Chapter 3

AGRICULTURAL, NATURAL, AND CULTURAL RESOURCES

INTRODUCTION

This chapter presents an inventory and analysis of the agricultural, natural and cultural resource base of Waukesha County. Included is descriptive information pertaining to climate, air quality, physiography, bedrock geology, topography, soils, groundwater resources, surface water resources, wetlands, woodlands, natural areas and critical species habitat sites, park and open space sites, environmental corridors, historic and cultural resources and agricultural lands.

The natural resource base of Waukesha County is one of the most important factors influencing the development potential of the County. It is the natural resource base, which makes the County an attractive location for residential, commercial, and industrial development. The natural resource base has great economic as well as recreational and aesthetic value. In order to preserve and protect this important asset, future urban development in Waukesha County must be carefully adjusted to the ability of the natural resource base to support various forms of urban and rural development without deterioration or destruction of that underlying and sustaining base.

The natural resource base is susceptible to irreversible damage through inappropriate land use, transportation, and public facility development, especially in Waukesha County, where a considerable proportion of the population resides in close proximity to environmentally sensitive inland lakes and waterways. Without sufficient understanding and recognition of the character and importance of the various elements of the natural resource base, human use and alteration of the natural environment proceeds at the risk of excessive costs in terms of both monetary expenditures and environmental degradation. A sound and meaningful countywide planning effort must therefore acknowledge that natural resources are limited, and that urban development should be properly adjusted to the natural resource base so that serious and costly environmental problems can be avoided.

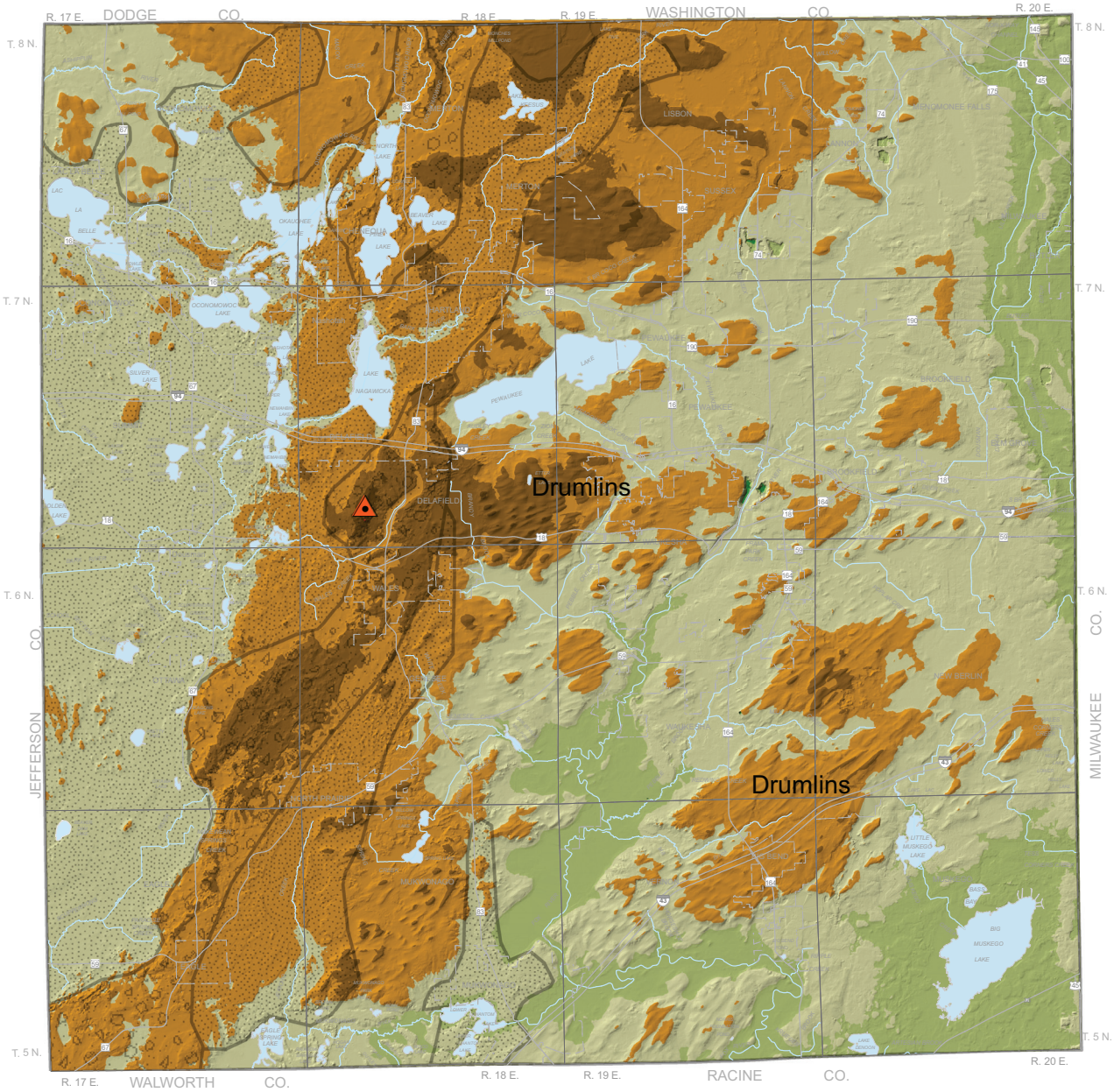
GEOLOGY AND PHYSIOGRAPHY

Surface Geology and Physiography

Four major stages of glaciation, the last of which was the Wisconsin stage, ending approximately 10,000 years ago in the State, have largely determined the physiography, topography, and soils of Waukesha County. Map III-1 presents the topographic and physiographic features of Waukesha County. The dominant physiographic and topographic feature in Waukesha County is the Kettle Moraine, an interlobate glacial deposit formed between the Green Bay and Lake Michigan lobes of the continental glacier that moved in a generally southerly direction from its origin in what is now Canada. The Kettle Moraine, which is oriented in a general northeast-southwest direction across western Washington, Waukesha, and Walworth Counties, is a complex system of kames, or crudely stratified conical hills; kettle holes formed by glacial ice blocks that became separated from the ice mass and melted to form depressions and small lakes as the meltwater deposited material around the ice blocks; and eskers, long, narrow ridges of drift deposited in abandoned drainage ways. The remainder of the County is covered by a variety of glacial landforms and features, including various types of moraines, drumlins, kames, outwash plains, and lake basin deposits.

Map III-1

TOPOGRAPHIC & PHYSIOGRAPHIC FEATURES OF WAUKESHA COUNTY



Legend

Elevation (In Feet)

- 1200 - 1232
- 1100 - 1200
- 1000 - 1100
- 900 - 1000
- 800 - 900
- 700-800
- <700
- Lapham Peak

Physiography

- Rolling Ground Moraine
- Nearly Level Outwash
- Kettle Moraine

N

0 1 2 Miles

0 4,000 8,000 12,000 16,000 Feet

Source: Waukesha County

The combined thickness of unconsolidated glacial deposits, alluvium, and marsh deposits overlying bedrock exceeds 100 feet throughout most of the County. Thicknesses are greatest where glacial materials fill the bedrock valleys and in areas of topographic highs formed by end moraines.

The most substantial glacial deposits, from 300 to 500 feet thick, are located in the northwestern part of the County in the lakes area and in portions of the Towns of Mukwonago and Vernon. The thinnest glacial deposits, 20 feet thick or less, are found along an approximately six-mile-wide band traversing the County in a northeasterly direction from the Village of Eagle to the Villages of Lannon and Menomonee Falls.

Geologic properties can influence the manner in which land is used, since geologic conditions, including the depth to bedrock, can affect the cost and feasibility of building site development and provision of public facilities and infrastructure. In the case of potential mineral extraction areas, the geologic attributes of the County are a valuable and irreplaceable resource. A need, therefore, exists in any planning program to examine not only how land is developed, but how the geologic resources can best be used and managed.

Topography

Topographic elevation in Waukesha County, as depicted in Map III-1, ranges from approximately 730 feet above mean sea level in the extreme eastern portions of the County along tributaries of the Menomonee River in Brookfield, Elm Grove, and Menomonee Falls, to 1,233 feet at Lapham Peak in the Town of Delafield, a variation of over 500 feet. Most of the high points in the County are located along the Kettle Moraine in three distinct areas: the southern half of the Town of Delafield near Lapham Peak, the southwestern quarter of the Town of Lisbon, and between State Highways 59 and 67 in the Towns of Genesee and Ottawa.

Bedrock Geology

Bedrock topography was shaped by preglacial and glacial erosion of the exposed bedrock. The consolidated bedrock underlying Waukesha County generally dips eastward at a rate of about 10 feet per mile. The bedrock surface ranges in elevation from about 900 feet above mean sea level, at Lapham Peak, to approximately 500 feet above mean sea level in the eastern portion of the County. The bedrock formations underlying the unconsolidated surficial deposits of Waukesha County consist of Precambrian crystalline rocks; Cambrian sandstone; Ordovician dolomite, sandstone, and shale; and Silurian dolomite. Figure III-1 shows a cross-section of the bedrock geology of Waukesha County. The uppermost bedrock unit throughout most of the County is Silurian dolomite, primarily Niagara dolomite, underlaid by a relatively impervious layer of Maquoketa shale. In some of the pre-Pleistocene valleys in the southwestern and central portions of the County, however, the Niagara dolomite is absent and the uppermost bedrock unit is the Maquoketa shale.

Suitability for Nonmetallic Mining

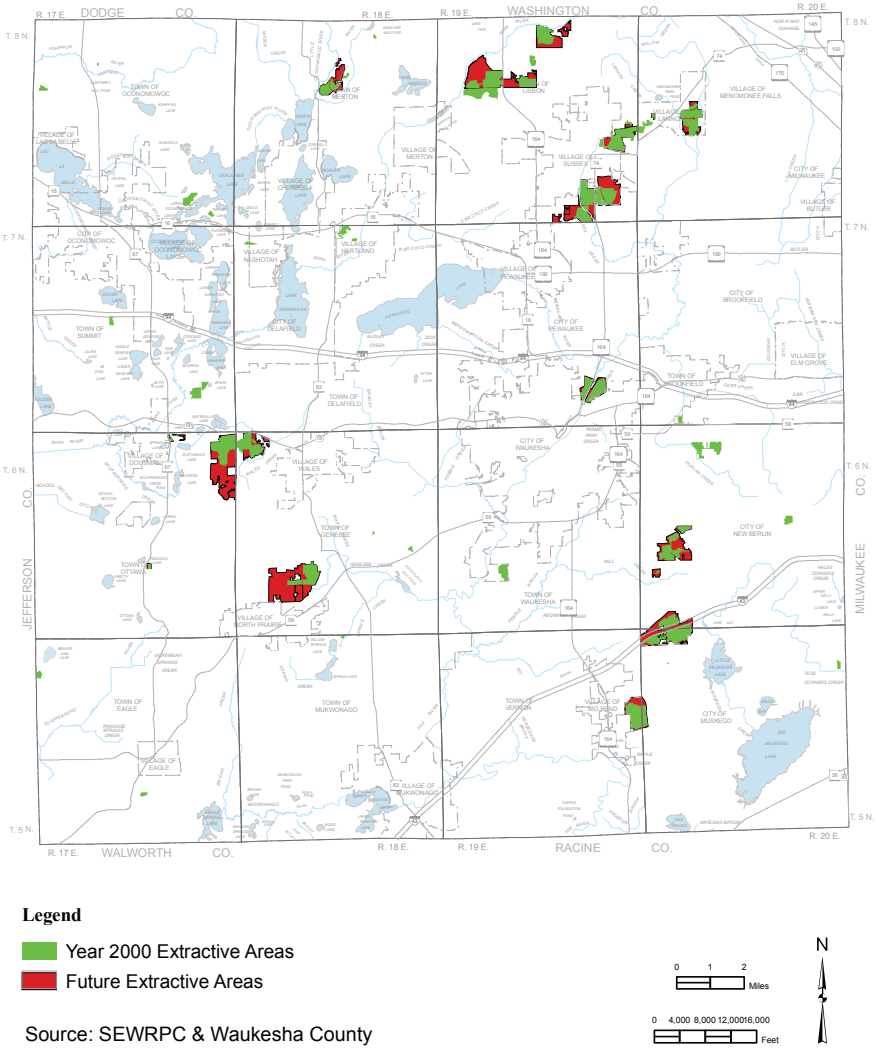
Waukesha County has an abundant supply of sand, gravel, and stone. The geology around and in the Kettle Moraine is the most likely source areas for sand and gravel. In this area, the melting waters of the glacier were most active in sorting and depositing high-quality sand and gravel as kames, eskers, and outwash terraces. Ground moraine, common in other parts of the County, typically has not been sorted, as has the glacial outwash, and is generally not as well suited for commercial sand and gravel. The most high quality material for nonmetallic mining is concentrated in the western half of the County along the Kettle Moraine and on outwash plains, although many other small deposits are also scattered throughout the remainder of the County. The most suitable areas for quarrying of stone are concentrated in the Villages of Lannon and Sussex, Town of Lisbon and the City of Pewaukee, with some smaller areas in other parts of the County.

Extractive land use in the County totaled about 4,000 acres, or about 1 percent of the total area of the County. This area consists primarily of lands devoted to the extraction of sand, gravel, and stone but also includes lands formerly used for such purposes and which lay idle. Areas devoted to extractive uses are scattered throughout the County.

Over the past approximately three decades, the area of the County devoted to extractive use increased by about 67 percent, from about 2,400 acres in 1963 to the 2000 level of 4,000 acres. Much of the additional extractive use during this time occurred in the form of the expansion of sites already used for extractive purposes in 1963 (see Map III-2).

In addition to the Waukesha County extractive land use data collated from the SEWRPC's 2000 land use inventory, information concerning existing ownership of lands utilized for mining or extractive operations, as well as adjacent lands with the potential for future commercially viable mining operations in the County, was provided by the Aggregate Producers of Waukesha County (see Map III-2). It should be noted that the information provided by the Aggregate Producers does not constitute a complete inventory of mineral resources in Waukesha County. An inventory of this type would involve the conduct of detailed studies concerning the economic viability of the potential extraction of nonmetallic mineral deposits in all areas of the County, given forecasts of the need or market demand for resource products of potential mining operations.

Map III-2
Waukesha County Nonmetallic Mineral Extraction Sites: 2005



Significant Geological Sites

A survey of scientifically and historically important bedrock geological sites in Southeastern Wisconsin was conducted by Dr. Joanne Klussendorf of the University of Illinois-Champaign-Urbana and Dr. Donald G. Mikulic of the Illinois State Geological Survey. Based on published literature, library archives of manuscripts, letters and unpublished reports, field notes and maps of earlier geologists and new field examinations, a list of significant geological sites known to have existed over the last 150 years, was compiled. The report identifies 30 significant geological sites in Waukesha County. Of the sites, 9 are classified as sites of statewide or greater significance, 8 sites are of county wide or regional significance and the remaining 13 sites are of local significance. Table III-1 presents the significant geological areas in Waukesha County.

