GROUND WATER POLLUTION POTENTIAL OF SENECA COUNTY, OHIO

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ABSTRACT

A ground water pollution potential mapping program for Ohio has been developed under the direction of the Division of Water, Ohio Department of Natural Resources, 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 form the basis of the system and incorporate the major hydrogeologic factors that affect and 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.

Seneca County lies within the Central Lowlands Province and consists of two physiographic sections, the Eastern Lake Plains and the Till Plains Section (Fenneman, 1938). The county is covered by a variable thickness of both sorted and unsorted deposits of clay, silt, sand, and gravel. These unconsolidated glaical deposits are underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting of limestone, dolomite, and shale. Ground water yields are dependent on the type of aquifer and vary greatly throughout the county. Pollution potential indexes are low in areas of glacial till over shale and moderately low to moderate in areas of moraine and marshes/swamps. P.P indexes are moderately high to high in areas of buried valley, alluvium over sedimentary rock, river alluvium over till, and thin till over limestone. Low to very high vulnerablities to contamination occure in areas of glacial till over solution limestone and areas of beaches, beach ridges, and sand dunes.

Ground water pollution potential analysis in Seneca County resulted in a map with symbols and colors which illustrate areas of varying vulnerability to ground water contamination. Ten hydrogeologic settings were identified in Seneca County with computed ground water pollution indexes ranging from 98 to 217.

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 Seneca 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.

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INTRODUCTION

The need for protection and management of ground water resources in Ohio has been clearly recognized. About 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 700,000 rural households depend on private wells; 5,000 of these wells exist in Seneca 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 clean-up 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 demonstrable 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, Ground Water Resources Section to implement the ground water pollution potential mapping program on a county-wide basis in Ohio.

ERM-Midwest, Inc. was selected by the Division of Water to assist in the timely production of these maps. Under the direct supervision of the Division of Water, ERM-Midwest, Inc. completed the pollution potential map for Seneca County. All work has been extensively reviewed and field checked by both ERM-Midwest, Inc. and the Division of Water.

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 more or less 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 results of 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 Seneca 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.

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

A pollution potential map can also assist in the development of 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 education tool to promote public awareness of ground water resources.

Pollution potential maps may also 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.

Other beneficial uses of the pollution potential maps will be recognized by individuals in the county who are familiar with specific land use and management problems. Planning commissions and zoning boards can use these maps to help make informed decisions about the development of areas within their jurisdiction. Developments proposed to occur within sensitive ground water 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

The system chosen for implementation of a ground water pollution potential mapping program in Ohio, DRASTIC, was developed by the National Water Well Association for the United States Environmental Protection Agency. 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. The vulnerability of an area 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 which 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, assuming a contaminant with the mobility of water, 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 with Seneca County. Inherent within each hydrogeologic setting are the physical characteristics which 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

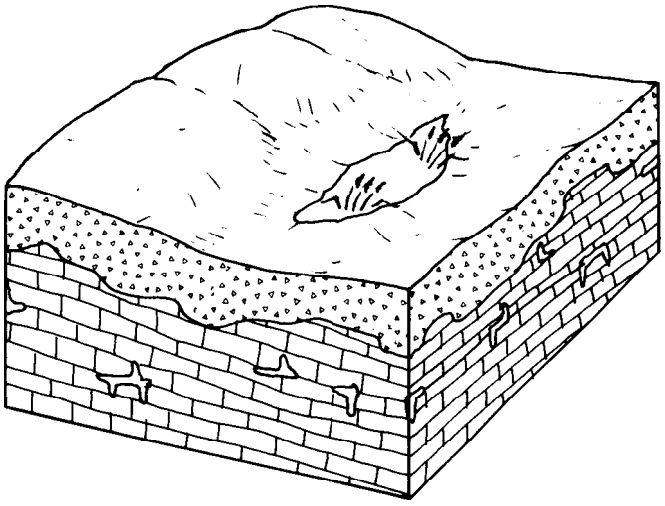
C - Conductivity (Hydraulic) of the Aquifer

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 applied to the land surface that infiltrates into the aquifer measured in inches per year. Recharge water is available to transport a contaminant from the surface into the aquifer and also 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 material capable of yielding sufficient quantities of water for use. Aquifer media accounts for the various physical characteristics of the material that provide mechanisms of attenuation, retardation, and flow pathways that affect a contaminant reaching and moving through an aquifer.



7Ac Glacial Till Over Solution Limestone

This hydrogeologic setting is characterized by low topography and solution limestone which are covered by varying thicknesses of glacial till. The till is principally unsorted deposits which may be interbedded with localized deposits of sand and gravel. Surficial deposits have usually weathered to a clay loam. Although ground water occurs in both the glacial deposits and in the underlying limestone, the limestone, which typically contains solution cavities, serves as the principal aquifer. The limestone is in direct hydraulic connection with the glacial till and the glacial till serves as a source of recharge for the underlying limestone. Although precipitation is abundant, recharge is moderate because of the relatively low permeability of the overlying glacial till. Depth to water is extremely variable depending in part on the thickness of the glacial till, but is typically moderately deep.

Figure 1. Format and description of the hydrogeologic setting - 7Ac Glacial Till Over Solution Limestone.

Soil media refers to the upper six feet of the unsaturated zone that is characterized by significant biological activity. The type of soil media can influence 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 though 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.

Topography refers to the slope of the land expressed as a percent slope. The amount of slope in an area affects the likelihood that a contaminant will run off from an area 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 significantly impacts 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 pollution potential 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 pollution potential 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 to be used 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. 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 significantly differs.

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
Massive Shale	1-3	2
Metamorphic/Igneous	2-5	3
Weathered Metamorphic / Igneous	3-5	4
Glacial Till	4-6	5
Bedded Sandstone, Limestone and Shale Sequences	5-9	6
Massive Sandstone	4-9	6
Massive Limestone	4-9	6
Sand and Gravel	4-9	8
Basalt	2-10	9
Karst Limestone	9-10	10
Weight: 3	Pesticide Weight: 3	

TABLE 5. RANGES AND RATINGS FOR SOIL MEDIA

SOIL MEDIA	
Range	Rating
Thin or Absent	10
Gravel	10
Sand	9
Peat	8
Shrinking and / or Aggregated Clay	7
Sandy Loam	6
Loam	5
Silty Loam	4
Clay Loam	3
Muck	2
Nonshrinking and Nonaggregated 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
Bedded Limestone, Sandstone, Shale	4-8	6
Sand and Gravel with significant Silt and Clay	4-8	6
Metamorphic/Igneous	2-8	4
Sand and Gravel	6-9	8
Basalt	2-10	9
Karst Limestone	8-10	10
Weight: 5	Pesticide Weight: 4	

TABLE 8. RANGES AND RATINGS FOR HYDRAULIC CONDUCTIVITY

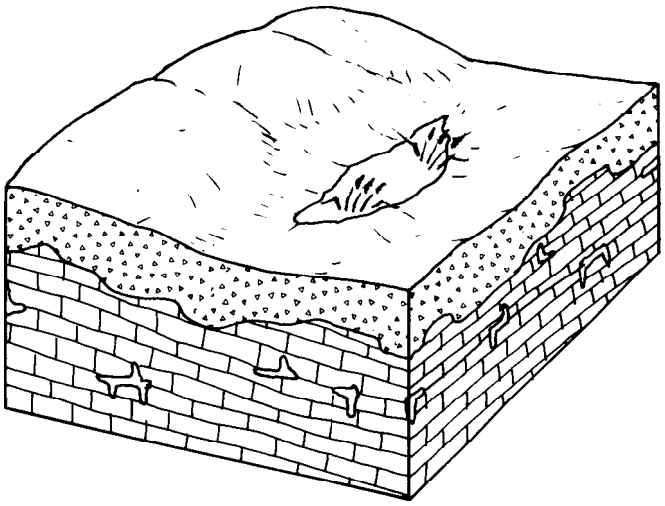
HYDRAULIC CONDUCTIVITY (GPD/FT^2)	
Range	Rating
1-100	1
100-300	2
300-700	4
700-1000	6
1000-2000	8
2000+	10
Weight: 3	Pesticide Weight: 2

Integration of Hydrogeologic Settings and DRASTIC Factors

Figure 2 illustrates the hydrogeologic setting 7Ac1, Glacial Till Over Solution Limestone identified in mapping Seneca 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 140. This numerical value has no intrinsic meaning, but can be readily compared to a value obtained for other settings in the county.

