


Figure 4. Teays Stage drainage-paleodrainage (after Rau, 1969).

to as Teays Stage even if they did not drain into the Teays River or its tributaries. Stout et al. (1943) showed that Wakeman Creek (or River) was the ancestral river that drained eastern Huron County. Wakeman Creek had a course somewhat similar to and was just to the east of the modern Vermillion River. Stout et al. (1943) showed a second river system that drained western Huron County. Totten referred to this system as the Norwalk River (Figure 5). The Norwalk River had a course similar to and was just east of the present Huron River.

During the numerous ice advances, these stream valleys were filled with drift. Portions of Wakeman Creek have been cut and eroded by tributaries of the Vermillion River (Totten, 1985). The majority of the former Norwalk River channel remained filled with drift (Totten, 1985).

Glacial Geology

During the Pleistocene Epoch (2 million to 10,000 years before present (Y.B.P.)) several episodes of ice advance occurred in northeastern Ohio. Table 9 summarizes the Pleistocene deposits found in Huron County. Older ice advances, which predate the most recent (Brunhes) magnetic reversal (about 730,000 Y.B.P.), are now commonly referred to as pre-Illinoian (formerly Kansan).

The majority of the glacial deposits fall into four main types: (glacial) till, lacustrine, outwash, and ice-contact sand and gravel (kames). Drift is an older term that collectively refers to the entire sequence glacial deposits. Buried valleys may contain a mix of all of these types of deposits. Ancestral stream channels filled with glacial/alluvial sediments are referred to as buried valleys. The buried valleys are filled with differing sequences of coarse sand and gravel outwash, glacial till, ice-contact deposits, finer-grained lacustrine (lake) and modern, silty alluvial or floodplain deposits. These deposits vary with the energy level of the streams at that time. Streams leading away from melting glaciers are high energy and deposit coarser outwash. Streams that are blocked by ice or by thick channel deposits tend to be ponded and filled with finer-grained sediments. Such valleys are also typically filled with till from the advancing ice sheets. As the ice sheets melt within the valleys, both outwash and ice-contact features may be deposited. Modern tributaries, which lead into streams overlying the buried valleys, tend to contain variable thicknesses of sand, gravel, and silty alluvium.

Till is an unsorted, non-stratified (non-bedded) mixture of sand, gravel, silt, and clay deposited directly by the ice sheet. There are two main types or facies of glacial till. Lodgement till is "plastered-down" or "bulldozed" at the base of an actively moving ice sheet. Lodgement till tends to be relatively dense and compacted and pebbles typically are angular, broken, and have a preferred direction or orientation. "Hardpan" and "boulder-clay" are two common terms used for lodgement till. Ablation or "melt-out" till occurs as the ice sheet melts or stagnates away. Debris bands are laid down or stacked as the ice between the bands melts. Ablation till tends to be less dense, less compacted, and slightly coarser as meltwater commonly washes away some of the fine silt and clay.

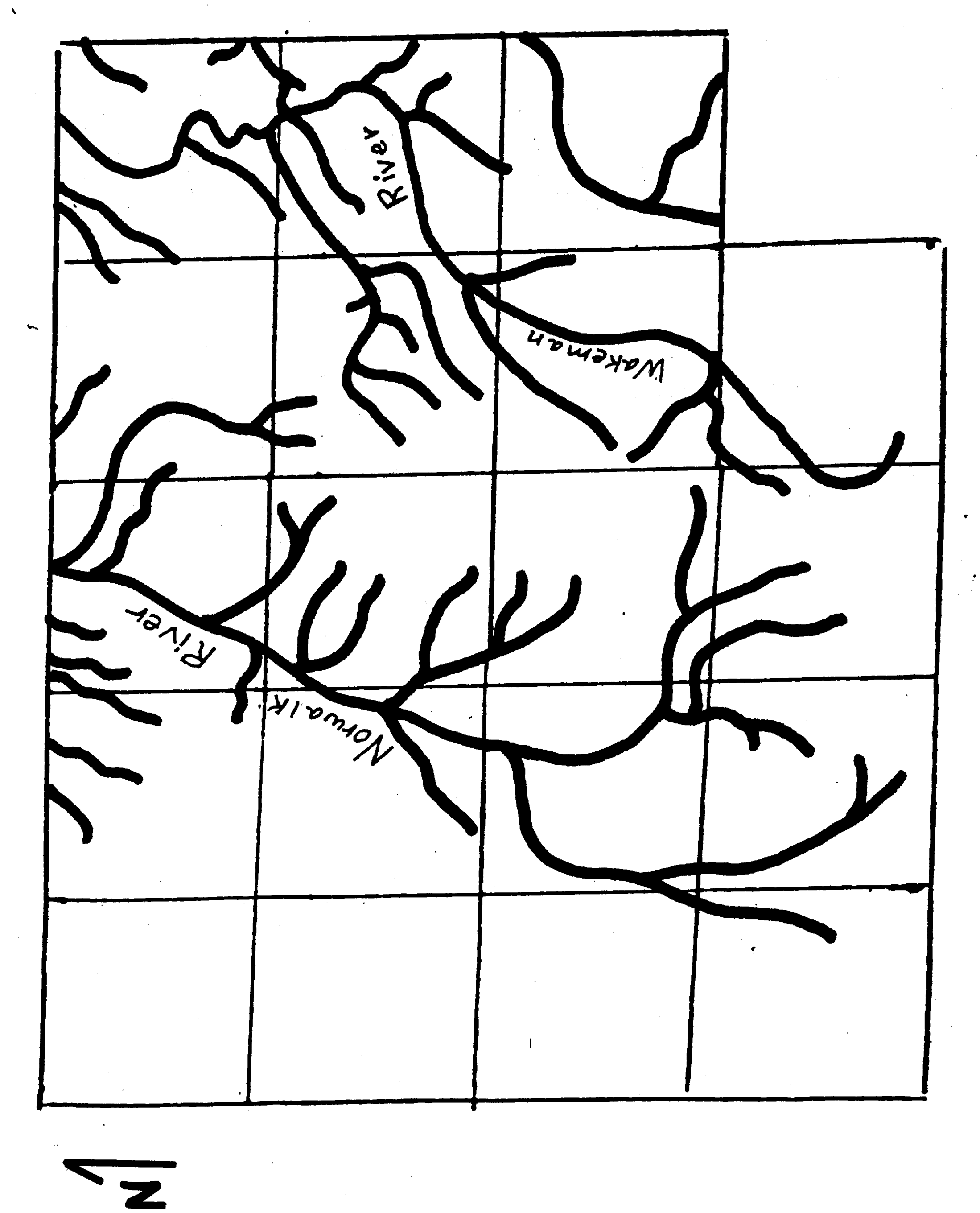


Figure 5. Teays Stage drainage (after Totten, 1985).

Table 9. Generalized Pleistocene stratigraphy of Huron County, Ohio

Epoch	Age (years ago)	Stage	Killbuck Lobe
	25,000 to 70,000	Wisconsinan	Hiram Till Hayesville Till Navarre Till
Pleistocene	70,000 to 120,000	Sangamonian	Buried weathered soil horizon?
	120,000 to 730,000	Iliinoian	Millbrook Till
	730,000 to 2,000,000	Pre-Illinoian	Sediments in deep buried valleys

Till has relatively low inherent permeability. Permeability in till is in part dependent upon the primary porosity of the till which reflects how fine-textured the particular till is. Vertical permeability in till is controlled largely by factors influencing the secondary porosity such as fractures (joints), worm burrows, root channels, sand seams, etc. (Brockman and Szabo, 2000).

At the land surface, till accounts for two primary landforms: ground moraine and end moraine. Ground moraine (till plain) is relatively flat to gently rolling. End moraines are ridge-like, with terrain that is steeper and more rolling or hummocky. Goldthwait et al. (1961) and Pavey et al. (1999) mapped end moraines regionally across the state. The ODNR, Division of Water Open File, Glacial State Aquifer Map (2000) depicts a generalized version of the more prominent moraines across Huron County. Campbell (1955) and Totten (1985) mapped the moraines of Huron County in great detail. Moraines are found in the southern half of Huron County, well to the south of the Lake Plain. The northernmost, the Defiance Moraine, extends across the entire width of the county, passing just north of the towns of Willard and New London. The Delphi Moraine (Totten, 1985) runs from the town of Plymouth northeast toward Hartland Township. The Fort Wayne Moraine lies south of the Defiance Moraine, extending from Plymouth east, passing south of Greenwich. The Wabash Moraine fringes the border with Richland County in southeastern Huron County.

Pre-Illinoian deposits have not been conclusively identified in Huron County (Totten, 1985). Illinoian–age Millbrook Till is limited to only deep excavations or found at the base of deeply incised stream cuts. Illinoian deposits in Huron County may also include subsurface till, lacustrine, outwash, and kames found at depth in the buried valleys in northern Richland County.

During the Wisconsinan (most recent) ice advance, ice advanced into north central Ohio in a series of distinct lobes. These lobes extended from the main ice sheet crossing the Lake Erie basin much like fingers extending from a hand. The Killbuck Lobe extended from eastern Medina County westward past Huron County. Ice movement in the Killbuck Lobe was primarily due south and southeast.

Totten (1985) initially reported that the Millbrook Till was the oldest Wisconsinan-age till in the Killbuck Lobe. Totten (1973), White et al. (1969), and White (1982) believed that these tills were correlative with the Titusville Till found in the Grand River Lobe of northeastern Ohio and northwestern Pennsylvania. The Titusville Till was proposed as being older than 40,000 Y.B.P. based upon radiocarbon (C^{14}) dates from exposures in northwestern Pennsylvania (White et al., 1969). White et al. (1969) and Totten (1985) referred to these tills as being "early" Wisconsinan and being much older than the other overlying Wisconsinan tills.

Current thinking (Totten, 1987 and Eyles and Westgate, 1987) suggests that there was probably insufficient ice available in North America for a major ice advance into the Great Lakes area until the Late Wisconsinan Woodfordian sub-stage (approximately 25,000 Y.B.P.). The age of deposits previously determined to be early to mid-Wisconsinan in age was re-evaluated. The age of the Millbrook Till has since been assigned to the Illinoian.

The Navarre Till of the Killbuck Lobe is the oldest of the Late Wisconsinan Woodfordian tills (Totten, 1985 and White, 1982). This ice advance occurred about 23,000 YBP. The Navarre Till is found at depth in stream cuts and excavations across the county; it always underlies the Hayesville Till and Hiram Till. The Navarre Till is friable (loose), non-compact, sandy, and stony. Sand and gravel lenses are common in these tills.

Following the deposition of the Navarre Till and Knox Lake Till, the late Wisconsinan Woodfordian ice sheet withdrew back to the Lake Erie Basin. This local ice-free interval is referred to as the Erie Interstade. Approximately 19,000 YBP, ice began to re-advance into northern Ohio along both lobes. The tills this time are typically much more clayey and silty, contain less rock fragments, and most of the rock fragments are shaley in nature. It is believed that when the ice re-advanced into the Lake Erie basin, it eroded a significant amount of fine shales and previous lacustrine deposits (White, 1982).

The Hayesville Till is found in shallow excavations and in almost all stream cuts. The Hayesville Till is moderately compact, dense, sparingly to moderately pebbly, and has a clayey-silty texture (Totten, 1985). The till is commonly relatively thick and continuous. The Hayesville Till may be hard to distinguish from the overlying Hiram Till. In places, the Hiram Till is so thin the Hayesville Till may serve in part as parent material to the till-derived soils.

The Hiram Till is the youngest till encountered in Huron County (Totten, 1985 and White, 1982). It is the surficial till found across the entire county. The Hiram Till is relatively soft, non-compact, and sparingly pebbly and has a silty-clay to clayey texture. The fine texture is probably due to the till eroding and incorporating lacustrine deposits or shale bedrock. The Hiram Till may have been deposited in a fairly wet environment transitional between lacustrine and an ablational environment. The Hiram Till is commonly thin;

however, it is thicker in areas of lower relief. The Hiram Till is especially thin along the end moraines in southeastern Huron County.

Lacustrine deposits in Huron County reflect two widely different settings. Lacustrine deposits in northern Huron County are located within the Lake Plain associated with the lake levels of ancestral Lake Erie. Lacustrine deposits in southern Huron County are the result of localized damming as a result of advancing or retreating ice sheets. Typically, lacustrine deposits are composed of fairly dense, cohesive, uniform silt and clay with minor fine sand. Thin bedding, referred to as laminations, is common in these deposits. Such sediments were deposited in quiet, low-energy environments with little or no current.

