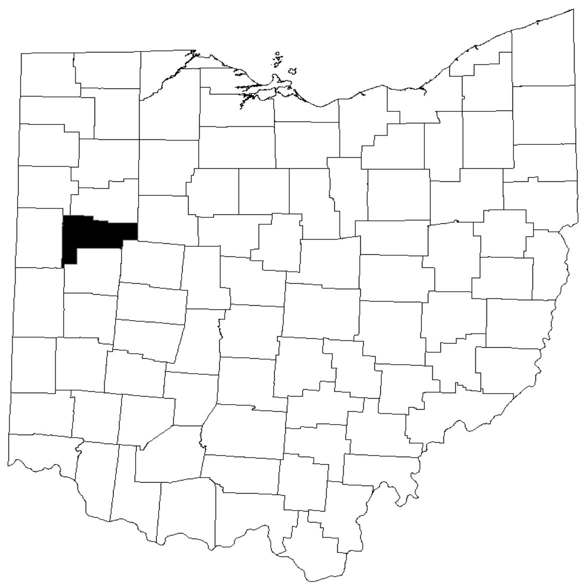
GROUND WATER POLLUTION POTENTIAL
OF AUGLAIZE COUNTY, OHIO

BY

MICHAEL P. ANGLE

AND

KELLY BARRETT



GROUND WATER POLLUTION POTENTIAL REPORT NO. 66

OHIO DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER

WATER RESOURCES SECTION

2005

ABSTRACT

A ground water pollution potential map of Auglaize 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 Auglaize County resulted in a map with symbols and colors, which illustrate areas of varying ground water pollution potential indexes ranging from 87 to 172.

Auglaize County lies entirely within the Glaciated Central hydrogeologic setting. Limestones and dolomites of the Silurian System compose the aquifer for most of the county. Yields in the uppermost carbonate aquifers range from 5 to 100 gallons per minute (gpm) for much of the county to over 100 gpm in the northeastern, southwestern, and south central portions of the county. Yields over 100 gpm are possible from larger diameter wells drilled deeper into the limestone for almost the entire county. The only areas with poor-yielding bedrock aquifers directly underlie the deep axis or troughs of the ancient Teays River Valley system in southern Auglaize County.

Deep layers of sand and gravel are utilized as the aquifer in the main trunk of the deep buried valley system found in central and western Auglaize County. These buried valleys are tributaries of the ancient Teays River valley system. Yields over 100 gpm are possible from properly designed large diameter wells completed in these deeper units. Wells completed in sand and gravel lenses within the St. Johns Moraine tend to be moderately higher yielding. Outside of the buried valley system, sand and gravel lenses interbedded in the glacial till locally serve as aquifers throughout most of Auglaize County. Yields for these sand and gravel lenses range from 5 to 25 gpm. These wells are suitable for domestic and farm purposes. The sand and gravel lenses may lie directly on top of the limestone bedrock and serve as the aquifer or provide additional recharge to the underlying bedrock. Glacial deposits are thinner in the northwestern portion of Auglaize County; few wells are completed in sand and gravel in these areas.

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 Auglaize 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 areas, or to assist in protection, monitoring, and clean-up efforts.

TABLE OF CONTENTS

LIST OF FIGURES

Number Page

LIST OF TABLES

Number Page

ACKNOWLEDGEMENTS

The preparation of the Auglaize County Ground Water Pollution Potential report and map involved the contribution and work of a number of individuals in the Division of Water. Grateful acknowledgement is given to the following individuals for their technical review and map production, text authorship, report editing, and preparation:

Map preparation and review:	Michael P. Angle Kelly Barrett
GIS coverage production and review:	Ryan Baie David Pitzer Paul Spahr Michael P. Angle Wayne Jones
Report production and review:	Michael P. Angle
Report editing:	Kathy Sprowls Jim Raab

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; 4,500 of these wells exist in Auglaize 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 Auglaize 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 Auglaize 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

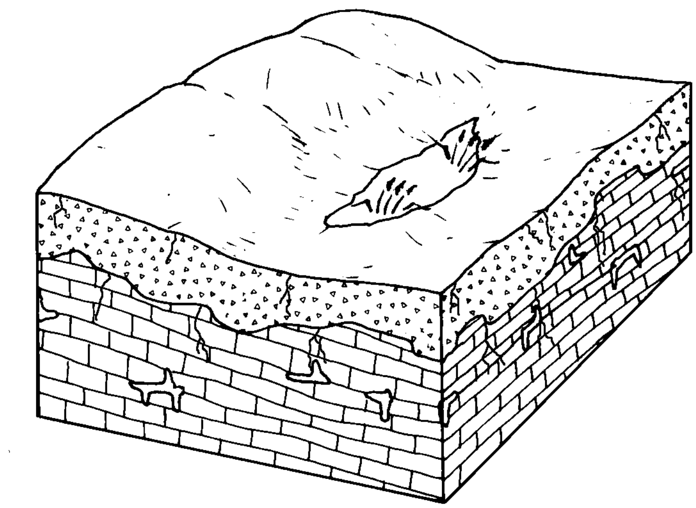
These factors incorporate concepts and mechanisms such as attenuation, retardation, and time or distance of travel of a contaminant with respect to the physical characteristics of the hydrogeologic setting. Broad consideration of these factors and mechanisms coupled with existing conditions in a setting 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.



7Ac-Glacial Till over Limestone

This hydrogeologic setting is most common in western and far eastern Auglaize County. The area is characterized by flat-lying topography and low relief associated with ground moraine. The vadose zone consists primarily of silty to clayey glacial till. The till may be fractured or jointed, particularly in areas where it is predominantly thin and weathered. Where the till is thin (less than 25 feet), fractured limestone along with the till is considered to be the vadose zone media. The aquifer is composed of fractured Silurian limestones and dolomites. These carbonate rocks may contain significant solution features. Depth to water is typically shallow to moderate, ranging from 15 to 50 feet. Soils typically are clay loams derived from till. Maximum ground water yields greater than 100 gpm are possible from the Silurian Lockport, Tymochtee, Greenfield and Salina Groups. Recharge is moderate due to the clayey nature of the soils and vadose zone and the relatively shallow depth to water and permeable nature of the bedrock aquifer. Recharge rates increase somewhat where the limestone bedrock is closer to the ground surface.

GWPP index values for the hydrogeologic setting of Glacial Till over Limestone range from 115 to 152, with the total number of GWPP index calculations equaling 36.

Figure 1. Format and description of the hydrogeologic setting – 7Ac Glacial Till over Limestone.

Topography refers to the slope of the land expressed as percent slope. The slope of an area affects the likelihood that a contaminant will run off or be ponded and ultimately 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/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	

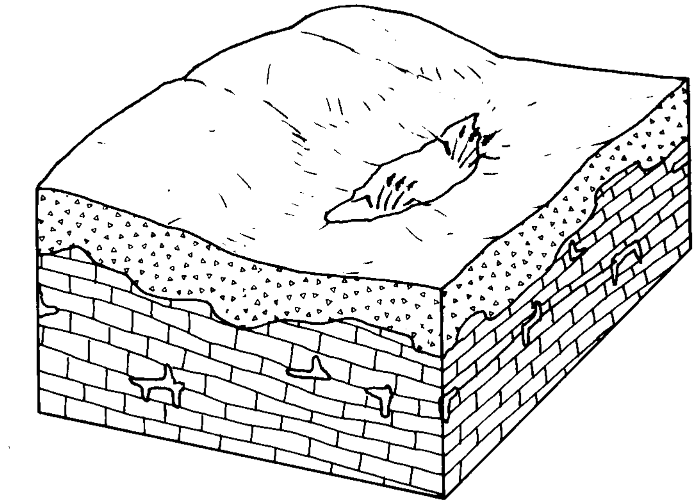
Table 8. Ranges and ratings for hydraulic conductivity

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 7Ac1, Glacial Till over Limestone, identified in mapping Auglaize 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 115. 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 Auglaize 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 87 to 172

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 Auglaize 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 Auglaize County is included with this report.



SETTING 7Ac1		GENERAL		
FEATURE	**RANGE**	**WEIGHT**	**RATING**	**NUMBER**
Depth to Water	30-50	5	5	25
Net Recharge	4-7	4	6	24
Aquifer Media	Limestone	3	8	24
Soil Media	Clay Loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Silt-clay	5	3	15
Hydraulic Conductivity	300-700	3	4	12
		DRASTIC	INDEX	115

Figure 2. Description of the hydrogeologic setting – 7Ac1 Glacial Till over Limestone.

INTERPRETATION AND USE OF GROUND WATER POLLUTION POTENTIAL MAPS

The application of the DRASTIC system to evaluate an aquifer's vulnerability to contamination produces hydrogeologic settings with corresponding pollution potential indexes. The susceptibility to contamination is 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:

7Ac1 - defines the hydrogeologic region and setting
115 - defines the relative pollution potential

The first number (**7**) refers to the major hydrogeologic region and the upper case letter and lower case letter (**Ac**) 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 (**115**) 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 AUGLAIZE COUNTY

Demographics

Auglaize County occupies approximately 400 square miles (Cunningham and Priest, 1981) in north central Ohio (Figure 3). Auglaize County is bounded to the north by Allen County, to the east by Hardin County, to the northwest by Van Wert County, to the southeast by Logan County, to the south by Shelby County and Darke County, and to the west by Mercer County.

The approximate population of Auglaize County, based upon year 2000 census estimates, is 46,611 (Department of Development, Ohio County Profiles, 2005). Wapakoneta is the largest community and the county seat. Agriculture accounts for roughly 88 percent of the land usage in Auglaize County. Row crops are the primary agricultural land usage. Woodlands, industry, 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 51 degrees Fahrenheit for Auglaize County. Harstine (1991) shows that precipitation averages approximately 35 inches per year for the county. The mean annual precipitation for Lima in neighboring Allen County is 37.2 inches per year based upon a thirty-year (1971-2000) period (National Oceanographic and Atmospheric Administration (NOAA), 2002). The mean annual temperature at Lima for the same thirty-year period is 50.9 degrees Fahrenheit (NOAA, 2002).

Physiography and Topography

Auglaize County lies entirely within the Central Till Plains Lowland Province (Frost, 1931; Fenneman, 1938, and Bier, 1956). Brockman (1998) and Schiefer (2002) depict Auglaize County as belonging in the Central Ohio Clayey Till Plain. Auglaize County is characterized by flat to gently rolling ground moraine separated by wide belts of hummocky end moraines.

Figure 3. Location map of Auglaize County, Ohio.

Modern Drainage

The majority of Auglaize County lies north of the major drainage divide crossing north central Ohio; all such portions of the county drain toward Lake Erie. The Auglaize River drains most of central Auglaize County. Pusheta Creek is a major tributary. The St. Marys River drains most of western Auglaize County. The St. Marys River flows westward into Indiana, eventually merging with the Maumee River east of Fort Wayne, Indiana.

The southwestern corner of Auglaize County drains into Grand Lake St. Marys and eventually is drained by the Wabash River. The Wabash River extends westward across Indiana and eventually turns south, emptying into the Ohio River. The headwaters of the Scioto River begin in the northeastern corner of Auglaize County. The southeastern corner of the county drains toward Indian Lake and serves as the headwaters of the Great Miami River.

Pre- and Inter-Glacial Drainage Changes

The drainage patterns of Auglaize County have changed significantly as a result of the multiple glaciations. The drainage changes are complex and not yet fully understood. More research and data are necessary in both Auglaize County and adjacent counties. Particularly, well log data for deeper wells that penetrate the entire drift thickness would be helpful in making interpretations. This would allow a more accurate reconstruction of the system of buried valleys and former drainage channels for the county.