Pollution potential indexes for typical hydrogeologic settings and values across the United States range from 45 to 223. The diversity of hydrogeologic conditions in Seneca County produces settings with a wide range of vulnerability to ground water contamination. Calculated pollution potential indexes for the ten settings identified in the county range from 98 to 217.

Hydrogeologic settings identified in an area are combined with the pollution potential indexes to create units that can be graphically displayed on maps. Pollution potential analysis in Seneca 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 Seneca County is included in this report.



SETTING 7Ac1		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	NUMBER
Depth to Water	5 - 1 5	5	9	4 5
Net Recharge	4 - 7	4	6	2 4
Aquifer Media	Massive Limestone	3	7	2 1
Soil Media	Shrink/Swell Clay	2	7	1 4
Topography	0 - 2 %	1	1 0	1 0
Impact Vadose Zone	Silt & clay	5	4	2 0
Hydraulic Conductivity	1 0 0 - 3 0 0	3	2	6
		DRASTIC	INDEX	1 4 0

Figure 2. Description of the hydrogeologic setting - 7Ac1 Glacial Till Over Solution Limestone

INTERPRETATION AND USE OF A GROUND WATER POLLUTION POTENTIAL MAP

The application of the DRASTIC system to evaluate an area's vulnerability to contamination produces hydrogeologic settings with corresponding pollution potential indexes. The higher the pollution potential index, the greater the susceptibility to contamination. 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 for those hydrogeologic settings. The symbols on the map represent the following information:

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

Here the first number (7) refers to the major hydrogeologic region and the upper and lower case letters (Ac) refer 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 (140) 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 in an area.

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 map also includes information on the locations of selected observation wells. Available information on these observation wells is referenced in Appendix A, Description of the Logic in Factor Selection. Large man-made features such as landfills, quarries, or strip mines have also been identified for reference.

GENERAL INFORMATION ABOUT SENECA COUNTY

Seneca County occupies an area of approximately 551 square miles in north-central Ohio (Figure 3). It is bounded on the north by Sandusky County, on the east by Huron County, on the south by Wyandot and Crawford Counties, and on the west by Hancock and Wood Counties. The county seat is Tiffin. The population of the county in 1990 was 59,733 (Ohio Department of Development, 1991). The county is primarily agricultural with 75 percent of the land used for crops (Ohio Department of Agriculture, 1992).

Physiography

The physiography of Seneca County consists of a mantle of unconsolidated glacial deposits overlying a sequence of relatively flat-lying sedimentary rocks. Seneca County lies within the Central Lowlands physiographic province (Fenneman, 1938) and consists of two physiographic sections.

The southern half of the county is located in the generally flat-lying to gently rolling Till Plains Section of the Central Lowland Province. Some hummocky terrain occurs along the Defiance Moraine. The northern half of the county is located in the Eastern Lake Plains Section of the Central Lowland Province. The topography in this area slopes gently northward toward Lake Erie. A series of east-west trending beach ridges occur at varying intervals across the lake plains.

Drainage and Climate

Seneca County lies within the St. Lawrence drainage basin and is primarily drained of surface water by the Sandusky River and its tributaries. Surface drainage in Seneca County is divided into five major river basins: 88.0% of the county lies in the Sandusky River basin, 5.2 % in the Huron River basin, 2.7 % in the Portage River basin, 2.7% in the Pickerel-Pipe Creek basin, and 1.4% in the Maumee River basin (Ohio Department of Natural Resources, (ODNR), 1960; 1966). All stream flow is northward, eventually discharging into Lake Erie.

The climate of Seneca County is typical of the temperate mid-continent region, characterized by a wide range between summer and winter temperatures and moderate amounts of precipitation. The average monthly precipitation at the U.S. Weather Bureau Station in Tiffin for the thirty year period from 1961 to 1990 ranged between 1.90 inches for February and 3.64 inches for July. The average annual precipitation for Tiffin was 36.40 inches (U.S. Department of Commerce, 1992). The average annual temperature range for the same 30 year period was between 31.2^{o}F (January) and 83.6^{o}F (July) with an average annual temperature of 59.1^{o}F (U.S. Department of Commerce, 1992).

Figure 3. Location of Seneca County in Ohio

Glacial Geology

Approximately 2 million years ago, the Pleistocene Epoch commenced with a series of continental glaciations covering the northern half of North America. Four major glacial advances: the Nebraskan (oldest), pre-Illinoian (Kansan), Illinoian, and Wisconsinan (youngest) are known to have occurred in North America during the Pleistocene Epoch. In Ohio, evidence exists for three glacial periods: the Wisconsinan, which occurred between 70,000 and 10,000 years ago, the Illinoian, which occurred at least 120,000 years ago, and the pre-Illinoian.

The continental glaciations greatly altered much of Ohio's preglacial landscape by burying its Tertiary topography and drainage systems beneath a mantle of unconsolidated clastic deposits. This unconsolidated glacial mantle consists of both sorted and unsorted deposits of clay, silt, sand and gravel.

Glacial sediments deposited in Seneca County consist mainly of glacial till, an unsorted mixture of silt and clay with variable amounts of sand and gravel deposited directly by the ice sheet. Glacial till in the county comprises two basic landforms: flat to gently-rolling ground moraines and hummocky end moraines. Ground moraines cover most of Seneca County and are generally 50 feet or less in thickness although some local deposits can range up to 150 feet where these deposits overlie buried preglacial valleys.

End moraines, deposited at the outer edge of a glacial ice sheet, often occur as long, hummocky ridges. In Seneca County, an east-west trending end moraine called the Defiance Moraine occurs along the southern half of the county (Goldthwait, et al., 1961).

As the last continental glaciation retreated from Ohio, meltwater impounded between the Great Lakes continental drainage divide and the retreating glacier created a series of ancient glacial lakes in northwest Ohio. Remnants of these ancient lakes occur in the northern half of Seneca County as a series of beach ridges.

Beach ridges deposited by Lakes Maumee I and III occur on the perimeter of the lake plains region and extend west to east from Fostoria to Tiffin. Beach ridges deposited by Lake Maumee II and Lake Whittlesey occur across the lake plains of northwest Seneca County. East of Tiffin, all four merge together to form a long, linear series of ridges extending northeast into Sandusky County (Forsyth, 1959). Also occurring within the lake plains region are a number of miscellaneous sand and silt deposits that probably represent sand spits and deltas associated with the ancient glacial lakes.

East of the Sandusky River, well log data indicates the existence of a buried valley comprised of thick sand and gravel deposits interbedded with till. This buried valley appears to start near the center of the county in Clinton Township and extends northward through Pleasant Township into Sandusky County.

Bedrock Geology

Seneca County is underlain by a relatively flat-lying sequence of Paleozoic sedimentary rocks consisting of limestone, dolomite, and shale. The majority of the bedrock beneath the county consists of dolomite and limestone from the Devonian and Silurian Systems (Table 9).

The bedrock formations of Seneca County lie on the eastern flank of a large regional structure referred to as the Findlay Arch. The crest of the Arch trends northward from the Findlay, Ohio area and crosses along the western edge of Seneca County. Bedrock formations on the eastern flank of the Arch dip gently southeast towards the ancient Appalachian basin (ODNR, 1970).

The Devonian carbonates consist mainly of massive to thin-bedded brown to gray fossiliferous limestone. Some thin shale beds occur intermittently within the Devonian carbonates, especially in the Delaware Formation (Stout, 1941).

The Silurian carbonate sequence is generally comprised of a micro-crystalline brown to gray argillaceous dolomite. Anhydrite and shale are interbedded with the dolomite in certain localities throughout the northwestern region of the state (Janssens, 1977).

In the southeastern corner of Seneca County, the carbonate bedrock grades into a massive sequence of shale. The shale consists of two formations: the Olentangy and Ohio Formations from the Devonian System. The Olentangy Shale is typically a blue-gray, calcareous shale interbedded with thin lenses of limestone or black, siliceous shale. Overlying the Olentangy Shale is the Ohio Shale; a black, fissile, siliceous shale with a high carbonaceous matter content and pyrite/carbonate concretions (Hoover, 1960).