The southwestern corner of Huron County contains a large lake bed area referred to as Lake Willard. Lake Willard is an example of an intermorainal lake; it occupies the low area of ground moraine between end moraines. The deposits of these lakes are composed of silty to clayey material. The lakes tend to become somewhat finer-grained near the center of the deposit or lake (Campbell, 1955, Totten, 1985, and Russell, 2002). Lacustrine deposits tend to be laminated (or varved) and contain various proportions of silts and clays. Thin layers of fine sand interbedded with the clayey to silty lacustrine deposits may reflect storm or flood events. Permeability is preferentially horizontal due to the laminations and water-laid nature of these sediments. The inherent vertical permeability is slow; however, secondary porosity features such as fractures, joints, root channels, etc. help increase the vertical permeability. Thin layers of sand typically occupy the margins of the lakes. These sands may reflect minor deltas that started to prograde into the lake, or they may mark the rough beginnings of a beach along the shoreline.

Lake Willard was created during the recession of the ice sheets. Meltwater was trapped between the Defiance Moraine and the Fort Wayne Moraine. The receding ice sheet may have also helped function as a temporary dam and blocked or ponded water. Lake Willard eventually drained through Honey Creek. Swampy bog and kettle areas formed on top of the clayey, poorly drained lake deposits. Peat and muck are organic-rich deposits associated with low-lying depression areas, bogs, kettles, and swamps. Muck is a dense, fine silt with a high content of organics and a dark black color. Peat is typically brownish and contains pieces of plant fibers, decaying wood, and mosses. The two deposits commonly occur together, along with the lacustrine clays and silts. Lake Willard contains some of the most extensive peat and muck deposits found anywhere in Ohio. These deposits and the overlying soils have allowed this area to become a leader in the production of vegetable crops. Hodges (1979) studied the nature and age of the deposits of Lake Willard.

Totten (1985) and Campbell (1955) also discussed the likelihood of lacustrine deposits associated within the deeper buried valleys of Huron County. The damming of northerly-flowing streams by the advancing ice sheets typically created the lakes. Smaller, localized lakes could be created along tributaries as they were cut-off from the main trunk streams.

The Lake Plain occupies portions of Norwalk, Ridgefield, Peru, and Lyme Townships. On the Lake Plain, the pre-existing ground moraine has been modified by wave activity. This roughly corresponds to elevations below 800 feet above mean sea level (msl). The till has been “wave-planed” or “water-modified” (Forsyth, 1965) at the land surface. Wave activity has eroded away previously existing topographic features. The resulting land surface is flat, gently sloping towards Lake Erie and Sandusky Bay.

The Lake Plains region of Ohio was flooded immediately upon the melting of glacial ice due to its basin-like topography. River flow into the basin also contributed to the formation of these lakes. Various drainage outlets in Indiana, Michigan, and New York controlled lake levels over time.

This series of lakes, from ancestral Lake Maumee to modern Lake Erie, had a profound influence on the surficial deposits and geomorphology of the area. Shallow wave activity had a beveling affect on the topography. Clayey to silty lacustrine sediments were deposited in deeper, quieter waters. In shallower areas, beaches and bars were formed. Some of the beach ridge sand and gravel was deposited by in situ erosion (Anderhalt et al., 1984); the remainder was transported in by local rivers and then re-deposited by wave activity. Coarser sand and gravel was deposited at the shoreline (strandline). Progressively offshore, finer sands, then silts, and then clay were deposited. This accounts for the variable soil types which progress from sands, to sandy loams, to silty loams, to either clays or shrink-swell clays.

The major beach levels in Huron County are listed in Table 10. Forsyth (1959 and 1973) gives a detailed discussion of the beach levels and lake history in northwestern Ohio. Campbell (1955) and Totten (1985) discuss the beach ridges and their sequence of formation in Huron County in great detail. The beaches form long and narrow low ridges of sand. Coarser sand and gravel form the core of the ridges. Thin sheets of fine sand may lie between the ridges. Wind activity has reworked the beach ridges creating dunes. Dunes cap many of the beach ridges, making it difficult to distinguish the features.

Outwash deposits are created by active deposition of sediments by meltwater streams. These deposits are generally bedded or stratified and are sorted. Outwash deposits in Huron County are commonly associated with buried valleys and are usually adjacent to modern streams. Outwash deposits associated with stream valleys were referred to in earlier literature as valley trains. Sorting and degree of coarseness depend upon the nature and proximity of the melting ice sheet. Braided streams usually deposited the outwash. Such streams have multiple channels, which migrate across the width of the valley floor, leaving behind a complex record of deposition and erosion. As modern streams downcut, the older, now higher elevation, remnants of the original valley floor are called terraces. Campbell (1955) and Totten (1985) have delineated the major outwash terraces in the county. The majority of the outwash terraces in Huron County flank the floodplains of the Huron River or Vermillion River.

Kames and eskers are ice contact features. They are composed of masses of generally poorly sorted sand and gravel with minor till, deposited in depressions, holes, tunnels, or other cavities in the ice. As the surrounding ice melts, a mound of sediment remains behind. Typically, these deposits may collapse or flow as the surrounding ice melts. These deposits may display high angle, distorted or tilted beds, faults, and folds. In Huron County, the

Table 10. Lake level sequence (after Forsyth, 1959 and 1973)

Lake Stage	Age (Years B.P)	Elevation (ft.)	Outlet	Found in Huron County
Erie (modern)	4,000	573	Niagara	no
Algonquin	> 12,000	605	Grand River, Mi or Mohawk River, N.Y.	no
Lundy	>12,200	?	Grand River, Mi or Mohawk River, N.Y.	no
(Elkton)		615	Grand River, Mi or Mohawk River, N.Y.	no
(Dana)		620	Grand River, Mi or Mohawk River, N.Y.	no
(Grassmere)		640	Grand River, Mi	no
Lower Warren		675	Grand River, Mi or Mohawk River, N.Y.	no
Wayne		655-660	Grand River, Mi or Mohawk River, N.Y.	no
Upper Warren	<13,000	685-690	Grand River, Mi.	no?
Whittlesey	>13,000	735	Grand River, Mi	yes
Lower Arkona		700	Grand River, Mi	yes
Upper Arkona		710-715	Grand River, Mi	yes
Middle Maumee	14,000	775-780	Wabash River, In	yes
Lower Maumee		760	Grand River, Mi	yes
Upper Maumee		800	Wabash River, In	yes

majority of the kames are deposited along the margins or flanks of valleys, particularly within the headwaters of the drainage systems. These kames tend to coalesce along the valley margins. Such features are referred to as kame terraces. Kame terraces are a linear belt of kames that have a similar appearance and a fairly uniform elevation. They represent deposition of materials between the melting ice sheet and the bedrock and till slopes flanking the ice-filled valleys. Eskers are elongate, sinuous deposits that marked deposition by drainage channels beneath the ice sheet. Crevasse fills are similar except that they occurred at the top of the ice sheet or within the ice sheet.

The kame deposits in some areas are immediately adjacent to outwash deposits. In these areas, the outwash deposits are commonly lower elevation and are flat lying, whereas the kame deposits have their characteristic rolling to hummocky nature. In Huron County both surficial kame deposits and outwash terraces generally lie above the water table. Although not saturated, the kame deposits and outwash terraces are commonly highly permeable and provide conduits for water movement. Buried or lower elevation kames and outwash terraces may be saturated. Totten (1985) and Campbell (1955) delineate the kames and eskers in Huron County.

Kames are most abundant in the vicinity of Plymouth and New Haven. Water percolating through these features probably help preserve the locally shallow water table found in Lake

Willard. An esker referred to by Totten (1985) as the Norwalk Esker flanks the west side of the Huron River.

Bedrock Geology

Bedrock varies widely in Huron County from west to east. Table 11 summarizes the bedrock stratigraphy found in Huron County. The ODNR, Division of Geological Survey, has Open-File Reconnaissance Bedrock Geological Maps done on a 1:24,000 scale USGS topographic map base available for the entire county. The ODNR, Division of Water, has Open File Bedrock State Aquifer mapping available for the county also.

The Devonian Columbus and Delaware Limestones are the oldest bedrock units exposed in Huron County. The Delaware is a gray-brown, thin-bedded to massive, argillaceous, carbonaceous limestone. The Columbus is a gray to brown, fossiliferous, massive-bedded limestone and dolomite. Karst features commonly occur in the Columbus. The Delaware and Columbus Limestones are limited to the northwest corner of Huron County. Underlying the Delaware and Columbus Limestones are Silurian-age dolomites and limestones. These rocks were deposited in warm, high-energy seas and reef areas.

The Devonian Ohio Shale forms a fairly wide band across western Huron County. The Ohio Shale is a brownish black to greenish gray thin-bedded carbonaceous shale. It is commonly found with carbonate/siderite concretions in the lowermost 50 feet of the formation. The Ohio Shale is typically fractured and contains a high degree of organic matter, pyrite, petroleum, and is also very mildly radioactive. The Ohio Shale was deposited in deep oceans that had limited circulation of fresher waters and sediments. Organic material was slow to decompose in the oxygen-starved, stagnant water. The Olentangy Shale is greenish gray to medium gray, thin-bedded, and contains limestone nodules in the lower third of the formation.

The Mississippian Bedford Shale forms a fairly narrow north-south band in central Huron County. The Bedford Shale is a gray to brown or reddish-brown shale with interbedded sandstone and siltstone. It is comprised of very fine-grained silt and clay particles deposited in the outer (distal) margins of a delta.

The Mississippian Berea Sandstone is found across the eastern half of Huron County. It is a fine- to medium-grained, light greenish-gray to brown sandstone that may contain minor shale interbeds. The thickness seldom exceeds 100 feet. The Berea Sandstone consisted of river channel and bank sediments deposited along the proximal or near-shore edge of a broad delta. The upper part of the Berea Sandstone appears to have been formed as encroaching marine waters submerged the sediments. The sediments were then re-deposited along adjacent shorelines (Rau, 1969).

Table 11. Bedrock stratigraphy of Huron County, Ohio

System	Group/Formation (Symbol)	Lithologic Description
Mississippian	Cuyahoga Formation (Mcg)	Gray to brown shale with thin sandstone and siltstone interbeds. Thickness commonly greater than 100 feet. Yields range from 5 to 25 gpm. Occupies uplands in eastern Huron County.
	Sunbury Shale (Ms)	The Sunbury Shale is a brownish-black to greenish-gray thin-bedded fissile shale. Poor aquifer, yields less than 5 gpm. Limited to southeastern Huron County.
	Berea Sandstone (Mb)	Fine- to medium-grained, light greenish-gray to brown sandstone. Thickness is typically <100 feet. Yields average 5-25 gpm. Found in eastern Huron County.
	Bedford Shale (Mbd)	Gray to reddish brown shale with minor siltstone. Thickness less than 100 feet. Poor aquifer, yields less than 5 gpm. Found in central Huron County.
Devonian	Ohio and Olentangy Shales (Dohol)	Black to brownish-black, thin-bedded, organic, pyritic, carbonaceous shale. Thickness >100 feet in western Huron County. Poor aquifer, typically yielding <5 gpm.
	Delaware and Columbus Limestones (Ddc)	The Delaware is a gray to brown thin-bedded to massive, argillaceous, carbonaceous limestone. The Columbus is a gray to brown, fossiliferous, massive-bedded limestone and dolomite. Karst features are common in the Columbus. Limited to northwestern Huron County, these units are <100 feet in thickness. Yields are usually 5-100 gpm. Thickness and yields for these formations decrease toward the western edge of the county. The water quality deteriorates in areas where these units are overlain by thick Ohio and Olentangy Shale.

The Mississippian Sunbury Shale is limited to the southeastern corner of Huron County. The Sunbury Shale is a brownish black to greenish gray thin-bedded carbonaceous shale. It is commonly found with carbonate/siderite concretions in the lowermost 50 feet of the formation. The Sunbury Shale is typically fractured and contains a high degree of organic matter, pyrite, petroleum, and is also very mildly radioactive. The Sunbury Shale was deposited in deep oceans that had limited circulation of fresher waters and sediments. Organic material was slow to decompose in the oxygen-starved, stagnant water.

The Mississippian Cuyahoga Formation occupies the rounded uplands of eastern Huron County. The Cuyahoga Formation consists of interbedded sandstones, siltstones, and shales that represent deltaic to fluvial sediments deposited in a rapidly fluctuating, shoreline environment. The Cuyahoga Formation becomes thicker and contains a higher proportion of sandstone in the southeast corner of Greenwich Township. The Cuyahoga Formation tends to become thinner and more shale-rich in the northern portion of the county.

Ground Water Resources

Ground water in Huron County is obtained from both unconsolidated (glacial-alluvial) and consolidated (bedrock) aquifers. Glacial aquifers are primarily associated with buried valleys and end moraines. Glacial aquifers are more commonly utilized where the underlying bedrock is low-yielding shale as opposed to limestone or sandstone.