Prior to glaciation, the drainage in Ohio is referred to as the Teays Stage. 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. The main trunk channel of the Teays River underlies western Auglaize County. The main channel of the Teays River enters Auglaize County just east of the village of New Knoxville. The Teays River then passes just north of New Knoxville and runs due westward, directly underlying Grand Lake St. Marys. An important tributary that Stout et al (1943) refers to as Wapakoneta Creek runs southward, passing beneath the present towns of Cridersville and Wapakoneta and joining the Teays River east of New Knoxville (Figure 4). Modern bedrock topography data (Cummins, 1959, Kostelnick, 1981 and 1983, and Open File Bedrock Topography Maps, ODNR, Division of Geological Survey) show an additional deep southerly flowing tributary to Wapapkoneta Creek that lies to the northeast of Wapakoneta. A northerly flowing tributary of the Teays River lies just west of New Bremen and is referred to as Montezuma Creek by Stout et al (1943).

As ice advanced through Ohio during the pre-Illinoian (Kansan) glaciations, drainage ways to the north and west were blocked. The pre-existing channels and valleys created by the Teays River drainage system were overrun by the advancing glaciers and filled with glacial till from the advancing ice sheets. Subsequent ice advances during the Illinoian and Wisconsinan ice advances further filled these former channels. These sediment-filled ancestral valleys are

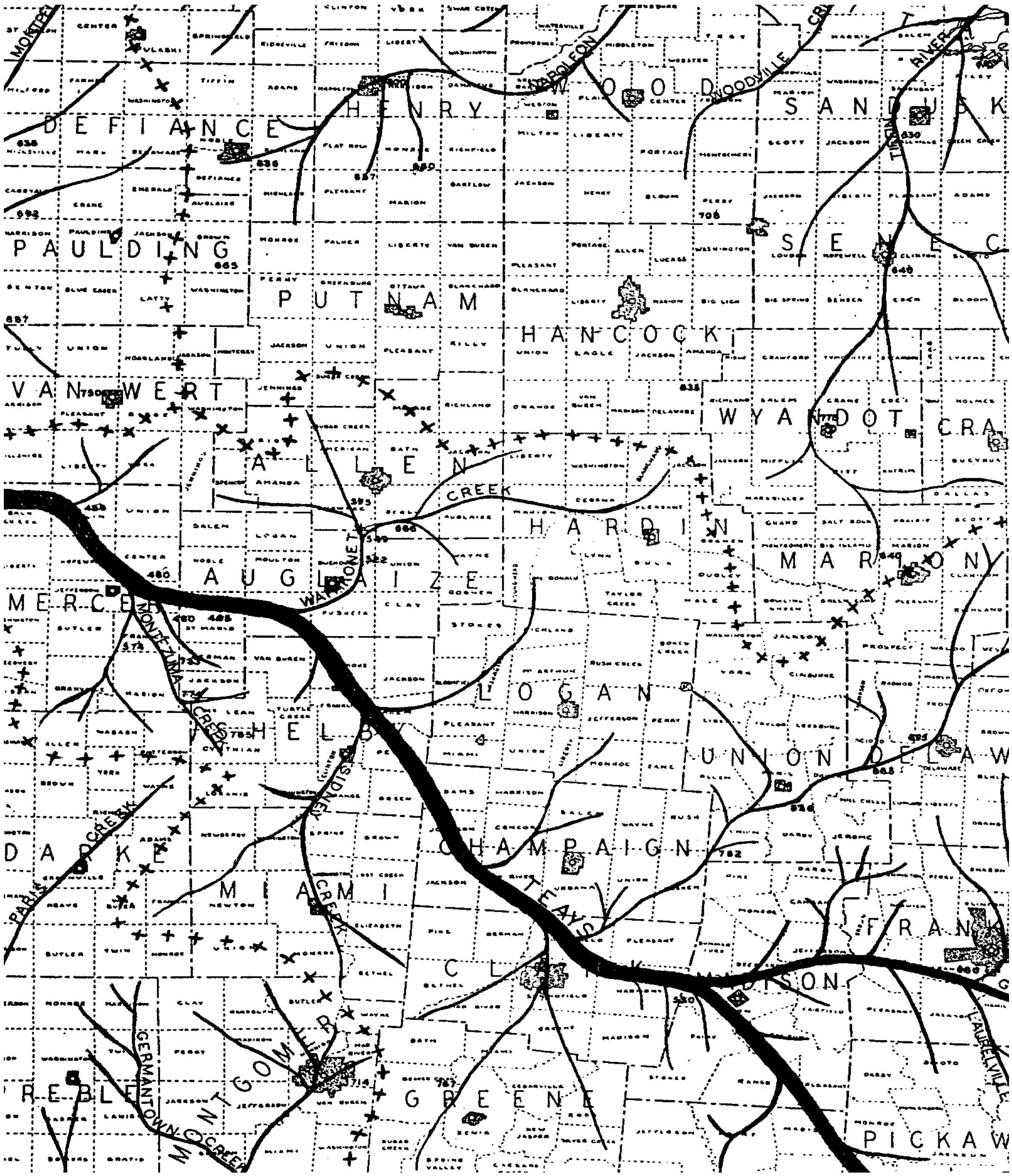


Figure 4. Teays Stage drainage in Auglaize County (after Stout et al., 1943).

referred to as buried valleys. Slowly the drainage patterns of Auglaize County evolved and drainage shifted towards the north for much of the county during ice-free intervals. The modern drainage reflects the nature of landforms deposited during the Wisconsinan advances, particularly end moraines. Drainage for the Scioto River, Great Miami River, and Wabash River all probably evolved during or following the Wisconsinan ice advance.

Glacial Geology

During the Pleistocene Epoch (2 million to 10,000 years before present (Y.B.P.)) several episodes of ice advances occurred in northwestern Ohio. Older ice advances that predate the most recent (Brunhes) magnetic reversal (about 730,000 Y.B.P.) are now commonly referred to as pre-Illinoian (formerly Kansan). Goldthwait et al. (1961) and Pavey et al. (1999) report that the last advance, the Late Wisconsinan Ice Sheet, deposited the surficial till in Auglaize County. Evidence for the earlier glaciations is lacking or obscured.

The unconsolidated (glacial) deposits in Auglaize County fall into four main types: (glacial) till, lacustrine deposits, alluvial (river) deposits and ice-contact sand and gravel (kames, eskers) deposits. Alluvium consists of both ancestral and relatively modern sediments deposited by rivers. Drift is an older term that collectively refers to the entire sequence of glacial deposits. Overall, drift is thinner in areas of ground moraine and thicker in end moraines. Drift is thickest in the buried valleys associated with the Teays River System throughout Auglaize County. In northwestern Auglaize County, there are areas where the drift is relatively thin (less than 25 ft) and the bedrock is close to the ground surface (ODNR, Division of Geological Survey, Open File Bedrock Topography and ODNR, Division of Water, Glacial State Aquifer Map, 2000).

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 and ablation tills. 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 or 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.

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 and Haefner, 2000). Fractures may also interconnect sand and gravel lenses.

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. End moraines commonly serve as a local drainage divide due to their ridge-like nature. The Fort Wayne Moraine extends across the far northwest corner of Auglaize County. The Wabash Moraine lies just north of Grand Lake St. Marys and extends eastward to Wapakoneta where it then turns more to the northeast. The St. Johns Moraine is a relatively broad moraine that crosses the southwestern extension of Auglaize County. Further east, the St. Johns Moraine reenters the county and trends from southwest to northeast underlying the villages of Fryburg, St. Johns (for which the Moraine was named), and Waynesfield. This eastern portion of the St. Johns Moraine contains both a higher number and greater thickness of shallow sand and gravel lenses than is typically found in other areas of ground moraine and end moraine elsewhere in the county. The Mississinewa Moraine roughly parallels the Wabash Moraine and extends into Clay Township in southeastern Auglaize County.

Alluvial deposits are sediments deposited by either the floodplain or channel of rivers and streams. As modern streams downcut, the older, now higher elevation remnants of the original valley floor are called terraces. Terraces in Auglaize County tend to be at elevations just above the current floodplain. Alluvium will vary in nature from fine sand to silty-sand to clayey silt. In Auglaize County, coarser alluvium is more common in the larger streams and finer alluvium is more common in the smaller tributaries or headwaters of streams.

Kames and eskers are ice contact features. They are generally composed of masses of 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. Kames are comprised of isolated or small groups of rounded mounds of dirty sand and gravel with minor till. Eskers are comprised of elongate, narrow, sinuous ridges of sand and gravel. The best examples of ice contact deposits are small, isolated kames found along the western edge of the St. Johns Moraine in Union Township and another small group of similar features just north of the village of New Hampshire (Goldthwait et al, 1961 and Pavey et al., 1999).

Lacustrine deposits are composed of silty to clayey material. These lakes are referred to as intermorainal lakes as they occupy low areas of ground moraine between end moraines. These thin, surficial lake deposits are limited to low-lying areas in the eastern portion of the county. 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.

The lakes were created during the recession of the ice sheets. Meltwater was trapped between the receding ice sheet and end moraines. It is worth noting that there are a number of small kame and esker ice-contact features immediately adjacent to the lacustrine deposits. Perhaps these deposits help indicate that a stagnating (melting) ice sheet was in the immediate vicinity during the initial formation of the intermorainal lakes. In some areas, meltwater may have been trapped between two end moraines forming a lake. Additional ponding may have resulted from northerly-flowing, run-off fed streams that were blocked by the ice sheets. Run-off in general helped to fill these ponds. Eventually, some of these ponds may have overflowed their margins and began to cut an outlet. Alternatively, the headwaters of emerging streams may have cutback and created an outlet for the lakes. As the modern drainage system slowly developed, streams downcut through the series of end moraines, draining the lakes over time. Swampy bog and kettle areas replaced many of the lakes. Many of these features diminished over time. Recently, many such remaining features were drained for agriculture.

Bedrock Geology

Bedrock underlying the surface of Auglaize County belongs to the Silurian System. Carbonate (limestone and dolomite) bedrock underlies the entire county. Table 9 summarizes the bedrock stratigraphy found in Auglaize County. The ODNR, Division of Geological Survey has Open-File Reconnaissance Bedrock Geological Maps completed at a 1:24,000 scale on USGS topographic map bases available for the entire county. The ODNR, Division of Water has Open File Bedrock State Aquifer maps available for the county also.

The youngest unit encountered in Auglaize County is the Salina Undifferentiated Group, which consists of dolomites, fine-grained limestones, and some minor evaporite deposits such as gypsum. These rocks were deposited in warm, shallow tidal areas. Units of the Salina Undifferentiated Group are encountered in the eastern portion of Auglaize County.

Underlying the Salina Undifferentiated Group are rocks of the Silurian Tymochtee and Greenfield Formations, which were also deposited in warm, shallow seas. The Tymochtee and Greenfield Formations are found in eastern and northern Auglaize County. These two formations tend to become thinner along the margins of the deep buried valley system in central Auglaize County.

The oldest unit typically encountered by water wells is the Silurian Lockport Group. Rocks of the Lockport are commonly found in the subsurface in eastern and northern Auglaize County, and are the uppermost bedrock unit in western and southern Auglaize County. These rocks become progressively deeper to the east. The Lockport Group rocks were associated with tidal reefs deposited in warm, high-energy shallow seas. This unit also thins along the margins of the deep channels associated with the Teays River valley.

Underlying the deep central channel of the Teays River are interbedded thin shales and limestones of the Ordovician System. These units are very deep, yield very little water, and are not considered to be an aquifer in Auglaize County.