Table 9. Generalized Stratigraphic Column of Seneca County, Ohio (Modified from Janssens, 1977 and Sparling, 1985)

SYSTEM	SERIES	GROUP	FORMATION	ROCK TYPE
DEVONIAN	Chautauquan		Ohio	Black Shale
	Senecan		Olentangy	Shale and Limestone
	Erian		Delaware	Limestone
	Ulsterian		Columbus	Limestone
SILURIAN	Cayugan	Salina	F Unit	Interbedded sequences of Anhydrite and Dolomite
			E Unit	
			C Unit	
			B Unit	
			A_2 Unit	Dolomite
			Tymochtee & Greenfield	
	Niagaran	Lockport	Lockport	Dolomite

Karst Geology

Buried beneath the mantle of glacial deposits in northeastern Seneca County is a preglacial karst terrain. A karst terrain has distinctive characteristics of relief and drainage resulting from the dissolution of limestone or dolomite by the action of surface and ground water (Bloom, 1978). The karst terrain typically has a well-developed underground drainage network ranging from fractures and minor solution channels to caverns with subterranean streams. Dolines (sinkholes), springs, sinking streams, ponors (swallow holes), and caves are surface expressions related to the underground drainage network. Karst topography is particularly well-developed in the Columbus Limestone.

The karst terrain in Seneca County appears to have developed in conjunction with a preglacial river system, the Erigan River system, that flowed north across Seneca County towards Lake Erie. Sinkholes or dolines are commonly found throughout Thompson and Adams Townships and may represent points of concentrated recharge to the underlying carbonate aquifer (Kihn, 1988). Seneca Caverns, located near the town of Flat Rock, are a series of solution channels and caverns that comprise part of the karstic underground drainage network occurring in the northeast corner of the county.

Hydrogeology

The hydrogeologic system of Seneca County consists of the large regional carbonate aquifer buried by deposits of glacial till. Generally the glacial till is not considered a major aquifer in Seneca County, although it does contain intermittent water-bearing pockets of sand and gravel. The pockets of sand and gravel are a source of recharge to the carbonate aquifer and a source of ground water for some domestic wells. Other sources of ground water include beach ridges and a buried valley near the center of the county.

The large regional carbonate aquifer underlies most of Seneca County and serves as a primary source of ground water for much of the county's population. Ground water within the limestone and dolomite of the carbonate aquifer occurs in a network of interconnected fractures, bedding planes, and solution channels. Yields to individual wells drilled into the carbonate aquifer are highly variable, dependent upon the number of fractures and solution channels in the rock encountered by the well bore.

Yields to wells drilled into the carbonate aquifer in the western half of the county generally range up to 200 gallons per minute. Well yields for the eastern half of the county may range from 500 to 1000 gallons per minute with the exception of the southeastern corner which contains shale bedrock (Schmidt, 1982; ODNR, 1970).

The higher well yields of the eastern half of Seneca County can be attributed to the presence of a buried karst terrain throughout the area. The greater degree of dissolution within the carbonate aquifer in this area provides greater capacity for the aquifer to store and transmit ground water to individual wells.

A potentiometric surface map of the carbonate aquifer for Seneca County (ODNR, 1970) shows a general northward-trending slope, indicating regional ground water flow from sources of recharge in central Ohio towards points of discharge in Lake Erie.

In the southeastern corner of the county, the carbonate aquifer is confined by a sequence of shale. Well yields from the shale are poor, generally ranging less than 2 gallons per minute (Schmidt, 1982). Despite its fine-grained texture, the first few feet of the shale is often very fractured, giving the shale some capacity to store and transmit water.

Overlying the bedrock aquifer of Seneca County is a mantle of glacial till. Because of the high clay/silt content of glacial till, it generally has a low hydraulic conductivity and is a poor source of ground water. Glacial till often has an interconnected network of vertical fractures which impart an enhanced capability for ground water flow (Freeze and Cherry, 1979). Lenses and pockets of permeable sand and gravel are also commonly found intermittently throughout the till deposits and may serve as a local source of ground water for some domestic wells.

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APPENDIX A

DESCRIPTION OF THE LOGIC IN FACTOR SELECTION

Depth to Water

Depth to water was evaluated using information obtained from well logs (ODNR, Division of Water), discussions with well drillers in the region, and from inference based on the topographic expression of the land and surface water elevations.

With the exception of the area underlying the Defiance Moraine, the depth to water was determined from the static water levels listed on Ohio Department of Natural Resources well logs completed for the area within the carbonate aquifer. Water levels in Seneca County varied considerably covering all depth ranges from 0 to 5 feet (10) to 75 to 100 feet (2).

Water levels within the Defiance Moraine had ranges of 5 to 15 feet (9), 15 to 30 feet (7), and 30 to 50 feet (5). At certain locations within the Defiance Moraine, water levels in the carbonate aquifer exceeded the total depth of the moraine. In these cases, depth to water was inferred (based upon the depths to sand and gravel pockets listed on well logs for the area) and evaluated as ranging from 30 to 50 feet (5).

In the northeast corner of the county, water levels within the carbonate aquifer ranged from 75 to 100 feet (2). Water levels in this region appear to be deep, due to discharge to the northeast towards Lake Erie along the karstic underground drainage network of the preglacial Erigan River system (Kihn, 1988).

Net Recharge

Recharge for much of the county was evaluated as ranging from 4 to 7 inches. A DRASTIC rating of 4 was used for areas covered by glacial till, based on recharge rates determined for area river basins in Pettyjohn and Henning (1979). Areas with sandy soils, such as the beach ridges, sand spits, and river alluvium, and those areas with thin or absent soils, were given a higher recharge rate of 7 to 10 inches (8).

Because the northeast corner of the county has a high number of sinkholes (dolines) and swallow holes (ponors), a recharge rate of 7 to 10 inches (8) was given to the entire area. The dolines and ponors may act as points of concentrated

recharge by funnelling precipitation and surface water into the underlying carbonate aquifer (Kihn, 1988).

Marshy areas with large accumulations of muck were rated a lower recharge value of 2 to 4 inches with a DRASTIC rating of (3), due to the presence of fine-grained clastic material restricting vertical infiltration into the ground.

Aquifer Media

The selection of aquifer media was based upon numerous sources of information including well logs on file with ODNR, Division of Water; Schmidt (1982); ODNR (1967; 1970); and the unpublished glacial geology map of Seneca County (ODNR, Division of Geological Survey, unpublished manuscript).

The majority of Seneca County is underlain by an extensive carbonate aquifer consisting of limestone and dolomite. The carbonate rocks comprised the aquifer media for much of the northern half of the county where overburden thicknesses were relatively thin and karstic conditions were identified or inferred. The carbonate aquifer in the western half of the county was evaluated as being a massive limestone with a DRASTIC rating of (7) based upon well yields (Schmidt, 1982), published and unpublished pumping test information, and field observations of quarry exposures.

The eastern half of the county was evaluated as having karst limestone aquifer media because of the numerous sinkholes found in Thompson and Adams Townships, the presence of Seneca Caverns, and the rapid response of water levels to storm events (Kihn, 1988). The northeast quarter of the county was rated as being a DRASTIC ten (10) because of the numerous karst features in this area. The area south of the Defiance Moraine was rated as a (9) since only a few karst surface features occur in this area.

In the southern half of the county, the thickness of the glacial till mantle increases considerably because of the Defiance Moraine. The aquifer media for areas covered with thick glacial till deposits was evaluated as being sand and gravel with a DRASTIC rating of (5) to emphasize the numerous intermittent water-bearing pockets of sand and gravel occurring within the glacial till.

Where shale underlies the southeastern corner of the county, the shale was identified as the principal aquifer based upon the inference that the upper shale surface is weathered and fractured to some degree, permitting water to be stored in the formation and transmitted to wells drilled into the shale. A number of domestic wells with shallow static water levels appear to support this hypothesis (ODNR, unpublished well logs).

Soil Media

The classification of the soils is based upon the dominant soil properties as described in the soil survey for Seneca County (Ernst et al., 1980). The majority of soils in Seneca County are developed on the clay-rich glacial moraines and were classified as clay loams with a rating of (3). Silt loam and sandy loam soils are generally associated with the beach ridges, river alluvium, and some lake deposits.

Two soil types, the Hoytville and Nappanee soil series, were classified as being a shrinking/aggregated clay (7) because of their high shrink-swell potential, and their low sand and gravel composition (Ernst et al., 1980). These two soil types comprised a majority of the soils occurring in the lake plains region in the north-western quarter of the county.

A number of soils were classified as thin or absent (10) because of the close proximity of bedrock to the ground surface. These soil types are associated with bedrock knolls, sinkholes, and rock outcrops.