Yields ranging between 100-500 gpm are obtainable from the coarse, well-sorted sand and gravel outwash deposits in the vicinity east of the town of Willard and for portions of the buried valley north of Norwalk (ODNR, Division of Water Open File, Glacial State Aquifer Map, 2000, and Hartzell, 1986). Test drilling or geophysical methods are recommended to help locate the higher yielding zones. Proper well construction and development is also needed to insure the high sustainable yields capable from these larger diameter wells. Smaller diameter wells should be suitable for serving domestic/farm needs within this aquifer.

Yields of 25 to 100 gpm are obtained from wells drilled in outwash, lacustrine, alluvial, or kame deposits. These areas include portions of buried valleys adjacent to the higher-yielding intervals. Typically, these deposits are thinner, less coarse, and are not as clean or well-sorted as the above, higher-yielding aquifers. They also may not have nearby overlying streams. The sand and gravel units may be interbedded with finer-grained silty to clayey lacustrine or alluvial deposits or till. (ODNR, Division of Water Open File Glacial State Aquifer Map, 2000 and Hartzell, 1986).

Yields of 5 to 25 gpm are obtained from thin lenses of sand and gravel interbedded with glacial till where the drift is of adequate thickness. This includes areas of ground moraine and end moraine in southwestern and eastern Huron County. In some portions of northwestern and eastern Huron County, the drift is too thin to be utilized as an aquifer and the presence of good, underlying sandstone or limestone aquifers helps minimize the number of wells completed in the drift found in these locales (ODNR, Division of Water Open File, Glacial State Aquifer Map, 2000 and Hartzell, 1986).

Yields from the consolidated, bedrock aquifers throughout the county are variable. The highest-yielding bedrock aquifers are the highly solutioned, fractured Silurian limestone and dolomites found at depth in northwestern Lyme Township. These units yield over 100 gpm (ODNR, Division of Water, Bedrock State Aquifer Map, 2000 and Hartzell, 1986). Yields of 25-100 gpm are obtained from the Devonian-age Delaware and Columbus Limestone. For roughly a mile or two past the contact between the shale and carbonates, the underlying limestone and dolomite remain the aquifer. To the east and south, the shale becomes too thick and the ground water quality becomes marginal, which prevents further utilization of the limestone as an aquifer (ODNR, Division of Water, Bedrock State Aquifer Map, 2000 and Hartzell, 1986). The Devonian Ohio and Olentangy Shale and the Mississippian Bedford Shale are both poor aquifers. Typically, the uppermost 10 to 15 feet of the shale is weathered and broken and provides the most water. Wells drilled deeper into the shale provide increased well storage, but typically little additional water. Historically, shallow dug wells have been common in the shale. The water quality becomes more objectionable with depth.

Yields of 5 to 25 gpm are obtained from the Berea Sandstone in much of eastern Huron County (ODNR, Division of Water, Bedrock State Aquifer Map, 2000 and Hartzell, 1986) The Sunbury Shale in southeastern Huron County is a poor aquifer similar to the Devonian Ohio and Olentangy Shale. Yields ranging from 5 to 25 gpm are associated with the interbedded shales, fine-grained sandstones, and siltstones of the Cuyahoga Formation in southern Greenwich Township. Units of the Cuyahoga Formation to the north of this area are usually too thin or too shaley to be used as aquifers. Wells are finished in the underlying Berea Sandstone in these areas.

The yield in any particular area is dependent upon the number and type of formations through which the well is drilled. Wells drilled to bedrock often intersect several aquifers or water producing zones. Sandstones and conglomerates tend to be better water-bearing units than shales or siltstones. Water tends to "perch" or collect on top of lower permeability units (e.g. shale) and move laterally along the base of an overlying unit with higher permeability (e.g. sandstone). Springs and seeps mark where these contacts meet the slope or land surface. The number of fractures and bedding planes intersected by the well also influences yields. The amount of fracturing tends to increase along hill slopes and valleys. Fracturing is also an influence on the direction of ground water flow (Schubert, 1980) and affects the amount of recharge.

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APPENDIX A
DESCRIPTION OF THE LOGIC IN FACTOR SELECTION

Depth to Water

This factor was primarily evaluated using information from water well log records on file at the Ohio Department of Natural Resources (ODNR), Division of Water, Water Resources Section (WRS). Approximately 5,000 water well log records are on file for Huron County. Data from roughly 2,200 located water well log records were analyzed and plotted on U.S.G.S. 7-1/2 minute topographic maps during the course of the project. Static water levels and information as to the depths at which water was encountered were taken from these records. The *Ground Water Resources of Huron County* (Hartzell, 1986) provided generalized depth to water information throughout the county. Depth to water trends mapped in adjoining Erie County (Smith, 1994), Lorain County (Barber, 1988), Sandusky County (Angle, 1991), Seneca County (Smith and Voytek, 1994), Crawford County (Angle and Russell, 2003), and Richland County (Angle, 2003) were used as a guideline.

Depths to water of 0 to 5 feet (10) were assigned to portions of central Huron County where the sandstone aquifers were close to the surface and maintained a very high static water level (i.e. very shallow to the water table). Depths to water of 5 to 15 feet (9) were common and associated with aquifer adjacent to streams, beach ridges, areas with shallow sand and gravel aquifers, and areas with shale bedrock. Depths of 15 to 30 feet (7) were very common across the county and were used for aquifer adjacent to streams, areas of ground moraine and many areas where till overlies sandstone or shale. Depths of 30 to 50 feet (5) were utilized for areas of thicker drift in western Huron County, especially areas associated with end moraines or the buried valley. Depths to water of 30-50 feet were also used for area of till over limestone bedrock. Depths to water of 50 to 75 feet (3) were selected for some of the higher moraine crests and for some of the areas with deeper wells in solution limestone. Depths to water of 75 to 100 feet (2) were applied to some of the deep, solution (karst) limestone aquifers.

Net Recharge

Net recharge is the precipitation that reaches the aquifer after evapotranspiration and run-off. This factor was evaluated using many criteria, including depth to water, topography, soil type, surface drainage, vadose zone material, aquifer type, and annual precipitation. General estimates of recharge provided by Pettyjohn and Henning (1979) and Dumouchelle and Schiefer (2002) proved to be helpful. Recharge ratings from adjoining Erie County (Smith, 1994), Lorain County (Barber, 1988), Sandusky County (Angle, 1991), Seneca County (Smith and Voytek, 1994), Crawford County (Angle and Russell, 2003), and Richland County (Angle, 2003) were used as a guideline.

Recharge values of 10+ inches per year (9) and 7 to 10 inches per year (8) were used for areas with karst limestone. Values of 4 to 7 inches per year (6) were used for areas with moderate recharge. These areas include areas with a depth to water of 15 feet or less or with a depth to water of 15-30 feet and having relatively coarse-grained soils, particularly the beach ridges. Values of 2 to 4 inches per year (3) were utilized for the remaining portions of the county as these areas were identified as having a greater depth to water and finer-grained soils and vadose zone media.

Aquifer Media

Information on evaluating aquifer media was obtained from the reports and maps of Hartzell (1986), Campbell (1955), Totten (1985), Division of Water (1961), Herdendorf (1966), and Rau (1969). Open File Bedrock Reconnaissance Maps and Open File Bedrock Topography Maps, based upon U.S.G.S. 7-1/2 minute topographic maps from the ODNR, Division of Geological Survey proved helpful. The ODNR, Division of Water, Glacial State Aquifer Map (2000) and Bedrock State Aquifer Map (2000) were an important source of aquifer data. Aquifer media data from adjoining Erie County (Smith, 1994), Lorain County (Barber, 1988), Sandusky County (Angle, 1991), Seneca County (Smith and Voytek, 1994), Crawford County (Angle and Russell, 2003), and Richland County (Angle, 2003) were used as a guideline. Water well log records on file at the ODNR, Division of Water, were the primary source of aquifer information.

An aquifer rating of (10) was assigned to the karst limestone due to the high amount of solution and the high potential yields of these units. The degree of vulnerability of these aquifers is addressed by the Division of Water (1961) report. An aquifer rating of (8) was used for the non-karst or massive limestone bordering Erie County. Aquifer ratings for the Berea Sandstone varied from (4) to (5) depending upon factors such as yield, draw down, and thickness of the unit. Typically, an aquifer rating of (2) was used for shale; in areas with higher yields, a rating of (3) was selected.

Aquifer ratings of (7) and (8) were applied to sand and gravel lenses that were thicker, coarser, better sorted, and cleaner. These sand and gravel units are typically associated with the 7D-Buried Valley setting, the Lake Willard area, and certain areas of end moraine that feature higher yields. Aquifer ratings of (6), (5), and (4) were selected for the remaining sand and gravel aquifers. These units are typically, thinner, less continuous lenses of sand and gravel interbedded in thicker sequences of fine-grained till, lacustrine, or alluvial deposits. The sand and gravel in these lenses tends to be less coarse, clean, and well sorted. The ratings are determined by factors such as yield, draw down and descriptions from well logs and from discussions from the reports

Soils

Soils were mapped using the data obtained from the *Soil Survey of Huron County* (Ernst and Martin, 1994). Each soil type was evaluated and given a rating for soil media.

Evaluations were based upon the texture, permeability, and shrink-swell potential for each soil material. The soils of Huron County showed a high degree of variability. This is a reflection of the parent material. Table 12 is a list of the soils, parent materials, setting, and corresponding DRASTIC values for Huron County.

Soils were considered to be thin or absent (10) in small locales in northwestern Huron County. Wave erosion of the former lakes was influential in eroding away most of the overlying drift. Sand (9) was evaluated as the soil media for areas of beach ridges and sand dunes. Shrink-swell (aggregated) clays (7) were evaluated for limited areas adjacent to Seneca County, where the till thinly overlies deteriorating limestone. Sandy loams (6) were selected for soils overlying outwash terraces, kames and beach ridges. Sandy loams (6) were also chosen for areas where residual sandstone bedrock was close to the surface. Loam soils (5) were designated for soils derived from loamy deltaic or lacustrine sediments, some alluvial and coarser, ablational glacial till. Silty Loam (4) was selected for a number of alluvial and till-derived soils, especially along end moraines. Clay loam (3) was assigned as soil media for till in most areas of ground moraine. Soils were rated as being muck (2) for the numerous organic soils in depressions or kettles associated with Lake Willard.

Topography

Topography, or percent slope, was evaluated using U.S.G.S. 7-1/2 minute quadrangle maps and the *Soil Survey of Huron County* (Ernst and Martin, 1994).

Slopes of 0 to 2 percent (10) and 2 to 6 percent (9) were selected for the vast majority of Huron County including flat-lying floodplains, valley floors, lake plain, and ground moraine. Slopes of 6 to 12 percent (5) were used primarily for steeper, hummocky portions of end moraines. Slopes of 12 to 18 percent (3) and greater than 18 percent (1) were selected for steeper slopes caused by sharp downcutting of adjacent streams in higher relief, upland areas.

Impact of the Vadose Zone Media

Information on evaluating vadose zone media was obtained from the reports and maps of Hartzell (1986), Campbell (1955), Totten (1985), and Division of Water (1961). Vadose zone media data from adjoining Erie County (Smith, 1994), Lorain County (Barber, 1988), Sandusky County (Angle, 1991), Seneca County (Smith and Voytek, 1994), Crawford County (Angle and Russell, 2003), and Richland County (Angle, 2003) proved useful as a guideline for evaluating vadose zone materials. Open File Bedrock Reconnaissance Maps based upon U.S.G.S. 7-1/2 minute topographic maps from the ODNR, Division of Geological Survey proved helpful. The ODNR, Division of Water, Glacial State Aquifer Map and Bedrock State Aquifer Map were an important source of vadose zone media data. Information on parent materials derived from the *Soil Survey of Huron County* (Ernst and Martin, 1994), also proved useful in evaluating vadose zone materials. Water well log records on file at the ODNR, Division of Water, were the primary source of information on vadose zone media for the county.