Table III-1

SIGNIFICANT GEOLOGICAL AREAS IN WAUKESHA COUNTY: 2005

Site Name	Classification Code	Location	Description and Comments
Scuppernong Creek Spillway	GA-1	T6N, R18E Sections 5, 6 Town of Genesee T7N, R18E Sections 32, 33 Town of Delafield	One of the finest examples of a glacial spillway remaining in the United States. Studied on a national and international basis. Associated with several other interlobate glacial features including kames, a kame delta, and kettles.
Johnston Quarry and Kilns	GA-1	T6N, R18E Section 24 Town of Genesee	Two quarries excavated in Silurian Waukesha Dolomite in side of 20-foot-high bedrock hill. Contains fossil cephalopods. Listed on National Register of Historic Places.
Carroll College Quarry	GA-1	T6N, R19E Section 3 City of Waukesha	Covered rock exposures of first quarry opened in Waukesha County. Visited by many prominent 19th-century geologists; source of large fossil collections, including those of major museums across the United States. The type section of the Waukesha Dolomite.
Jones Quarry	GA-1	T7N, R18E Sections 23, 24 Town of Delafield	Undisturbed 19th-century quarry remains only source of rich Ordovician fossil biota in Southeastern Wisconsin. To east is an excellent exposure of the Niagara Escarpment.
Pewaukee Stone Pits, Quarries, and Outcrops	GA-1	T7N, R19E Section 9 Village of Pewaukee	Small stone pits, quarries, and outcrops expose only reef known in the Waukesha Dolomite in Southeastern Wisconsin. This reef is older than any other fossil reef in the area.
Sussex Lime Kiln	GA-1	T8N, R19E Section 23 Village of Sussex	One of the best-unaltered late-19th-century kilns remaining in Southeastern Wisconsin. Eligible for listing on the National Register of Historic Places.
Menomonee Falls Reef	GA-1	T8N, R20E Section 10 Village of Menomonee Falls	Series of natural outcrops which form a river gorge, as well as old quarry exposures and lime kilns, situated along the Menomonee River. Falls form from exposure-resistant reef rock. One of the earliest bedrock sites described in Southeastern Wisconsin, having been noted by Increase Lapham in the 1840s.

Site Name	Classification Code	Location	Description and Comments
Raasch's Dome	GA-1	T8N, R20E Section 17 Village of Lannon	Elliptical rock dome with sides that dip as much as 20 degrees away from center. Excellent example of an unusual geologic feature.
Kettle Moraine	GA-1	Western portion of County	Interlobate moraine consisting of a complex system of irregular, knobby ridges, trending northeast-southwest across the western portion of the Region.
Scuppernong Pitted Outwash	GA-2	T5N, R17E Sections 7-9, 16-20 Town of Eagle	A large, pitted outwash plain.
Eagle Esker	GA-2	T5N, R17E Sections 28, 29 Town of Eagle	Good example of an esker with a local relief of between 40 feet and 65 feet.
Eagle Kettle Hole	GA-2	T5N, R17E Section 30 Town of Eagle	Deepest kettle hole in Waukesha County (approximately 90 feet deep).
Delafield Drumlin Fields	GA-2	T6N, R18E Sections 1, 2 Town of Genesee T7N, R18E Sections 34, 35, 36 Town of Delafield	A very well developed example of a drumlin field.
Delafield Interurban Cut	GA-2	T7N, R18E Sections 23, 24 Town of Delafield	Fossil-rich exposure of lower Mayville Dolomite along abandoned interurban railway line.
Menomonee Park Quarry and Domes	GA-2	T8N, R20E Sections 7, 8 Village of Menomonee Falls	Natural and human-made exposures of Racine Dolomite. Contains some of the least-disturbed rock-controlled geomorphology in Waukesha County.
Menomonee River Outcrop	GA-2	T8N, R20E Section 36 Village of Butler Village of Menomonee Falls	Low outcrops of Racine Dolomite interreef strata along Menomonee River.
Little Menomonee River Reef District	GA-2	T9N, R20E Sections 35, 36 Village of Germantown T9N, R21E Sections 19, 20, 30 City of Mequon T8N, R20E Section 2 Village of Menomonee Falls	Silurian Racine Dolomite reef rock exposures. Has considerable importance in scientific research. Contains a wide variety of reef features.

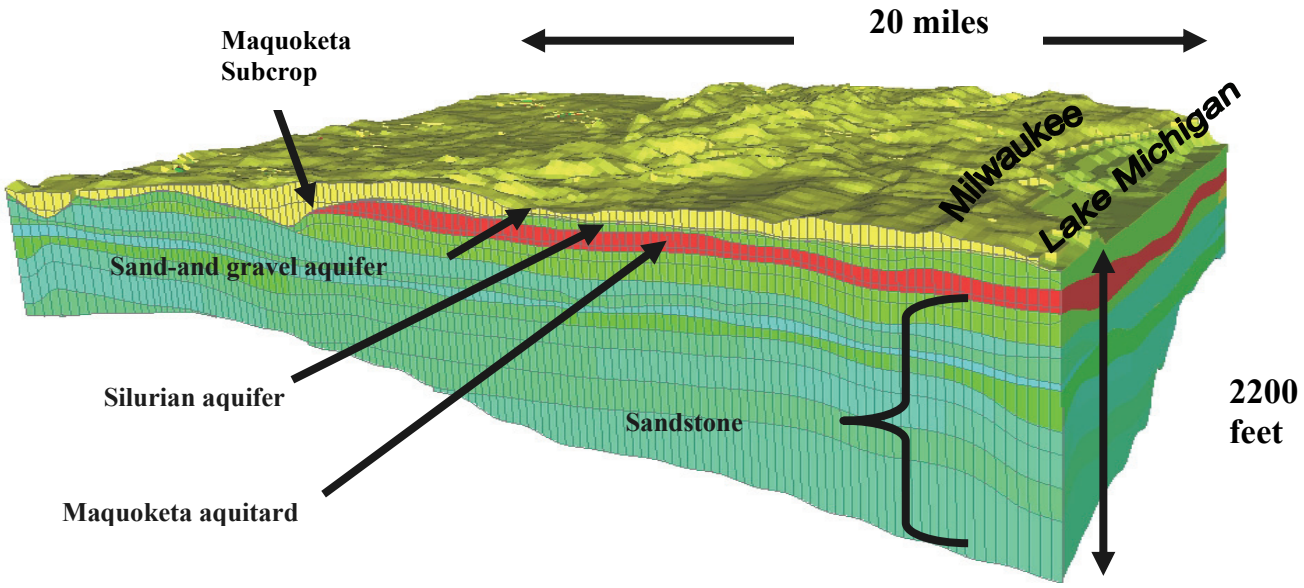
Site Name	Classification Code	Location	Description and Comments
Stark Road Quarry	GA-3	T5N, R17E Section 10 Town of Eagle	Exposed wall of small, old quarry containing good exposure of Niagara Escarpment.
Brady's Rock	GA-3	T5N, R17E Section 10 Town of Eagle	Natural rock bluff along west edge of Kettle Moraine representing some of the southernmost exposures of Niagara Escarpment in Wisconsin.
Scuppernong Glacial Lake	GA-3	T5N, R17E Sections 3-5, 8, 9, 16-18 Town of Eagle	Eastern edge of extensive glacial lake.
Jericho Creek Outcrop	GA-3	T5N, R17E Section 24 Town of Eagle	Natural outcrops of Mayville Dolomite along banks of Jericho Creek, first studied by Increase Lapham in 1840s.
Hunter's bluff	GA-3	T6N, R17E Sections 11, 14 Town of Ottawa	Natural rock bluff along west side of Kettle Moraine representing some of the southernmost exposures of Niagara Escarpment in Wisconsin.
Unnamed bluff	GA-3	T6N, R17E Section 22 Town of Ottawa	Natural bluff exposing Niagara Escarpment.
Unnamed Quarry	GA-3	T6N, R17E Section 14 Town of Ottawa	Old quarry with exposures of Niagara Escarpment.
Prospect Hill Drumlin	GA-3	T6N, R20E Sections 29-32 City of New Berlin	A conspicuous drumlin.
Tessmann Drumlin	GA-3	T7N, R18E Section 36 Town of Delafield	Drumlin with a local relief of 80 feet.
Audley's Quarry	GA-3	T7N, R18E Section 20 City of Delafield	Old quarry with exposure of Niagara Escarpment.
Merton Esker	GA-3	T8N, R18E Section 4 Town of Merton	Perfectly preserved, northwest-southeast, 50-foot-high esker.
Sussex Railroad Cut	GA-3	T8N, R19E Section 21 Town of Lisbon	Cuts through low bedrock hill along railway right-of-way expose Lannon beds of the Racine Dolomite, rocks that supplied the Lannon stone industry.
Derrick Quarry	GA-3	T8N, R20E Section 8 Village of Menomonee Falls	Small abandoned Lannon stone quarry, noted for containing only surviving 19th-century-style wooden stone-hoisting derrick.

GA-1 identifies Geological Area sites of statewide or greater significance
GA-2 identifies Geological Area sites of countywide or regional significance
GA-3 identifies Geological Area sites of local significance

Source: Wisconsin Department of Natural Resources, Wisconsin Geological and Natural History Survey, and SEWRPC.

Figure III-1

GENERAL HYDROGEOLOGY OF SOUTHEAST WISCONSIN



SOILS

Soil properties exert a strong influence on the manner in which land is used, since they affect the costs and feasibility of building site development and provision of public facilities. In the case of productive agricultural lands and potential mineral extraction areas, soils are a valuable and irreplaceable resource. A need, therefore, exists in any planning program to examine not only how land and soils are currently used, but also how they can best be used and managed. Soil suitability interpretations for specific types of urban and rural land uses are therefore important aids to physical development planning and for determining the best use of soils within an area.

In 1963, to assess the significance of the diverse soils found in Southeastern Wisconsin, the Southeastern Wisconsin Regional Planning Commission negotiated a cooperative agreement with the U. S. Department of Agriculture, Soil Conservation Service (SCS), now known as the Natural Resources Conservation Service (NRCS), under which detailed operational soil surveys were completed for the entire Region. The results of the soil surveys have been published in SEWRPC Planning Report No. 8, Soils of Southeastern Wisconsin and subsequently updated by the NRCS, 2003. These soil surveys have resulted in the mapping of the soils within the Region in great detail. At the same time, the surveys have provided definitive data on the physical, chemical, and biological properties of the soils and, more importantly, have provided interpretations of the soil properties for planning, engineering, agricultural, and resource conservation purposes.

Major Soil Association Groups

The soils in Waukesha County range from very poorly drained organic soils to excessively drained mineral soils. General grouping of these soils into soil associations is useful for comparing the suitability of relatively large areas of the County for various land uses. A soil association is defined as a landscape with a distinctive proportional pattern of soils, typically comprised of one or more major soil types and at least one minor soil type, as identified by the U. S. Department of Agriculture, Natural Resources Conservation Service, and named after the major soils. Nine soil associations are found in the County.

Suitability for Agriculture
In order to lend uniformity to the identification of productive farmlands throughout the nation, the NRCS established a soil classification system under which soils are categorized relative to their agricultural productivity. The two most highly productive soils are categorized as either National prime farmland or as farmland of statewide significance. National prime farmland is defined as land that is well suited for the production of food, feed, forage, fiber, and oilseed crops, with the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when properly treated and managed. Farmland of statewide importance includes land in addition to national prime farmland, which is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops.

As shown on Map III-3, approximately 28% of the land in Waukesha County (104,475 acres) was in agricultural uses in 2005. Of those lands, 77% is covered by soils that are classified as National prime farmland by NRCS, and 23% is classified as farmland of statewide importance.

Suitability for Development
Map III-4 shows the primary soil features that present potential limitations for land development, including depth to water table and bedrock and steep slopes. The soil features are presented for planning purposes only. Detailed on-site soil analysis is necessary to validate site conditions. Hydric soils generally have seasonal depth to water table of one (1) foot or less and are capable of supporting wetland vegetation. Poorly drained soils have seasonal depth to water table of three (3) feet and are concentrated on the eastern part of the county where many of the soils have a high clay content, often causing a perched water table condition. Shallow water table conditions risk groundwater contamination from on-site septic systems and could cause wetness problems for dwellings with basements. Shallow bedrock conditions pose higher construction costs for basements and also risk groundwater contamination from on-site septic systems because of the lack of a filtering soil layer. Steep slopes represent possible increased grading costs and higher risks for soil erosion during land development activities. Note that steep slopes are concentrated near the Kettle Moraine area. Shallow bedrock is concentrated near the northeast part of the county, where a number of quarry operations are also located, as noted earlier.

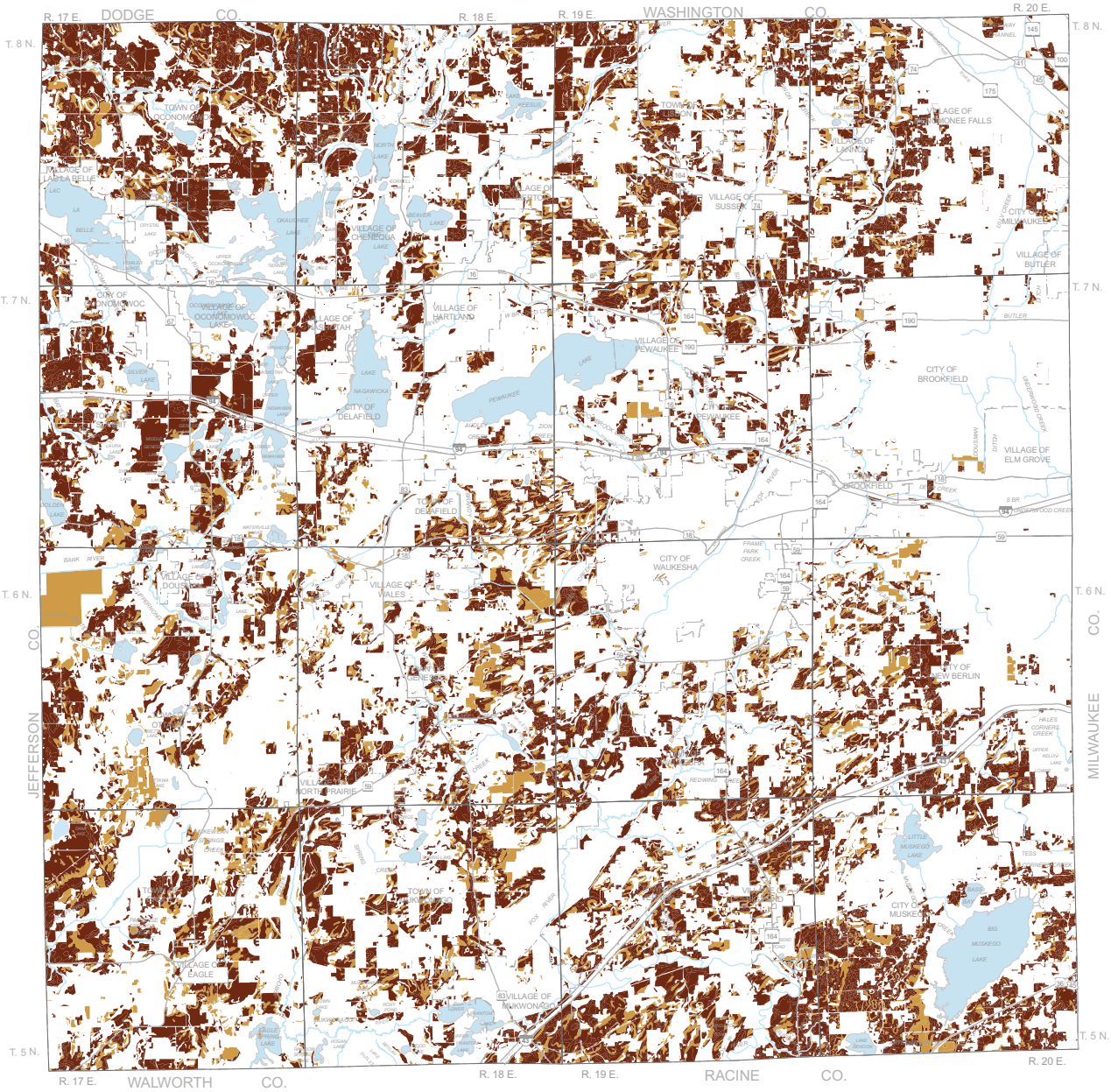
GROUND WATER RESOURCES

Groundwater is a vital natural resource of Waukesha County, which not only sustains lake levels and wetlands and provides the perennial base flow of the streams, but also is a major source of water supplies. In general, the County has an adequate supply of groundwater to support its growing population, agriculture, commerce, and a viable, diverse industry. However, overproduction and water shortages may occur in areas of concentrated development and intensive water demand, especially in the sandstone aquifer and in selected areas served by the shallow aquifers. The amount, recharge, movement, and discharge of the groundwater is controlled by several factors, including precipitation, topography, drainage, land use, soil, and the lithology and water-bearing properties of rock units ranging in age from Quaternary to Precambrian.