Topography

Sources of information used to evaluate the topography of Seneca County were Ernst et al. (1980), and USGS 7 and 1/2 minute topographic quadrangle maps.

Generally the topography in Seneca County is flat to gently-rolling with slopes ranging from 0 to 2% (10). The low relief is due in part to the extensive cover of ground moraine.

Some relief occurs in the vicinity of the Defiance Moraine where slopes ranging from 2 to 6% (9) are common. Steeper slopes of 6 to 12% (5), 12 to 18% (3), and 18+% (1) are limited to escarpments found along the Sandusky River and its tributaries where these rivers and streams have cut into the Defiance Moraine.

Impact of the Vadose Zone

The impact of the vadose zone media was evaluated using information obtained from well logs on file with ODNR, Division of Water; Ernst, et al. (1980); and Kihn (1988). The material comprising the vadose zone was determined by the type of glacial deposits present in the county.

The southern half of the county is covered with a significant thickness of glacial till and was evaluated as sand and gravel with significant silt and clay (5). North of the beach ridges in the lake plains region of the county, the glacial till comprising the vadose zone media is generally clay-rich with very low percentages of sand and gravel (Ernst, et al., 1980). The vadose zone was evaluated as being a silt/clay media with a rating of (4). In areas within this region where the overburden is thin or absent, the vadose was evaluated as limestone (6).

In areas of Seneca County where the beach ridges and sand spits occur, the vadose zone was evaluated as sand and gravel with a rating of (8), based on information from the well logs on file with Ohio Department of Natural Resources, Division of Water and Ernst et al. (1980). Additionally, the north-central area of the county between the Sandusky River and the karst region to the east was evaluated as having a sand and gravel vadose zone with a rating of (8). This number was chosen because of the numerous sand and gravel deposits found in the area, and the presence of a buried valley. Sources of information include Schmidt (1982) and well logs on file with Ohio Department of Natural Resources, Division of Water.

Vadose media for the southeast corner of the county, underlain by the shale bedrock, was evaluated as a silt/clay media with a rating of (3).

The karst region of the northeast corner of the county is characterized by a relatively thin cover of till, a limestone aquifer with strong secondary porosity, and deep water levels. This region was subsequently evaluated as having a karst limestone vadose zone with a rating of (8) for areas covered with till and a rating of (10) for areas with thin or absent soils. Information used to evaluate this region includes Kihn (1988), Ernst, et al. (1980), well logs on file with Ohio Department of Natural Resources, Division of Water and USGS 7 and 1/2 minute topographic quadrangle maps.

Hydraulic Conductivity

Hydraulic conductivity for the aquifers underlying the county was evaluated based upon published and unpublished pumping test information; well logs on file with ODNR, Division of Water; Schmidt (1982); and ODNR (1970).

The hydraulic conductivities for the carbonate aquifer were evaluated as 100 to 300 gpd/ft^2 (2) for the western half of the county based upon the transmissivitiy and well yields reported throughout the area. The low hydraulic conductivity can be attributed to the occurrence of the upper Lockport dolomite in this region whose structure, as exposed in local quarries, is massive (Janssens, 1977).

For the northeastern corner of the county a rating of 2000+ gpd/ft^2 (10) was given to the karst region due to the strong underground drainage network, and the rapid response of water levels in Seneca Caverns and domestic wells to storm events (Kihn, 1988; Tibboles, personal communication). A range of 1000 to 2000 gpd/ft^2 (8) was given for the southeastern quarter of the county based the high well yields for the area, some pumping test information, and upon the inference that the karst terrain continues south along the subcrop of the Columbus Limestone formation in this area.

The hydraulic conductivity of the shale bedrock occurring in the southeast corner of the county was evaluated as 1 to 100 gpd/ft^2 (1), based upon the known hydraulic properties of shale bedrock, a review of well log data, and Schmidt (1982).

Areas in the county covered with considerable thicknesses (greater than 30 feet) of glacial till containing pockets of moderately-sorted sand and gravel were evaluated as having a hydraulic conductivity of 100 to 300 gpd/ft^2 based upon expected ranges of hydraulic conductivity for silty sands and gravels (Freeze and Cherry, 1979).

Because the beach ridges cross a number of large, regional hydrogeologic settings, the hydraulic conductivities for the beach ridge settings vary depending upon the most significant aquifer media occurring beneath the beach ridge areas. In the western half of the county, the beach ridges overlie a massive carbonate aquifer with an estimated hydraulic conductivity range of 100-300 gpd/ft^2 (2). In the north-central portion of the county, the beach ridges cross a region containing thick deposits of glacial till with numerous pockets of sand and gravel, and a buried valley. The aquifer media mapped for these areas is sand and gravel with a hydraulic conductivity range of 300-700 gpd/ft^2 (4). Where the beach ridges cross into the karst terrain, the aquifer media is the karst limestone with a hydraulic conductivity of 2000+ gpd/ft^2 (10).

The hydraulic conductivity for the sand and gravel aquifer comprising the river alluvium was estimated to be in the 100-300 gpd/ft^2 range (2), based on interpretation of well log data for these areas.

The sand and gravel aquifer media of the north-south trending buried valley occurring in Clinton and Pleasant townships was evaluated as having a hydraulic conductivity of 300-700 gpd/ft^2 (4).

APPENDIX B

DESCRIPTION OF HYDROGEOLOGIC SETTINGS AND CHARTS

In the pollution potential mapping of Seneca County, ten hydrogeologic settings within the Glaciated Central Region of DRASTIC were identified. The list of these settings, the range of pollution potential index calculations, and the number of pollution potential index calculations for each setting are provided in Table 10. Computed pollution potential index values range from 98 to 217.

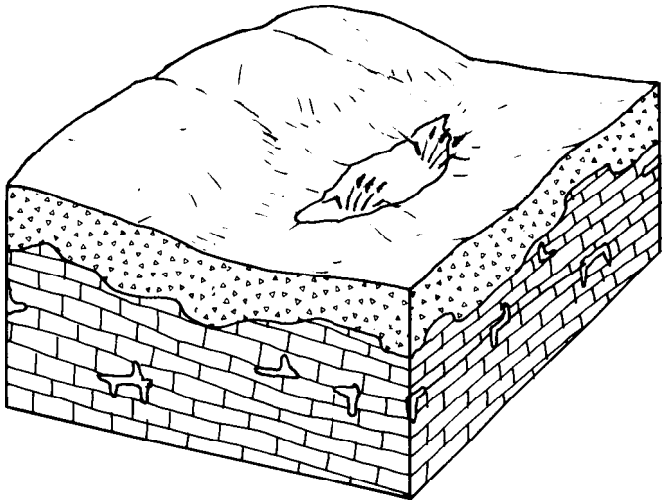
Table 10. Hydrogeologic Settings Mapped in Seneca County, Ohio

Hydrogeologic Settings	Range of GWPP Indexes	Number of Index Calculations
7Ac- Glacial Till Over Solution Limestone	117-217	67
7Ae- Glacial Till Over Shale	98-111	7
7Af- Sand / Gravel Interbedded in Glacial Till	102-160	55
7C- Moraine	102 -137	20
7D- Buried Valley	135-163	16
7Ec- Alluvium Over Sedimentary Rock	155-172	10
7Ed- River Alluvium Over Till	146-159	6
7Gb- Thin Till Over Limestone	153-168	5
7H- Beaches, Beach Ridges, and Sand Dunes	142-195	21
7I- Marshes and Swamps	108-113	2

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 indexes were derived and are a quick and easy reference for the accompanying ground water pollution 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.

NOTE:

GWPP index setting tables with an (*) are tables that may appear with incorrect GWPP index values on the GWPP map of Seneca County. Please refer to the GWPP index setting tables for accurate GWPP index values.



7Ac Glacial Till Over Solution Limestone

This hydrogeologic setting is characterized by low topography and limestone bedrock covered by varying thicknesses of glacial till. The till consists primarily of clay with varying amounts of silt, sand, and gravel. Sand and gravel layers within the till are extremely thin or nonexistent. The limestone bedrock serves as the aquifer in this setting. Ground water occurs in fractures and solution channels within the formation. The limestone is in direct hydraulic connection with the glacial till, and precipitation infiltrating through the till serves as a source of recharge for the underlying limestone. Depth to water is extremely variable, depending in part on the thickness of the glacial till, but is usually moderately deep. Soils are typically clay loam.

GWPP index values for the hydrogeologic setting of glacial till over solution limestone range from 117 to 217 with the total number of GWPP index calculations equaling 67.