Table 12. Huron County soils

Soil Name	Parent Material or Setting	DRASTIC Rating	Soil Media
Alexandria	Silty Till	3	Clay loam
Bennington	Clayey till	3	Clay loam
Bixler	Beach ridges	9	Sand
Blount	Silty till	3	Clay loam
Brecksville	Shale bedrock	10	Thin or absent
Cardington	Silty till	3	Clay loam
Carlisle	Bogs, depressions	2	Muck
Castalia	Limestone	10	Thin or absent
Chili	Outwash, kames	6	Sandy loam
Colwood	Loamy lacustrine, deltaic	5	Loam
Condit	Clayey till	3	Clay loam
Elnora	Beach ridge, dune	9	Sand
Fries	Shale	10	Thin or absent
Glynwood	Loamy till	3	Clay loam
Haskins	Loamy outwash over till	5	Loam
Holly	Coarse alluvium	6	Sandy loam
Jimtown	Outwash, kames, beach ridges	6	Sandy loam
Kibbie	Beach ridge	6	Sandy loam
Lenawee	Fine lacustrine	3	Silty loam
Linwood	Bogs, depressions	2	Muck
Lobdell	Alluvium, floodplain	4	Silt loam
Millsdale	Till over limestone	7	Shrink-swell clay
Milton	Limestone	10	Thin or absent
Miner	Clayey till	3	Clay loam
Mitiwanga	Till over sandstone	10	Thin or absent
Orrville	Alluvium, floodplain	4	Silt loam
Oshtemo	Beach ridge	6	Sandy loam
Otisville	Beach ridge	6	Sandy loam
Pandora	Fine till	3	Clay loam
Pewamo	Clayey till	3	Clay loam
Pinnebog	Bogs, depressions	2	Muck
Prout	Weathered limestone	10	Thin or absent
Saylesville	Silty lacustrine	4	Silty loam
Shinrock	Clayey lacustrine	3	Clay loam
Spinks	Beach ridge, dune	9	Sand
Tioga	Alluvium, floodplain	5	Loam
Tiro	Lacustrine over till	3	Clay loam
Tuscola	Outwash, kames, beach ridges	6	Sandy loam
Walkill	Kettle, depression	8	Peat

Vadose zone media was given ratings of (10) or (8) for areas with karst limestone in northwestern Huron County. The Division of Water (1961) report discussing the contamination in the Bellevue area helps to illustrate the vulnerability of these vadose zone media. Vadose zone media ratings of (8) and (7) were selected for thin deposits of sand and gravel which directly overlie karst limestone or other shallow bedrock. Vadose zone media ratings of (7) and (6) were selected for thinner, finer-grained sand and gravel lenses that directly overlie the aquifer. Sand and gravel with silt and clay was used to denote areas with glacial till as these are the primary materials composing the till. The ratings for the sand and gravel with silt and clay include (7), (6), (5), (4), and (3) depending upon how thick these materials are, with thicker sequences given the lower ratings. Silt and clay with ratings of (3), (4), and (5) were selected for vadose zone media for floodplains, lacustrine deposits, and for some areas reported as clay in the water well log records where further differentiations could not be made.

Hydraulic Conductivity

Values for hydraulic conductivity were inferred from the map of Hartzell (1986). Mapping in adjoining Erie County (Smith, 1994), Lorain County (Barber, 1988), Sandusky County (Angle, 1991), Seneca County (Smith and Voytek, 1994), Crawford County (Angle and Russell, 2003), and Richland County (Angle, 2003) were used as a guideline for determining the range of hydraulic conductivity values. The ODNR, Division of Water, Glacial State Aquifer Map (2000) and Bedrock State Aquifer Map (2000) proved valuable. Water well log records on file at the ODNR, Division of Water, were the primary sources of information. Textbook tables (Freeze and Cherry, 1979, Fetter, 1980, and Driscoll, 1986) were useful in obtaining estimated values for hydraulic conductivity in a variety of sediments.

Values for hydraulic conductivity correspond to aquifer ratings; i.e., the more highly rated aquifers have higher values for hydraulic conductivity. A hydraulic conductivity of greater than 2,000 gpd/ ft^2 (10) was selected for karst limestone aquifers. A hydraulic conductivity of 1,000-2,000 gpd/ft^2 (8) was selected for the massive limestone aquifer bordering Erie County. Sand and gravel aquifers were given ratings of 300-700 gpd/ft^2 (4), 100-300 gpd/ft^2 (2), or 1-100 gpd/ft^2 (1) depending upon how coarse, clean, and thick these deposits are and the yield obtained from these aquifers. Sandstone and shale aquifers were assigned hydraulic conductivity values of 1-100 gpd/ft^2 (1).

APPENDIX B

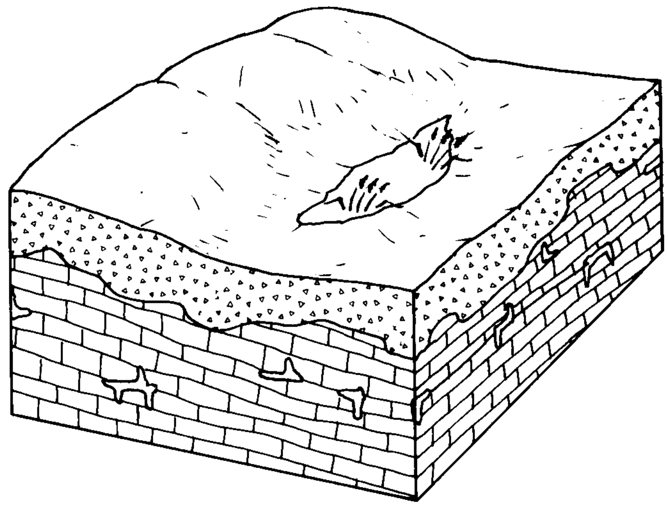
DESCRIPTION OF HYDROGEOLOGIC SETTINGS AND CHARTS

Ground water pollution potential mapping in Huron County resulted in the identification of nine hydrogeologic settings within the Glaciated Central Region. The list of these settings, the range of pollution potential index calculations, and the number of index calculations for each setting are provided in Table 13. Computed pollution potential indexes for Huron County range from 80 to 217.

Table 13. Hydrogeologic settings mapped in Huron County, Ohio

Hydrogeologic Settings	Range of GWPP Indexes	Number of Index Calculations
7Ac-Glacial till over limestone	150-217	23
7Ad-Glacial till over sandstone	81-152	94
7Ae-Glacial till over shale	80-129	37
7Af-Sand and gravel interbedded in glacial till	90-147	61
7C-Moraine	83-144	149
7D-Buried valley	81-131	23
7Ec-Alluvium over bedded sedimentary rock	126-130	2
7Ed-Alluvium over glacial till	110-152	15
7H-Beaches, beach ridge, and sand dunes	81-165	32

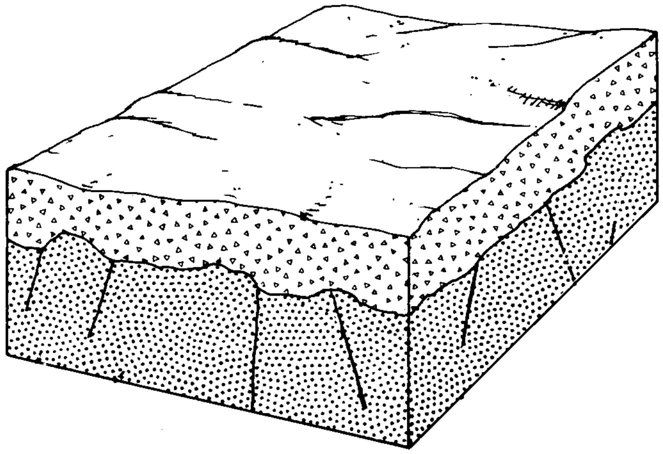
The following information provides a description of each hydrogeologic setting identified in the county, a block diagram illustrating the characteristics of the setting, and a listing of the charts for each unique combination of pollution potential indexes calculated for each setting. The charts provide information on how the ground water pollution potential index was derived and are a quick and easy reference for the accompanying ground water pollution potential map. A complete discussion of the rating and evaluation of each factor in the hydrogeologic settings is provided in Appendix A, Description of the Logic in Factor Selection.



7Ac Glacial Till Over Limestone

This hydrogeologic setting is limited to the northwestern corner of Huron County. This setting is associated with an area of fairly low relief and karst (“sinkhole”) topography. The aquifer consists of the Columbus and Delaware Limestones and underlying Silurian age dolomites. Most of the limestone displays karst or solution features. Varying thicknesses of glacial till typically overlies the aquifer. The various till units commonly weather into either silt loams or clay loams. In some areas, thin sandy beach deposits may overlie the till. Where the till or sand is very thin, the limestone may be right at the land surface. In such areas the soil is rated as thin or absent and limestone is the vadose zone media. The depth to water is variable, averaging from 15 to 30 feet in areas adjacent to margins of the karst area to very deep wells within the karst area. Recharge is typically high to moderate due to the internal drainage of the sinkholes, and depending upon the depth to water and how thick the overlying till is.

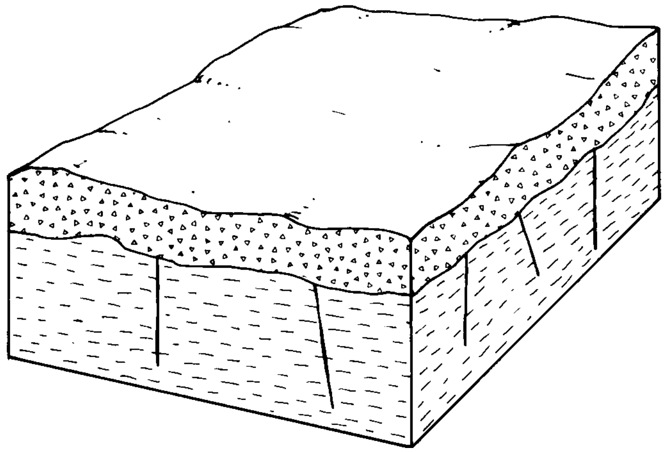
GWPP index values for the hydrogeologic setting of glacial till over limestone range from 150 to 217, with the total number of GWPP index calculations equaling 23.



7Ad Glacial Till over Sandstone

This hydrogeologic setting is common throughout much of eastern Huron County. This setting is characterized by relatively flat-lying to gently rolling topography. The aquifer commonly consists of fractured, fine-grained sandstone. In some areas, wells may be completed in thin sand or gravel lenses or thin layers of shale overlying the sandstone. Depths to water are commonly fairly shallow, averaging less than 30 feet. Soils are clay loams, loams, or silt loams derived from the underlying tills. The vadose zone is commonly fractured till and was denoted as sand and gravel with significant silt and clay or as silt and clay depending upon the texture of the till and how it weathers. Yields commonly average 5 to 25 gpm. Recharge is commonly moderate to low due to low permeability soils and vadose and moderate to shallow depth to water.

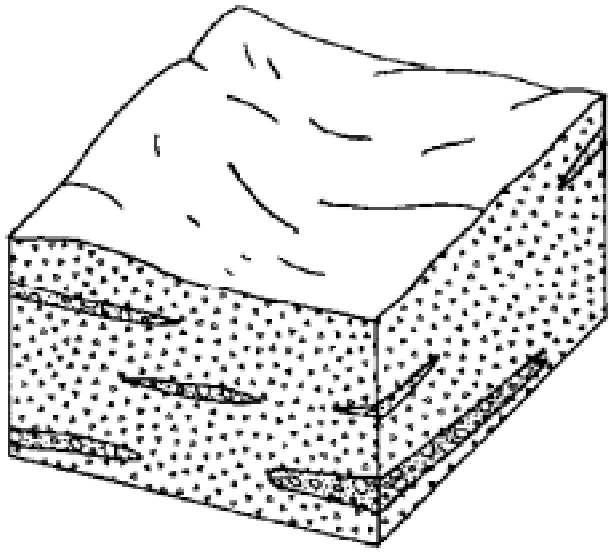
GWPP index values for the hydrogeologic setting of glacial till over sandstone ranges from 81 to 152, with the total number of GWPP index calculations equaling 94.



7Ae Glacial Till over Shale

This hydrogeologic setting is common in western and northern Huron County. This setting is characterized by relatively flat-lying to gently rolling topography. In a few areas, the topography may be steep due to downcutting by the Huron River. The setting is associated with clayey glacial till overlying shaley bedrock of the Devonian Ohio and Olentangy Shales or the Mississippian Bedford Shale. Wells are completed in the shale and siltstone bedrock. Yields are commonly less than 5 gpm. Soils are clay loams, loams, or silt loams derived from the underlying tills. The vadose zone is commonly fractured till and was denoted as sand and gravel with significant silt and clay or as silt and clay depending upon the texture of the till and how it weathers. Depths to water are commonly shallow, averaging less than 20 feet. Recharge is moderate to low due to the low permeability of the soils, vadose, and aquifer media itself and the very shallow depth to water.

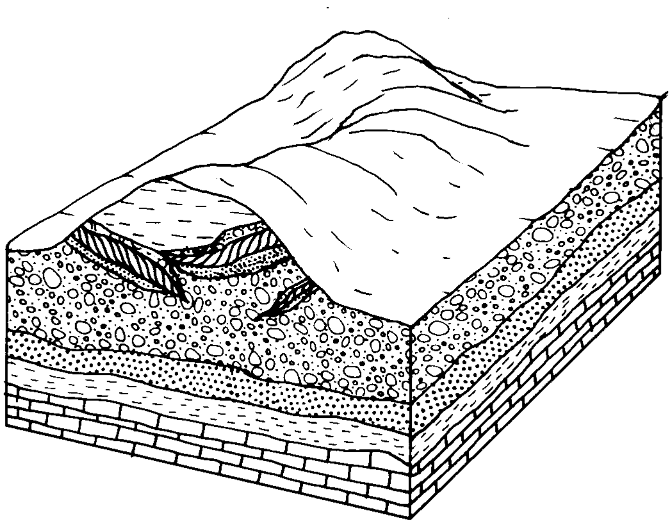
GWPP index values for the hydrogeologic setting of glacial till over shale ranges from 80 to 129, with the total number of GWPP index calculations equaling 37.