In 2002, SEWRPC published Technical Report 37 entitled, Groundwater Resources of Southeastern Wisconsin. The Report provided baseline information regarding groundwater availability and use in southeastern Wisconsin.

Map III-3

AGRICULTURAL USE AND CLASSIFICATION OF SOILS FOR WAUKESHA COUNTY



Legend

NRCS Prime Agricultural Soils Group (includes prime if drained or protected from flooding)

Soils of Statewide Importance (not in NRCS Prime group)

Note: Agricultural land use data from 2000 SEWRPC inventory. All subdivisions and condominium plats recorded up to March 2005 have been removed.

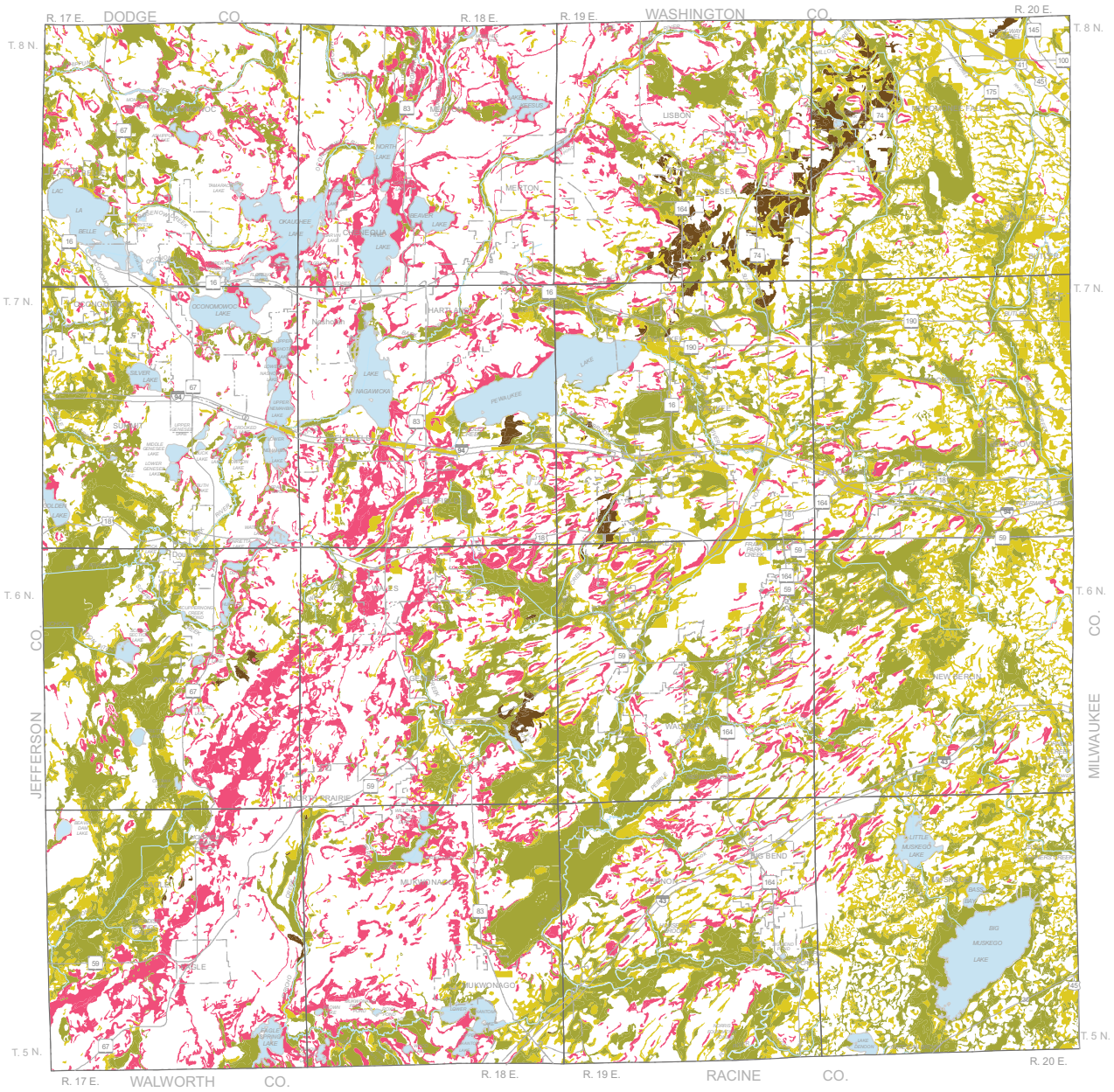
N

0 1 2 Miles

0 4,000 8,000 12,000 16,000 Feet

Map III-4

WAUKESHA COUNTY POTENTIAL SOIL LIMITATIONS FOR DEVELOPMENT



Legend

- Hydric Soils
- Poorly Drained Soils
- Bedrock < 6'
- Slopes > 12%

N

0 1 2 Miles

0 4,000 8,000 12,000 16,000 Feet

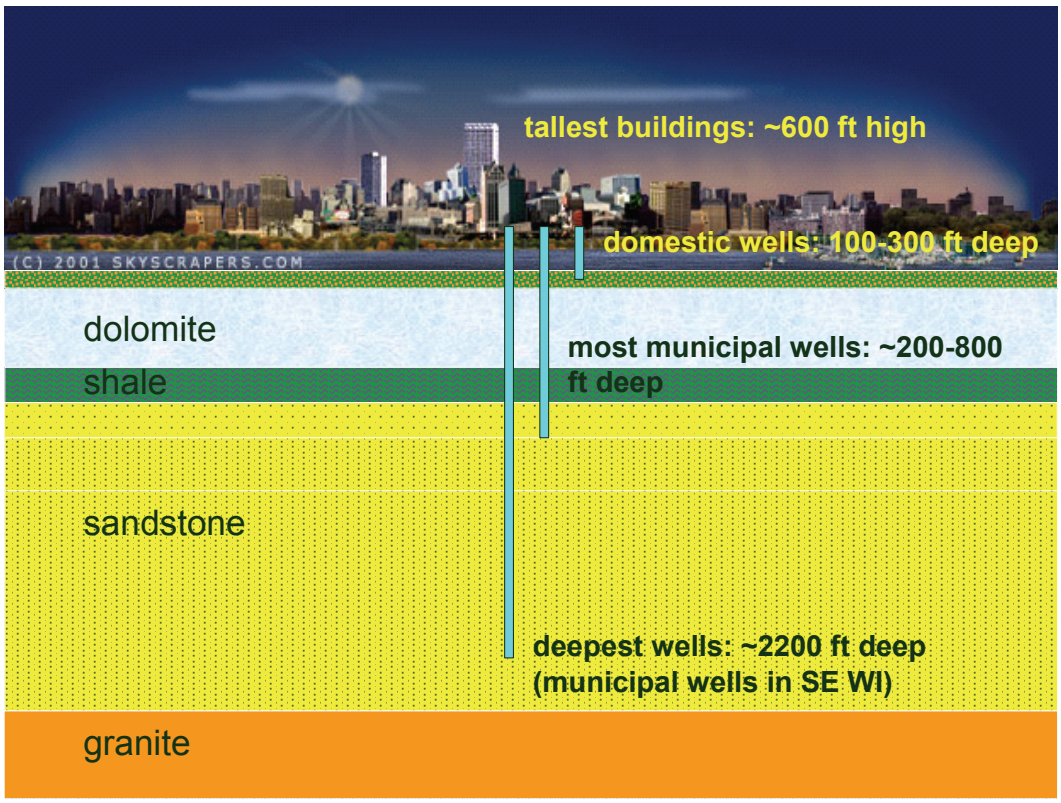
Source: NRCS, SEWRPC & Waukesha County

Groundwater Aquifers

Groundwater is present within three major aquifers that underlie the County. From the land's surface downward, they are: 1) the sand and gravel deposits in the glacial drift; 2) the shallow dolomite strata in the underlying bedrock; and 3) the deeper sandstone, dolomite, siltstone, and shale strata. Because of their proximity to the land's surface and hydraulic interconnection, the first two aquifers are commonly referred to collectively as the "shallow aquifer," while the latter is referred to as the deep aquifer. Within most of the County, the shallow and deep aquifers are separated by the Maquoketa shale, which forms a relatively impermeable barrier between the two aquifers (see Figure III-1). That shale layer is absent in the far western portion of the County. Figure III-2 depicts the typical well depths as they relate to the groundwater aquifers.

Figure III-2

RELATIVE WELL DEPTHS



Source: SEWRPC

Groundwater Use

The importance of groundwater as a source of water supply in Waukesha County and Southeastern Wisconsin can be shown by analyzing water use data. According to estimates by the U.S. Geological Survey, water users in the Southeastern Wisconsin Region used about 324 million gallons per day (mgd) of water from surface and groundwater sources in 2000, not including water used for thermoelectric-power production (see Table III-2). From this amount, 228 mgd, or about 70 percent, was withdrawn from surface water sources, primarily Lake Michigan; and 96 mgd, or about 30 percent, from groundwater (see Table III-3). In Waukesha County, nearly all of the water supply has historically been obtained from the groundwater system. This has recently changed somewhat with the conversion of the eastern portion of the Village of Menomonee Falls, the Village of Butler, and the eastern portion

Table III-2

ESTIMATED USE OF WATER WITHIN THE COUNTIES LOCATED WITHIN, OR PARTIALLY WITHIN, THE REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE STUDY AREA: 2000 (IN MILLION GALLONS PER DAY)

County	Domestic	Agricultural	Irrigation	Industrial	Commercial	Public Use and Losses	Total
Kenosha	7.02	0.18	0.25	4.44	2.95	3.89	18.73[a]
Milwaukee	54.06	0.01	0.81	57.92	33.14	43.60	189.54[b]
Ozaukee	4.11	0.32	0.51	1.88	1.08	1.42	9.32[c]
Racine	13.00	1.80	2.16	10.82	5.22	6.87	39.87
Walworth	5.13	2.16	0.66	3.20	1.67	2.20	15.02
Washington	5.64	0.62	0.31	2.55	1.84	2.42	13.38[d]
Waukesha	14.12	0.27	2.68	9.10	5.07	6.67	37.91
Total	103.08	5.36	7.38	89.91	50.97	67.07	323.77
Percent of Total	31.80	1.70	2.30	27.80	15.70	20.70	100.00

[a]Does not include 15.2 mgd of thermo-electric use.

[b]Does not include 1,867.6 mgd of thermo-electric use.

[c]Does not include 118.8 mgd of thermo-electric use.

[d]Does not include 2.4 mgd of thermo-electric use.

Source: B.R. Ellefson, G.D. Mueller, and C.A. Buchwald, U.S. Geological Survey, "Water Use in Wisconsin, 2000."

Table III-3

TRENDS IN REPORTED WATER USE IN SOUTHEASTERN WISCONSIN: 1979-2000 (IN MILLION GALLONS PER DAY)

	1979			1985			1990			2000		
County Name	SW	GW	Total	SW	GW	Total	SW	GW	Total	SW	GW	Total
Kenosha	17.81	3.42	21.23	17.87	2.54	20.41	20.41	2.56	22.97	16.04	2.69	18.73
Milwaukee	172.47	10.18	182.65	213.26	9.91	223.17	184.96	6.17	191.13	183.22	6.32	189.54
Ozaukee	1.19	6.66	7.85	1.15	6.33	7.48	1.43	6.66	8.09	1.52	7.80	9.32
Racine	22.55	7.69	30.24	22.55	7.28	29.83	29.32	8.85	38.17	26.24	13.63	39.87
Walworth	0.14	9.89	10.03	1.16	9.14	10.30	0.08	16.07	16.15	0.07	14.95	15.02
Washington	0.15	10.11	10.26	0.06	9.37	9.43	0.08	9.76	9.84	0.08	13.30	13.38
Waukesha	0.02	33.37	33.39	0.12	27.84	27.96	0.04	30.78	30.82	0.35	37.56	37.91
Total	214.33	81.32	295.65	256.17	72.41	328.58	236.32	80.85	317.17	227.52	96.25	323.77
Percent of Total	72.5	27.5	100.0	78.0	22.0	100.0	74.5	25.5	100.0	70.3	29.7	100.0

NOTE: The trends are based on currently available data, but the sources of information and accuracy of data may vary from one reporting period to another. The USGS obtains most of water use data from files of state agencies, and makes estimates for categories for which data are not reported (private domestic and agricultural uses). Water used for thermoelectric power is not included. *GW = Ground water source; SW = Surface water source.*

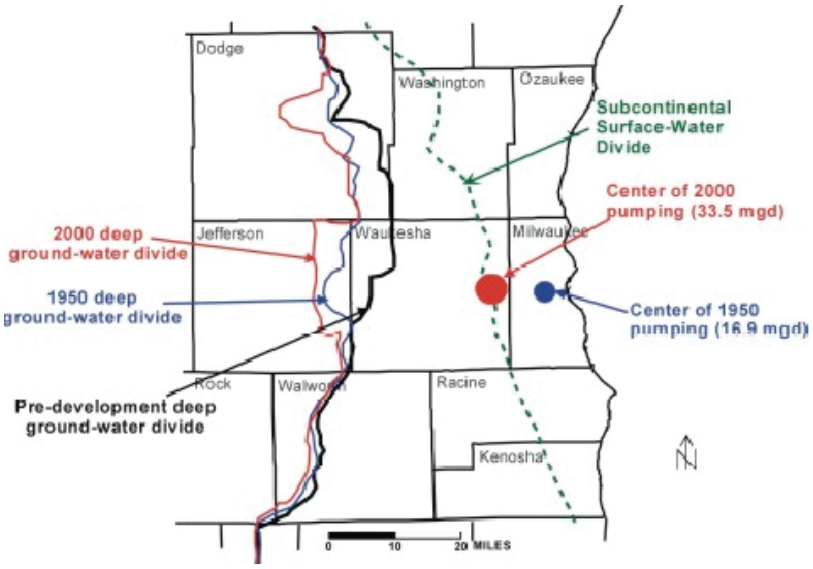
Source: SEWRPC, U.S. Geological Survey, 2000.

of the City of New Berlin to Lake Michigan water over the period of 1999 to 2005. Groundwater use and total water use in Waukesha County have risen steadily since 1985, increasing by about 36 percent over the period 1985 to 2000.