Setting: 7Ac1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	140

Setting: 7Ac2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	132

Setting: 7Ac3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	136

Setting: 7Ac4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	134

Setting: 7Ac5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	157

Setting: 7Ac6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	158

Setting: 7Ac7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sand	2	9	18
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	172

Setting: 7Ac8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	130

Setting: 7Ac9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Shrink/swell clay	2	7	14
Topography	2-6%	1	9	9
Impact of Vadose Zone	Silt & clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	139

Setting: 7Ac10		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Silt & clay	5	4	20
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	133

Setting: 7Ac11		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sand	2	9	18
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	171

Setting: 7Ac12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	137

Setting: 7Ac13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	139

Setting: 7Ac14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	138

Setting: 7Ac15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	129

Setting: 7Ac16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	119

Setting: 7Ac17		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	143

Setting: 7Ac18		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	133

Setting: 7Ac19		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	131

Setting: 7Ac20		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	25	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	121

Setting: 7Ac21		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	141

Setting: 7Ac22		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	128

Setting: 7Ac23		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	207

Setting: 7Ac24		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	217

Setting: 7Ac25		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	197

Setting: 7Ac26		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	187

Setting: 7Ac27		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	75-100’	5	2	10
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	182

Setting: 7Ac28		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	75-100’	5	2	10
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Thin/absent	2	10	20
Topography	2-6%	1	9	9
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	2000 +	3	10	30
			GWPP INDEX	181

Setting: 7Ac29		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	75-100’	5	2	10
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
			GWPP INDEX	158

Setting: 7Ac30		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	75-100’	5	2	10
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
			GWPP INDEX	157

Setting: 7Ac31		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
			GWPP INDEX	173

Setting: 7Ac32		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
			GWPP INDEX	172

Setting: 7Ac33		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	183

Setting: 7Ac34		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	191

Setting: 7Ac35		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	182

Setting: 7Ac36		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	193

Setting: 7Ac37		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	163

Setting: 7Ac38		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	162

Setting: 7Ac39		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	176

Setting: 7Ac40		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	178

Setting: 7Ac41		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	181

Setting: 7Ac42		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	171

Setting: 7Ac43		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	188

Setting: 7Ac44		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	150

Setting: 7Ac45		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	149

Setting: 7Ac46		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	159

Setting: 7Ac47		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	151

Setting: 7Ac48		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	161

Setting: 7Ac49		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	155

Setting: 7Ac50		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	141

Setting: 7Ac51		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	151

Setting: 7Ac52		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	161

Setting: 7Ac53		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	131

Setting: 7Ac54		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	153

Setting: 7Ac55		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	198

Setting: 7Ac56		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Karst Lms.	5	10	50
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	188

Setting: 7Ac57		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	2-4"	4	3	12
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Muck	2	2	4
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	117

Setting: 7Ac58		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	2-4"	4	3	12
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	129

Setting: 7Ac59		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	2-4"	4	3	12
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Muck	2	2	4
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	127

Setting: 7Ac60		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	135

Setting: 7Ac61		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	145

Setting: 7Ac62		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	163

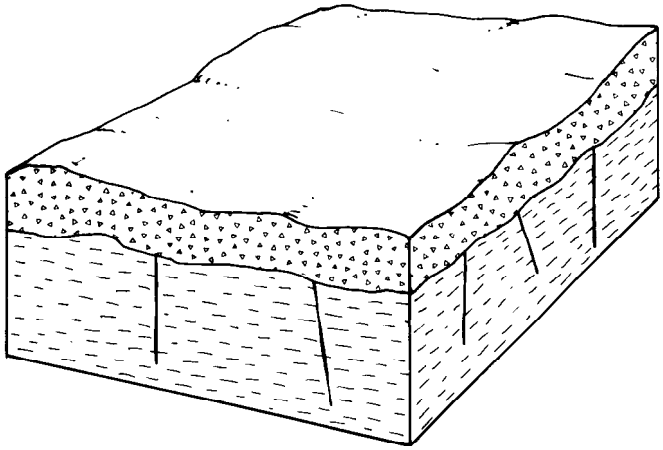
Setting: 7Ac63		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	157

Setting: 7Ac64		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	123

Setting: 7Ac65		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	147

Setting: 7Ac66		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Karst Lms.	3	9	27
Soil Media	Silty loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	1000-2000	3	8	24
		GWPP	INDEX	143

Setting: 7Ac67		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	1000-2000	3	10	30
		GWPP	INDEX	184



7Ae Glacial Till Over Shale

This hydrogeologic setting is characterized by low to moderate topography and deposits of thin glacial till overlying fractured shale bedrock. The till consists primarily of clay with little, if any, sand and gravel and does not serve as a source of ground water. Small supplies of ground water are derived from wells developed in the upper portion of the shale. Infiltration of precipitation through the till recharges the aquifer. Water levels are fairly shallow. Soils are typically clay loam.

GWPP index values for the hydrogeologic setting of glacial till over shale range from 98 to 111 with the total number of GWPP index calculations equaling 7.

Setting: 7Ae1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Shale	3	2	6
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	109

Setting: 7Ae2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Shale	3	2	6
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	99

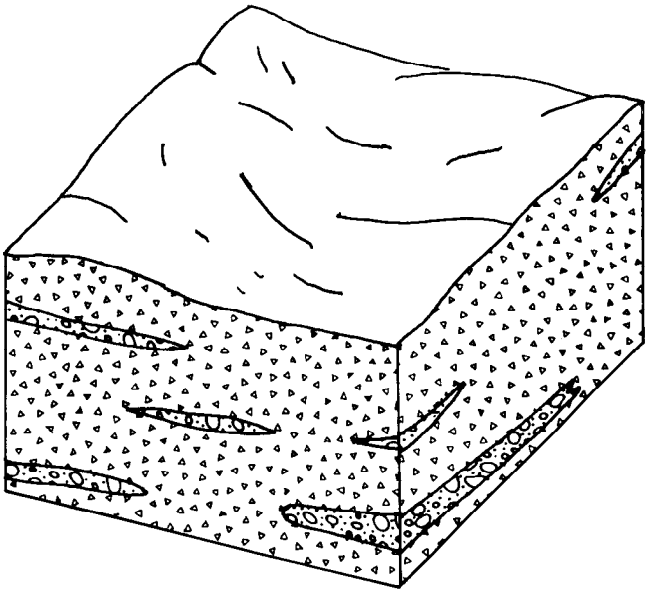
Setting: 7Ae3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Shale	3	2	6
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	110

Setting: 7Ae4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Shale	3	2	6
Soil Media	Clay Loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	108

Setting: 7Ae5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Shale	3	2	6
Soil Media	Clay Loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	98

Setting: 7Ae6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Shale	3	2	6
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	100

Setting: 7Ae7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Shale	3	2	6
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & Clay	5	3	15
Hydraulic Conductivity	1-100	3	1	3
		GWPP	INDEX	111



7Af Sand and Gravel Interbedded in Glacial Till

This hydrogeologic setting is characterized by low topography with sand and gravel deposits interbedded within glacial till. The till is composed primarily of clay with varying amounts of unsorted silt, sand, and gravel. The sand and gravel may be relatively thin and discontinuous lens-shaped bodies or they may be thick and cover a large area. These units are usually confined to common horizons within the till. Ground water occurs in both the till and the sand and gravel; however, the sand and gravel serves as the principal aquifer. Recharge to the sand and gravel is primarily due to infiltration of precipitation through the till. Depth to water is highly variable. Soils are typically classified as clay loam.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 102 to 160 with the total number of GWPP index calculations equaling 55.