<u>7Af Sand and Gravel Interbedded in Glacial Till</u>

This hydrogeologic setting occurs in central and eastern Huron County. The setting encompasses areas where sand and gravel lenses interbedded within till are the aquifer. It is associated with moderately thick sequences of glacial till comprising areas of ground moraine. The setting is characterized by relatively flat-lying to rolling topography. Soils are usually clay loams, loams, or silt loams derived from the weathering of glacial tills. In some areas with kettles, muck may comprise the overlying soil. The sand and gravel aquifers are typically thin, discontinuous, lenses. Yields average 5 to 25 gpm and are adequate for domestic purposes. The vadose zone is commonly fractured till and was denoted as sand and gravel with significant silt and clay or as silt and clay depending upon the texture of the till and how it weathers. Depth to water is commonly shallow, averaging less than 30 feet. Recharge is moderate to low due to the low relief, shallow depth to water and relative low permeability of the overlying vadose zone media and soils.

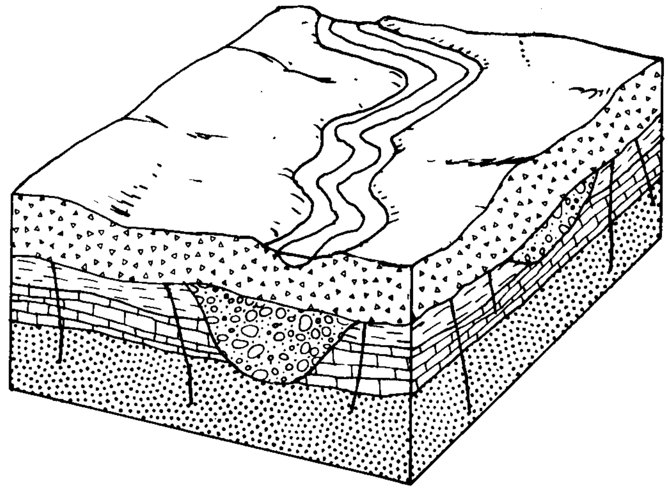
GWPP index values for the hydrogeologic setting of sand and gravel interbedded in glacial till range from 90 to 147, with the total number of GWPP index calculations equaling 61.



7C Moraine

This hydrogeologic setting consists of segments of the numerous end moraines that cross Huron County. This setting is characterized by hummocky to rolling topography. Relief tends to become steeper near the margins of the moraine, especially if enhanced by the downcutting of an adjacent stream. The aquifer consists of relatively thin sand and gravel lenses interbedded with glacial till within the moraine. If a sufficient thickness of sand and gravel is not encountered, wells are completed in the underlying sandstone or shale bedrock. These sand and gravel deposits differ as to lateral extent and thickness and are found at variable depths. Yields range from the 5 to 25 gpm. Soils are clay loams, loams, or silt loams derived from the underlying tills. The vadose zone is commonly fractured till and was denoted as sand and gravel with significant silt and clay or as silt and clay depending upon the texture of the till and how it weathers. The till may be fractured or jointed, particularly in areas where it is predominantly thin and weathered. Depth to water is variable and depends primarily upon the thickness of the overlying till. Recharge is moderate to low depending upon the thickness of the clayey till.

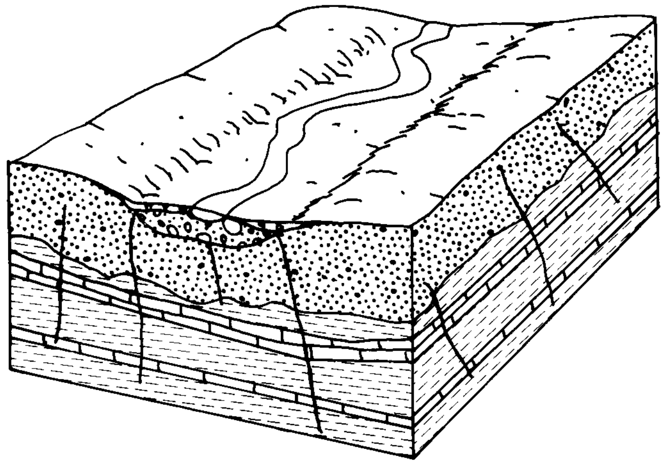
GWPP index values for the hydrogeologic setting of Moraine range from 83 to 144, with the total number of GWPP index calculations equaling 149.



7D Buried Valley

This hydrogeologic setting is limited to north central Huron County. The buried valley lies slightly east of the modern Huron River. The setting is characterized by flat to gently rolling topography and low relief. The buried valley is not obvious on the ground surface. Depth to water is moderate, averaging about 40 feet. The aquifer consists of sand and gravel lenses interbedded with finer-grained till, alluvial, or lacustrine deposits. If a sufficient thickness of sand and gravel is not encountered, wells are completed in the underlying sandstone or shale bedrock. Soils are extremely variable due to the high variability of parent materials including till, alluvium, lacustrine, beach, or outwash deposits. The vadose zone is commonly fractured till and was denoted as sand and gravel with significant silt and clay or as silt and clay depending upon the texture of the till and how it weathers. The till may be fractured or jointed, particularly in areas where it is predominantly thin and weathered. Recharge is moderate to low depending upon the thickness and permeability of the overlying drift.

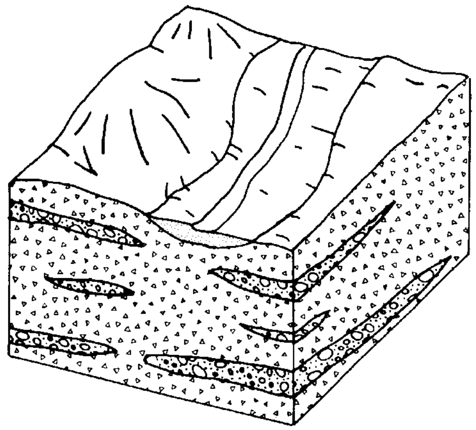
GWPP index values for the hydrogeologic setting of Buried Valley range from 81 to 131, with the total number of GWPP index calculations equaling 23.



7Ec Alluvium Over Bedded Sedimentary Rock

This hydrogeologic setting is limited to the northeastern corner of Huron County. This setting consists of the headwaters of small tributary streams in upland areas with thin glacial cover. The setting is characterized by narrow, flat-bottomed stream valleys, which are flanked by rolling uplands. The aquifer consists of fractured shale. Yields developed from the fractures and bedding planes average roughly 5 to 10 gpm. Soils vary but are usually silt loams or sandy loams. Vadose zone media is silty to sandy alluvium. The depth to water is commonly shallow, averaging less than 15 feet. The alluvium is commonly in direct hydraulic connection with the underlying aquifer. Recharge is moderately high due to the shallow depth to water, flat-lying topography, proximity of modern streams, and the moderately low permeability of the soils, alluvium, and bedrock.

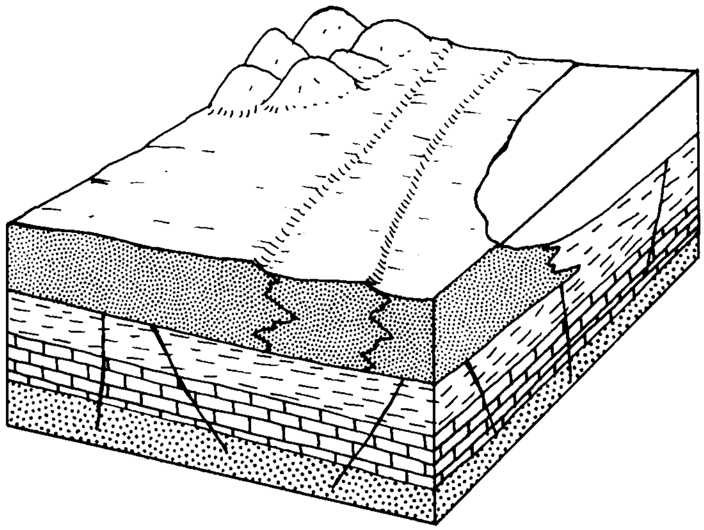
GWPP index values for the hydrogeologic setting of alluvium over bedded sedimentary rocks ranges from 126 to 130, with the total number of GWPP index calculations equaling 2.



7Ed Alluvium Over Glacial Till

This hydrogeologic setting is comprised of flat-lying floodplains and stream terraces containing thin to moderate thicknesses of modern alluvium. This setting is similar to the 7Af - Sand and Gravel Interbedded in Glacial Till setting except for the presence of the modern stream and related deposits. The setting is similar to the 7Ec Alluvium over Bedded Sedimentary Rocks except that the drift is thicker. This setting is associated with the Huron River and the Vermillion River. The stream may or may not be in direct hydraulic connection with the underlying sand and gravel lenses, which constitute the aquifer. The surficial, silty to loamy alluvium is typically more permeable than the surrounding till. The alluvium is too thin to be considered the aquifer. Yields commonly range from 10 to 25 gpm. Soils are silt loams or loams. Depth to water is typically shallow with depths averaging less than 15 feet. Recharge is moderate due to the shallow depth to water, flat-lying topography, and the moderate permeability of the glacial till and alluvium.

GWPP index values for the hydrogeologic setting Alluvium Over Glacial Till range from 110 to 152, with the total number of GWPP index calculations equaling 15.



7H Beaches, Beach Ridge, and Sand Dunes

This hydrogeologic setting is characterized by narrow, elongate, low-lying ridges of sand overlying the lacustrine plain or wave-planed till uplands. This setting is common to the northwestern and north central portions of Huron County. The beach ridges are most commonly found along the outer margin of the lake plain. The vadose zone media is composed of clean, fine-grained quartz sand that has high permeability and low sorptive capability. Where the beach deposits are thin, the vadose zone may include some underlying clayey to silty glacial till or lacustrine deposits. Wells are completed in sand and gravel lenses interbedded with the underlying till or if adequate sand and gravel is lacking, wells are finished in the underlying shale, sandstone, or limestone bedrock. Depth to water is highly variable depending upon the depth to the aquifer. Soils are sand, sandy loams, or loams. Recharge is highly variable; recharge is high for shallow, surficial beach ridge aquifers due to shallow depth to water and highly permeable soils and vadose. Recharge is moderate to low where the aquifers and depth to water are deeper and where finer-grained lacustrine or till vadose zone media underlie thin beach deposits.

GWPP index values for the hydrogeologic setting of Beaches, Beach Ridges, and Sand Dunes range from 81 to 165 with the total number of GWPP index calculations equaling 32.