Figure III-3 illustrates the impact of increased groundwater pumping in southeastern Wisconsin on the groundwater divide as well as the shift in the center of pumping (cone of depression). As development occurred west of Lake Michigan with a reliance on groundwater supply, the groundwater divide pushed west along with the center of pumping. Figure III-3 depicts the approximate groundwater divide and center of pumping by the years 1950 and 2000.

Figure III-3

IMPACTS OF PUMPING ON THE DEEP SANDSTONE AQUIFER



In 2003, the Wisconsin Legislature passed the Groundwater Protection Act (Act 310) which sets new standards and conditions for approval of high capacity wells by the Department of Natural Resources (DNR) and other requirements for the management of the use of groundwater. Under Act 310, groundwater management areas were established in Southeastern and Northeastern Wisconsin, most notably Waukesha and Brown Counties, respectively. Those areas were designated as such because declining groundwater levels have become a chronic concern.

Groundwater Availability

Recharge to groundwater is derived almost entirely from precipitation. Much of the groundwater in shallow aquifers originates from precipitation that has fallen and infiltrated within a radius of about 20 or more miles from where it is found. The deeper sandstone aquifers are recharged by downward leakage of water through the Maquoketa Formation from the overlying aquifers or by infiltration of precipitation in western Waukesha County where the sandstone aquifer is not overlain by the Maquoketa Formation and is unconfined. On the average, precipitation annually brings about 32 inches of water to the surface area of the County. It is estimated that approximately 80 percent of that total is lost by evapotranspiration. Of the remaining water, part runs off in streams and part becomes groundwater. It is likely that the average annual groundwater recharge to shallow aquifers is 10 to 15 percent of annual precipitation.

To document the utilization of the shallow aquifers in the County, it may be assumed, for example, that, on the average, 10 percent of the annual precipitation reaches groundwater. Then, the average groundwater recharge in the County would be about 32 billion gallons annually, or about 88 million gallons per day (mgd). As previously noted in Table III-3, the estimated daily use of groundwater in 2000 was about 38 mgd, which is about 43 percent of the total amount of groundwater assumed to be recharged. This indicates that there is an adequate annual groundwater recharge to satisfy consumptive water demands on the shallow aquifer system in Waukesha County on a countywide basis. However, the availability for consumptive use on a localized area basis and the impact on local surface water resources will vary depending upon usage, pumping system configuration, and groundwater flow patterns.

The situation is different for the deep aquifers where withdrawals of groundwater cause supply/demand imbalance in areas of concentrated use of groundwater, which has resulted in the declining potentiometric surface and mining of groundwater. For example, Professor Douglas Cherkauer of the University of Wisconsin-Milwaukee, estimated that the demand on groundwater from the deep sandstone aquifer in Waukesha County is greater than the available supply (see Table III-4).

Table III-4

ESTIMATES OF AVAILABLE GROUNDWATER IN WAUKESHA COUNTY: 1999

Aquifer	Recharge Area (square miles)	Estimated Recharge Rate (inches per year)	Average Daily Recharge (mgd)	Average Daily Demand (mgd)
Shallow	400	3.1	59	3.5
Deep	100	3.1	14.8	31.5

Source: D.S. Cherkauer, 1999

Radium Concentrations

Certain formations within the Cambrian sandstones in southeastern Wisconsin are known to produce relatively high concentrations of naturally occurring radium, a radioactive metallic element. This naturally occurring radium has been found to exceed U. S. EPA standards in approximately 50 of the 1,300 municipal water supplies in Wisconsin. Most of the water supplies which exceed the radium standard draw water from the deep sandstone aquifer and lie in a narrow band from the Illinois-Wisconsin border through Kenosha, Racine, and Waukesha Counties and north through Green Bay. Evaluations are being undertaken to consider means of reducing the radium level in these wells. Systems serving portions of the Cities of Brookfield, Delafield, Muskego, Pewaukee, and Waukesha; the Villages of Eagle, Mukwonago, Pewaukee, and Sussex; and a few private water systems have reported some violations of the current radium standard.

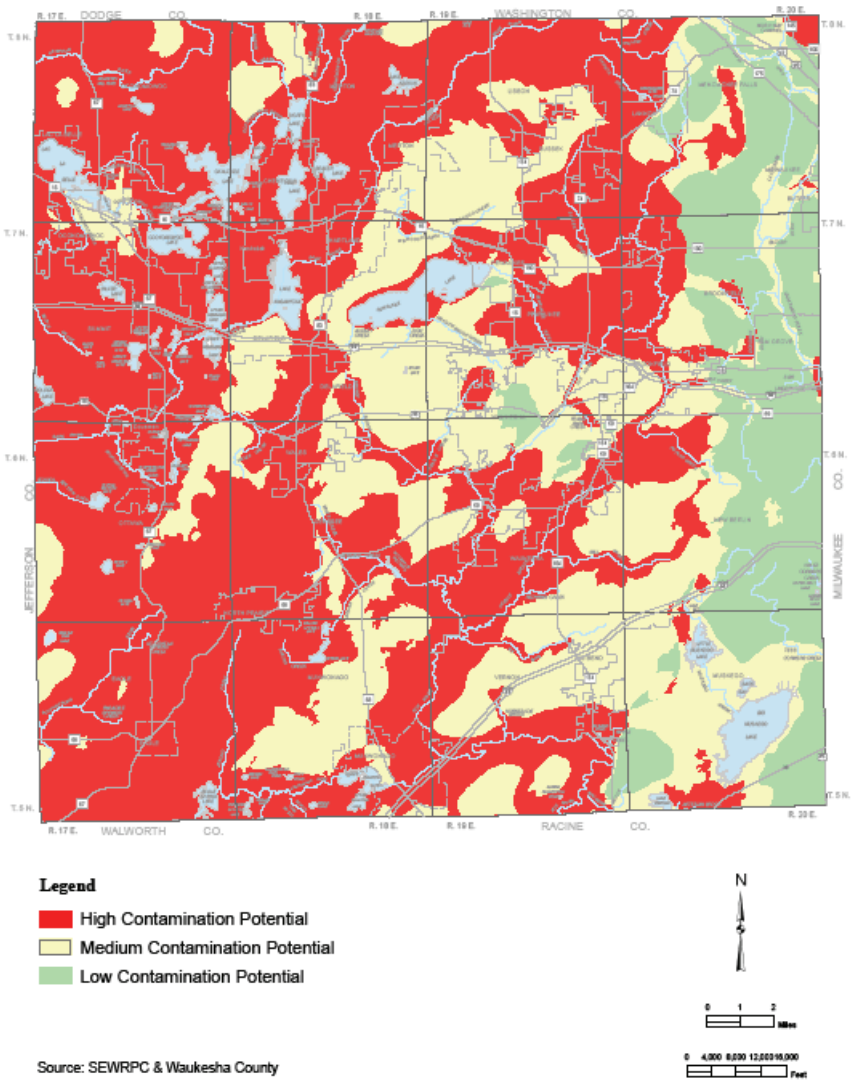
Vulnerability to Contamination

Groundwater quality conditions can through improper construction or management, be impacted by such sources of pollution on the surface as infiltration of storm water runoff, landfills, agricultural fertilizer, pesticides, manure storage and application sites, chemical spills, leaking surface or underground storage tanks, and onsite sewage disposal systems. The potential for groundwater pollution in the shallow aquifer is dependent on the depth to groundwater, the depth and type of soils through which precipitation must percolate, the location of groundwater recharge areas, and the subsurface geology. As shown in Map III-5 most of Waukesha County exhibits moderate to high potential for contamination of groundwater in the shallow glacial drift and Niagara aquifers. Generally, the areas of the County most vulnerable to groundwater contamination are where both Niagara dolomite and the water table are near the surface.

Compared to the deep aquifer, the shallow aquifers are more susceptible to pollution from the surface because they are nearer to the source in terms of both distance and time, thus minimizing the potential for dilution, filtration, and other natural processes that tend to reduce the potential detrimental effects of pollutants. Isolated cases of contamination have been identified in portions of Waukesha County. Such problems can often be traced to runoff pollution sources, septic system discharges, and chemical spills or leakage.

In the far western portion of the County, there is no confining impermeable layer of rock between the glacial drift and the sandstone aquifer. This is cause for concern in planning for the future development of that area. Urban development adversely affects both the quantity and quality of recharge water, especially where the aquifer is overlaid by outwash, end moraine, or other highly permeable glacial material. An increase in the area of impervious surfaces such as pavement affects the recharge of the sandstone aquifer by diverting larger amounts of precipitation into surface drainage courses as runoff, rather than allowing it to percolate into the ground.

Map III-5
Groundwater Contamination Potential in Waukesha County



Water Supply Planning
In January 2005, the Southeastern Wisconsin Regional Planning Commission announced that it has initiated the conduct of a regional water supply study for the Southeastern Wisconsin Region. That study will lead to the preparation and adoption of a regional water supply system plan. The preparation of the regional water supply plan represents the third, and final, element of the SEWRPC regional water supply management program. The first two elements, comprising the development of basic groundwater inventories and the development of a groundwater simulation model for the Southeastern Wisconsin Region, were completed previously.

The regional water supply plan is intended to include the following major components:

- Development of water supply service areas and of forecast demand for water use.
- Development of recommendations for water conservation efforts to reduce water demand.
- Evaluation of alternative sources of supply, culminating in identification of recommended sources of supply for each service area and in recommendations for development of the basic infrastructure required to deliver that supply.
- Identification of groundwater recharge areas to be protected from incompatible development.
- Specification of any new institutional structures found necessary to carry out the plan recommendations.
- Identification of any constraints to development levels in sub areas of the Region that may emanate from water supply sustainability concerns.

The regional water supply plan will be based upon a design year of 2035. It is expected that the regional water supply plan will be completed by the end of 2008.

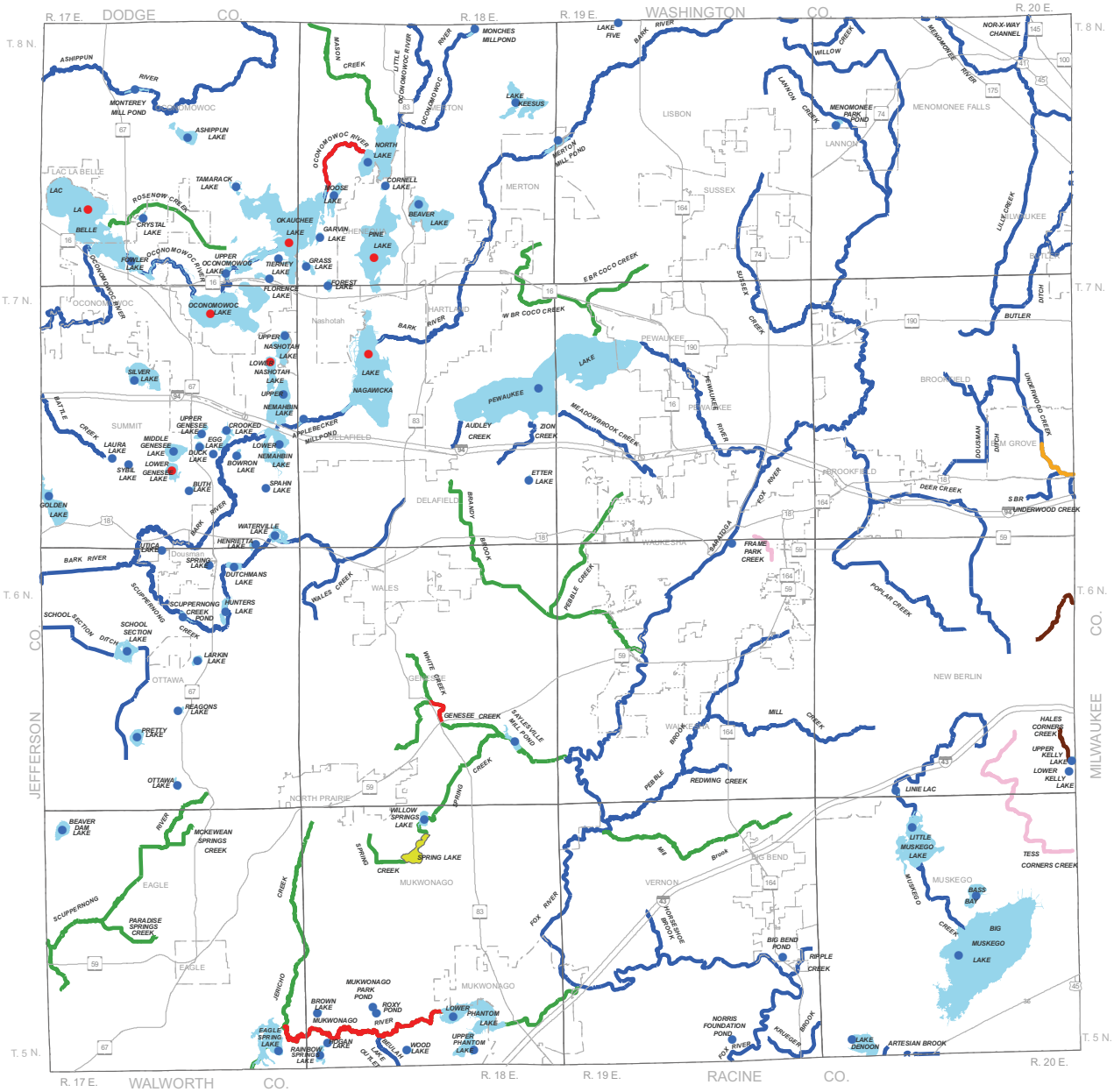
SURFACE WATER RESOURCES

Surface water resources constitute an extremely valuable part of the natural resource base of Waukesha County. Surface waters are a focal point of water-related recreational activities and provide an attractive setting for properly planned residential development. Surface waters, particularly the major lakes, also provide substantial economic benefits. Expenditures by boaters and other recreational users of surface waters benefit the owners of restaurants, grocery and convenience stores, service stations, and sporting goods stores in the County. Lakeshore properties, which generally have high-assessed valuations, also serve to enhance the property tax base of the County. In addition, when viewed in the context of open space areas, surface waters greatly enhance the aesthetic and scenic characteristics of the natural environment. Because surface water quality is highly susceptible to deterioration from pollutant runoff, both urban and rural land uses must be carefully managed to achieve a balance between level and extent of use and the maintenance of water quality. Surface water resources in the County, consisting of lakes and streams are shown on Map III-6 and described below.

Lakes
In 1997, the Wisconsin Legislature created a lake classification grant program. The program was intended to further the degree of protection of lakeshore habitat with the State. In 2000, Waukesha County received a Lake Protection Grant to initiate a program for the classification of the lakes within the County. The objective was to develop criteria for determining the sensitivity of lakes within the County to disturbance from land-based activities. Specifically, these criteria could be used to review and potentially refine the County's shoreland zoning code to provide an appropriate degree of protection for aquatic ecosystems. Previous county-wide inventories of lake classification were conducted by the Wisconsin Department of Natural Resources in 1963 (then the Wisconsin Conservation Department) and subsequently updated by the Southeastern Wisconsin Regional Planning Commission as part of regional water quality management plans.