Table 9. Bedrock stratigraphy of Auglaize County

System	Group/Formation (Symbol)	Lithologic Description
Silurian	Undifferentiated Salina Dolomite (Sus)	Gray to brown, thin-bedded, argillaceous dolomite. Thin evaporite zones common. This unit thins to the west. Yields and thickness increase to the east. Yields may exceed 100 gpm when fractures or solution features are encountered and this unit is sufficiently thick. Found in the eastern portion of the county.
	Tymochtee and Greenfield Dolomites (Stg)	Thin- to massive-bedded, olive-gray to yellowish-brown. The Tymochtee contains shale partings. The Greenfield has a laminated dolomite lithology. Thickness decreases to the west, south, and along margins of buried valleys. Yields are usually less than100 gpm.
	Lockport Dolomite (Sl)	White to medium gray, medium- to massive-bedded dolomite. Commonly contains cavernous solution zones. Thickness >100 feet. Yields can exceed 100 gpm, especially in cavernous or solution zones. Is in the subsurface in the eastern part of the county and is the uppermost unit in western and southern part of the county.

Ground Water Resources

Ground water in Auglaize County is obtained from both unconsolidated (glacial-alluvial) and consolidated (bedrock) aquifers. Deep layers of sand and gravel are utilized as the aquifer in the main trunk of the deep buried valley system found in central and western Auglaize County.

Typical yields of 5 to 100 gpm can be obtained from sand and gravel lenses interbedded with fine-grained glacial till that overlie these deeper deposits. These wells are suitable for domestic and farm purposes. Yields over 100 gpm are possible from properly designed large diameter wells completed in these deeper units. Yields exceeding 300 gpm have been obtained from these deposits near Cridersville, Wapakoneta, and south of the village of St. Marys (Kostelnick, 1983).

Thin lenses of sand and gravel interbedded with till comprise the glacial aquifers in many portions of central and southwestern Auglaize County. These thin sand and gravel aquifers are commonly associated with glacial complexes that flank the buried valley system in central and southwestern Auglaize County. Glacial complexes are areas of thick glacial drift that is predominantly comprised of dense till (ODNR, Division of Water, Glacial State

Aquifer Map, 2000). Complexes typically lack surface expression unlike end moraines and some buried valleys. Modern perennial streams usually do not overlie complexes.

Thin lenses of sand and gravel interbedded in glacial till also serve as the local aquifer for areas of end moraine and ground moraine in central Auglaize County. The proportion and yield of sand and gravel wells increases for some areas of the St. Johns Moraine. Sand and gravel lenses are also associated with the kame and esker ice contact deposits in eastern Auglaize County.

The sand and gravel lenses may directly overlie the carbonate bedrock. These lenses may serve as an aquifer or, more commonly, serve as an extra source of recharge to the underlying fractured bedrock. Well drillers may penetrate the bedrock directly below the sand and gravel to complete the well. In such cases the bedrock acts as a "screen" to help filter fines out of the gravel.

The carbonate aquifer is an important regional aquifer for most of northwestern and north central Ohio and underlies all of Auglaize County (ODNR, Div. of Water, 1970, ODNR, Division of Water, Bedrock State Aquifer Map, 2000, and Kostelnick, 1983). Completed water wells typically penetrate multiple bedrock units. Yields exceeding 100 gpm are available from deep, large diameter wells drilled into the Silurian Salina Undifferentiated Group in eastern Auglaize County, and from the Lockport Dolomite throughout the county (ODNR, Div. of Water, Open File, Bedrock State Aquifer Map, 2000, ODNR, Div. of Water, 1970, and Kostelnick, 1983). In areas of western and southern Auglaize County and along the margins of the buried valleys, the thicknesses of the Salina Undifferentiated Group and the Tymochtee and Greenfield Dolomites decrease appreciably, and their yields drop correspondingly. However, higher yields may still be obtained by completing the wells deeper into the Lockport Dolomite. The amount of fracturing, solution, and vuggy (porous) zones has great local importance. Deeper wells are more likely to contain highly mineralized water and have objectionable water quality.

REFERENCES

Aller, L., T. Bennett, J.H. Lehr, R.J. Petty, and G. Hackett, 1987. DRASTIC: A standardized system for evaluating ground water pollution potential using hydrogeological settings. U.S. Environmental Protection Agency EPA/600/2-87-035, 622 pp.

Angle, M.P., 1997. Ground water pollution potential of Shelby County, Ohio. Ohio Department of Natural Resources, Division of Water, GWPP Report No. 46, 83 pp.

Angle, M. P. and K. Barrett, 2005. Ground water pollution potential of Allen County, Ohio. Ohio Department of Natural Resources, Division of Water, GWPP Report No. 37, 46 pp.

Bier, J.A., 1956. Landforms of Ohio. Ohio Department of Natural Resources, Division of Geological Survey, map.

Brockman, C.S., 1998. Physiographic regions of Ohio. Ohio Department of Natural Resources, Div. of Geological Survey, map with text.

Brockman, C.S. and J.P. Szabo, 2000. Fractures and their distribution in the tills of Ohio. The Ohio Journal of Science, Vol. 100, No. ¾, p. 39-55.

Cunningham, F.L. and T.C. Priest, 1981. Soil survey of Auglaize County, Ohio. U.S. Department of Agriculture, Natural Resources Conservation Service, Soil Survey, 106 pp.

Cunningham, J.W., 1959. Probable surface of bedrock underlying the glaciated area in Ohio. Ohio Department of Natural Resources, Division of Water, Ohio Water Plan Inventory, Report No.10, Plate I.

Driscoll, F.G., 1986. Groundwater and wells. Johnson Filtration Systems , St. Paul, Mn, 1089 pp.

Dumouchelle, D.H. and M.C. Schiefer, 2002. Use of streamflow records and basin characteristics to estimate ground-water recharge rates in Ohio. Ohio Department of Natural Resources, Division of Water, Bulletin 46, 45 pp.

Eagon, H.B., Jr., 1969. Report of investigation of water levels in eastern Pusheta Township-Fryburg area, Auglaize County. Ohio Department of Natural Resources, Division of Water, unpublished report of investigations, 4 pp.

Eyles, N. and J.A. Westgate, 1987. Restricted regional extent of the Laurentide Ice Sheet in the Great Lakes Basin during early Wisconsinan Glaciation. Geology, v. 15, p. 537-540.

Fenneman, N.M., 1938. Physiography of the eastern United States. McGraw-Hill Book Co., New York, New York, 714 pp.

Fetter, C.W., 1980. Applied hydrogeology. Charles E. Merrill Publishing Co., Columbus, Ohio, 488 pp.

Freeze, R.A. and J.A. Cherry, 1979. Ground water. Prentice-Hall, Englewood Cliffs, N.J., 604 pp.

Frost, R.B., 1931. Physiographic map of Ohio. Oberlin College, The Geographical Press, Columbia Univ., N.Y., N.Y., map with text.

Goldthwait, R.P., G.W. White, and J.L. Forsyth, 1961. Glacial map of Ohio. U. S. Department of Interior, Geological Survey, Miscellaneous Map, I-316, map with text.

Haefner, R.J., 2000. Characterization methods for fractured glacial tills. The Ohio Journal of Science, Vol. 100, No. ¾, p. 73-87.

Harstine, L.J., 1991. Hydrologic atlas for Ohio. Ohio Department of Natural Resources, Division of Water, Water Inventory Report, No. 28, 13 pp.

Heath, R.C., 1984. Ground-water regions of the United States. U. S. Geological Survey, Water Supply Paper 2242, 78 pp.

Kostelnick, R.J., 1981. Ground-water resources of Allen County. Ohio Department of Natural Resources, Division of Water, Ground Water Resources Map, map with text.

Kostelnick, R.J., 1983. Ground-water resources of Auglaize County. Ohio Department of Natural Resources, Division of Water, Ground Water Resources Map, map with text.

National Oceanographic and Atmospheric Administration, 2002. Monthly station normals of temperature, precipitation, and heating and cooling degree-days, 1971-2000. Climatography of the United States No. 81, OHIO. U.S. Department of the Interior, Project A-051-OHIO, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 30 pp.

Norris, S.E. and R.E. Fidler, 1973. Availability of water from limestone and dolomite aquifers in southwest Ohio and the relation of water quality to the regional flow system. U.S. Geological Survey, Water-Resources Investigations 17-73. 42 pp.

Ohio Department of Natural Resources, Division of Geological Survey, Open File, Reconnaissance Bedrock Geology Maps. Available on a U.S.G.S. 7-1/2 minute quadrangle basis.

Ohio Department of Natural Resources, Division of Geological Survey, Open File, Bedrock Topography Maps. Available on a U.S.G.S. 7-1/2 minute quadrangle basis.

Ohio Department of Natural Resources, Division of Water, 1970. Ground water for planning in northwest Ohio: a study of the carbonate rock aquifers. Ohio Water Plan Inventory Report no. 22, 63 pp.

Ohio Department of Natural Resources, Division of Water, Open File Bedrock State Aquifer Maps, 2000. Available on a U.S.G.S. 7-1/2 minute quadrangle basis.

Ohio Department of Natural Resources, Division of Water, Open File Glacial State Aquifer Maps, 2000. Available on a U.S.G.S. 7-1/2 minute quadrangle basis.

Pavey, R.R., R.P. Goldthwait, C.S. Brockman, D.N. Hull, E.M. Swinford, and R.G. Van Horn, 1999. Quaternary geology of Ohio. Ohio Department of Natural Resources, Division of Geological Survey, Map No. 2, map with text.

Pettyjohn, W.A. and R. Henning, 1979. Preliminary estimate of ground water recharge rates, related streamflow and water quality in Ohio. U.S. Department of the Interior, Project A-051-OHIO, Project Completion Report No. 552, Water Resources Center, The Ohio State University, Columbus, Ohio, 323 pp.

Schiefer, M.C., 2002. Basin descriptions and flow characteristics of Ohio streams. Ohio Department of Natural Resources, Div. of Water, Bulletin 47, 161 pp.

Spahr, P.N., 1991. Ground water pollution potential of Darke County, Ohio. Ohio Department of Natural Resources, Division of Water, GWPP Report No. 25, 99 pp.

Sprowls, K.M., 1995. Ground water pollution potential of Logan County, Ohio. Ohio Department of Natural Resources, Division of Water, GWPP Report No. 36, 105 pp.

Stout, W., K. Ver Steeg, and G.F. Lamb, 1943. Geology of water in Ohio. Ohio Department of Natural Resources, Division of Geological Survey, Bulletin 44, 694 pp.

Sugar, D.J., 1989. Ground water pollution potential of Mercer County, Ohio. Ohio Department of Natural Resources, Division of Water, GWPP Report No. 5, 41 pp.

UNPUBLISHED DATA

Ohio Department of Development. Ohio County Profiles, 2005.

Ohio Department of Natural Resources, Division of Water. Well log and drilling reports for Auglaize County.

APPENDIX A
DESCRIPTION OF THE LOGIC IN FACTOR SELECTION

<u>Depth to Water</u>

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 4,500 water well log records are on file for Auglaize County. Data from roughly 700 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 Auglaize County* (Kostelnick, 1983) provided generalized depth to water information throughout the county. Generalized regional depth to water information was obtained from the ODNR, Division of Water (1970) report. Depth to water trends mapped in adjoining Shelby County (Angle, 1997), Mercer County (Sugar, 1989), Logan County (Sprowls, 1995), Darke County (Spahr, 1991), and Allen County (Angle and Barrett, 2005) were used as a guideline. A localized study by Eagon (1969) provided information on the depth to water and water levels in the vicinity of Fryburg. Topographic and geomorphic trends were utilized in areas where other sources of data were lacking.

Depths of 5 to 15 feet (9) were selected for most of the alluvial settings and for almost all of the 7Fc-Intermorainal Lakes Plain hydrogeologic setting in eastern Auglaize County. Depths to water of 5-15 feet (9) were also used for some limited areas of ground moraine with a thin to moderate thickness of overlying till. Depths of 5-15 feet (9) were typical in the vicinity of Grand Lake St. Marys. Depths to water of 15 to 30 feet (7) were used for most areas of ground moraine associated with the 7Ac-Glacial Till over Limestone setting and the 7Af-Sand and Gravel interbedded in Glacial Till setting. Depths to water of 30 to 50 feet (5) were utilized for the majority of the 7C-Moraine settings. The cover of glacial till overlying the aquifer was thicker in most of these areas. Depths to water of 50 to 75 feet (3) were utilized for some higher elevation crests of the end moraines and for a few areas of 7J-Glacial Complex with thicker than average drift.