Table 14. Hydrogeologic Settings, DRASTIC Factors, and Ratings

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Ac01	30-50	10+	karst limestone	Clay Loam	0-2	karst limestone	2000+	187	196
7Ac02	75-100	10+	karst limestone	Clay Loam	2-6	karst limestone	2000+	171	178
7Ac03	50-75	10+	karst limestone	Clay Loam	0-2	karst limestone	2000+	177	186
7Ac04	5-15	7-10	karst limestone	Clay Loam	0-2	sand+gravel w/silt+clay	2000+	188	200
7Ac05	5-15	7-10	karst limestone	Thin/Absent	0-2	karst limestone	2000+	217	247
7Ac06	15-30	4-7	karst limestone	Clay Loam	0-2	sand & gravel	2000+	170	182
7Ac07	50-75	2-4	karst limestone	Silty Loam	0-2	sand & gravel	2000+	150	163
7Ac08	30-50	2-4	karst limestone	Silty Loam	0-2	sand & gravel	2000+	150	165
7Ac09	50-75	7-10	karst limestone	Loam	0-2	sand & gravel	2000+	172	188
7Ac10	15-30	7-10	karst limestone	Shrink-swell Clay	0-2	sand & gravel	2000+	191	214
7Ac11	5-15	7-10	karst limestone	Clay Loam	0-2	sand & gravel	2000+	188	200
7Ac12	75-100	4-7	karst limestone	Sandy Loam	2-6	sand & gravel	2000+	160	177
7Ac13	5-15	7-10	karst limestone	Sand	0-2	silt & clay	2000+	205	234
7Ac14	15-30	4-7	massive limestone	Clay Loam	0-2	sand+gravel w/silt+clay	1000-2000	153	168
7Ac15	15-30	7-10	karst limestone	Clay Loam	0-2	karst limestone	2000+	183	194
7Ac16	5-15	7-10	karst limestone	Clay Loam	2-6	sand+gravel w/silt+clay	2000+	187	197
7Ac17	5-15	7-10	karst limestone	Clay Loam	0-2	silt & clay	2000+	193	204
7Ac18	75-100	7-10	karst limestone	Clay Loam	0-2	karst limestone	2000+	158	169
7Ac19	30-50	7-10	karst limestone	Clay Loam	0-2	sand & gravel	2000+	173	184
7Ac20	30-50	7-10	karst limestone	Thin/Absent	0-2	karst limestone	2000+	197	227
7Ac21	15-30	7-10	karst limestone	Thin/Absent	0-2	karst limestone	2000+	207	237
7Ac22	50-75	7-10	karst limestone	Thin/Absent	0-2	karst limestone	2000+	187	217
7Ac23	50-75	7-10	karst limestone	Clay Loam	0-2	karst limestone	2000+	168	179
7Ad01	15-30	2-4	sandstone	Clay Loam	0-2	silt & clay	1-100	93	118
7Ad02	15-30	2-4	sandstone	Silty Loam	2-6	silt & clay	1-100	94	120
7Ad03	15-30	2-4	sandstone	Clay Loam	2-6	silt & clay	1-100	92	115
7Ad04	15-30	2-4	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	97	119
7Ad05	15-30	2-4	sandstone	Silty Loam	0-2	silt & clay	1-100	95	123
7Ad06	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	98	122
7Ad07	15-30	2-4	sandstone	Silty Loam	12-18	silt & clay	1-100	88	102
7Ad08	5-15	4-7	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	129	158
7Ad09	15-30	2-4	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	99	124
7Ad10	15-30	2-4	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	107	136

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Ad11	15-30	2-4	sandstone	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	100	127
7Ad12	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	120	144
7Ad13	5-15	4-7	sandstone	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	122	149
7Ad14	5-15	4-7	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	124	154
7Ad15	5-15	4-7	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	121	146
7Ad16	15-30	4-7	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	115	146
7Ad17	5-15	4-7	sandstone	Silty Loam	0-2	silt & clay	1-100	117	145
7Ad18	15-30	2-4	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	103	126
7Ad19	15-30	2-4	sandstone	Silty Loam	2-6	silt & clay	1-100	104	128
7Ad20	15-30	2-4	sandstone	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	105	131
7Ad21	5-15	4-7	sandstone	Silty Loam	18+	silt & clay	1-100	108	118
7Ad22	5-15	4-7	sandstone	Clay Loam	0-2	silt & clay	1-100	115	140
7Ad23	5-15	4-7	sandstone	Clay Loam	12-18	silt & clay	100-300	114	124
7Ad24	5-15	4-7	sandstone	Clay Loam	0-2	silt & clay	100-300	121	145
7Ad25	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	126	149
7Ad26	5-15	4-7	sandstone	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	131	163
7Ad27	0-5	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	125	149
7Ad28	0-5	4-7	sandstone	Clay Loam	0-2	silt & clay	1-100	120	145
7Ad29	0-5	4-7	sandstone	Silty Loam	2-6	silt & clay	100-300	127	152
7Ad30	5-15	4-7	sandstone	Silty Loam	2-6	silt & clay	100-300	122	147
7Ad31	5-15	4-7	sandstone	Clay Loam	12-18	silt & clay	100-300	114	124
7Ad32	5-15	4-7	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	140	168
7Ad33	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	125	148
7Ad34	5-15	4-7	sandstone	Silty Loam	2-6	silt & clay	1-100	116	142
7Ad35	15-30	2-4	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	102	123
7Ad36	30-50	2-4	sandstone	Clay Loam	0-2	silt & clay	1-100	83	108
7Ad37	30-50	2-4	sandstone	Silty Loam	2-6	silt & clay	1-100	84	110
7Ad38	15-30	4-7	sandstone	Sandy Loam	0-2	silt & clay	1-100	111	145
7Ad39	5-15	4-7	sandstone	Sandy Loam	0-2	silt & clay	1-100	121	155
7Ad40	5-15	4-7	sandstone	Loam	0-2	sand & gravel	100-300	145	171
7Ad41	5-15	4-7	sandstone	Silty Loam	2-6	sand & gravel	100-300	142	163
7Ad42	5-15	4-7	sandstone	Sand	0-2	sand+gravel w/silt+clay	1-100	152	190
7Ad43	5-15	4-7	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	119	141

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Ad44	5-15	4-7	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	100-300	131	161
7Ad45	5-15	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	100-300	139	168
7Ad46	5-15	4-7	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	126	150
7Ad47	5-15	4-7	sandstone	Clay Loam	0-2	sand & gravel	100-300	141	161
7Ad48	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	131	153
7Ad49	5-15	4-7	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	125	146
7Ad50	5-15	4-7	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	127	151
7Ad51	5-15	4-7	sandstone	Clay Loam	2-6	sand & gravel	100-300	140	158
7Ad52	5-15	4-7	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	132	155
7Ad53	5-15	4-7	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	130	150
7Ad54	15-30	4-7	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	100-300	136	163
7Ad55	15-30	4-7	sandstone	Sandy Loam	0-2	sand+gravel w/silt+clay	100-300	137	166
7Ad56	15-30	4-7	sandstone	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	129	160
7Ad57	5-15	4-7	sandstone	Loam	0-2	sand+gravel w/silt+clay	100-300	140	167
7Ad58	0-5	4-7	sandstone	Clay Loam	0-2	silt & clay	100-300	131	154
7Ad59	5-15	4-7	sandstone	Silty Loam	2-6	sand & gravel	100-300	137	159
7Ad60	5-15	4-7	sandstone	Sandy Loam	2-6	sand & gravel	100-300	141	169
7Ad61	5-15	4-7	sandstone	Clay Loam	0-2	sand & gravel	100-300	141	161
7Ad62	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	126	149
7Ad63	0-5	4-7	sandstone	Clay Loam	0-2	silt & clay	100-300	126	150
7Ad64	0-5	4-7	sandstone	Clay Loam	2-6	silt & clay	100-300	125	147
7Ad65	0-5	4-7	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	132	156
7Ad66	0-5	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	131	154
7Ad67	0-5	4-7	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	130	151
7Ad68	5-15	4-7	sandstone	Clay Loam	2-6	silt & clay	100-300	120	142
7Ad69	0-5	4-7	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	135	155
7Ad70	5-15	4-7	sandstone	Silty Loam	2-6	silt & clay	100-300	122	147
7Ad71	15-30	2-4	sandstone	Silty Loam	2-6	sand & gravel	100-300	115	137
7Ad72	15-30	4-7	sandstone	Sandy Loam	2-6	silt & clay	100-300	116	147
7Ad73	15-30	2-4	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	105	129
7Ad74	15-30	2-4	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	99	123

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Ad75	15-30	2-4	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	104	127
7Ad76	15-30	2-4	sandstone	Clay Loam	0-2	silt & clay	100-300	99	123
7Ad77	15-30	2-4	sandstone	Sandy Loam	0-2	silt & clay	100-300	110	154
7Ad78	50-75	2-4	sandstone	Silty Loam	0-2	silt & clay	100-300	81	108
7Ad79	15-30	2-4	shale	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	94	121
7Ad80	15-30	2-4	sandstone	Silty Loam	0-2	silt & clay	100-300	101	128
7Ad81	15-30	2-4	sandstone	Silty Loam	0-2	sand+gravel w/silt+clay	100-300	106	132
7Ad82	15-30	4-7	sandstone	Sandy Loam	0-2	sand+gravel w/silt+clay	100-300	122	154
7Ad83	15-30	4-7	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	100-300	121	151
7Ad84	15-30	2-4	shale	Loam	0-2	sand+gravel w/silt+clay	1-100	96	126
7Ad85	15-30	2-4	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	92	116
7Ad86	15-30	2-4	shale	Silty Loam	2-6	silt & clay	1-100	88	114
7Ad87	15-30	2-4	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	93	118
7Ad88	15-30	4-7	shale	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	109	140
7Ad89	15-30	2-4	shale	Clay Loam	0-2	silt & clay	1-100	87	112
7Ad90	5-15	4-7	sandstone	Sandy Loam	2-6	silt & clay	1-100	120	152
7Ad91	5-15	4-7	sandstone	Loam	2-6	sand+gravel w/silt+clay	100-300	134	160
7Ad92	15-30	4-7	sandstone	Sandy Loam	2-6	silt & clay	100-300	129	158
7Ad93	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	113	136
7Ad94	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	108	132
7Ae01	15-30	2-4	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	92	116
7Ae02	15-30	2-4	shale	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	91	113
7Ae03	15-30	2-4	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	93	118
7Ae04	15-30	4-7	shale	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	110	143
7Ae05	5-15	4-7	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	110	136
7Ae06	5-15	4-7	shale	Clay Loam	0-2	silt & clay	1-100	109	134
7Ae07	5-15	4-7	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	120	144
7Ae08	5-15	4-7	shale	Clay Loam	2-6	silt & clay	1-100	108	131
7Ae09	5-15	4-7	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	119	142
7Ae10	5-15	4-7	shale	Silty Loam	0-2	silt & clay	1-100	111	139

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Ae11	15-30	2-4	shale	Silty Loam	0-2	silt & clay	1-100	89	117
7Ae12	5-15	4-7	shale	Loam	2-6	silt & clay	1-100	112	141
7Ae13	15-30	2-4	shale	Clay Loam	0-2	silt & clay	1-100	87	112
7Ae14	15-30	2-4	shale	Clay Loam	2-6	silt & clay	1-100	86	109
7Ae15	15-30	2-4	shale	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	94	121
7Ae16	15-30	4-7	shale	Loam	0-2	sand+gravel w/silt+clay	1-100	108	138
7Ae17	15-30	2-4	shale	Silty Loam	18+	sand+gravel w/silt+clay	1-100	85	94
7Ae18	30-50	2-4	shale	Sandy Loam	6-12	sand+gravel w/silt+clay	1-100	83	106
7Ae19	30-50	2-4	shale	Sandy Loam	0-2	silt & clay	1-100	83	117
7Ae20	5-15	4-7	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	118	143
7Ae21	15-30	4-7	shale	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	109	140
7Ae22	15-30	2-4	shale	Silty Loam	2-6	silt & clay	1-100	88	114
7Ae23	5-15	4-7	shale	Clay Loam	0-2	sand & gravel	1-100	129	150
7Ae24	5-15	4-7	sandstone	Clay Loam	0-2	silt & clay	1-100	115	140
7Ae25	5-15	4-7	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	117	141
7Ae26	5-15	4-7	shale	Clay Loam	2-6	silt & clay	1-100	111	134
7Ae27	5-15	4-7	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	122	145
7Ae28	5-15	4-7	shale	Loam	0-2	sand+gravel w/silt+clay	1-100	126	155
7Ae29	5-15	4-7	shale	Silty Loam	2-6	silt & clay	1-100	113	139
7Ae30	5-15	4-7	shale	Thin/Absent	0-2	silt & clay	1-100	123	169
7Ae31	5-15	4-7	shale	Loam	0-2	silt & clay	1-100	113	144
7Ae32	5-15	4-7	shale	Sandy Loam	2-6	silt & clay	1-100	114	146
7Ae33	5-15	4-7	shale	Sandy Loam	0-2	silt & clay	1-100	115	149
7Ae34	5-15	4-7	shale	Clay Loam	0-2	silt & clay	1-100	112	137
7Ae35	15-30	2-4	shale	Loam	0-2	silt & clay	1-100	91	122
7Ae36	15-30	4-7	shale	Sandy Loam	2-6	silt & clay	1-100	104	136
7Ae37	15-30	2-4	shale	Silty Loam	18+	silt & clay	1-100	80	90
7Af01	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	101	125
7Af02	15-30	2-4	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	100	122
7Af03	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	105	129
7Af04	15-30	2-4	sand & gravel	Silty Loam	18+	sand+gravel w/silt+clay	100-300	97	105
7Af05	5-15	4-7	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	122	143