Map III-6

SURFACE WATER RESOURCES OF WAUKESHA COUNTY



WATER RESOURCE CLASSIFICATION CODES

- Outstanding Resource Water (ORW)
- Exceptional Resource Water (ERW)
- Lake Supports Fish and Aquatic Life (FAL)
- Lake Supports Cold Water Species (Cold)
- Cold Water Streams (Cold)
- Fish and Aquatic Life (FAL)
- Special Variance Waters
- Limited Forage Fish (LFF)
- Limited Aquatic Life (LAL)

N

0 1 2 Miles

0 4,000 8,000 12,000 16,000 Feet

Source: WDNR, SEWRPC & Waukesha County

Major inland lakes are defined as those with a surface area of 50 acres or larger, a size capable of supporting reasonable recreational use with minimal degradation of the resource. Waukesha County contains all or portions of 33 major lakes with a combined surface area of approximately 14,000 acres, or 21.9 square miles, or about 3.8 percent of the total area of the County. This represents about 38 percent of the combined surface area of the 101 major lakes in the seven-county Southeastern Wisconsin Region, more than any other county in the Region. Thirty of the major lakes are located entirely within the County, while three major lakes, Lake Denoon, Golden Lake, and Lake Five, are located only partly within the County.

The major lakes in Waukesha County and their surface areas are presented in Table III-5. As indicated in Table III-5, the major lakes in the County range in size from 58 acres, Crooked Lake, to the second-largest lake in the Region, Pewaukee Lake, with a surface area of 2,493 acres. Seven lakes in the County have a surface area exceeding 640 acres, or one square mile.

In addition to the major lakes, there are 45 other water bodies with lake characteristics referenced in the DNR publication, "Wisconsin Lakes", PUBL-FM-800 91.

Because lake water quality is significantly affected by surrounding land use and cover, urban development and agricultural activity on land that drains into lakes and streams has led to a decline in water quality on many lakes in Waukesha County. Water quality often changes as a result of increasing levels of such nutrients as nitrogen and phosphorus entering a lake. Eutrophication is the condition reached by lakes when the accumulation of nutrients produces increasing amounts of aquatic plants. As the resulting lush aquatic plant growth dies each year, organic deposits fill in the lake. This is a natural process that is generally more prevalent in warm, shallow lakes, such as Big Muskego Lake, than in colder, deep lakes, such as Oconomowoc Lake. However, the process can be greatly accelerated by additional nutrients from inadequate or failing onsite sewage disposal systems, lawn fertilizers, agricultural runoff containing fertilizer and animal wastes, construction site runoff, and street debris.

The trophic status of most major lakes in Waukesha County is also presented in Table III-5. The trophic state serves as an indicator of overall water quality, taking into consideration water clarity, phosphorus content, algae content, and regional location in Wisconsin. In some cases, the current lake trophic state is a combination of two (i.e. Meso-eutrophic).

An oligotrophic lake is one in which little of the eutrophication process can be measured. As a result of very little nutrient accumulation, there is little aquatic plant and algae growth and the water appears very clear. The lake is probably very deep and the bottom is sandy or marly. This type of lake will support such cold-water fish as trout. No such lakes are present in Waukesha County.

A mesotrophic lake shows some signs of eutrophication. The presence of a greater amount of nutrients than in an oligotrophic lake results in lowered clarity and the presence of aquatic plants. Swimming and boating can be enjoyed on this type of lake without limitations.

A eutrophic lake has relatively large amounts of aquatic plants because of higher nutrient levels. The water may be cloudy because of suspended algae cells, dying plants may produce unpleasant smells, and mats of plants may interfere with swimming and boating. These lakes are generally shallow, with mucky bottoms. Eutrophic lakes can be excellent warm-water fishing lakes for such fish as bass and bluegills.

As indicated in Table III-5, of the 33 major lakes in the County, two, Big Muskego Lake and Little Muskego Lake, were classified as eutrophic; nine lakes were classified as meso-eutrophic, or between mesotrophic and eutrophic rankings; 18 lakes were classified as mesotrophic; and two lakes could not be classified because of lack of data.

Table III-5

MAJOR LAKES IN WAUKESHA COUNTY

Lake	Watershed	Township	Surface Area (acres)	Max. Depth (feet)	Lake Type	Trophic State	Class. Code(s)
Ashippun	Ashippun	Oconomowoc	83	40	SP	Mesotrophic	FAL
Bass Bay	Middle Fox	Muskego	100	23		Eutrophic	FAL
Beaver	Oconomowoc	Merton	316	49	SP	Mesotrophic	FAL
Big Muskego	Middle Fox	Muskego	2,260	4	DG	Eutrophic	FAL
Crooked	Bark	Summit	58	16	DG	Mesotrophic	FAL
Denoon	Middle Fox	Muskego	162	55	SE	Mesotrophic	FAL
Eagle Spring	Mukwonago	Eagle	311	8	DG	Mesotrophic	FAL
Fowler	Oconomowoc	Oconomowoc	99	50	DG	Mesotrophic	FAL
Golden	Bark	Summit	250	46	SP	Mesotrophic	FAL
Hunters	Bark	Ottawa	57	46	SP	Mesotrophic	FAL
Keesus	Oconomowoc	Merton	237	42	SP	Mesotrophic	FAL
Lac La Belle	Oconomowoc	Oconomowoc	1,117	45	DG	Mesotrophic	Cold, 303(d)
Larkin	Bark	Ottawa	57	4	SP	N/A	FAL
Little Muskego	Middle Fox	Muskego	506	65	DG	Mesotrophic	303(d)
Lower Genesee	Bark	Summit	66	45	SP	Mesotrophic	Cold
Lower Nashotah	Bark	Summit	90	43	SP	Mesotrophic	Cold
Lower Nemahbin	Bark	Summit	271	36	DG	Mesotrophic	FAL
Lower Phantom	Mukwonago	Mukwonago	433	12	DG	Mesotrophic	FAL
Middle Genesee	Bark	Summit	109	40	SE	Mesotrophic	FAL
Nagawicka	Bark	Delafield	957	90	DG	Mesotrophic	Cold
North	Oconomowoc	Merton	439	78	DG	Mesotrophic	FAL
Oconomowoc	Oconomowoc	Oconomowoc	804	62	DG	Mesotrophic	Cold, 303(d)
Okauchee	Oconomowoc	Oconomowoc	1,187	94	DG	Mesotrophic	Cold
Pewaukee	Upper Fox	Delafield	2,493	45	SP	Mesotrophic	FAL
Pine	Oconomowoc	Merton	703	85	SP	Mesotrophic	Cold, 303(d)
Pretty	Bark	Ottawa	64	35	SE	Oligo-mesotrophic	FAL
School Section	Bark	Ottawa	125	8	DG	Mesotrophic	FAL
Silver	Oconomowoc	Summit	222	44	SE	Mesotrophic	FAL
Spring	Middle Fox	Mukwonago	105	22	SP	Mesotrophic	ORW
Upper Nashotah	Bark	Summit	133	53	SP	Mesotrophic	FAL
Upper Nemahbin	Bark	Summit	283	61	DG	Mesotrophic	FAL
Upper Phantom	Mukwonago	Mukwonago	110	29	SP	Mesotrophic	FAL
Waterville	Bark	Summit	68	12	DG	Eutrophic	FAL

Source: WDNR,SEWRPC

Notes: N/A indicates not available.
Cold = Supports a cold water community either naturally occurring or artificially stocked.
FAL = Fish and Aquatic Life. This is a default classification equivalent to Warm Water Sport Fish Community.
303(d) = Water body appears on the Wisconsin Impaired Waters List.
ORW = An Outstanding Resource Water as defined by Chapter NR 102 Wisconsin Administrative Code.
DG (Drainage Lake) = Impoundments and natural lakes with the main water source from stream drainage.
SE (Seepage Lake) = Landlocked. Water level maintained by groundwater table and basin seal. May have intermittent outlet.
SP (Spring Lake) = Groundwater fed lakes always with an outlet of substantial flow.

Sediments and associated substances delivered to lakes and streams in Waukesha County are a significant source of water pollution. Nutrients, in the form of fertilizers and animal wastes, are carried on eroded soil particles from agricultural and urban lands. This may cause the excessive growth of aquatic plants and thereby affect water clarity and increase oxygen demand.

Streams may exhibit a net deposition, net erosion, or no net change in internal sediment transport, depending on the tributary land uses, hydrology, precipitation, and geology. Thus some streams are capable of removing sediments before they reach lakes.

Rivers and Streams

For flood control and water quality planning purposes, the Southeastern Wisconsin Regional Planning Commission has divided the Region into 11 major watersheds, four of which are located wholly or partially in Waukesha County. The subcontinental divide traverses the County in a north-south direction in the eastern tier of communities, separating the County between the Mississippi River and the Great Lakes-St. Lawrence River drainage systems. As shown on Map III-7, two of the major watersheds, the Menomonee River and Root River watersheds, lie east of the subcontinental divide and are part of the Great Lakes-St. Lawrence River drainage system. The other two watersheds, the Fox (Illinois) and Rock River watersheds, lie west of the sub-continental divide and are part of the Mississippi River drainage area. The watershed covering the largest area of Waukesha County is that of the Fox River, encompassing about 58 percent of the total area of the County.

Major streams are perennial streams, which maintain, at a minimum, a small contiguous flow throughout the year except under unusual drought conditions. The major streams in Waukesha County are presented in Table III-6**.** As indicated in Table III-6, Waukesha County contains a total of approximately 268 miles of perennial streams. The longest major streams are the Fox (Illinois) and Bark Rivers, with 46.1 and 31.8 stream miles, respectively, in the County.

Map III-7
Watersheds of Waukesha County

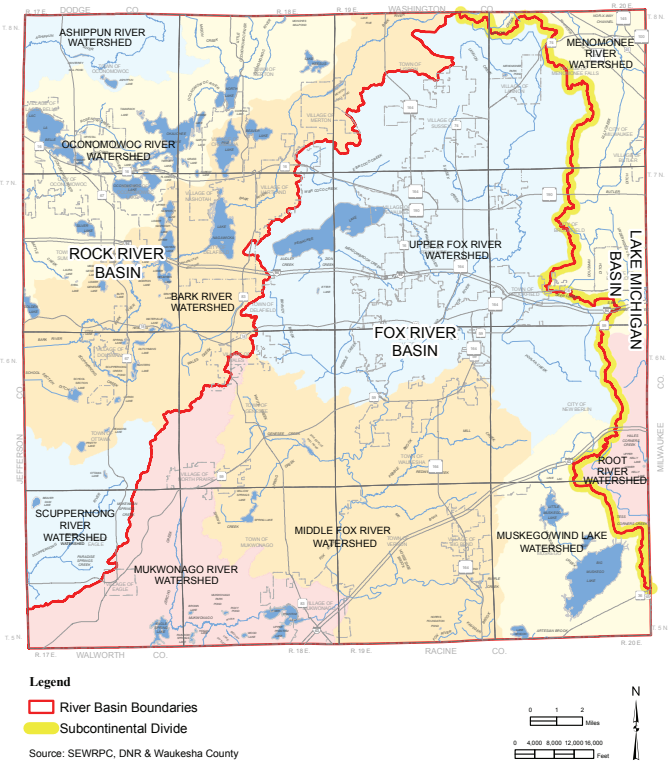


Table III-6

MAJOR STREAMS IN WAUKESHA COUNTY

Stream Name	Watershed	Township	Length (miles)	Classification Code(s)
Ashippun River	Ashippun	Oconomowoc	11.1	FAL, AQ-3 (RSH)
Bark River	Bark	Delafield	29.7	FAL, AQ-1 & AQ-2 (RSH)
School Section Ditch	Bark	Ottawa	5.7	FAL
Scuppernong Creek	Bark	Ottawa	12.8	FAL, AQ-2 (RSH)
Wales Creek	Bark	Genesee	2.1	FAL
Butler Ditch	Menomonee	Brookfield	3.9	FAL
Dousman Ditch	Menomonee	Brookfield	2	FAL
Lilly Creek	Menomonee	Menomonee Falls	5.1	FAL
Menomonee River	Menomonee	Menomonee Falls	7.8	FAL, AQ-3
Nor-X-Way Channel	Menomonee	Menomonee Falls	1.3	FAL
Underwood Creek	Menomonee	Brookfield	6.9	Special Variance
Willow Creek	Menomonee	Lisbon	2.3	FAL
Artesian Brook	Muskego-Wind	Vernon	1	FAL
Muskego Creek	Muskego-Wind	Muskego	6.6	FAL
Krueger Brook	Middle Fox	Vernon	2.1	FAL
Ripple Creek	Middle Fox	Vernon	1	FAL
Horseshoe Brook	Middle Fox	Vernon	1.5	FAL
Mill Brook	Middle Fox	Vernon	5.7	COLD, AQ-2 (RSH)
Pebble Brook	Middle Fox	Vernon	8.7	FAL, AQ-3
Redwing Creek	Middle Fox	Waukesha	1.4	FAL
Mill Creek	Middle Fox	Waukesha	5.1	FAL, AQ-3
Genesee Creek	Middle Fox	Waukesha	6.7	ERW, COLD, AQ-2 (RSH)
Spring Creek	Middle Fox	Mukwonago	6	COLD
White Creek	Middle Fox	Genesee	1.4	COLD
Beulah Lake Outlet	Mukwonago	Mukwonago	1.1	FAL
Mukwonago River	Mukwonago	Mukwonago	10.2	ERW, COLD, AQ-1 (RSH)
Jericho Creek	Mukwonago	Eagle	5.8	COLD, AQ-2 (RSH)
Battle Creek	Oconomowoc	Summit	2.8	FAL, 303(d)
Little Oconomowoc	Oconomowoc	Merton	3.5	FAL, AQ-3 (RSH)
Mason Creek	Oconomowoc	Merton	4.5	COLD, 303(d), AQ-2 (RSH)
Oconomowoc River	Oconomowoc	Merton	14.3	ERW, FAL, AQ-3 (RSH)
Rosenow Creek	Oconomowoc	Oconomowoc	3.5	COLD, AQ-3
Hales Corners Creek	Root	New Berlin	1	LAL
Tess Corners Creek	Root	Muskego	5.5	LFF
Paradise Springs Creek	Scuppernong	Eagle	1.6	COLD
Scuppernong River	Scuppernong	Eagle	7.4	COLD, AQ-2 (RSH)
Audley Creek	Upper Fox	Delafield	1.2	FAL
Brandy Brook	Upper Fox	Genesee	5	COLD, AQ-3
Deer Creek	Upper Fox	Brookfield	6.6	FAL, 303(d)
Fox (Ill River)	Upper Fox	Waukesha	50.6	FAL, 303(d), AQ-2 (RSH)
Frame Park Creek	Upper Fox	Waukesha	1	LFF, 303(d)
Lannon Creek	Upper Fox	Menomonee Falls	5.4	FAL
Pebble Creek	Upper Fox	Waukesha	6.9	COLD, AQ-3

Stream Name	Watershed	Township	Length (miles)	Classification Code(s)
Pewaukee River	Upper Fox	Pewaukee	6.4	FAL, AQ-3 (RSH)
Poplar Creek	Upper Fox	Brookfield	8	FAL, 303(d), AQ-3 (RSH)
Sussex Creek	Upper Fox	Brookfield	6.6	FAL, 303(d)
Coco Creek (East Br.)	Upper Fox	Pewaukee	2	COLD, AQ-3
Coco Creek (West Br.)	Upper Fox	Pewaukee	4.8	COLD, AQ-3
Zion Creek	Upper Fox	Delafield	1.6	FAL, 303(d)

Classification Codes

COLD = Includes surface waters capable of supporting a community of cold water fish and other aquatic life.