<u>Net Recharge</u>

Recharge is the precipitation that reaches the aquifer. 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 neighboring Shelby County (Angle, 1997), Mercer County (Sugar, 1989), Logan County (Sprowls, 1995), Darke County (Spahr, 1991), and Allen County (Angle and Barrett, 2005) were used as a guideline.

Values of 7 to 10 inches per year (8) were used for areas of high recharge. This was limited to a localized area in the northwestern part of the county where a stream overlies limestone bedrock that is within a few feet of the ground surface, and the soils were derived in part from bedrock residuum and the thin cover of alluvium.

Values of 4 to 7 inches per year (6) were selected for areas with moderate recharge. This range of recharge values was selected for the majority of settings in Auglaize County.

Values of 2 to 4 inches per year (3) were assigned primarily to the 7Fc-Intermorainal Lake Deposits setting due to the very clayey nature of the soils and vadose zone media. Values of 2 to 4 inches per year (3) were also chosen for a few localized areas with a great depth to water and a substantial cover of fine-grained glacial till.

Aquifer Media

Information on evaluating aquifer media was obtained from the *Ground Water Resources of Auglaize County* (Kostelnick, 1983). 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. Aquifer ratings from neighboring Shelby County (Angle, 1997), Mercer County (Sugar, 1989), Logan County (Sprowls, 1995), Darke County (Spahr, 1991), and Allen County (Angle and Barrett, 2005) were used as a guideline. The ODNR, Division of Water, Glacial State Aquifer Map (2000) and Bedrock State Aquifer Map (2000) were an important source of aquifer data. The *Glacial Map of Ohio* (Goldthwait et al., 1961), and the *Quaternary Geology of Ohio* (Pavey et al., 1999) provided useful information on the nature of the glacial aquifers and the delineation of the hydrogeologic settings. Additional information on limestone aquifers was obtained from a report (Division of Water, 1970) on carbonate rocks in northwestern Ohio and a similar report (Norris and Fidler, 1973) on carbonate rocks in southwestern Ohio. Well log records on file at the ODNR, Division of Water, were the primary source of aquifer information.

All of the bedrock and most of the interbedded lenses of sand and gravel are semi-confined or leaky; however, for the purposes of DRASTIC, they have been evaluated as being unconfined (Aller et al., 1987). Limestone was evaluated as the aquifer for large portions of western and eastern Auglaize County. A rating of (8) was assigned to limestones along the far western margin of the county due to some increased solution and jointing at depth in the Silurian Lockport Dolomite in adjoining Mercer County. A rating of (7) was applied to all of the Silurian limestone aquifers in Auglaize County.

Sand and gravel was evaluated as the aquifer in a broad band across central and southwestern Auglaize County. Sand and gravel was evaluated as the aquifer for the 7D-Buried Valley settings associated with the ancestral Teays River System. Sand and gravel in these and in immediately adjacent 7C-End Moraine and 7J-Glacial Complex settings were assigned an aquifer rating of (7). The sand and gravel aquifer rating of (7) was more widely applied for the St. Johns Moraine than the other end moraines. Sand and gravel was selected as the aquifer for the 7Af-Sand and Gravel Interbedded in Glacial Till and the 7Ed-Alluvium over

Glacial Till settings and given a rating of (6). Sand and gravel aquifers associated with 7C-End Moraine and 7J-Glacial Complex settings located further away from the 7D-Buried Valley settings were given a rating of (6), as the sand and gravel lenses tended to thin and become finer-grained further from the buried valleys. Yields and drawdown data reported on water well log records were also used to help evaluate the sand and gravel deposits.

An arbitrary decision was made to evaluate the trunk or axis of the Teays River Valley as being in the 7D-Buried Valley hydrogeologic setting and adjacent areas with thick drift were evaluated as 7J-Glacial Complex or 7C-End Moraine settings, depending upon their surficial geomorphology. To help make this delineation more consistent, a bedrock surface elevation of 700 feet msl was selected as the cut-off between these two settings. Valleys that were cut deeper than 700 feet msl based on bedrock topography data (Cummins, 1959, Kostelnick, 1983, Open File Bedrock Topography Maps, ODNR, Division of Geological Survey, and ODNR, Division of Water, Glacial State Aquifer Map, 2000) were evaluated as buried valleys, adjoining areas were evaluated as glacial complexes.

Soils

Soils were mapped using the data obtained from the *Soil Survey of Auglaize County* (Cunningham and Priest, 1981). 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. Special emphasis is placed upon determining the most restrictive layer. The soils of Auglaize County showed a high degree of variability. This is a reflection of the parent material. Table 10 is a list of the soils, parent materials, setting, and corresponding DRASTIC values for Auglaize County.

Peat (8) was selected for some minor depressions and kettles associated with the 7Fc-Intermorainal Lake Deposits setting. Most of these areas are so small that they do not meet the criteria of 100 acres necessary to make them a mapable size unit as specified by the DRASTIC system (Aller, et al, 1987). Shrink-swell (non-aggregated) clays (7) were selected for the highly clayey soils found at the surface of the 7Fc-Intermorainal Lake Deposits settings. Sandy loam (6) soils were associated with sandy sediments associated with thin outwash mantling alluvial terraces, coarse alluvium, and areas of kames and eskers. Loam (5) soils were selected for a number of areas where the surficial deposits had an intermediate texture soil. These areas commonly consist of thin layers of fine sand overlying finer-grained materials. This includes mostly areas of thin outwash or coarse alluvium overlying either finer alluvium or till along the margins of major streams. Silt loam (4) was designated for silty, finer-grained alluvial and floodplain deposits. Clay loam (3) soils were evaluated for the majority of the county including till overlying ground moraine and end moraine areas. Clay loam (3) was also selected for some fine-grained alluvial deposits.

Table 10. Auglaize County soils

Soil Name	Parent Material/ Setting	DRASTIC Rating	Soil Media
Blount	Clayey till	3	Clay Loam
Carlisle	Depressions, bogs, kettles	8	Peat
Defiance	Fine-grained alluvium	3	Clay Loam
Del Rey	Silty lacustrine	3	Clay Loam
Digby	Minor, thin outwash	6	Sandy Loam
Eldean	Kame, esker, outwash	6	Sandy Loam
Gallman	Dirty, fine outwash, kames	6	Sandy Loam
Genesee	Alluvium	4	Silt Loam
Glynwood	Clayey till	3	Clay Loam
Haskins	Beach sand over till	5	Loam
Latty	Clayey lacustrine	7	Shrink-Swell Clay
McGary	Clayey lacustrine	7	Shrink-Swell Clay
Linwood	Peat, muck	8	Peat
Milgrove	Thin outwash over till	5	Loam
Milford	Silty lacustrine	3	Clay Loam
Milgrove	Thin outwash sand over fines	5	Loam
Montgomery	Clayey lacustrine, oxbows	7	Shrink-Swell Clay
Morley	Clayey to loamy till	3	Clay Loam
Muskego	Depressions, bogs, kettles	8	Peat
Pewamo	Till in low areas, depressions	3	Clay Loam
Shoals	Alluvium	4	Silt loam
Sloan	Alluvium	4	Silt loam

Topography

Topography, or percent slope, was evaluated using U.S.G.S. 7-1/2 minute quadrangle maps and the *Soil Survey of Auglaize County* (Cunningham and Priest, 1981). Slopes of 0 to 2 percent (10) were selected for the 7Fc-Intermorainal Lake Deposits setting, alluvial and floodplain deposits, and flatter-lying portions of ground moraine. Slopes of 2 to 6 percent (9) were widespread in Auglaize County and reflected most areas of both slightly rolling ground moraine and end moraines. Slopes of 6 to 12 percent (5) were selected for a limited number of areas along the margins of end moraines where down-cutting streams had more steeply-dissected the topography. In general, the St. Johns Moraine is more hummocky and has much steeper relief than the other end moraines.

Impact of the Vadose Zone Media

Information on evaluating vadose zone media was obtained primarily from the *Ground Water Resources of Auglaize County* (Kostelnick, 1983) and water well log records on file at the ODNR, Division of Water. 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. Vadose zone media ratings from neighboring Shelby County (Angle, 1997), Mercer County (Sugar, 1989), Logan County (Sprowls, 1995), Darke County (Spahr, 1991), and Allen County (Angle and Barrett, 2005) were used as a guideline. The ODNR, Division of Water, Glacial State Aquifer Map (2000) and Bedrock State Aquifer Map (2000) were important sources of vadose zone media data. The *Soil Survey of Auglaize County* (Cunningham and Priest, 1981) provided valuable information on parent materials. The *Glacial Map of Ohio* (Goldthwait et al., 1961), and the *Quaternary Geology of Ohio* (Pavey et al., 1999) were useful in delineating vadose zone media.

The vadose zone media is a critical component of the overall DRASTIC rating in Auglaize County. The rating varies with the restrictive properties of the various glacial materials. The higher the proportion of silt and clay and the greater the compaction (density) of the sediments, the lower the permeability and the lower the vadose zone media are rated.

Limestone/fractured till with a vadose zone media rating of (6) was selected for parts of Auglaize County where the till covering the underlying limestone was thin, averaging from roughly 5 to 25 ft. Vadose zone media of limestone with fine sand, silt, and clay was selected for a tributary stream in northwestern Auglaize County and given a rating of (6). This vadose zone media was limited to a stream that had eroded down close to the surface of the limestone, leaving less than fifteen feet of alluvium.

Glacial till was given vadose zone media ratings of (6), (5), or (4). A vadose zone media rating of (5) was applied to most areas with a thin to moderate thickness (less than 100 feet) of till. A vadose zone media rating of (4) was used for most areas with thick till (greater than 100 feet). In these areas it was assumed that the bulk of the till was unweathered and nonfractured. Ratings of (4) were most common in the 7C-End Moraine and 7J-Glacial Complex settings. A vadose zone media rating of (3) was chosen for limited areas in southeast Auglaize County that had very thick till and great depth to water. Sandy till with a vadose zone media rating of (5) was evaluated for portions of the St. Johns Moraine in central Auglaize County where the thickness of till was greater than 100 feet and depths to water were moderate. In these areas, numerous sand and gravel lenses create higher permeability in the till than is commonly associated with this thickness of till.

Sand and gravel with a vadose zone media rating of (6) was assigned to a pair of tributary streams in southeastern Auglaize County that had especially thin, clean, coarse alluvium. A vadose zone media rating have was chosen for sand and gravel with significant silt and clay for the majority of the 7D-Buried Valley settings associated with the Teays River System. In many of these areas, it is hard to determine from well log records whether the deeper sediments are till, lacustrine, or alluvial in nature. Sand and gravel with significant silt and clay with a rating of (5) was also utilized for many trunk streams containing moderately coarse alluvium and terraces.

Silt and clay with till with a vadose zone media rating of (4) or (3) was selected for areas in the 7Fc-Intermorainal Lake Deposits setting. These areas contain exceptionally fine-grained till with pockets of lacustrine silt and clay. Shrink-swell (non-aggregated) clay soils and fine clay loams developed from these clayey sediments. Thin lacustrine sediments overlap into a number of adjacent settings. Silt and clay with a vadose zone media rating of (5) was selected for alluvial settings in portions of the Auglaize River and St. Marys River. Silt and clay with a rating of (4) was applied to fine-grained alluvium associated many minor tributary streams and the headwaters of streams. Silt and clay with a vadose zone rating of (3) or (4) was used along the border of Mercer County. Silt and clay was utilized to represent glacial till as till was not recognized as a separate vadose zone media in Mercer County at the time it was mapped (Sugar, 1989).