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Af06	15-30	2-4	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	300-700	117	144
7Af07	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	101	125
7Af08	5-15	4-7	sand & gravel	Silty Loam	0-2	silt & clay	100-300	123	150
7Af09	5-15	4-7	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	131	153
7Af10	15-30	2-4	sand & gravel	Clay Loam	0-2	silt & clay	100-300	99	123
7Af11	15-30	2-4	sand & gravel	Silty Loam	0-2	silt & clay	100-300	101	128
7Af12	15-30	2-4	sand & gravel	Silty Loam	2-6	silt & clay	100-300	100	125
7Af13	5-15	4-7	sand & gravel	Clay Loam	0-2	silt & clay	100-300	121	145
7Af14	5-15	4-7	sand & gravel	Silty Loam	2-6	silt & clay	100-300	122	147
7Af15	15-30	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	100-300	120	149
7Af16	5-15	4-7	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	132	155
7Af17	5-15	4-7	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	130	150
7Af18	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	100-300	121	151
7Af19	5-15	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	125	149
7Af20	5-15	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	300-700	141	171
7Af21	30-50	4-7	sand & gravel	Sandy Loam	18+	silt & clay	100-300	98	113
7Af22	15-30	4-7	sand & gravel	Sandy Loam	0-2	silt & clay	100-300	117	150
7Af23	15-30	2-4	sand & gravel	Silty Loam	0-2	silt & clay	300-700	110	135
7Af24	15-30	2-4	sand & gravel	Muck	0-2	silt & clay	300-700	106	125
7Af25	15-30	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	115	139
7Af26	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	109	131
7Af27	15-30	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	100-300	106	132
7Af28	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	121	141
7Af29	15-30	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	100-300	127	158
7Af30	15-30	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	112	135
7Af31	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	117	139
7Af32	15-30	2-4	sand & gravel	Clay Loam	2-6	silt & clay	300-700	110	130
7Af33	15-30	2-4	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	300-700	115	134
7Af34	5-15	4-7	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	138	159
7Af35	15-30	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	111	133
7Af36	15-30	2-4	sand & gravel	Silty Loam	0-2	silt & clay	300-700	113	138
7Af37	15-30	2-4	sand & gravel	Silty Loam	6-12	silt & clay	300-700	108	123

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Af38	15-30	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	300-700	139	168
7Af39	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	116	137
7Af40	15-30	2-4	sand & gravel	Silty Loam	6-12	sand+gravel w/silt+clay	300-700	113	127
7Af41	15-30	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	300-700	134	164
7Af42	5-15	4-7	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	140	164
7Af43	15-30	4-7	sand & gravel	Loam	2-6	sand+gravel w/silt+clay	300-700	128	153
7Af44	15-30	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	300-700	131	161
7Af45	15-30	2-4	sand & gravel	Muck	0-2	sand+gravel w/silt+clay	300-700	114	132
7Af46	5-15	4-7	sand & gravel	Muck	0-2	sand+gravel w/silt+clay	300-700	136	154
7Af47	15-30	2-4	sand & gravel	Muck	0-2	sand+gravel w/silt+clay	300-700	111	129
7Af48	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	113	134
7Af49	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	135	162
7Af50	30-50	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	103	124
7Af51	30-50	2-4	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	300-700	107	134
7Af52	15-30	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	300-700	129	156
7Af53	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	130	158
7Af54	5-15	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	300-700	142	169
7Af55	5-15	4-7	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	144	165
7Af56	5-15	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	133	156
7Af57	5-15	4-7	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	140	160
7Af58	5-15	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	300-700	147	173
7Af59	5-15	4-7	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	143	163
7Af60	5-15	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	145	172
7Af61	30-50	2-4	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	90	112
7C001	15-30	2-4	sandstone	Clay Loam	0-2	silt & clay	1-100	93	118
7C002	15-30	2-4	sandstone	Silty Loam	2-6	silt & clay	1-100	94	120
7C003	15-30	2-4	sandstone	Clay Loam	2-6	silt & clay	1-100	92	115

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7C004	15-30	2-4	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	97	119
7C005	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	98	122
7C006	15-30	2-4	sandstone	Silty Loam	6-12	silt & clay	1-100	90	108
7C007	15-30	2-4	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	99	124
7C008	15-30	2-4	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	107	136
7C009	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	120	144
7C010	5-15	4-7	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	124	154
7C011	15-30	2-4	shale	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	91	113
7C012	15-30	2-4	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	103	134
7C013	15-30	2-4	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	104	128
7C014	5-15	4-7	sandstone	Clay Loam	0-2	silt & clay	1-100	115	140
7C015	5-15	4-7	sandstone	Clay Loam	0-2	silt & clay	100-300	121	145
7C016	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	126	149
7C017	5-15	4-7	sandstone	Silty Loam	2-6	silt & clay	100-300	122	147
7C018	5-15	4-7	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	125	148
7C019	5-15	4-7	shale	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	113	135
7C020	5-15	4-7	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	100-300	131	161
7C021	5-15	4-7	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	125	146
7C022	5-15	4-7	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	127	151
7C023	5-15	4-7	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	132	155
7C024	5-15	4-7	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	130	150
7C025	15-30	2-4	sandstone	Silty Loam	2-6	silt & clay	100-300	100	125
7C026	5-15	4-7	sandstone	Silty Loam	2-6	sand & gravel	100-300	137	159
7C027	5-15	4-7	sandstone	Sandy Loam	2-6	sand & gravel	100-300	141	169
7C028	5-15	4-7	sandstone	Clay Loam	2-6	silt & clay	100-300	120	142
7C029	5-15	4-7	sandstone	Silty Loam	0-2	sand+gravel w/silt+clay	100-300	128	154
7C030	5-15	4-7	sandstone	Sandy Loam	2-6	silt & clay	100-300	126	157
7C031	15-30	2-4	sandstone	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	105	129
7C032	15-30	2-4	sandstone	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	103	124
7C033	15-30	2-4	sandstone	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	104	127

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7C034	15-30	2-4	sandstone	Clay Loam	0-2	silt & clay	100-300	99	123
7C035	15-30	2-4	sandstone	Silty Loam	6-12	silt & clay	100-300	96	113
7C036	15-30	2-4	sandstone	Clay Loam	2-6	silt & clay	100-300	98	120
7C037	15-30	2-4	shale	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	94	121
7C038	15-30	2-4	sandstone	Silty Loam	0-2	silt & clay	100-300	101	128
7C039	15-30	2-4	sandstone	Silty Loam	6-12	sand+gravel w/silt+clay	100-300	101	117
7C040	5-15	4-7	sandstone	Sandy Loam	0-2	silt & clay	100-300	127	160
7C041	15-30	2-4	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	92	116
7C042	15-30	2-4	shale	Silty Loam	2-6	silt & clay	1-100	88	114
7C043	15-30	2-4	shale	Clay Loam	0-2	silt & clay	1-100	87	112
7C044	5-15	4-7	shale	Clay Loam	0-2	silt & clay	1-100	109	134
7C045	5-15	4-7	shale	Silty Loam	2-6	silt & clay	1-100	110	136
7C046	5-15	4-7	shale	Clay Loam	2-6	silt & clay	1-100	108	131
7C047	15-30	2-4	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	93	118
7C048	5-15	4-7	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	114	138
7C049	15-30	4-7	shale	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	110	143
7C050	5-15	4-7	shale	Clay Loam	2-6	sand+gravel w/silt+clay	1-100	113	135
7C051	5-15	4-7	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	115	140
7C052	5-15	4-7	shale	Silty Loam	2-6	silt & clay	1-100	110	136
7C053	5-15	4-7	shale	Silty Loam	6-12	silt & clay	1-100	106	124
7C054	5-15	4-7	shale	Clay Loam	2-6	silt & clay	1-100	108	131
7C055	15-30	2-4	shale	Silty Loam	0-2	silt & clay	1-100	89	117
7C056	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	136	164
7C057	15-30	2-4	shale	Silty Loam	6-12	silt & clay	1-100	84	102
7C058	15-30	2-4	shale	Silty Loam	2-6	silt & clay	1-100	88	114
7C059	15-30	4-7	shale	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	109	140
7C060	5-15	4-7	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	100-300	130	150
7C061	5-15	4-7	shale	Clay Loam	0-2	silt & clay	1-100	112	137
7C062	5-15	4-7	shale	Silty Loam	2-6	silt & clay	1-100	113	139
7C063	15-30	2-4	shale	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	94	121
7C064	15-30	2-4	shale	Silty Loam	6-12	sand+gravel w/silt+clay	1-100	89	106
7C065	30-50	2-4	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	83	108
7C066	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	105	129

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7C067	15-30	2-4	sand & gravel	Silty Loam	18+	silt & clay	100-300	92	101
7C068	5-15	4-7	sand & gravel	Silty Loam	0-2	silt & clay	100-300	123	150
7C069	5-15	4-7	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	100-300	131	153
7C070	5-15	4-7	sand & gravel	Silty Loam	2-6	silt & clay	300-700	134	157
7C071	5-15	4-7	sand & gravel	Clay Loam	2-6	silt & clay	300-700	132	152
7C072	5-15	4-7	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	139	161
7C073	5-15	4-7	shale	Silty Loam	2-6	silt & clay	1-100	110	136
7C074	5-15	4-7	shale	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	115	140
7C075	5-15	4-7	shale	Clay Loam	0-2	sand+gravel w/silt+clay	1-100	114	138
7C076	5-15	4-7	shale	Clay Loam	0-2	silt & clay	1-100	109	134
7C077	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	125	146
7C078	5-15	4-7	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	132	155
7C079	15-30	4-7	sand & gravel	Sandy Loam	2-6	silt & clay	300-700	128	157
7C080	15-30	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	112	135
7C081	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	117	139
7C082	15-30	2-4	sand & gravel	Clay Loam	2-6	silt & clay	300-700	110	130
7C083	15-30	2-4	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	300-700	115	134
7C084	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	130	158
7C085	5-15	4-7	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	138	159
7C086	15-30	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	109	132
7C087	15-30	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	111	133
7C088	15-30	2-4	sand & gravel	Silty Loam	12-18	sand+gravel w/silt+clay	300-700	111	121
7C089	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	117	139
7C090	5-15	4-7	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	300-700	137	156
7C091	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	116	137
7C092	15-30	2-4	sand & gravel	Silty Loam	6-12	sand+gravel w/silt+clay	300-700	113	127
7C093	15-30	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	112	135
7C094	5-15	4-7	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	140	164
7C095	30-50	2-4	sand & gravel	Clay Loam	2-6	silt & clay	1-100	97	132
7C096	30-50	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	98	120
7C097	30-50	2-4	sand & gravel	Clay Loam	2-6	silt & clay	300-700	97	117
7C098	30-50	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	99	122
7C099	30-50	2-4	sand & gravel	Loam	0-2	silt & clay	300-700	102	130

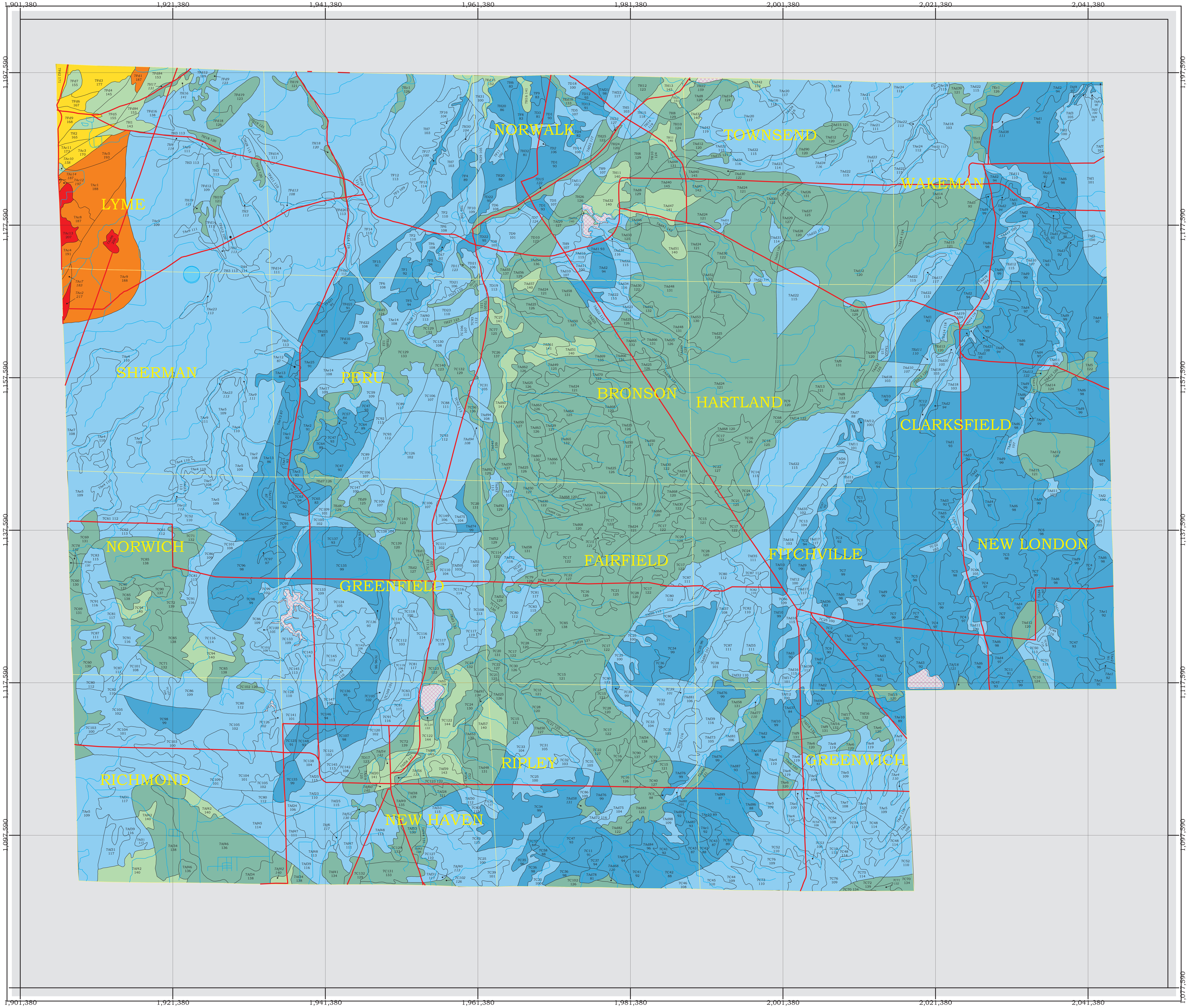
Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7C100	15-30	2-4	sand & gravel	Silty Loam	6-12	silt & clay	300-700	105	120
7C101	15-30	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	108	130
7C102	15-30	4-7	sand & gravel	Loam	2-6	silt & clay	300-700	126	152
7C103	30-50	2-4	sand & gravel	Clay Loam	2-6	silt & clay	300-700	100	120
7C104	30-50	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	101	123
7C105	30-50	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	102	125
7C106	30-50	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	107	129
7C107	30-50	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	98	120
7C108	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	113	134
7C109	30-50	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	100-300	101	125
7C110	30-50	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	104	126
7C111	30-50	2-4	sand & gravel	Loam	6-12	sand+gravel w/silt+clay	300-700	102	119
7C112	30-50	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	103	124
7C113	30-50	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	120	148
7C114	15-30	4-7	sand & gravel	Sandy Loam	18+	sand+gravel w/silt+clay	300-700	122	134
7C115	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	130	158
7C116	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	114	136
7C117	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	119	140
7C118	30-50	2-4	sand & gravel	Silty Loam	6-12	sand+gravel w/silt+clay	300-700	100	114
7C119	30-50	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	106	127
7C120	30-50	2-4	sand & gravel	Clay Loam	2-6	sand+gravel w/silt+clay	300-700	102	121
7C121	30-50	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	103	124
7C122	5-15	4-7	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	144	165
7C123	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	122	143
7C124	5-15	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	133	156
7C125	50-75	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	91	113
7C126	30-50	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	102	125
7C127	15-30	2-4	sand & gravel	Silty Loam	6-12	sand+gravel w/silt+clay	300-700	110	124
7C128	15-30	2-4	sand & gravel	Clay Loam	2-6	silt & clay	300-700	110	130
7C129	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	133	161