FAL = Fish & Aquatic Life. Default classification equivalent to Warm Water Sport Fish Community.

LFF = Limited Forage Fishery. Surface waters capable of supporting only a limited community of forage fish.

LAL = Limited Aquatic Life. Marginal surface waters that support only a limited aquatic life community.

303(d) = Water body appears on the Wisconsin Impaired Waters list.

ERW = An Exceptional Resource Water as defined by Chapter NR102 of the WI Administrative Code.

AQ-1 = Identifies Aquatic Areas of statewide or greater significance.

AQ-2 = Identifies Aquatic Areas of countywide or regional significance.

AQ-3 = Identifies Aquatic Areas of local significance.

RSH = Rare Species Habitat. Aquatic areas which support endangered, threatened, or "special concern species" officially designated by the DNR.

Source: SEWRPC, DNR

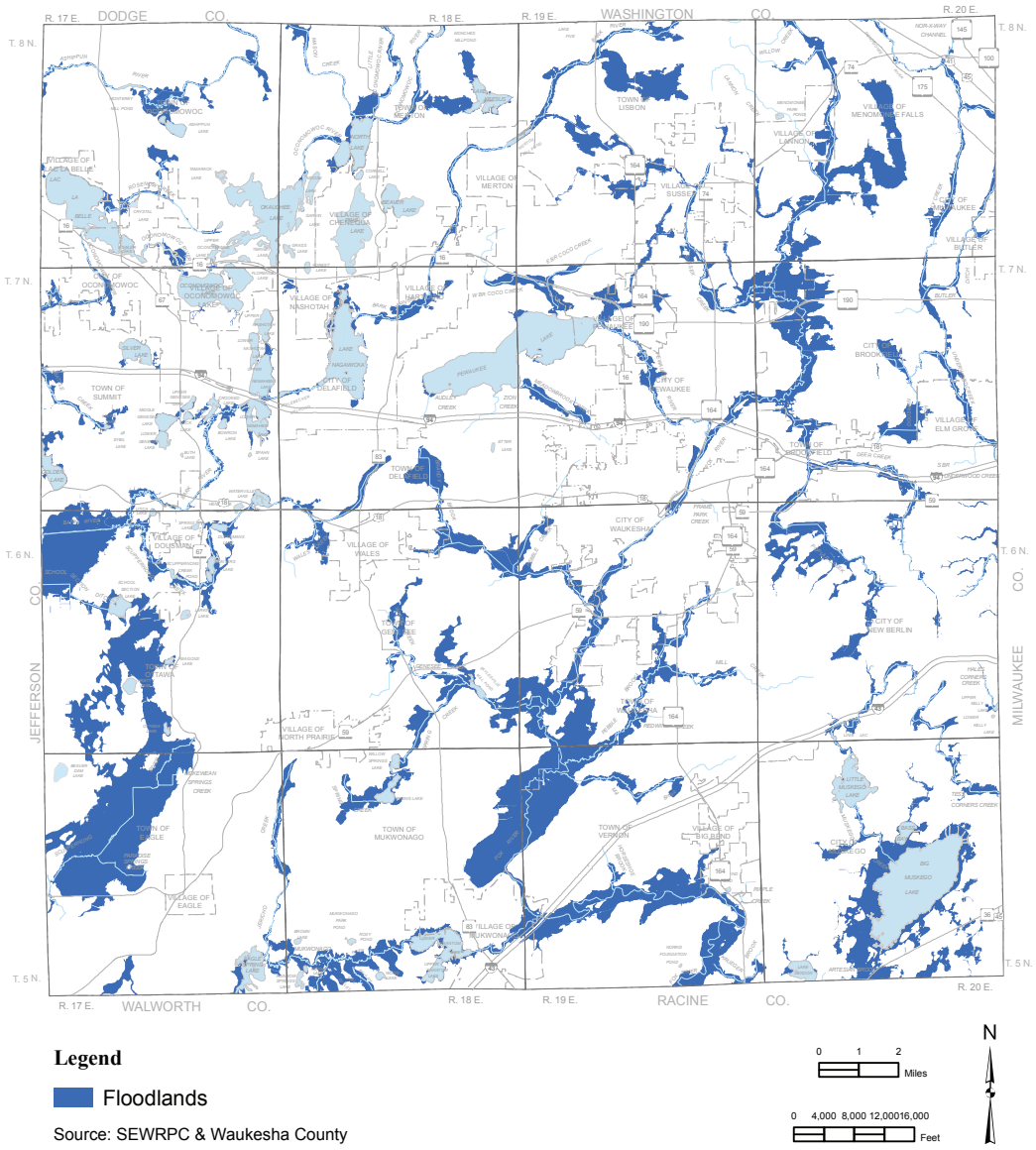
Floodlands

The floodlands of a stream are the wide, gently sloping areas contiguous with and usually lying on both sides of a stream channel. Streams occupy their channels most of the time. However, during even minor flood events, stream discharges increase beyond the capacity of the channel to accommodate the entire flow, especially where urban development increases runoff or alters the stream channel. As a result, stages increase and the river or stream spreads laterally over the floodlands. The periodic flow of a river onto its floodlands is a recurring phenomenon and, in the absence of costly flood control measures, will occur regardless of the extent of urban development in floodlands.

For planning and regulatory purposes, floodlands are normally defined as the areas, excluding the channel, subject to inundation by the 100-year recurrence interval flood event. This is the event that would be reached or exceeded in severity on the average of once every 100 years. It should be noted that the 100-year recurrence interval floodland contains within its boundaries the areas inundated by floods of less severe but more frequent occurrence such as every 5, 25, or 50 years. Floodlands are not suited to urban development because of flood hazards, high water tables, and inadequate soils. These areas are, however, generally suitable locations for valuable park and open space areas. Floodlands also provide storage for floodwaters and thereby decrease downstream flood discharges and stages.

General floodlands in Waukesha County, delineated by the Southeastern Wisconsin Regional Planning Commission, the Federal Emergency Management Agency, and the Wisconsin Department of Natural Resources, are shown on Map III-8. The 100-year flood recurrence interval flood hazard area encompasses about 72 square miles, not including nearly 24 square miles of surface water in lakes and streams, or about 13 percent of the County's total land area. In 1990, a total of about 13.7 square miles, or about 19 percent, of these floodlands were located within state, county, or local public park and open space land.

Map III-8
General Floodlands of Waukesha County



Impaired Waters List (303d)

The Department of Natural Resources (DNR) is required every two years to submit a list to the Environmental Protection Agency (EPA) which identifies waters which are not meeting water quality standards, including both water quality criteria for specific substances or the designated biological and recreational uses. This list is known as the "impaired waters list" or simply the "303(d) list" in reference to the particular section of the Clean Water Act. Several factors can cause waters to become impaired and therefore be identified on the "impaired waters list". These factors include: 1) Point source dominated; 2) nonpoint source dominated; 3) Point source and nonpoint source

combined; 4) Contaminated sediment waters; 5) Atmospheric deposition dominated; 6) Habitat/physical impaired; or 7) Other factors.

Biological Use Classification

Surface waters are classified into one of the following water resource classifications. The type of aquatic community a particular surface water resource is capable of supporting is represented by the biological use objectives. Only the first three classifications are considered suitable for the protection and propagation of a balanced fish and other aquatic life community. These waters usually exhibit the highest degree of water quality. The last two classifications are unable to maintain the specified water quality conditions and support a balanced community because of their naturally limited habitat or water quality. The water resource classifications are:

Cold Water Communities (COLD) include surface waters capable of supporting a community of cold-water fish and other aquatic life or serving as a spawning area for cold water species. This use includes, but is not restricted to, surface waters identified as trout waters in the publication (6-3600[80]) *Wisconsin Trout Streams.* Also present in these communities are forage fish and macroinvertebrates, which are intolerant of pollution. In Waukesha County, Brandy Brook, Coco Creek, Jericho Creek, Mason Creek, McKeawn Spring Creek, Mill Brook, Mukwonago River, Paradise Springs Creek, Pebble Creek, Rosenow Creek, Scuppernong River, South Branch Scuppernong River and Spring Brook are classified as cold-water communities.

Warm Water Sport Fish Communities (WWSF) are capable of supporting a community of warm water sport fish or have served as a spawning area for warm water sport fish. Macroinvertebrates, which are relatively intolerant of pollution, are present in these communities.

Warm Water Forage Fish Communities (WWFF) are capable of supporting an abundant diverse community of forage fish and other aquatic life. Macroinvertebrates, which are relatively intolerant of pollution, are present in these communities.

Limited Forage Fishery Communities (LFF) are communities capable of supporting only a limited community of forage fish and aquatic life. These surface waters have naturally poor water quality and habitat. Pollution-tolerant macroinvertebrates are present in these communities.

Limited Aquatic Life Communities (LAL) includes surface waters severely limited because of very low or intermittent flow and naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.

In addition to the above classifications, the Wisconsin Department of Natural Resources has two other special classifications used for the highest quality lakes and streams. These classifications are Outstanding Resource Waters and Exceptional Resource Waters. They are described as:

Outstanding Resource Waters (ORW) have the highest quality water and fisheries in the state and are therefore deserving of special protection. They do not receive wastewater discharges and point source discharges will not be allowed in the future unless the quality of the wastewater discharged is equal to or better than background conditions. The only outstanding resource water in Waukesha County is Spring Lake.

Exceptional Resource Waters (ERW) provides valuable fisheries, hydrologically or geologically unique features, outstanding recreational opportunities, or unique environmental settings, which are not significantly impacted by human activities. These resource waters already receive wastewater discharges or may receive future discharges. In Waukesha County, Genesee Creek, the Mukwonago River and the Oconomowoc River between North Lake and Okauchee Lake are designated as exceptional water resources.

More stringent site design and storm water management requirements are typically necessary to address thermal and other runoff impacts to cold-water communities, outstanding water resources and exceptional water resources. Map III-6 depicts the current water resource classifications in Waukesha County.

ENVIRONMENTAL CORRIDORS AND ISOLATED NATURAL RESOURCE AREAS

The most important elements of the natural resource base of the County, including the best remaining woodlands, wetlands, prairies, wildlife habitat, surface water and associated shorelands and floodlands, and related features, including existing park and open space sites, scenic views, and natural areas and critical species habitat sites, occur in linear patterns in the landscape, termed "environmental corridors." The most important of these have been identified as "primary environmental corridors," which are by definition at least two miles long, 200 feet wide, and 400 acres in area. As shown on Map III-9 primary environmental corridors are generally located along river and major stream valleys, around major inland lakes, and in the Kettle Moraine. This County comprehensive plan recommends the preservation of primary environmental corridors in essentially natural, open use. The preservation of these corridors is considered essential to the overall environmental quality of the County and the maintenance of its unique cultural and natural heritage and natural beauty. Because these corridors are generally poorly suited for urban development owing to soil limitations, steep slopes, or flooding potential, their preservation will also help to avoid the creation of new environmental and developmental problems.

In addition to primary environmental corridors, other concentrations of natural resources—referred to as "secondary environmental corridors" and "isolated natural resource areas"—have been identified as warranting strong consideration for preservation. Secondary environmental corridors contain a variety of resource features and are by definition at least one mile long and 100 acres in area. Isolated natural resource areas are concentrations of natural resources of at least five acres in size and 200 feet in width that have been separated from the environmental corridor network by urban or agricultural uses. Planned secondary environmental corridors and isolated natural resources are also shown on Map III-9.

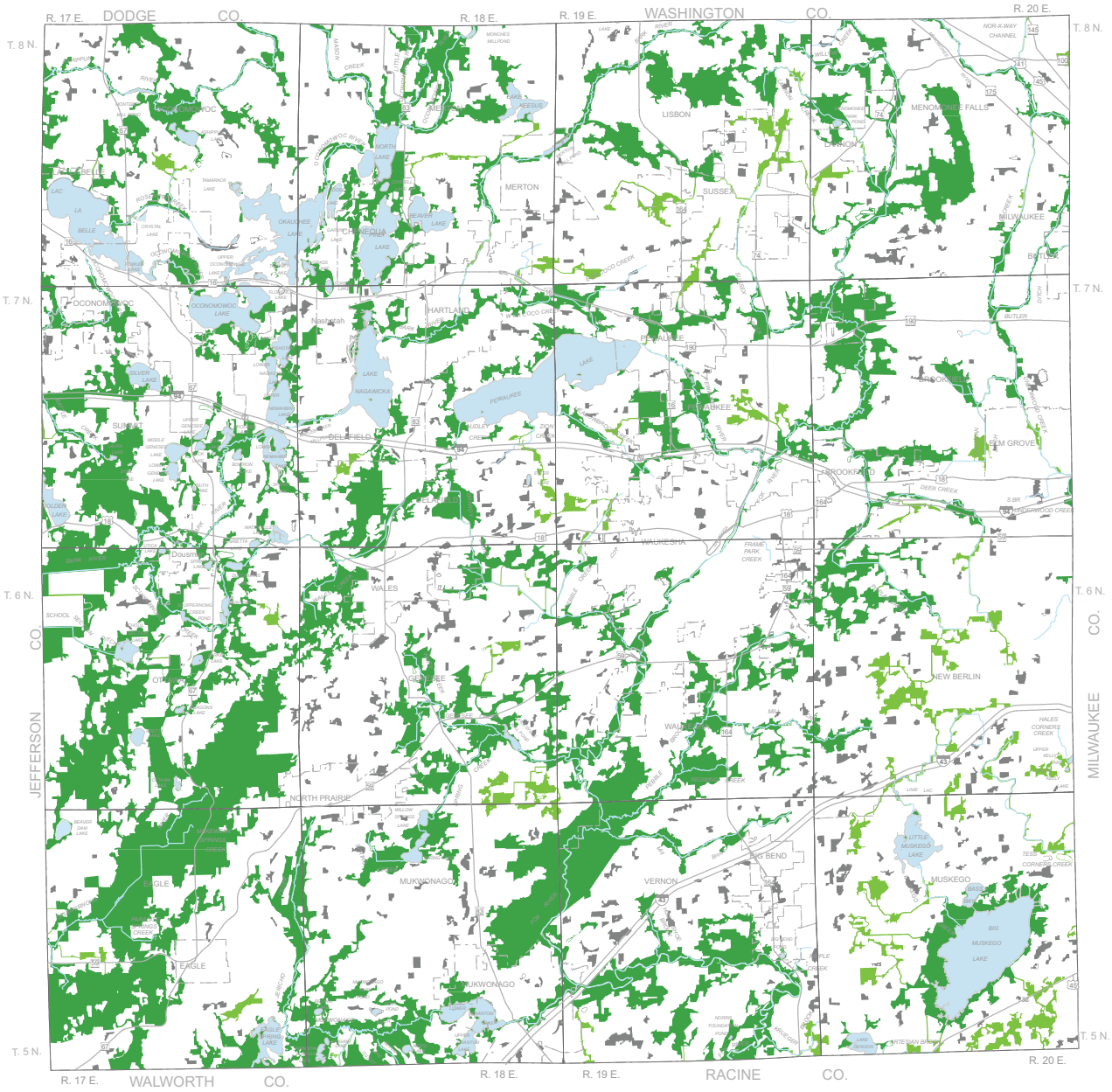
While this plan recommends the protection of environmental corridors and isolated natural resource areas, it recognizes that certain development may be accommodated in such areas without jeopardizing their overall integrity. The plan recognizes that certain transportation and utility uses may of necessity have to be located within such areas and that limited residential and recreational uses may be accommodated in such areas. Guidelines pertaining to such development within environmental corridors are presented in Table II-20, contained in the planning standards section of Chapter 2. Under these guidelines, residential development in environmental corridors would be limited to upland environmental corridors at an overall density of no more than one dwelling unit per five acres. Conservation subdivision designs are strongly encouraged where such rural density residential development is accommodated.