Hydraulic Conductivity

Information on evaluating the hydraulic conductivity was obtained from the maps and report of the ODNR, Div. of Water, (1970), Norris and Fidler (1973), and the *Ground Water Resources of Auglaize County* (Kostelnick, 1983). 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. Hydraulic conductivity ratings from neighboring Shelby County (Angle, 1997), Mercer County (Sugar, 1989), Logan County (Sprowls, 1995), Darke County (Spahr, 1991), and Allen County (Angle and Barrett, 2005) were used as a guideline. The ODNR, Division of Water, Glacial State Aquifer Map (2000) and Bedrock State Aquifer Map (2000) were important sources of hydraulic conductivity data. Water well log records on file at the ODNR, Division of Water, were also used to help determine hydraulic conductivity. Textbook tables (Freeze and Cherry, 1979, Fetter, 1980, and Driscoll, 1986) were useful in obtaining estimated values for hydraulic conductivity in a variety of aquifers.

Values for hydraulic conductivity correspond to aquifer ratings; i.e., the more highly rated aquifers have higher values for hydraulic conductivity. Sand and gravel aquifers associated with the 7D-Buried Valley setting that lie within the Teays River Valley System have been assigned a hydraulic conductivity range of 700-1,000 gallons per day per square foot (gpd/ft^2) (6). This rating reflects the higher yields of the deeper sand and gravel layers in the core of the ancestral Teays River Valley System. All remaining sand and gravel aquifers were assigned a hydraulic conductivity range of 300-700 (4).

Limestone aquifers in the southeastern corner of the county bordering Logan County were given a hydraulic conductivity range of 700-1,000 gpd/ft^2 . This was due to the high amount of karst and solution features encountered in Logan County. All remaining limestone aquifers were assigned a hydraulic conductivity range of 300-700 gpd/ft^2 (4).

APPENDIX B

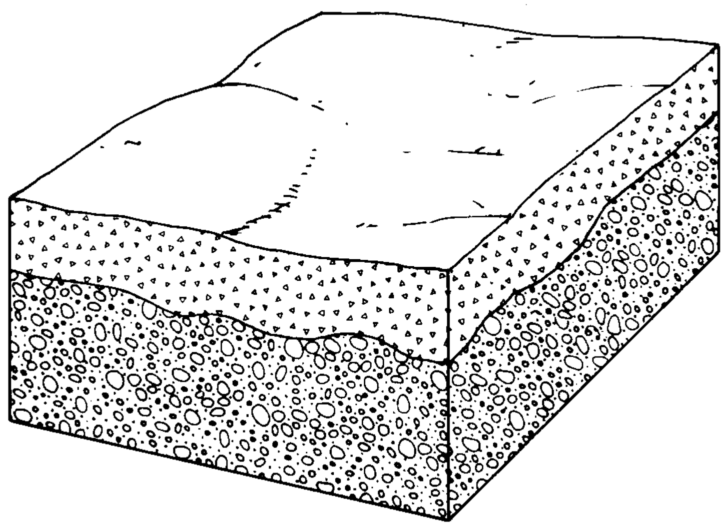
DESCRIPTION OF HYDROGEOLOGIC SETTINGS AND CHARTS

Ground water pollution potential mapping in Auglaize 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 11. Computed pollution potential indexes for Auglaize County range from 87 to 172.

Table 11. Hydrogeologic settings mapped in Auglaize County, Ohio

Hydrogeologic Settings	**Range of GWPP Indexes**	**Number of Index Calculations**
7Ab-Glacial till over outwash	134-139	3
7 Ac-Glacial till over limestone	115-152	36
7 Af-Sand and gravel interbedded in glacial till	87-151	20
7 C-Moraine	103-147	61
7 D-Buried valley	87-157	35
7 Ec-Alluvium over sedimentary rock	128-149	13
7 Ed-Alluvium over glacial till	142-172	14
7 Fc-Intermorainal lake deposits	114-134	4
7 J-Glacial complex	108-141	31

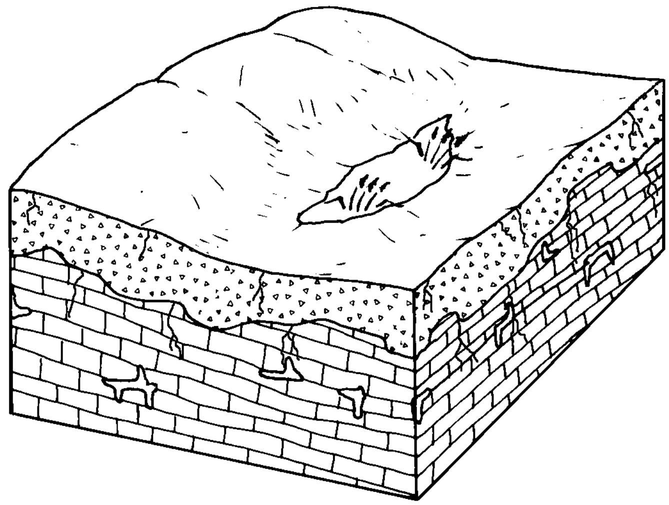
The following information provides a description of each hydrogeologic setting identified in the county, a block diagram illustrating the characteristics of the setting, and a listing of the charts for each unique combination of pollution potential indexes calculated for each setting. The charts provide 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.



7Ab-Glacial Till over Outwash

This hydrogeologic setting is limited to eastern Auglaize County. This setting is characterized by a number of small, gently rolling kame and esker ice-contact features. These features have a thin cover or mantle of fine-grained glacial till or lake sediments. This setting is immediately adjacent to the 7Fc-Intermorainal Lake Deposits setting. The vadose zone consists primarily of thin silty to clayey glacial till. The vadose zone media may also contain a mix of fine sand and gravel, silt, or clay lacustrine or ice-contact sediments. The till may be fractured or jointed, particularly in areas where it is predominantly thin and weathered. The aquifer is composed of the underlying sand and gravel. Depth to water is typically shallow, averaging less than 30 feet. Soils typically are clay loams or loams derived from till. Ground water yields average 5 to 25 gpm and are limited by the overall thin nature of these deposits. Recharge is moderately high due to the relatively permeable nature of the sand and gravel and the thinness of the till.

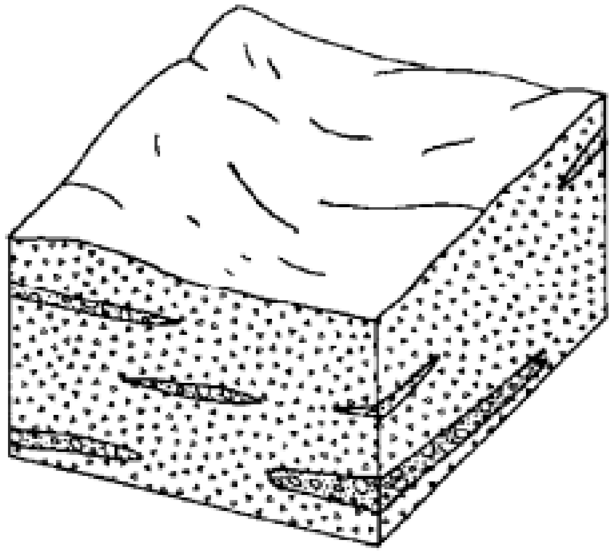
GWPP index values for the hydrogeologic setting of Glacial Till over Outwash range from 134 to 139, with the total number of GWPP index calculations equaling 3.



<u>7Ac-Glacial Till over Limestone</u>

This hydrogeologic setting is most common in western and far eastern Auglaize County. The area is characterized by flat-lying topography and low relief associated with ground moraine. The vadose zone consists primarily of silty to clayey glacial till. The till may be fractured or jointed, particularly in areas where it is predominantly thin and weathered. Where the till is thin (less than 25 feet), fractured limestone along with the till is considered to be the vadose zone media. The aquifer is composed of fractured Silurian limestones and dolomites. These carbonate rocks may contain significant solution features. Depth to water is typically shallow to moderate, ranging from 15 to 50 feet. Soils typically are clay loams derived from till. Maximum ground water yields greater than 100 gpm are possible from the Silurian Lockport, Tymochtee, Greenfield and Salina Groups. Recharge is moderate due to the clayey nature of the soils and vadose zone and the relatively shallow depth to water and permeable nature of the bedrock aquifer. Recharge rates increase somewhat where the limestone bedrock is closer to the ground surface.

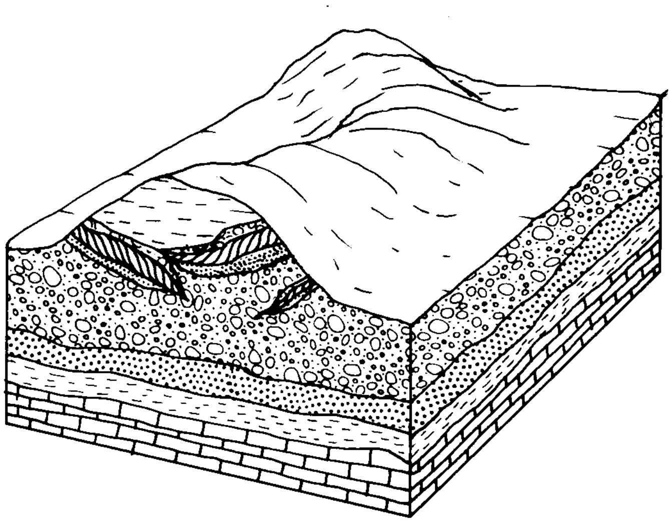
GWPP index values for the hydrogeologic setting of Glacial Till over Limestone range from 115 to 152, with the total number of GWPP index calculations equaling 36.



7Af-Sand and Gravel Interbedded in Glacial Till

This hydrogeologic setting is scattered throughout Auglaize County. The area is characterized by flat lying topography and low relief. The setting is commonly associated with areas of ground moraine. The setting also features a moderate thickness of glacial drift opposed to the thicker drift encountered in the 7C-Moraine, 7D-Buried Valley, and 7J-Glacial Complex settings. The vadose zone is composed of silty to clayey glacial till. The till may be fractured or jointed, particularly in areas where it is predominantly thin and weathered. Depth to water is usually shallow to moderate typically averaging less than 50 feet. Soils are generally clay loams. The aquifer consists of thin lenses of sand and gravel interbedded in the glacial till. Ground water yields range from 5 to 25 gpm. Recharge is moderate due to the relatively low permeability of the clayey soils and vadose zone material and the relative shallow depth to the sand and gravel aquifers.

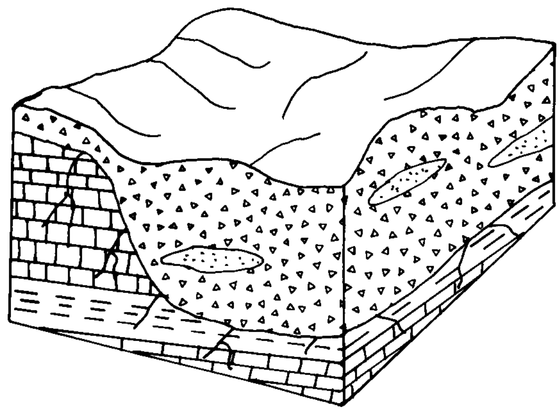
GWPP index values for the hydrogeologic setting of Sand and Gravel Interbedded in Glacial Till range from 87 to 151, with the total number of GWPP index calculations equaling 20.



7C-Moraine

This hydrogeologic setting consists of elongated, broad belts of end moraines that cross Auglaize 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. Some crests of the moraines may also become steeper and more hummocky. The aquifer consists of sand and gravel lenses interbedded with the fine-grained glacial till. In areas of the moraine where useable sand and gravel lenses are not encountered, the wells are completed in the underlying Silurian limestone and dolomite bedrock. Yields for the sand and gravel lenses average from 5 to 25 gpm. Maximum ground water yields greater than 100 gpm are possible from the Silurian Lockport, Tymochtee, Greenfield and Salina Groups. The vadose zone is composed of silty to clayey glacial till. 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 how deep the underlying aquifer is and how thick the till is. Depths to water increase along the central axis or ridge of the end moraines. Soils are commonly clay loams. Recharge is moderate to low depending upon how thick the till is and how deep the underlying limestone is. The end moraines are the primary local sources of recharge.