Setting: 7Af1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	131

Setting: 7Af2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	130

Setting: 7Af3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	121

Setting: 7Af4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	120

Setting: 7Af5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	111

Setting: 7Af6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	110

Setting: 7Af7		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	135

Setting: 7Af8		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	134

Setting: 7Af9		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	133

Setting: 7Af10		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	132

Setting: 7Af11		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	137

Setting: 7Af12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	122

Setting: 7Af13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	129

Setting: 7Af14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	125

Setting: 7Af15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	123

Setting: 7Af16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	127

Setting: 7Af17		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	117

Setting: 7Af18		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	116

Setting: 7Af19		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	113

Setting: 7Af20		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sand	2	9	18
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	151

Setting: 7Af21		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	106

Setting: 7Af22		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	18% +	1	1	1
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	102

Setting: 7Af23		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	12-18%	1	3	3
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	104

Setting: 7Af24		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	116

Setting: 7Af25		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	18% +	1	1	1
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	112

Setting: 7Af26		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	126

Setting: 7Af27		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	12-18%	1	3	3
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	114

Setting: 7Af28		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	120

Setting: 7Af29		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	110

Setting: 7Af30		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	135

Setting: 7Af31		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	112

Setting: 7Af32		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	124

Setting: 7Af33		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	132

Setting: 7Af34		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	142

Setting: 7Af35		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	141

Setting: 7Af36		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	131

Setting: 7Af37		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	133

Setting: 7Af38		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	146

Setting: 7Af39		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	148

Setting: 7Af40		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	143

Setting: 7Af41		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	147

Setting: 7Af42		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	160

Setting: 7Af43		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	18% +	1	1	1
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	143

Setting: 7Af44		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Shrink/swell clay	2	7	14
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	149

Setting: 7Af45		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel w/silt & clay	5	5	25
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	128

Setting: 7Af46		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	147

Setting: 7Af47		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	140

Setting: 7Af48		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	134

Setting: 7Af49		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	138

Setting: 7Af50		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	136

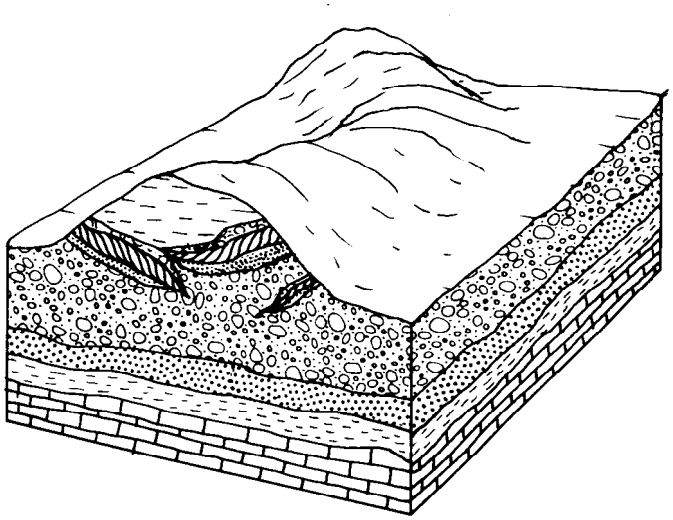
Setting: 7Af51		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Clay loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	132

Setting: 7Af52		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	150

Setting: 7Af53		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	144

Setting: 7Af54		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Sandy loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	148

Setting: 7Af55		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & gravel	3	5	15
Soil Media	Silt loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	154



7C Moraine

This hydrogeologic setting is characterized by moderate to moderately steep topography and varying thicknesses of mixed glacial deposits which overlie sequences of relatively flat-lying fractured sedimentary rocks. Sand and gravel within the morainal deposits may be well-sorted and serve as the principal aquifer in the area. These deposits also serve as a source of recharge for the underlying bedrock. Moraines also contain sediments that are typically unsorted and unstratified; these deposits contain more fines than outwash deposits, are less permeable and characteristic of glacial till. Moraines are typically mounds or ridges of till which were deposited along the margin of a stagnant or retreating glacier. Surficial deposits often weather to sandy loam. Precipitation is abundant throughout the region and ground water recharge is moderate. Water levels are extremely variable, based in part on the thickness of the glacial till, but are typically fairly shallow.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 102 to 137 with the total number of GWPP index calculations equaling 20.

Setting: 7C1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	131

Setting: 7C2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	121

Setting: 7C3		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	111

Setting: 7C4		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	130

Setting: 7C5		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	120

Setting: 7C6		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	110

Setting: 7C7		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	125

Setting: 7C8		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	115

Setting: 7C9		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	114

Setting: 7C10		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	123

Setting: 7C11		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	137

Setting: 7C12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	113

Setting: 7C13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	106

Setting: 7C14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	18% +	1	1	1
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	102

Setting: 7C15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	116

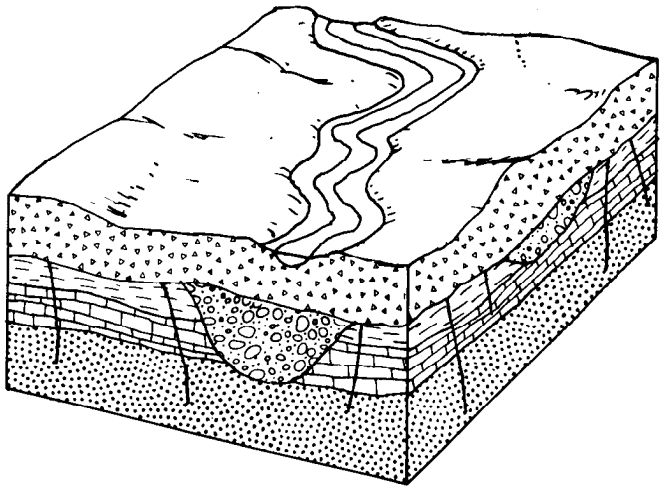
Setting: 7C16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	112

Setting: 7C17		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	100

Setting: 7C18		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	132

Setting: 7C19		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Clay Loam	2	3	6
Topography	6-12%	1	5	5
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	116

Setting: 7C20		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	5	15
Soil Media	Sandy Loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	5	25
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	116



7D Buried Valley

This hydrogeologic setting is characterized by thick deposits of sand and gravel that have been deposited in a former topographic low (a pre-glacial or inter-glacial river valley) by glacial melt waters. These deposits are capable of yielding large quantities of ground water. The deposits may or may not underlie a present-day stream and may or may not be in direct hydraulic connection with a stream. Glacial till or recent alluvium often overlies the buried valley. The sand and gravel deposits are several times more permeable than the surrounding bedrock and till. Soils are highly variable ranging from clay loam to sand, but are typically a silty loam. Static water levels are typically shallow, but may be highly variable depending on surficial deposits. Recharge to the aquifer can be attributed to infiltration of precipitation, and regional ground-water flow from the surrounding till plains and bedrock.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 135 to 163 with the total number of GWPP index calculations equaling 16.

Setting: 7D1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50'	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	135

Setting: 7D2		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	144

Setting: 7D3		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	136

Setting: 7D4		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	146

Setting: 7D5		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	143

Setting: 7D6		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	153

Setting: 7D7		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	147

Setting: 7D8		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	137

Setting: 7D9		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	141

Setting: 7D10		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	139

Setting: 7D11		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Shrink/swell clay	2	7	14
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	163

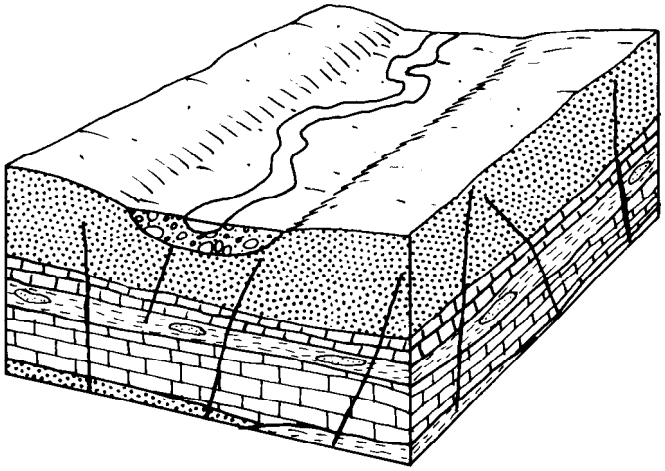
Setting: 7D12		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	157

Setting: 7D13		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	151

Setting: 7D14		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15	5	9	45
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	161

Setting: 7D15		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Clay Loam	2	3	6
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	145

Setting: 7D16		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30	5	7	35
Net Recharge	4-7"	4	6	24
Aquifer Media	Sand & Gravel	3	6	18
Soil Media	Sandy Loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	150



7Ec Alluvium Over Sedimentary Rock

This hydrogeologic setting is characterized by low topography with thin to moderate thicknesses of present-day, stream-deposited alluvium. The alluvium is composed of silt, sand, gravel, and clay. Depth to water is shallow and the stream is usually in hydraulic contact with the alluvial deposits. The alluvial deposits are underlain by fractured sedimentary bedrock, which are described in settings 7Ae, 7Gb, 7Ac. The bedrock serves as the principal aquifer in this setting. The alluvial deposits may serve as a source of recharge to the bedrock. Water levels are typically shallow. Surficial deposits are usually silty loam.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 155 to 172 with the total number of GWPP index calculations equaling 10.