Under the comprehensive plan, the existing (year 2000) configuration of environmental corridors and isolated natural resource areas would be modified slightly. These modifications include minor deletions attendant to prior local commitments documented in adopted sewer service area plans, along with certain additions. The additions include currently farmed floodplains adjacent to existing environmental corridors within planned urban service areas that may be expected to revert to more natural conditions over time and become part of the corridor.

Under the comprehensive plan, primary environmental corridors would encompass about 148.5 square miles, or about 31 percent of the County, in 2035. This represents a net increase of 5.7 square miles, or 4 percent, over the existing 2000 area. Secondary environmental corridors would encompass 11 square miles in 2035, a decrease of about 2 percent, from 2000. Isolated natural resource areas would encompass about 12.5 square miles in 2035, a decrease of about 4 percent from 2000.

Map III-9

PLANNED ENVIRONMENTAL CORRIDORS & ISOLATED NATURAL RESOURCE AREAS IN WAUKESHA COUNTY: 2000



Legend

- Primary Environmental Corridor (PEC)
- Secondary Environmental Corridor (SEC)
- Isolated Natural Resource Area (INRA)

N

0 1 2 Miles

0 4,000 8,000 12,000 16,000 Feet

Source: SEWRPC & Waukesha County

NATURAL AREAS AND CRITICAL SPECIES HABITAT

A comprehensive inventory of natural areas within the County was conducted by the Southeastern Wisconsin Regional Planning Commission in 1994 as part of the natural areas and critical species habitat protection and management plan being prepared by the Commission and currently being updated. The inventory systematically identified all remaining high-quality natural areas and critical species habitat then existing within the Region.

Natural areas were classified based upon the natural area classification system developed by the Wisconsin Department of Natural Resources. Three classification categories are used: NA-1, natural areas of Statewide or greater significance, which contain nearly complete and relatively undisturbed plant and animal communities which are believed to resemble closely those of presettlement times; NA-2, natural areas of countywide or regional significance, which contain native biotic communities judged to be of lower than NA-1 significance, either because of evidence of a limited amount of human disturbance or because of limited size; and NA-3, natural areas of local significance, which have been substantially altered by human activities, but which provide refuge for native plant and animal species that no longer exist in the surrounding area because of land uses and associated activities.

A total of 105 natural areas, encompassing about 13,710 acres, or about 4 percent of the County, were identified by the Regional Planning Commission in Waukesha County in 1994. Of the 105 identified sites, nine were classified as NA-1 sites and encompass about 1,775 acres, 30 were classified as NA-2 sites and encompass about 4,890 acres, and 66 were classified as NA-3 sites and encompass about 7,045 acres.

The inventory also identified a total of 77 critical species habitat sites within Waukesha County, including 22 critical bird habitat sites, one critical mammal habitat site, and 54 critical plant habitat sites. Of the total sites, 12 critical bird habitat sites, one critical mammal habitat site, and 23 critical plant habitat sites were located outside an identified natural area, for a total of 36 critical species habitat sites located outside natural areas.

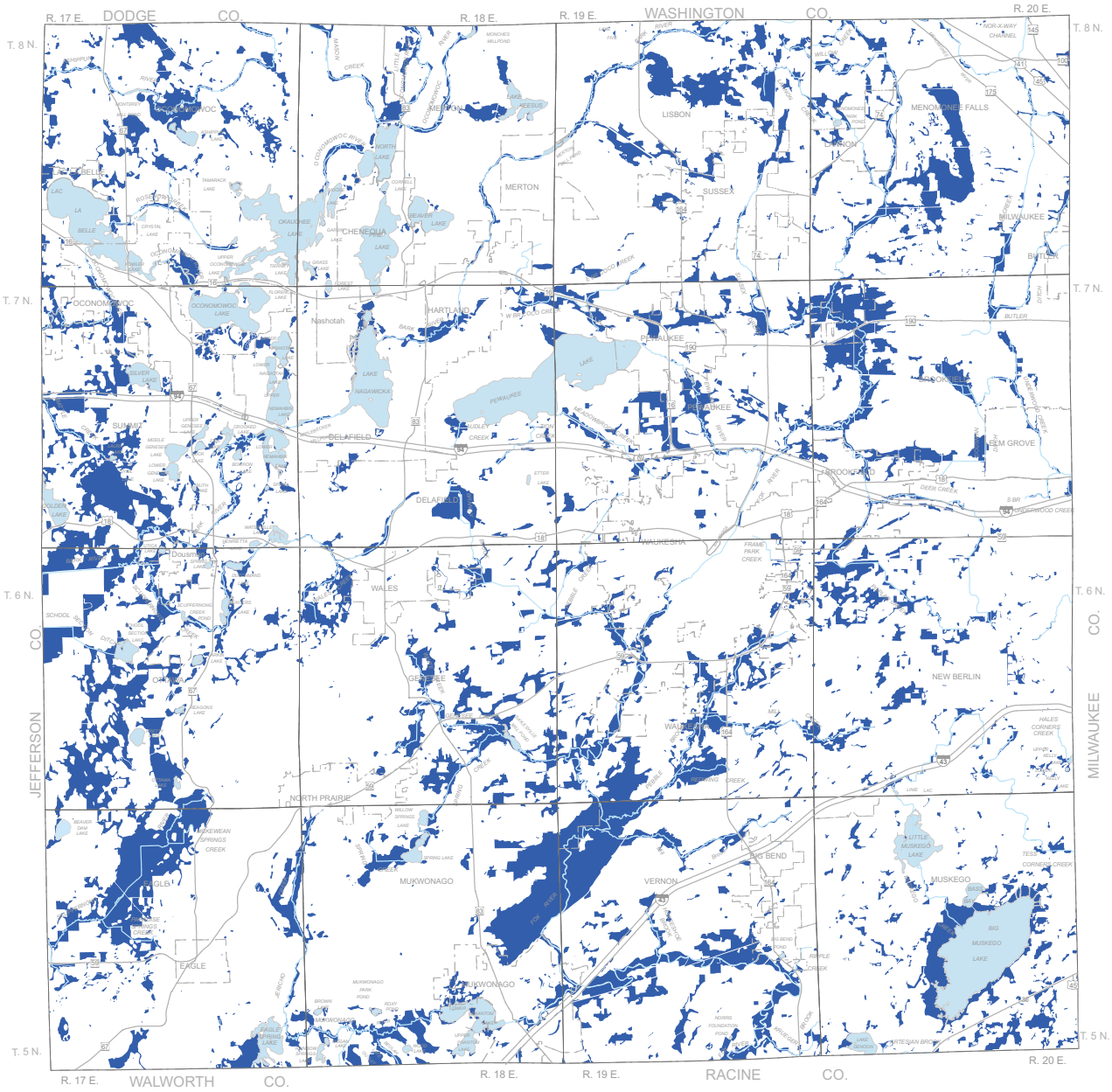
Wetlands

Wetlands perform an important set of natural functions, which make them particularly valuable resources lending to overall environmental health and diversity. Some wetlands provide seasonal groundwater recharge or discharge. Those wetlands that provide groundwater discharge often provide base flow to surface waters. Wetlands contribute to the maintenance of good water quality, except during unusual periods of high runoff following prolonged drought, by serving as traps, which retain nutrients and sediments, thereby preventing them from reaching streams and lakes. They act to retain water during dry periods and hold it during flooding events, thus keeping the water table high and relatively stable. They provide essential breeding, nesting, resting, and feeding grounds and predator escape cover for many forms of fish and wildlife. These attributes have the net effect of improving general environmental health; providing recreational, research, and educational opportunities; maintaining opportunities for hunting and fishing; and adding to the aesthetics of an area.

Wetlands pose severe limitations for urban development. In general, these limitations are related to the high water table, and the high compressibility and instability, low bearing capacity, and high shrink-swell potential of wetland soils. These limitations may result in flooding, wet basements, unstable foundations, failing pavements, and failing sewer and water lines. Moreover, there are significant and costly onsite preparation and maintenance costs associated with the development of wetland soils, particularly in connection with roads, foundations, and public utilities. Wetlands existing in 2000 are shown on Map III-10, covering 52,652 acres scattered throughout the County.

Map III-10

GENERAL WETLANDS OF WAUKESHA COUNTY



Legend

Wetlands

N

0 1 2 Miles

0 4,000 8,000 12,000 16,000 Feet

Source: SEWRPC & Waukesha County

Woodlands
Woodlands have both economic and ecological value and can serve a variety of uses providing multiple benefits. Located primarily on ridges and slopes and along streams and lakeshores, woodlands provide an attractive natural resource, accentuating the beauty of the lakes, streams, and the topography of the County. In addition to contributing to clean air and water, woodlands contribute to the maintenance of a diversity of plant and animal life and provide for important recreational opportunities.

Under balanced use and sustained yield management, woodlands can, in many cases, serve scenic, wildlife, educational, recreational, environmental protection, and forest production benefits simultaneously. Woodlands existing in 2000 cover 28,931 acres, are shown on Map III-11. These woodlands exist in large contiguous areas along the Kettle Moraine in the western half of the County and in scattered small areas throughout the remainder of the County.

Prairies
Prairies are open, treeless or generally treeless areas dominated by native grasses. Such areas have important ecological and scientific value and consist of four basic types: low prairies, mesic or moderately moist prairies, dry prairies, and oak openings. The low prairies typically occupy ancient glacial lake beds; mesic prairies tend to occur on glacial outwash plains, the glacial till of recessional moraines, and the loessial, windblown depositional soils which cover the dolomitic bedrock; dry prairies occur on well-drained soils, usually on steep hillsides; oak openings are savannahs dominated by dry prairie grasses, with between one and 17 oak trees, usually bur oaks, per acre.

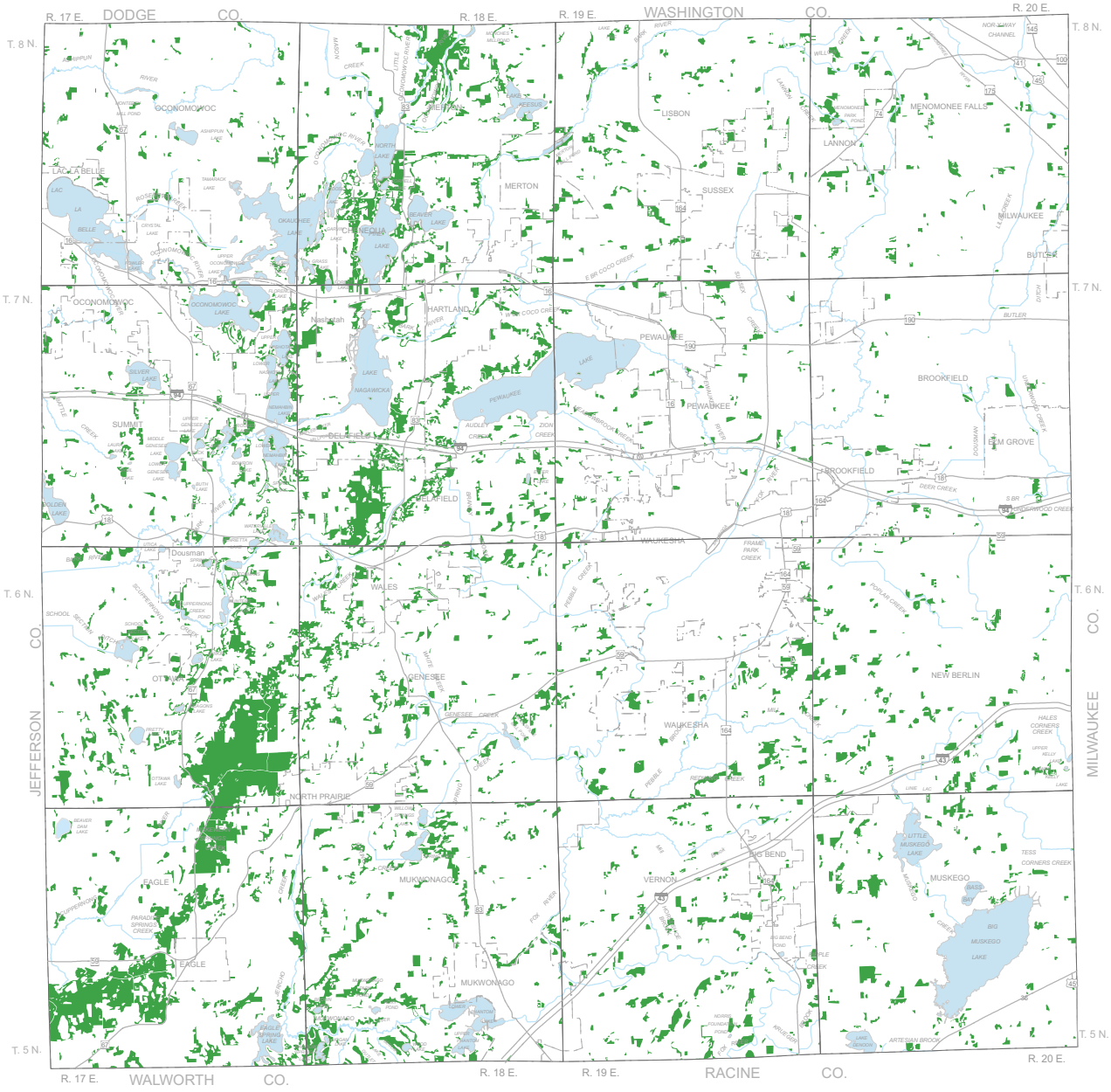
Prairies existing in 1990 consist of 34 sites covering a combined total of approximately 280 acres, a very small portion of the total land area of the County, located mostly in the southwestern quarter of the County. Very few native prairies are left in Waukesha County, although they once covered large portions of the County. The loss of native prairie and oak openings was primarily a result of agricultural practices, urbanization, and the suppression of the wildfires, which had served to restrain the advancing shrubs and trees that shade out prairie plants.

Wildlife
Inventories of wildlife habitat in the Southeastern Wisconsin Region were conducted jointly by the Wisconsin Department of Natural Resources and the Southeastern Wisconsin Regional Planning Commission in 1985. As a part of the 1985 inventory, three classes of wildlife habitat were identified: Class I (high-value) wildlife habitat, Class II (medium-value) wildlife habitat, and Class III (other significant) wildlife habitat. Class I habitat areas contain a good diversity of wildlife, are adequate in size to meet all of the habitat requirements for the species concerned, and are generally located in proximity to other wildlife habitat areas. Class II wildlife habitat areas generally lack one of the three criteria for Class I wildlife habitat. However, they do retain a good plant and animal diversity. Class III wildlife habitat areas are remnant in nature in that they generally lack two of the three criteria for a Class I wildlife habitat, but may, nevertheless, be important if located in proximity to high- or medium-value wildlife habitat areas, if they provide corridors linking higher-value wildlife habitat areas, or if they provide the only available range in the area.