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7C130	30-50	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	108	132
7C131	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	133	161
7C132	15-30	4-7	sand & gravel	Sandy Loam	6-12	sand+gravel w/silt+clay	300-700	129	149
7C133	15-30	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	109	132
7C134	15-30	2-4	sand & gravel	Silty Loam	6-12	silt & clay	300-700	105	120
7C135	30-50	2-4	sand & gravel	Silty Loam	2-6	silt & clay	300-700	99	122
7C136	30-50	2-4	sand & gravel	Silty Loam	6-12	silt & clay	300-700	95	110
7C137	30-50	2-4	sand & gravel	Silty Loam	12-18	silt & clay	300-700	93	104
7C138	30-50	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	104	126
7C139	30-50	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	120	148
7C140	30-50	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	123	151
7C141	30-50	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	101	123
7C142	15-30	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	108	130
7C143	15-30	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	114	136
7C144	15-30	2-4	sand & gravel	Silty Loam	6-12	sand+gravel w/silt+clay	300-700	110	124
7C145	15-30	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	113	134
7C146	50-75	2-4	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	300-700	94	116
7C147	30-50	2-4	sand & gravel	Silty Loam	6-12	sand+gravel w/silt+clay	300-700	100	114
7C148	50-75	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	93	114
7C149	15-30	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	106	133
7D01	30-50	2-4	sandstone	Loam	0-2	silt & clay	100-300	93	123
7D02	30-50	4-7	sandstone	Sandy Loam	2-6	silt & clay	100-300	106	137
7D03	30-50	2-4	shale	Loam	0-2	silt & clay	1-100	81	112
7D04	30-50	2-4	sandstone	Silty Loam	18+	silt & clay	100-300	82	91
7D05	30-50	4-7	sandstone	Sandy Loam	0-2	silt & clay	100-300	107	140
7D06	30-50	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	108	132
7D07	30-50	4-7	sand & gravel	Sand	2-6	silt & clay	300-700	124	162
7D08	30-50	2-4	sand & gravel	Loam	0-2	silt & clay	300-700	105	133
7D09	30-50	2-4	sand & gravel	Clay Loam	0-2	silt & clay	300-700	101	123
7D10	15-30	4-7	sand & gravel	Loam	0-2	silt & clay	300-700	127	155
7D11	30-50	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	123	151
7D12	30-50	2-4	sand & gravel	Loam	0-2	silt & clay	100-300	93	123

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7D13	30-50	2-4	sand & gravel	Silty Loam	0-2	silt & clay	100-300	91	118
7D14	30-50	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	106	132
7D15	15-30	4-7	sand & gravel	Sand	2-6	silt & clay	100-300	122	162
7D16	30-50	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	123	151
7D17	5-15	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	123	144
7D18	50-75	2-4	sand & gravel	Sand	0-2	silt & clay	300-700	100	140
7D19	30-50	2-4	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	300-700	113	140
7D20	30-50	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	131	158
7D21	30-50	2-4	sand & gravel	Clay Loam	0-2	sand+gravel w/silt+clay	300-700	106	127
7D22	30-50	2-4	shale	Loam	0-2	sand+gravel w/silt+clay	300-700	95	122
7D23	30-50	2-4	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	300-700	110	137
7Ec1	5-15	4-7	shale	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	126	151
7Ec2	5-15	4-7	shale	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	130	161
7Ed01	5-15	4-7	sand & gravel	Silty Loam	2-6	sand+gravel w/silt+clay	1-100	127	152
7Ed02	5-15	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	1-100	127	157
7Ed03	5-15	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	1-100	132	161
7Ed04	5-15	4-7	sand & gravel	Loam	0-2	silt & clay	1-100	119	150
7Ed05	5-15	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	1-100	124	154
7Ed06	5-15	4-7	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	122	149
7Ed07	5-15	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	126	159
7Ed08	5-15	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	129	162
7Ed09	5-15	4-7	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	125	152
7Ed10	5-15	4-7	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	100-300	133	160
7Ed11	5-15	2-4	sand & gravel	Loam	0-2	silt & clay	1-100	110	141
7Ed12	5-15	2-4	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	1-100	115	145
7Ed13	5-15	2-4	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	1-100	120	149
7Ed14	5-15	2-4	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	1-100	118	144

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7Ed15	5-15	4-7	sand & gravel	Silty Loam	0-2	sand+gravel w/silt+clay	300-700	152	173
7H01	50-75	2-4	karst limestone	Sandy Loam	2-6	sand & gravel	2000+	143	162
7H02	30-50	4-7	karst limestone	Sandy Loam	2-6	sand & gravel	2000+	165	184
7H03	5-15	4-7	shale	Loam	0-2	silt & clay	1-100	113	144
7H04	5-15	4-7	shale	Sandy Loam	2-6	silt & clay	1-100	114	146
7H05	15-30	4-7	shale	Loam	0-2	sand+gravel w/silt+clay	1-100	103	134
7H06	30-50	2-4	shale	Sandy Loam	0-2	silt & clay	1-100	83	117
7H07	15-30	4-7	shale	Loam	0-2	silt & clay	1-100	103	134
7H08	5-15	4-7	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	129	158
7H09	15-30	2-4	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	107	136
7H10	5-15	4-7	sandstone	Loam	0-2	sand+gravel w/silt+clay	1-100	124	154
7H11	5-15	4-7	sandstone	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	140	168
7H12	5-15	4-7	shale	Loam	0-2	sand+gravel w/silt+clay	1-100	123	152
7H13	5-15	4-7	shale	Sand	2-6	sand & gravel	1-100	145	181
7H14	5-15	4-7	shale	Sandy Loam	2-6	sand+gravel w/silt+clay	1-100	119	150
7H15	5-15	4-7	shale	Loam	0-2	sand+gravel w/silt+clay	1-100	118	148
7H16	5-15	4-7	shale	Sand	0-2	sand & gravel	1-100	141	180
7H17	5-15	4-7	shale	Silty Loam	0-2	sand & gravel	1-100	131	155
7H18	5-15	4-7	shale	Sand	2-6	silt & clay	1-100	120	161
7H19	5-15	4-7	shale	Sand	0-2	silt & clay	1-100	121	164
7H20	30-50	2-4	shale	Loam	0-2	sand+gravel w/silt+clay	1-100	86	116
7H21	5-15	4-7	sandstone	Sand	2-6	sand+gravel w/silt+clay	1-100	151	187
7H22	5-15	7-10	sandstone	Sand	2-6	sand & gravel	1-100	159	195
7H23	15-30	4-7	sand & gravel	Sand	2-6	sand+gravel w/silt+clay	100-300	127	166
7H24	15-30	4-7	sand & gravel	Loam	0-2	sand+gravel w/silt+clay	100-300	120	149
7H25	15-30	4-7	sand & gravel	Sandy Loam	0-2	sand+gravel w/silt+clay	100-300	122	154
7H26	15-30	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	100-300	126	155
7H27	30-50	4-7	sand & gravel	Sandy Loam	2-6	sand+gravel w/silt+clay	300-700	123	151
7H28	5-15	4-7	shale	Sandy Loam	0-2	silt & clay	1-100	115	149
7H29	15-30	4-7	shale	Sandy Loam	0-2	silt & clay	1-100	105	139
7H30	15-30	4-7	shale	Sandy Loam	2-6	silt & clay	1-100	104	136
7H31	30-50	4-7	shale	Sandy Loam	0-2	sand+gravel w/silt+clay	1-100	100	133

Setting	Depth To Water	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% Slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating
7H32	30-50	2-4	shale	Loam	0-2	silt & clay	1-100	81	112



Ground Water Pollution Potential of Huron County

by

Kathy Sprowls

After Brian G. Powers, Stan E. Norris, and Gerald R. Myers of Metcalf & Eddy, Inc. and Mike Angle, Ohio Department of Natural Resources

2003

Ground Water Pollution Potential maps are designed to evaluate the susceptibility of ground water to contamination from surface sources. These maps are based on the DRASTIC system developed for the USEPA (Aller et al., 1987). The DRASTIC system consists of two major elements: the designation of mappable units, termed hydrogeologic settings, and a relative rating system for determining the ground water pollution potential within a hydrogeologic setting. The application of DRASTIC to an area requires the recognition of a set of assumptions made in the development of the system. The evaluation of pollution potential of an area assumes that a contaminant with the mobility of water is introduced at the surface and is flushed into the ground water by precipitation. DRASTIC is not designed to replace specific on-site investigations.

In DRASTIC mapping, hydrogeologic settings form the basis of the system and incorporate the major hydrogeologic factors that affect and control ground water movement and occurrence. The relative rating system is based on seven hydrogeologic factors: Depth to water, net Recharge, Aquifer media, Soil media, Topography, Impact of the vadose zone media, and hydraulic Conductivity. These factors form the acronym DRASTIC. The relative rating system uses a combination of weights and ratings to produce a numerical value called the ground water pollution potential index. Higher index values indicate higher susceptibility to ground water contamination. Polygons (outlined in black on the map at left) are regions where the hydrogeologic setting and the pollution potential index are combined to create a mappable unit with specific hydrogeologic characteristics, which determine the region's relative vulnerability to contamination. Additional information on the DRASTIC system, hydrogeologic settings, ratings, and weighting factors is included in the report.

Description of Map Symbols

Hydrogeologic Region → 7D24 ← Hydrogeologic Setting

170 ← Relative Pollution Potential

Legend

Colors are used to depict the ranges in the pollution potential indexes shown below. Warm colors (red, orange, yellow) represent areas of higher vulnerability (higher pollution potential indexes), while cool colors (green, blue, violet) represent areas of lower vulnerability to contamination (lower pollution potential indexes).

- Roads
- Streams
- Lakes
- Townships

Index Ranges

- Not Rated
- Less Than 79
- 80 - 99
- 100 - 119
- 120 - 139
- 140 - 159
- 160 - 179
- 180 - 199
- Greater Than 200

N

Black grid represents the State Plane South Coordinate System (NAD27, feet).

0 1 2 3 4 5

Miles

0 1 2 4 6 8

Kilometers

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