Setting: 7Ec1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	169

Setting: 7Ec2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	167

Setting: 7Ec3		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	155

Setting: 7Ec4		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	0-5’	5	10	50
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Massive Lms.	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	172

Setting: 7Ec5		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	165

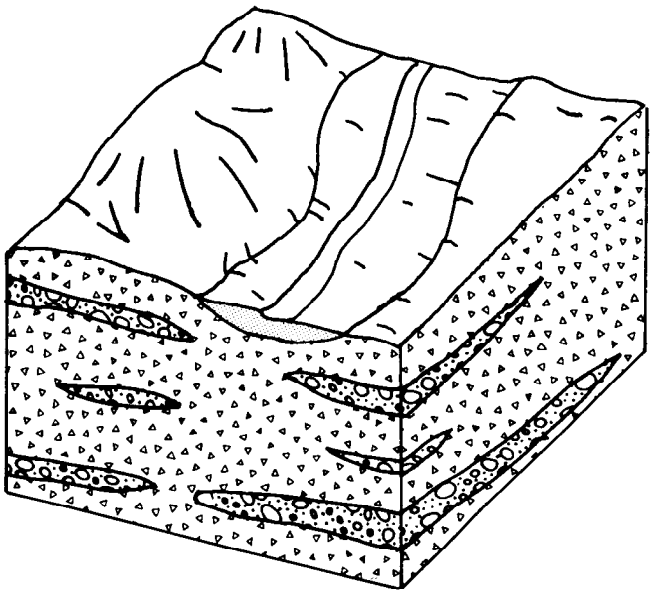
Setting: 7Ec6		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	166

Setting: 7Ec7		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	168

Setting: 7Ec8		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	0-5’	5	10	50
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	170

Setting: 7Ec9		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	156

Setting: 7Ec10		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	157



7Ed Alluvium Over Glacial Till

This setting is characterized by low topography with thin to moderate thicknesses of present-day, stream-deposited alluvium. The alluvium is composed of silt, sand, gravel, and clay. The underlying sand and gravel lenses within the till serve as the aquifer. The depth to the water table is shallow and the stream is usually in hydraulic contact with the deposits. Soils are usually classified as silty loam. The underlying till deposits are described in setting 7Af. The alluvial deposits serve as a source of recharge to the sand and gravel lenses within the till.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 146 to 159 with the total number of GWPP index calculations equaling 6.

Setting: 7Ed1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt and clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	155

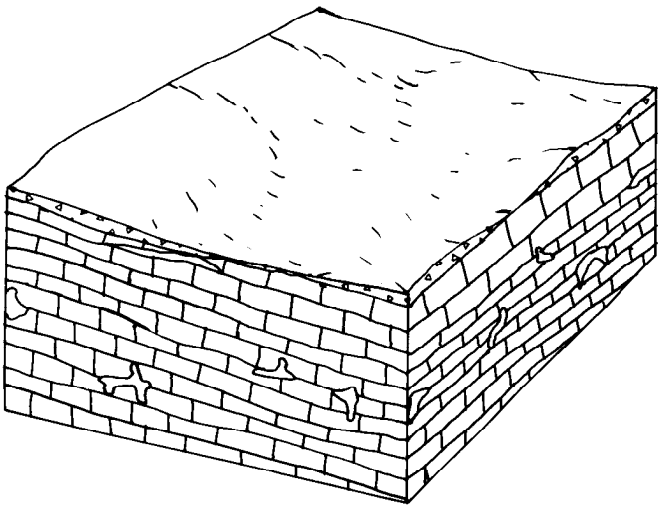
Setting: 7Ed2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt and clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	157

Setting: 7Ed3		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt and clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	147

Setting: 7Ed4		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt and clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	146

Setting: 7Ed5		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt and clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	159

Setting: 7Ed6		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt and clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	149



7Gb Thin Till Over Limestone

This hydrogeologic setting is characterized by moderate to low topography and deposits of thin, patchy glacial till overlying weathered, fractured limestone or dolomite bedrock. The till is primarily a weathered, unsorted deposit of clay, silt, sand, and gravel. Often it is very channery, containing numerous blocks and cobbles from the underlying carbonate bedrock. The underlying carbonate bedrock serves as the principal aquifer for the area with ground water occurring in the many fractures, bedding planes and solution channels of the formation. Areas with a thin or absent till cover often have moderate to high rates of recharge to the underlying bedrock because precipitation can pass more readily through the thin vadose zone. These areas are sensitive to pollutants as there is little protection between the ground surface and the underlying aquifer.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 153 to 168 with the total number of GWPP index calculations equaling 5.

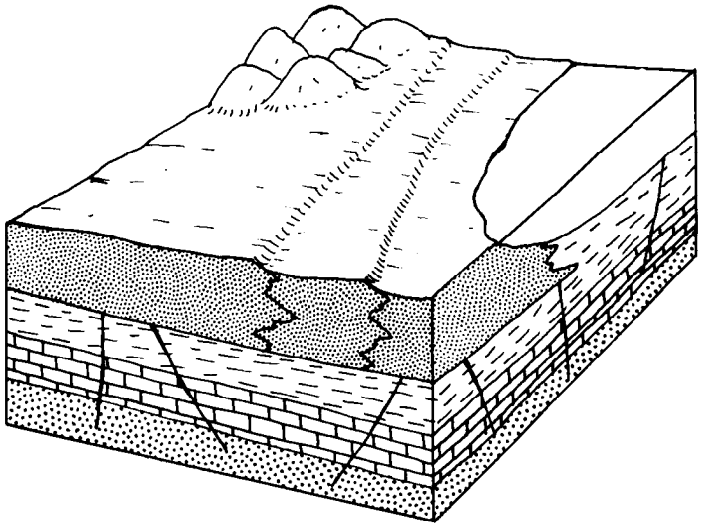
Setting: 7Gb1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	164

Setting: 7Gb2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Thin/absent	2	10	20
Topography	2-6%	1	9	9
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	163

Setting: 7Gb3		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Thin/absent	2	10	20
Topography	0-2%	1	10	10
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	154

Setting: 7Gb4		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Thin/absent	2	10	20
Topography	2-6%	1	9	9
Impact of Vadose Zone	Limestone	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	153

Setting: 7Gb5		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Thin/absent	2	10	20
Topography	2-6%	1	9	9
Impact of Vadose Zone	Limestone	5	7	35
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	168



7H Beaches, Beach Ridges and Sand Dunes

This hydrogeologic setting is characterized by low relief, sandy surface soil that is predominantly silica sand, extremely high infiltration rates and low sorptive capacity in the thin vadose zone. The water table is very shallow beneath the beaches bordering the Great Lakes. These beaches are commonly ground water discharge areas. The water table is slightly deeper beneath the rolling dune topography and the vestigial inland beach ridges. All of these areas serve as recharge sources for the underlying sedimentary bedrock aquifers, and they often serve as local sources of water supply.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 142 to 195 with the total number of GWPP index calculations equaling 21.

Setting: 7H1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15'	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sandy Loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	165

Setting: 7H2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sandy Loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	155

Setting: 7H3		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	152

Setting: 7H4		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	142

Setting: 7H5		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	163

Setting: 7H6		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Sand	2	9	18
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	171

Setting: 7H7		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	7-10"	4	8	32
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Silt Loam	2	4	8
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel w/silt & clay	5	6	30
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	151

Setting: 7H8		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sand	2	9	18
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	195

Setting: 7H9		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sand	2	9	18
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	185

Setting: 7H10		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	50-75’	5	3	15
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sand	2	9	18
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	175

Setting: 7H11		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	75-100’	5	2	10
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sand	2	9	18
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	170

Setting: 7H12		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	75-100’	5	3	15
Net Recharge	7-10"	4	8	32
Aquifer Media	Karst Lms.	3	10	30
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	2000 +	3	10	30
		GWPP	INDEX	169

Setting: 7H13		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	154

Setting: 7H14		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	153

Setting: 7H15		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Sand	2	9	18
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	160