Wildlife habitat areas encompassed a combined area of 182 square miles, or 31 percent of the total area of the County in 1985. These areas are concentrated on the Kettle Moraine, in the Vernon Marsh, along Scuppernong Creek and the Scuppernong River, and around the major lakes in the County. Class I wildlife habitat encompassed 88 square miles, or 49 percent of total wildlife habitat; Class II wildlife habitat encompassed 61 square miles, or 33 percent of total wildlife habitat; and Class III wildlife habitat encompassed 33 square miles, or 18 percent of total wildlife habitat.

Map III-11

MAJOR WOODLANDS OF WAUKESHA COUNTY: 2000



Legend

Woodlands

N

0 1 2 Miles

0 4,000 8,000 12,000 16,000 Feet

Source: SEWRPC & Waukesha County

CLIMATE

Its midcontinental location gives Waukesha County a continental climate that spans four seasons, one season succeeding the other through varying time periods of unsteady transition. Summers, generally the months of June, July, and August, are relatively warm, with occasional periods of hot, humid weather and sporadic periods of cool weather. The cold winter, accentuated by prevailing frigid northwesterly winds, generally spans the months of December, January, and February, but may in some years include parts of November and March. Autumn and spring in the County are transitional times of the year between the dominant seasons and usually periods of widely varying weather conditions. Temperatures are extremely varied, and long periods of precipitation are common in autumn and spring. Some of the more pronounced weather events include tornadoes and major snowmelt occurrences.

Air temperatures within the County are subject to extreme seasonal variation. Data on temperature observations in the County, recorded at the City of Waukesha, indicate variations in temperature from a low in January with a mean daily temperature of 18.7 degrees to a high in July with a mean daily temperature of 71.8 degrees. The growing season, which is defined as the number of days between the last freeze in the spring and the first freeze in the fall, averages about 155 days in Waukesha County. The last freeze in the spring normally occurs during the first two weeks in May and the first freeze in the fall normally occurs in mid-October.

Precipitation in Waukesha County, in the form of rain, sleet, hail, and snow, ranges from gentle showers to destructive thunderstorms. The more pronounced weather events can cause major property and crop damage, inundation of poorly drained areas, and lake and stream flooding. Daily precipitation data for observations recorded at the City of Waukesha record that the total average annual precipitation observed is slightly more than 32 inches, expressed as water equivalent. Monthly averages range from a low of 1.2 inches in February to a high of 3.70 inches in June. Snowfall and sleet averages approximately 41 inches annually, with January receiving the most snow and sleet, at about 11 inches.

Waukesha County is positioned astride cyclonic storm tracks along which low-pressure centers move from the west and southwest. The County also lies in the path of high-pressure centers moving in a generally southeasterly direction. This location at the confluence of major migratory air masses results in the County being influenced by a continuously changing pattern of air masses associated with alternately high- and low-pressure centers and results in frequent weather changes superimposed on the aforementioned annual range in weather characteristics, especially in winter and spring.

Prevailing winds in the County are northwesterly in the late fall and winter, northeasterly in the spring, and southwesterly in the summer and early fall. Wind velocities are less than five miles per hour (mph) for about 15 percent of the year, between five and 15 mph for about 60 percent of the year, and more than 15 mph for about 25 percent of the year.

AIR QUALITY

The Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set national ambient air quality standards (NAAQS) for six criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides) which are considered harmful to public health and the environment. Areas not meeting the NAAQS for one or all of the criteria pollutants are designated as nonattainment areas by the EPA. In areas where observed pollutant levels exceed the established NAAQS and which are designated as “nonattainment” areas by the EPA, growth and development patterns may be constrained. For example, major sources of pollutants seeking to locate or expand in a designated nonattainment area, or close enough to impact upon it, must apply emission control technologies. In addition, new or expanding industries may be required to obtain a greater than one-for-one reduction in emissions from other sources in the nonattainment area so as to provide a net improvement in ambient air quality. Nonattainment area designation may therefore create an economic disincentive for industry with significant emission levels to locating or expanding within or near the boundaries of such an area. In order to eliminate this disincentive and relieve the potential constraint on development, it is necessary to demonstrate compliance with the NAAQS and petition EPA for redesignation of the nonattainment areas.

The Southeastern Wisconsin Region currently meets all but the ozone NAAQS, and the EPA has designated a single six-county ozone nonattainment area within the Region which is made up of Kenosha, Milwaukee, Ozaukee, Racine, Washington, and Waukesha Counties. Ozone is formed when precursor pollutants, such as volatile organic compounds and nitrogen oxides, react in the presence of sunlight. The ozone air quality problem within the Region is a complex problem because ozone is meteorologically dependant. In addition, the ozone problem in the Region is believed to be attributable in large part to precursor emissions which are generated in the large urban areas located to the south and southeast and carried by prevailing winds into the Region. The ozone problem thus remains largely beyond the control of the Region and State and can be effectively addressed only through a multi-state abatement effort. Over the past decade, the combination of local controls and offsets implemented within and external to the Region, along with national vehicle emissions control requirements have resulted in a significant improvement in ambient air quality within the Region as well as nationally, and projections of future emissions indicate a continued decline in precursor emissions and a continued improvement in air quality.

CULTURAL RESOURCES

Historic sites in Waukesha County often have important recreational, educational, and cultural value. A variety of inventories and surveys of sites that possess architectural, cultural, and archaeological value have been conducted by the Wisconsin Historical Society and by various units and agencies of government in Waukesha County. Certain sites of known historic significance in Waukesha County are listed on the National Register of Historic Places. In 2005, there were 652 sites listed on the National Register. Historic sites in Waukesha County listed on the National Register of Historic Places in 2005 are presented in Appendix B.

It is important to note that the potential exists for the identification of additional sites of historical significance which either are eligible for listing on the National Register or which are potentially eligible for listing but would require additional evaluation. In 2005, there were 44 eligible historic sites in Waukesha County that have not been listed on the National Register. Eligible historic sites in Waukesha County that have not been listed on the National Register in 2005 are presented in Appendix B. In addition, there were 102 sites in Waukesha County that are potentially eligible but would require additional evaluation. Historic sites in Waukesha County that are potentially eligible but would require additional evaluation are presented in Appendix B.

Archeological Sites
Data provided by the Wisconsin Historical Society (www.wisconsinhistory.org) indicate that over 500 historic and prehistoric archaeological sites have been identified in Waukesha County. Of these sites, 5 have been listed on the National Register of Historic Places (see Table III-7).

Cultural Based Facilities
Adding to the quality of life in Waukesha County is the presence of cultural based facilities such as museums and community theaters. Table III-8 presents data on cultural based facilities provided by municipalities and convention and visitors bureau's.

PARK AND OPEN SPACE

The first park and open space plan for Waukesha County was developed by the County Park System in 1973. The second generation of the planning effort was presented in A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000, adopted by the Southeastern Wisconsin Regional Planning Commission on December 1, 1977. Since that time, the County and several municipalities have updated their park and open space plans.

Through the planning process for updating this Comprehensive Development Plan, County Department of Parks and Land Use staff met with the park staff and Boards of each municipality, local nonprofit conservation organizations, the Wisconsin Department of Natural Resources and the Southeastern Wisconsin Regional Planning Commission. The Waukesha County Parks System is a natural resource based system, which demonstrates stewardship while

Table III-7

ARCHAEOLOGICAL SITES IN WAUKESHA COUNTY LISTED ON THE NATIONAL REGISTER OF HISTORIC PLACES: 2005

Site Name	Location	National Register Listing Date	Description
Barforth Blood Mound Group	Town of Mukwonago T5N, R18E, Section 13	September 2, 1982	Middle Woodland mound group
Goodwin-McBean	Town of Vernon T5N, R19E, Section 15	September 17, 1982	Late Woodland village and former mound group
Dewey Group	Town of Vernon T5N, R19E, Section 28	December 19, 1978	Large effigy mound group
Nicolai-Peterson	Town of Vernon T5N, R19E, Section 25	September 2, 1982	Middle and Late Woodland campsite and mounds
Big Bend Group #2	Town of Vernon T5N, R19E, Section 24	December 19, 1978	Effigy mound group

Source: Wisconsin Historical Society

Table III-8
CULTURAL BASED FACILITIES

Facility Name	Location	Description
Dousman Stagecoach Inn	1075 Pilgrim Parkway Brookfield	The historical site includes a 1847 farmhouse and Stagecoach Inn, smokehouse, ice house, and original Woodside School bell tower. The site was originally on the route of horse drawn carriages along the Watertown Plank Road.
Ploch Art Gallery	located in the Sharon Lynne Wilson Center 198th and Capitol Drive Brookfield	Free art gallery displaying the work of Wisconsin artists, providing juried exhibits throughout the year in collaboration with the Wisconsin Academy of Sciences, Arts & Letters in Madison.
Sharon Lynne Wilson Center for the Arts	198th and Capitol Drive Brookfield	Auditorium, Studio Theater, Outdoor Theater, and Arts education.
Milwaukee Opera Theater	145 Ormsby Street Pewaukee	Opera performances.
Sunset Playhouse	800 Elm Grove Road Elm Grove	Community theater.
Waukesha Civic Theater (Margaret Brate Bryant Civic)	264 W. Main Street Waukesha	Live theater performances and educational programs.
Shattuck Auditorium	Carroll College 100 N. East Ave Waukesha	Theater and symphony orchestra performances.
Lake Country Playhouse	221 E. Capitol Drive Hartland	Community theater.
Old World Wisconsin	S103 W37890 Hwy 67 Eagle	History of Wisconsin's immigrants and pioneers.
Friends of the East Troy Railroad	Hwy's ES & J Mukwonago	Historic Electric Trolley Rides
Red Brick House Mukwonago Museum	103 Main Street Mukwonago	Waukesha County's first brick house
Ten Chimneys Foundation	S42 W31610 Depot Road, Genesee Depot	Former estate of Alfred Lunt and Lynn Fontanne, open for public tours and specialized programs for theatre, arts, and arts education professionals.

Source: Wisconsin Historical Society

providing recreational and educational opportunities. Through this vision, Waukesha County seeks to provide resource related and self-actualized recreational opportunities. City, village and town governments typically provide sites and facilities for intensive nonresource-oriented recreational facilities. The intent was to prepare a Park and Open Space Plan for Waukesha County that conveys a shared vision for park and open space lands and facilities to serve the resident County population anticipated under full development of the County land use plan. The updated park and open space plans are also prepared to meet planning requirements for use of State and Federal parkland and recreational grants.

Inventory data needed for the preparation of the park and open space plan are provided in other chapters of this Comprehensive Development Plan. Such data includes historic and planned population and household levels, existing and planned land use and the location and extent of environmental corridors, natural areas, floodlands and other important natural resource related information. These data were carefully considered and used in the preparation of the park and open space plan presented in Appendix A.

IMPLEMENTATION RECOMMENDATIONS

1. Following completion of the Regional Water Supply Plan or availability of sufficient data, the planning objectives and standards used to prepare this plan may need to be refined to address groundwater supply and recharge issues.

2. Amend land use categories to direct development away from areas with seasonally high groundwater one-foot or less from the surface and steep slopes (12% or greater) and to discourage development of below grade structures on soils with groundwater limitations less than 3 feet from the surface. Amend applicable zoning and land division codes to establish a minimum of one-foot separation between structures (including basements) and the seasonally high groundwater level.

3. Amend applicable zoning codes, land division and storm water management ordinances to more stringent site design and storm water management requirements necessary to address thermal and other runoff impacts detail to cold-water communities, outstanding water resources and exceptional water resources.

4. Provide to the municipalities in Waukesha County the lists of historical sites that are eligible for historic designation but have not been designated and the list of potentially eligible sites that need additional evaluation for inclusion as eligible sites.

5. Amend the planned land use map and appropriate zoning codes and maps to reflect lands identified as prime agricultural areas using the planning standards contained in this chapter.

6. To protect and encourage the preservation of high quality agricultural tillable lands, (U.S.D.A. Class I and II soils) contained in the Prime Agricultural and Rural Density and Other Agricultural Land plan categories, discourage residential development on agriculturally productive and environmentally sensitive areas, provide for some marketability of such lands and encourage more economical use of lands suited to limited and controlled residential development by permitting more intensive use of such lands without changing overall rural character, it is recommended land use tools such as residential density transfer opportunities be provided. Within land use regulatory codes, these opportunities, with the following components, should be provided:

    a. Through development design techniques, including but not limited to Planned Unit Developments and conservation design developments, high quality agricultural tillable lands can be preserved.
    b. The density transfer technique would permit variable lot sizes in the utilization of the most desirable terrain for housing sites while encouraging preservation of high quality agricultural tillable lands worthy of such preservation.

c. To transfer residential density opportunities to promote the preservation of the rural character of the County by encouraging farm fields, pastures, orchards, and natural open spaces to be retained either as common open spaces, or as part of a farm operation. The transfer of residential development rights from one area of a parcel to another, from one tract of land to another, and from the Prime Agricultural and Rural Density and Other Agricultural Land plan categories thereby is recommended allowing the increase in density of development on suitable lands for development in exchange for establishing the preservation of more desirable agriculturally productive lands.
d. In order to preserve the rural character as well as the efficiency and safety of existing road systems, the inappropriate development of lots strung out along such roads with individual driveway accesses from each lot should be minimized. The goal of this objective is to encourage grouping of lots on an interior street, which will then access the existing road system.
e. Any land claimed in addition to the actual described residential lots, for credit toward meeting the density factor requirement, would have its status established, and guaranteed, either by dedication to the public, or by appropriate covenants running with the lands, through the conveyance of agricultural easements. Such covenants and easements would be recorded in the office of the Register of Deeds and would restrict the property against any development or use except as is consistent with its preservation as high quality agricultural tillable land or as a form of common open space unless the zoning of the property is changed in accordance with an update to the Comprehensive Development Plan for Waukesha County. The preserved land status of any parcel would be indicated on official zoning maps.

7. To protect and encourage the preservation of primary and secondary environmental corridors and isolated natural areas, discourage residential development in environmentally sensitive areas, provide for some marketability of such lands, encourage more economical use of lands suited to limited and controlled residential development by permitting more intensive use of such lands without impacting the environmentally sensitive areas, it is recommended residential density transfer opportunities be provided. Within land use regulatory codes, these opportunities, with the following components should be provided:

   a. Through development design techniques, including but not limited to Planned Unit Developments and conservation design developments, primary and secondary environmental corridors and isolated natural areas should be preserved.
   b. The density transfer technique would permit variable lot sizes while encouraging preservation of primary and secondary environmental corridors and isolated natural areas.
   c. To transfer residential density opportunities to promote the preservation of the rural character of the County by preserving primary and secondary environmental corridors and isolated natural areas to be retained as common open spaces.

8. In an effort to prevent land use conflicts with nonmetallic mining operations in the County, the Waukesha County Mineral Extraction Advisory Committee developed a series of recommendations. They are:

   a. Within appropriate land use regulatory codes, create a Mineral Extraction Notification Overlay District that extends beyond the property lines of nonmetallic mining operations. Creation of the Overlay District would require notifications to appear on recorded documents associated with land divisions within the District denoting the parcel's proximity to an active or planned mining operation. Loundon County, Virginia is an example of the use of overlay districts.
   b. Within appropriate land use regulatory codes, a minimum setback from nonmetallic mining operations and adjoining properties should be established. Landscape berms and vegetative screening could be provided in the setback area.
   c. New wells placed on properties immediately adjacent to nonmetallic mining operations should be constructed to minimize the impacts from mining operations.