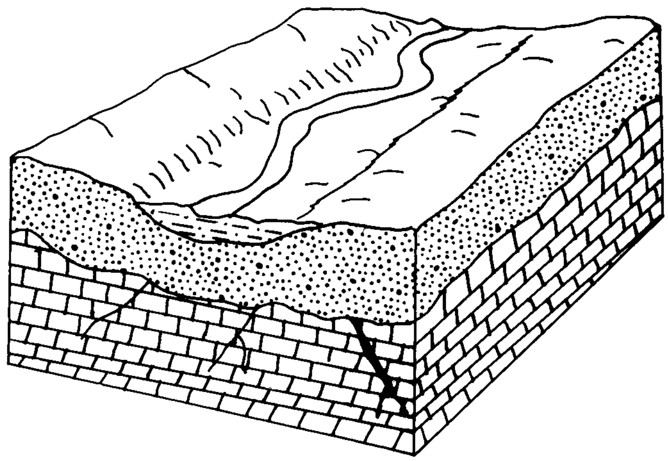
GWPP index values for the hydrogeologic setting of Moraine range from 103 to 147, with the total number of GWPP index calculations equaling 61.



7D-Buried Valley

This hydrogeologic setting consists of narrow bands that extend across portions of central and southern Auglaize County. In western Auglaize County the axis of these buried valleys mark the ancestral channel of a major tributary of the Teays River System. The ancestral channels that these deposits lie in are cut to elevations deeper than 700 feet mean sea level (msl). Along the border of eastern Shelby County and Logan County, buried valleys indicate thick areas of drift. When these neighboring counties were mapped, the 7J-glacial Complex setting and 7C-Moraine setting were not in common usage. These latter-mentioned buried valleys are not related to the trunk of the Teays River Valley System. The surface topography is flat and has low relief. Modern streams may or may not overly these deposits. The setting is characterized by a thick sequence of glacial till. The aquifer consists of thinner, less continuous lenses of sand and gravel interbedded with thicker sequences of fine-grained glacial till. At greater depths, the layers of sand and gravel become thicker, cleaner, and more productive. Thin layers of alluvial or lacustrine silt, clay, or fine sand may also be present at greater depths. The setting is similar to the 7J-Glacial Complex except that the sand and gravel lenses are more numerous, more continuous in lateral extent, and constitute the aquifer. The total drift thickness also tends to be greater than in the 7J-Glacial Complex setting. In the 7J setting, the underlying limestone is more commonly the aquifer. Yields from relatively shallow sand and gravel lenses are commonly less than 25 gpm. Yields from deep, thicker, clean sand and gravel outwash associated with the axis of the Teays River Valley System may exceed 300 gpm. Soils are usually clay loams derived from the overlying glacial till. Depths to water are highly variable. Depths to water vary with the depth to the aquifer and the overall thickness of the till. Recharge is typically moderate due to the fine-grained nature of the soils and vadose zone media and the relatively shallow depth to the sand and gravel aquifers.

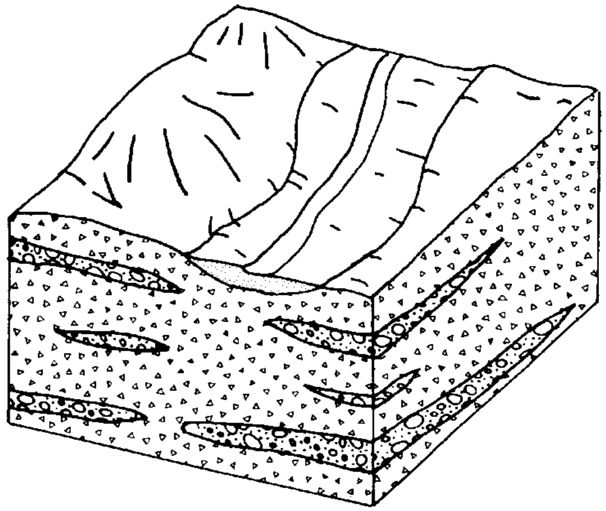
GWPP index values for the hydrogeologic setting of Buried Valley range from 87-157, with the total number of GWPP index calculations equaling 35.



7Ec-Alluvium over Sedimentary Rock

This hydrogeologic setting is common in northwestern and eastern Auglaize County. It is commonly found adjacent to the 7Ac-Glacial Till over Limestone setting. 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 7Ed-Alluvium over Glacial Till except that the underlying aquifers consist of bedrock. The aquifers consist of Silurian limestones and dolomites. The vadose zone consists of the sandy to silty to clayey alluvial deposits overlying thin glacial till. In some places, the limestone bedrock is close enough to the surface to comprise the vadose zone media. Soils are variable due to the varying texture of the alluvial materials and are usually silt loams. Depth to water is commonly very shallow, averaging less than 20 feet. The alluvium may be in direct hydraulic connection with the underlying bedrock or there may be thin till in between. Maximum ground water yields greater than 100 gpm are possible from the Silurian Lockport, Tymochtee, Greenfield and Salina Groups. Recharge is typically moderately high due to the flat-lying topography, shallow depth to water, the moderate permeability of the soils and vadose zone media, and the relatively high permeability of the underlying bedrock.

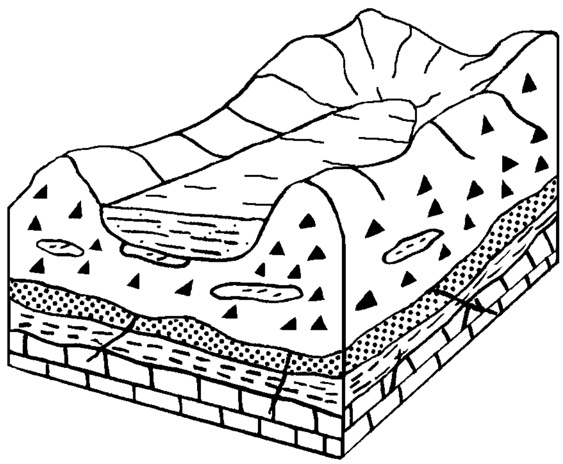
The GWPP index values for the hydrogeologic setting Alluvium over Sedimentary Rocks range from 128 to 149, with the total number of GWPP index calculations equaling 13.



<u>7Ed-Alluvium over Glacial Till</u>

This hydrogeologic setting is comprised of flat-lying floodplains and stream terraces containing thin to moderate thicknesses of modern alluvium. This setting is most common in central Auglaize County. 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 also similar to the 7Ec-Alluvium over Sedimentary Rock except that the underlying aquifer consists of shallow sand and gravel lenses instead of bedrock. The stream may or may not be in direct hydraulic connection with the underlying sand and gravel lenses that constitute the aquifer. The surficial, silty to sandy alluvium is typically more permeable than the underlying till. The alluvium is too thin to be considered the aquifer. The vadose zone consists of the sandy to silty to clayey alluvial deposits. Soils are silt loams, loams, or sandy loams. Yields commonly range from 5 to 25 gpm from the sand and gravel lenses. Depth to water is typically shallow with depths averaging less than 20 feet. Recharge is moderately high due to the shallow depth to water, flat-lying topography, and the moderate permeability of the glacial till and alluvium.

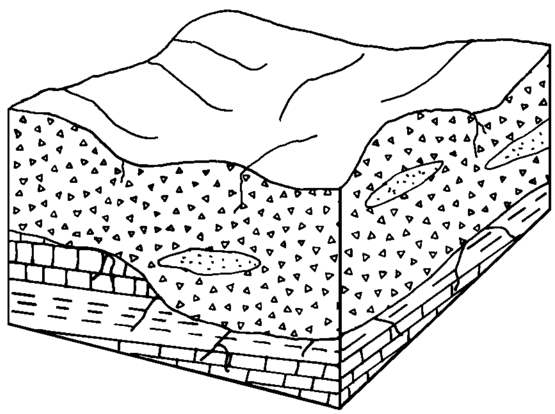
The GWPP index values for the hydrogeologic setting Alluvium Over Glacial Till range from 142 to 172, with the total number of GWPP index calculations equaling 14.



7Fc-Intermorainal Lake Deposits

This hydrogeologic setting is characterized by flat-lying topography and varying thicknesses of fine-grained lacustrine sediments. Surficial drainage is typically very poor; ponding is very common after rains. These sediments were deposited in shallow lakes formed between end moraines and the retreating ice sheets before the modern drainage system evolved. This setting occupies low-lying areas in eastern Auglaize County. The vadose zone media consists of silty to clayey lacustrine sediments that overlie glacial till. The aquifer consists of the underlying Silurian limestones and dolomite. Maximum ground water yields greater than 100 gpm are possible from the Silurian Lockport, Tymochtee, Greenfield and Salina Groups. Depth to water is shallow to moderate. Soils are fine clay loams or shrink-swell (aggregated) clays derived from clayey lacustrine sediments. Recharge in this setting is low due to the relatively low permeability soils and vadose.

GWPP index values for the hydrogeologic setting of Intermorainal Lake Deposits range from 114 to 134, with the total number of GWPP index calculations equaling 4.



7J-Glacial Complex

This setting is found in central Auglaize County. This setting is comprised of predominantly thick glacial till that lies adjacent to the 7D-Buried Valley setting and lacks the distinctive surficial topography of the 7C-Moraine setting. The surface topography is flat and has low relief. Modern streams typically do not overly these deposits. The aquifer consists of thinner, less continuous lenses of sand and gravel interbedded with thicker sequences of fine-grained glacial till. Yields from wells completed in the sand and gravel lenses average from 5 to 25 gpm. Wells that do not encounter adequate-yielding sand and gravel deposits are completed in the limestone bedrock. Maximum ground water yields greater than 100 gpm are possible from the Silurian Lockport, Tymochtee, Greenfield and Salina Groups. The setting is similar to the 7D-Buried Valley except that the sand and gravel lenses are less common, less continuous in lateral extent, and the overall thickness of drift is somewhat less. Soils are usually clay loams derived from the overlying glacial till. These deposits lie at an elevation above 700 feet msl. Depths to water are variable and depend upon how deep the aquifer is and the thickness of till. Recharge is typically moderate to low due to the fine-grained nature of the soils and vadose zone media and the moderate depth to the limestone or sand and gravel aquifers.

GWPP index values for the hydrogeologic setting of Glacial Complex range from 108 to 141, with the total number of GWPP index calculations equaling 31.