Setting: 7H16		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	151

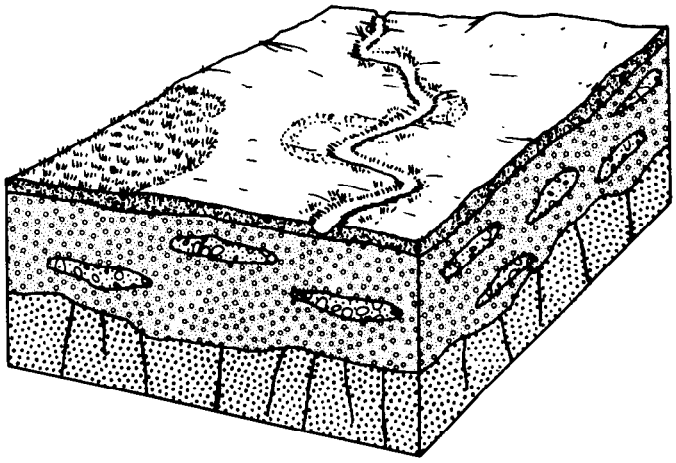
Setting: 7H17		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	155

Setting: 7H18		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	30-50’	5	5	25
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	152

Setting: 7H19		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Silt Loam	2	4	8
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	161

Setting: 7H20		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Sandy Loam	2	6	12
Topography	2-6%	1	9	9
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	164

Setting: 7H21		GENERAL		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	15-30’	5	7	35
Net Recharge	7-10"	4	8	32
Aquifer Media	Sand & Gravel	3	8	24
Soil Media	Loam	2	5	10
Topography	0-2%	1	10	10
Impact of Vadose Zone	Sand & Gravel	5	8	40
Hydraulic Conductivity	300-700	3	4	12
		GWPP	INDEX	163



7I Swamp / Marsh

This hydrogeologic setting is characterized by low topographic relief, high water levels and high organic silt and clay deposits. These wetlands occur along the courses of floodplains and in upland areas as a result of vertically restricted drainage. Common features of upland wetlands include those characteristics attributable to glacial cranberry bogs. Recharge is moderate in most of the region due to restriction by clayey soils and limited by significant aquifers but, frequently recharge the underlying sand and gravel or bedrock aquifers.

GWPP index values for the hydrogeologic setting of beaches, beach ridges and sand dunes range from 108 to 113 with the total number of GWPP index calculations equaling 2.

Setting: 7I1		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	0-5’	5	10	50
Net Recharge	2-4"	4	3	12
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Muck	2	2	4
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & Clay	5	2	10
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	113

Setting: 7I2		**GENERAL**		
FEATURE	RANGE	WEIGHT	RATING	INDEX
Depth to Water	5-15’	5	9	45
Net Recharge	2-4"	4	3	12
Aquifer Media	Massive Lms.	3	7	21
Soil Media	Muck	2	2	4
Topography	0-2%	1	10	10
Impact of Vadose Zone	Silt & Clay	5	2	10
Hydraulic Conductivity	100-300	3	2	6
		GWPP	INDEX	108

Ground-Water Pollution Potential of SENECA COUNTY

by

Kelly C. Smith and John Voytek
ERM-Midwest, Inc.

prepared in cooperation with
Ohio Department of Natural Resources, Division of Water

1 0 1 2 Miles

1 0 1 2 Kilometers

CONTOUR INTERVAL 5 FEET

County Line

Township Line

Incorporated City Limit

Pollution Potential Index Range

Higher	200+
	180 - 199
	160 - 179
to	140 - 159
	120 - 139
	100 - 119
Lower	80 - 99

Description of Map Symbols

Hydrogeologic Region — 7Ad 6 — Hydrogeologic Setting
98 — Relative Pollution Potential

Observation Well Site **

Gravel Pit / Quarry

Hydrogeologic Settings

7Ac - Glacial Till Over Solution Limestone

7Ae - Glacial Till Over Shale

7Af - Sand and Gravel Interbedded in Glacial Till

7C - Moraine

7D - Buried Valley

7Ec - River Alluvium Over Sedimentary Rocks (Limestone)

7Ed - River Alluvium Over Glacial Till

7Gb - Thin Till Over Limestone

7H - Beaches, Beach Ridges and Sand Dunes

7I - Marshes and Swamps

A more detailed description of the hydrogeologic settings and the evaluation of the pollution potential may be found in the publication "Ground-Water Pollution Potential of Seneca County", GWPP Report No. 9 Ohio Dept. of Natural Resources, Division of Water.

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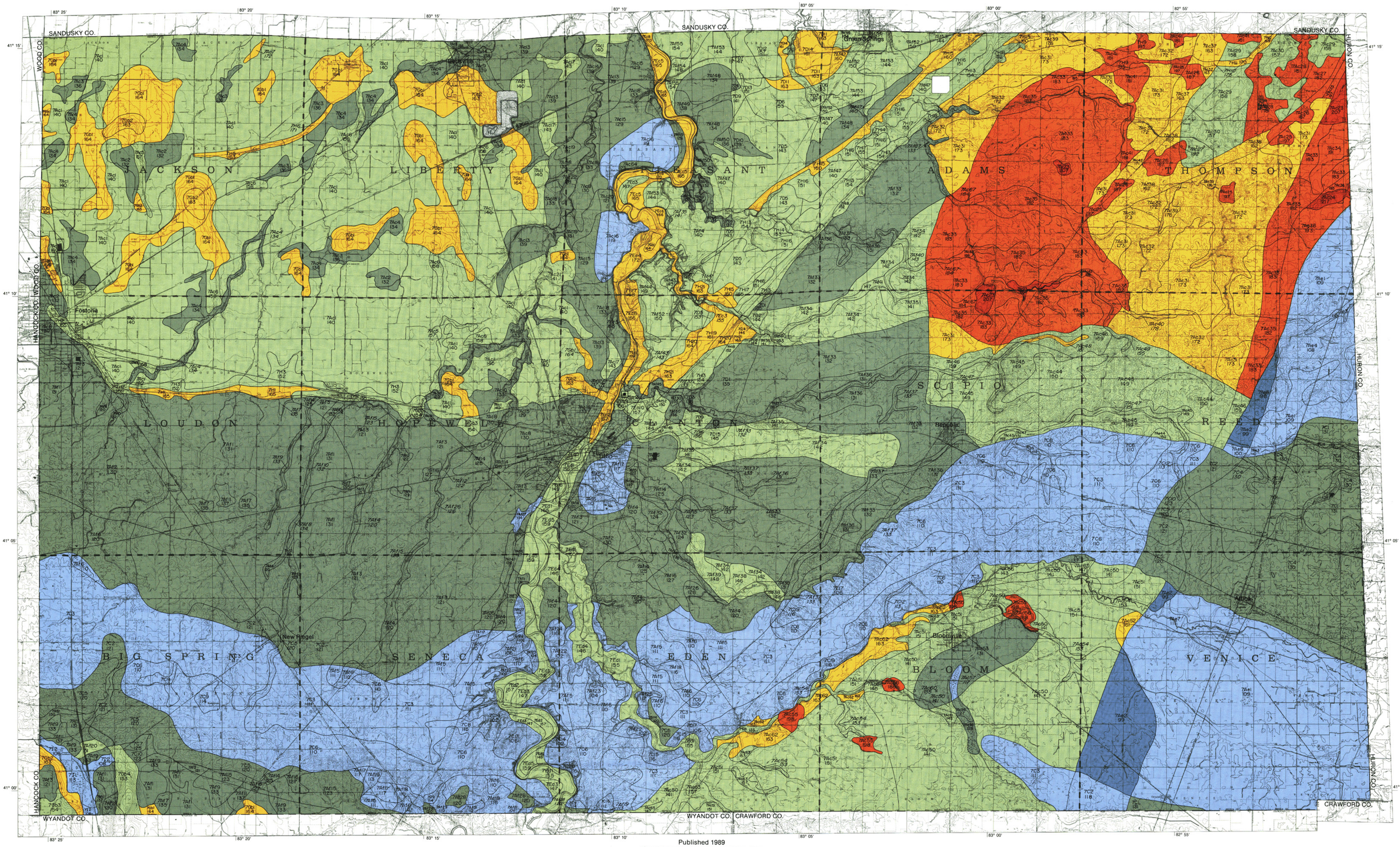
The ground-water pollution potential of this county has been mapped using the methodology described in U.S. EPA Publication EPA/600-2-87/035, "DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings (Aller et al., 1987)".

** Observation well sites indicate the location of wells used to collect ground-water level information. These wells are part of the State observation well network. Hydrographs of the water levels recorded in these and other State observation wells can be obtained through ODNR-Division of Water.



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"Naturally OHIO, the best of all!"