Table 12. Hydrogeologic Settings, DRASTIC Factors, and Ratings

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7Ab1	15-30	4-7	sand and gravel	Loam	0-2	sd and gvl with sl and cl	300-700	139	164
7Ab2	15-30	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	135	154
7Ab3	15-30	4-7	sand and gravel	Clay Loam	2-6	sd and gvl with sl and cl	300-700	134	151
7Ac1	30-50	4-7	limestone	Clay Loam	2-6	silt and clay	300-700	115	135
7Ac2	15-30	4-7	limestone	Clay Loam	2-6	silt and clay	300-700	130	149
7Ac3	15-30	4-7	limestone	Silty Loam	2-6	silt and clay	300-700	132	154
7Ac4	15-30	4-7	limestone	Clay Loam	0-2	till	300-700	133	153
7Ac5	15-30	4-7	limestone	Sandy Loam	2-6	till	300-700	138	165
7Ac6	15-30	4-7	limestone	Loam	0-2	till	300-700	137	163
7Ac7	15-30	4-7	limestone	Clay Loam	2-6	till	300-700	132	150
7Ac8	5-15	4-7	limestone	Clay Loam	2-6	silt and clay	300-700	145	163
7Ac9	5-15	4-7	limestone	Clay Loam	2-6	till	300-700	142	160
7Ac10	15-30	4-7	limestone	Clay Loam	0-2	silt and clay	300-700	131	152
7Ac11	15-30	4-7	limestone	Clay Loam	0-2	lst-frac till	300-700	138	157
7Ac12	15-30	4-7	limestone	Clay Loam	2-6	lst-frac till	300-700	137	154
7Ac13	15-30	4-7	limestone	Sandy Loam	0-2	till	300-700	139	168
7Ac14	30-50	4-7	limestone	Clay Loam	2-6	lst-frac till	300-700	127	144
7Ac15	30-50	4-7	limestone	Clay Loam	2-6	till	300-700	117	136
7Ac16	5-15	4-7	limestone	Clay Loam	0-2	till	700-1000	144	163
7Ac17	5-15	4-7	limestone	Shrink/Swell Clay	0-2	till	700-1000	152	183
7Ac18	15-30	4-7	limestone	Clay Loam	0-2	till	700-1000	134	153
7Ac19	15-30	4-7	limestone	Clay Loam	2-6	till	700-1000	133	150
7Ac20	15-30	4-7	limestone	Clay Loam	6-12	till	700-1000	129	138
7Ac21	15-30	4-7	limestone	Shrink/Swell Clay	0-2	till	700-1000	142	173
7Ac22	15-30	4-7	limestone	Shrink/Swell Clay	0-2	sl and cl with till	300-700	136	169
7Ac23	5-15	4-7	limestone	Sandy Loam	2-6	silt and clay	300-700	151	178
7Ac24	5-15	4-7	limestone	Clay Loam	0-2	silt and clay	300-700	146	166
7Ac25	30-50	4-7	limestone	Clay Loam	0-2	till	300-700	118	139
7Ac26	30-50	4-7	limestone	Clay Loam	0-2	till	300-700	123	143
7Ac27	15-30	4-7	limestone	Clay Loam	0-2	till	300-700	128	149
7Ac28	5-15	4-7	limestone	Silty Loam	2-6	silt and clay	300-700	147	168
7Ac29	5-15	4-7	limestone	Clay Loam	0-2	till	300-700	143	163
7Ac30	15-30	4-7	limestone	Shrink/Swell Clay	0-2	silt and clay	300-700	144	176
7Ac31	30-50	4-7	limestone	Clay Loam	0-2	till	300-700	121	142
7Ac32	30-50	4-7	limestone	Clay Loam	0-2	sd and gvl with sl and cl	300-700	123	143

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7Ac33	30-50	4-7	limestone	Shrink/Swell Clay	0-2	till	300-700	129	162
7Ac34	30-50	4-7	limestone	Sandy Loam	0-2	sd and gvl with sl and cl	300-700	129	158
7Ac35	30-50	4-7	limestone	Clay Loam	2-6	sd and gvl with sl and cl	300-700	122	140
7Ac36	30-50	4-7	limestone	Clay Loam	6-12	till	300-700	118	128
7Af1	15-30	4-7	sand and gravel	Loam	2-6	till	300-700	133	157
7Af2	15-30	4-7	sand and gravel	Clay Loam	2-6	till	300-700	129	147
7Af3	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	130	150
7Af4	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	119	137
7Af5	5-15	4-7	sand and gravel	Clay Loam	0-2	sandy till	300-700	143	163
7Af6	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	sandy till	300-700	151	183
7Af7	15-30	4-7	sand and gravel	Shrink/Swell Clay	0-2	sandy till	300-700	141	173
7Af8	15-30	4-7	sand and gravel	Clay Loam	0-2	sandy till	300-700	133	153
7Af9	5-15	4-7	sand and gravel	Sandy Loam	0-2	sd and gvl with sl and cl	300-700	149	178
7Af10	15-30	4-7	sand and gravel	Loam	0-2	till	300-700	134	160
7Af11	5-15	4-7	sand and gravel	Loam	0-2	till	300-700	144	170
7Af12	15-30	4-7	sand and gravel	Sandy Loam	2-6	till	300-700	135	162
7Af13	30-50	4-7	sand and gravel	Clay Loam	0-2	till	300-700	120	140
7Af14	5-15	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	143	163
7Af15	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	128	149
7Af16	5-15	4-7	sand and gravel	Clay Loam	0-2	till	300-700	138	159
7Af17	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	125	146
7Af18	5-15	4-7	sand and gravel	Clay Loam	0-2	till	300-700	140	160
7Af19	5-15	4-7	sand and gravel	Clay Loam	2-6	till	300-700	139	157
7Af20	50-75	2-4	sand and gravel	Clay Loam	2-6	till	300-700	87	107
7C1	30-50	4-7	limestone	Clay Loam	2-6	till	300-700	122	140
7C2	15-30	4-7	limestone	Clay Loam	6-12	till	300-700	128	138
7C3	15-30	4-7	limestone	Sandy Loam	2-6	till	300-700	138	165

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7C4	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	119	137
7C5	15-30	4-7	sand and gravel	Clay Loam	2-6	till	300-700	129	147
7C6	30-50	4-7	limestone	Clay Loam	2-6	till	300-700	117	136
7C7	50-75	4-7	limestone	Clay Loam	2-6	till	300-700	107	126
7C8	30-50	4-7	limestone	Clay Loam	6-12	till	300-700	118	128
7C9	15-30	4-7	limestone	Loam	0-2	till	300-700	132	159
7C10	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	114	133
7C11	30-50	4-7	sand and gravel	Sandy Loam	2-6	till	300-700	128	155
7C12	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	122	140
7C13	50-75	4-7	limestone	Clay Loam	2-6	till	300-700	112	130
7C14	30-50	4-7	limestone	Clay Loam	0-2	till	300-700	123	143
7C15	15-30	4-7	limestone	Clay Loam	0-2	till	300-700	133	153
7C16	50-75	4-7	limestone	Clay Loam	0-2	till	300-700	113	133
7C17	15-30	4-7	limestone	Clay Loam	2-6	till	300-700	132	150
7C18	30-50	2-4	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	111	144
7C19	30-50	4-7	sand and gravel	Clay Loam	6-12	till	300-700	110	121
7C20	30-50	4-7	sand and gravel	Clay Loam	0-2	till	300-700	115	136
7C21	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	130	150
7C22	30-50	4-7	limestone	Sandy Loam	2-6	sd and gvl with sl and cl	300-700	128	155
7C23	5-15	4-7	limestone	Clay Loam	0-2	sd and gvl with sl and cl	300-700	138	159
7C24	5-15	4-7	limestone	Shrink/Swell Clay	0-2	sl and cl with till	300-700	146	179
7C25	5-15	4-7	limestone	Clay Loam	2-6	till	300-700	142	160
7C26	15-30	4-7	limestone	Clay Loam	2-6	sd and gvl with sl and cl	300-700	132	150
7C27	15-30	4-7	sand and gravel	Clay Loam	2-6	sd and gvl with sl and cl	300-700	132	150
7C28	15-30	4-7	limestone	Clay Loam	0-2	till	300-700	128	149
7C29	5-15	4-7	limestone	Loam	0-2	till	300-700	147	173
7C30	30-50	4-7	sand and gravel	Loam	2-6	till	300-700	118	143
7C31	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	117	136
7C32	15-30	4-7	sand and gravel	Clay Loam	2-6	till	300-700	127	146
7C33	15-30	4-7	limestone	Clay Loam	2-6	till	300-700	127	146
7C34	15-30	4-7	sand and gravel	Clay Loam	2-6	till	300-700	124	143

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7C35	30-50	4-7	sand and gravel	Sandy Loam	6-12	till	300-700	116	136
7C36	30-50	4-7	sand and gravel	Sandy Loam	0-2	till	300-700	126	155
7C37	30-50	4-7	sand and gravel	Sandy Loam	2-6	sandy till	300-700	128	155
7C38	30-50	4-7	sand and gravel	Clay Loam	6-12	sandy till	300-700	118	128
7C39	50-75	4-7	sand and gravel	Clay Loam	6-12	sandy till	300-700	108	118
7C40	30-50	4-7	sand and gravel	Clay Loam	2-6	sandy till	300-700	122	140
7C41	15-30	4-7	sand and gravel	Clay Loam	2-6	sandy till	300-700	132	150
7C42	50-75	4-7	sand and gravel	Sandy Loam	6-12	sandy till	300-700	114	133
7C43	30-50	4-7	sand and gravel	Sandy Loam	6-12	sandy till	300-700	124	143
7C44	50-75	4-7	sand and gravel	Sandy Loam	2-6	sandy till	300-700	118	145
7C45	50-75	4-7	sand and gravel	Clay Loam	2-6	sandy till	300-700	112	130
7C46	50-75	4-7	limestone	Sandy Loam	0-2	sandy till	300-700	119	148
7C47	50-75	4-7	limestone	Clay Loam	2-6	sandy till	300-700	112	130
7C48	15-30	4-7	limestone	Shrink/Swell Clay	0-2	sl and cl with till	300-700	136	169
7C49	30-50	4-7	limestone	Clay Loam	6-12	till	300-700	113	124
7C50	50-75	4-7	limestone	Clay Loam	6-12	till	300-700	103	114
7C51	30-50	4-7	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	118	152
7C52	30-50	4-7	limestone	Clay Loam	0-2	till	300-700	118	139
7C53	30-50	4-7	sand and gravel	Clay Loam	0-2	till	300-700	118	139
7C54	50-75	4-7	sand and gravel	Clay Loam	2-6	till	300-700	107	126
7C55	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	128	149
7C56	15-30	4-7	sand and gravel	Shrink/Swell Clay	0-2	till	300-700	136	169
7C57	50-75	4-7	limestone	Clay Loam	0-2	till	300-700	108	129
7C58	5-15	4-7	limestone	Clay Loam	0-2	till	300-700	138	159
7C59	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	125	146
7C60	30-50	4-7	sand and gravel	Clay Loam	2-6	sandy till	300-700	127	144
7C61	30-50	4-7	sand and gravel	Sandy Loam	2-6	till	300-700	120	148
7D1	30-50	4-7	sand and gravel	Clay Loam	2-6	sd and gvl with sl and cl	700-1000	128	144

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7D2	30-50	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	700-1000	129	147
7D3	15-30	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	700-1000	139	157
7D4	15-30	4-7	sand and gravel	Clay Loam	2-6	sd and gvl with sl and cl	700-1000	138	154
7D5	5-15	4-7	sand and gravel	Silty Loam	0-2	sd and gvl with sl and cl	700-1000	151	172
7D6	15-30	4-7	sand and gravel	Sandy Loam	0-2	sd and gvl with sl and cl	700-1000	145	172
7D7	15-30	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	133	153
7D8	5-15	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	700-1000	149	167
7D9	5-15	4-7	sand and gravel	Loam	0-2	sd and gvl with sl and cl	700-1000	153	177
7D10	5-15	4-7	sand and gravel	Sandy Loam	0-2	sd and gvl with sl and cl	700-1000	155	182
7D11	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	sd and gvl with sl and cl	700-1000	157	187
7D12	5-15	4-7	sand and gravel	Clay Loam	2-6	sd and gvl with sl and cl	700-1000	148	164
7D13	30-50	4-7	sand and gravel	Clay Loam	2-6	sd and gvl with sl and cl	300-700	119	137
7D14	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	128	149
7D15	30-50	4-7	sand and gravel	Shrink/Swell Clay	0-2	sd and gvl with sl and cl	700-1000	137	167
7D16	30-50	4-7	sand and gravel	Clay Loam	2-6	silt and clay	300-700	112	132
7D17	15-30	4-7	sand and gravel	Clay Loam	2-6	silt and clay	300-700	127	146
7D18	15-30	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	130	150
7D19	15-30	4-7	sand and gravel	Sandy Loam	0-2	sd and gvl with sl and cl	300-700	136	165
7D20	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	114	133
7D21	15-30	4-7	sand and gravel	Sandy Loam	2-6	sd and gvl with sl and cl	300-700	135	162
7D22	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	sd and gvl with sl and cl	300-700	148	180
7D23	15-30	4-7	sand and gravel	Clay Loam	2-6	sd and gvl with sl and cl	300-700	129	147
7D24	15-30	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	125	146
7D25	5-15	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	140	160
7D26	30-50	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	120	140
7D27	30-50	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	123	143
7D28	5-15	4-7	sand and gravel	Clay Loam	0-2	sd and gvl with sl and cl	300-700	143	163

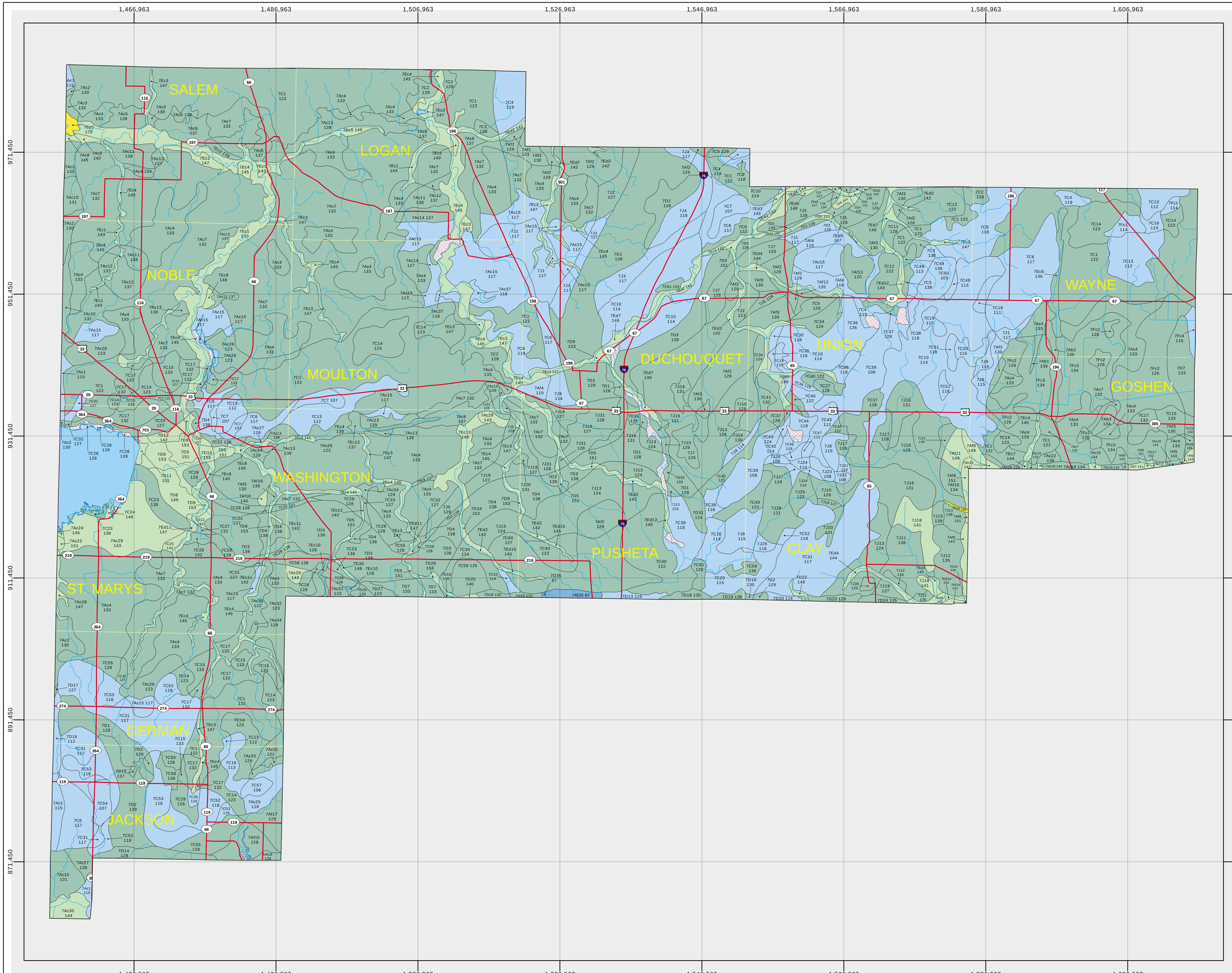
Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7D29	5-15	4-7	sand and gravel	Shrink/Swell Clay	2-6	sd and gvl with sl and cl	700-1000	156	184
7D30	5-15	4-7	sand and gravel	Silty Loam	0-2	sd and gvl with sl and cl	700-1000	148	169
7D31	30-50	4-7	sand and gravel	Clay Loam	6-12	sd and gvl with sl and cl	700-1000	124	132
7D32	30-50	4-7	sand and gravel	Loam	0-2	sd and gvl with sl and cl	700-1000	133	157
7D33	30-50	4-7	sand and gravel	Sandy Loam	0-2	sd and gvl with sl and cl	700-1000	135	162
7D34	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	silt and clay	700-1000	152	183
7D35	50-75	2-4	sand and gravel	Clay Loam	2-6	till	300-700	87	107
7Ec1	5-15	4-7	limestone	Clay Loam	0-2	silt and clay	300-700	143	163
7Ec2	15-30	4-7	limestone	Sandy Loam	0-2	sd and gvl with sl and cl	300-700	139	168
7Ec3	5-15	4-7	limestone	Loam	0-2	sd and gvl with sl and cl	300-700	147	173
7Ec4	15-30	4-7	limestone	Sandy Loam	0-2	silt and clay	300-700	139	168
7Ec5	5-15	4-7	limestone	Sandy Loam	0-2	sd and gvl with sl and cl	300-700	149	178
7Ec6	15-30	4-7	limestone	Shrink/Swell Clay	0-2	silt and clay	300-700	136	169
7Ec7	5-15	4-7	limestone	Clay Loam	0-2	till	700-1000	144	163
7Ec8	5-15	4-7	limestone	Silty Loam	0-2	till	300-700	140	164
7Ec9	5-15	4-7	limestone	Clay Loam	0-2	sd, sl, and cl with ls	300-700	148	167
7Ec10	15-30	4-7	limestone	Clay Loam	0-2	silt and clay	300-700	128	149
7Ec11	5-15	4-7	limestone	Loam	0-2	till	300-700	142	169
7Ec12	15-30	4-7	limestone	Loam	0-2	silt and clay	300-700	137	163
7Ec13	5-15	4-7	limestone	Shrink/Swell Clay	0-2	sl and cl with till	300-700	146	179
7Ed1	5-15	7-10	limestone	Shrink/Swell Clay	0-2	sd and gvl with sl and cl	300-700	172	202
7Ed2	5-15	4-7	sand and gravel	Silty Loam	0-2	sd and gvl with sl and cl	300-700	142	165
7Ed3	5-15	4-7	sand and gravel	Sandy Loam	2-6	sd and gvl with sl and cl	300-700	145	172
7Ed4	5-15	4-7	sand and gravel	Loam	0-2	sd and gvl with sl and cl	300-700	144	170
7Ed5	5-15	4-7	sand and gravel	Loam	0-2	sd and gvl with sl and cl	300-700	147	173
7Ed6	5-15	4-7	sand and gravel	Sandy Loam	2-6	sd and gvl with sl and cl	300-700	148	175
7Ed7	5-15	4-7	sand and gravel	Sandy Loam	0-2	sd and gvl with sl and cl	300-700	146	175
7Ed8	5-15	4-7	sand and gravel	Clay Loam	6-12	sand and gravel	700-1000	149	156

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7Ed9	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	sandy till	700-1000	162	191
7Ed10	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	silt and clay	700-1000	152	183
7Ed11	5-15	4-7	sand and gravel	Loam	0-2	silt and clay	300-700	147	173
7Ed12	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	silt and clay	300-700	143	176
7Ed13	5-15	4-7	sand and gravel	Silty Loam	0-2	sd and gvl with sl and cl	300-700	145	168
7Ed14	5-15	4-7	sand and gravel	Clay Loam	0-2	sand and gravel	700-1000	154	171
7Fc1	30-50	2-4	limestone	Shrink/Swell Clay	0-2	sl and cl with till	300-700	114	147
7Fc2	5-15	2-4	limestone	Clay Loam	0-2	sl and cl with till	300-700	126	147
7Fc3	5-15	2-4	limestone	Shrink/Swell Clay	0-2	sl and cl with till	300-700	134	167
7Fc4	15-30	2-4	limestone	Clay Loam	0-2	sl and cl with till	300-700	116	137
7J1	30-50	4-7	limestone	Clay Loam	2-6	till	300-700	117	136
7J2	15-30	4-7	sand and gravel	Clay Loam	2-6	till	300-700	127	146
7J3	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	117	136
7J4	30-50	4-7	sand and gravel	Clay Loam	0-2	till	300-700	118	139
7J5	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	128	149
7J6	15-30	4-7	sand and gravel	Sandy Loam	0-2	till	300-700	134	164
7J7	15-30	4-7	sand and gravel	Clay Loam	0-2	till	300-700	125	146
7J8	30-50	4-7	sand and gravel	Clay Loam	0-2	till	300-700	115	136
7J9	30-50	4-7	sand and gravel	Clay Loam	2-6	till	300-700	114	133
7J10	15-30	4-7	sand and gravel	Loam	0-2	till	300-700	129	156
7J11	5-15	4-7	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	138	172
7J12	5-15	4-7	sand and gravel	Clay Loam	0-2	till	300-700	135	156
7J13	15-30	4-7	sand and gravel	Clay Loam	2-6	till	300-700	124	143
7J14	15-30	4-7	sand and gravel	Sandy Loam	2-6	till	300-700	130	158
7J15	5-15	4-7	sand and gravel	Loam	0-2	till	300-700	139	166
7J16	15-30	4-7	sand and gravel	Sandy Loam	0-2	till	300-700	131	161

Setting	Depth to Water (feet)	Recharge (In/Yr)	Aquifer Media	Soil Media	Topography (% slope)	Vadose Zone Media	Hydraulic Conductivity	Rating	Pesticide Rating_
7J17	15-30	4-7	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	128	162
7J18	5-15	4-7	sand and gravel	Sandy Loam	0-2	till	300-700	141	171
7J19	15-30	4-7	limestone	Clay Loam	2-6	till	300-700	127	146
7J20	15-30	4-7	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	131	165
7J21	30-50	4-7	sand and gravel	Loam	0-2	till	300-700	119	146
7J22	50-75	4-7	sand and gravel	Loam	0-2	till	300-700	109	136
7J23	50-75	4-7	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	108	142
7J24	50-75	4-7	limestone	Sandy Loam	0-2	till	300-700	114	144
7J25	30-50	4-7	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	123	156
7J26	50-75	4-7	limestone	Clay Loam	0-2	till	300-700	108	129
7J27	30-50	4-7	limestone	Clay Loam	0-2	till	300-700	118	139
7J28	30-50	4-7	limestone	Shrink/Swell Clay	0-2	sl and cl with till	300-700	121	155
7J29	30-50	4-7	sand and gravel	Shrink/Swell Clay	0-2	sl and cl with till	300-700	118	152
7J30	15-30	4-7	sand and gravel	Clay Loam	6-12	till	300-700	120	131
7J31	15-30	4-7	limestone	Clay Loam	0-2	till	300-700	128	149

Ground Water Pollution Potential of Auglaize County

by
Mike Angle and Kelly Barrett
Ohio Department of Natural Resources
Divison of Water



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

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

Ohio Department of Natural Resources
Division of Water
Ground Water Resources Section
2045 Morse Road
Columbus Ohio 43229-6605
www.dnr.state.oh.us

June 2005