MEMORANDUM REPORT NO. 149

A LAKE PROTECTION PLAN FOR SPRING LAKE AND WILLOW SPRING LAKE

WAUKESHA COUNTY WISCONSIN

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A LAKE PROTECTION PLAN FOR SPRING LAKE AND WILLOW SPRING LAKE WAUKESHA COUNTY, WISCONSIN

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Chapter I

INTRODUCTION

Spring Lake and Willow Spring Lake, both located in the Town of Mukwonago, Waukesha County, Wisconsin, are valuable aquatic resources offering a unique urban residential setting and providing a variety of recreational and aesthetic opportunities to the resident community and its visitors. Both lakes are located on Spring Creek, a tributary stream to the Fox River system. Originating in Spring Lake and the wetland complex to its west, Spring Creek discharges in a northerly direction into Willow Spring Lake, from which is continues in a northerly and easterly direction to its confluence with Genesee Creek in the unincorporated hamlet of Saylesville in the vicinity of the Saylesville Millpond. Spring Lake is designated as an Outstanding Resource Water of the State pursuant to Chapter NR 102 of the *Wisconsin Administrative Code*.[1]

The Lakes are an integral part of these lake-centered communities. Nevertheless, the recreational and visual values of the Lakes are perceived to be adversely affected by changing land use conditions within the Spring Lake and Willow Spring Lake drainage area. Seeking to improve the usability and to prevent deterioration of the natural assets and recreational potential of Willow Spring Lake, the riparian residents formed the Spring Brook Watershed Lake Management District during 1998. This special purpose governmental unit, created under Chapter 33 of the *Wisconsin Statutes*, complements the Spring Lake of Waukesha County Property Owners Association, Inc., a nonstock, not-for-profit corporation created under Chapter 181 of the *Wisconsin Statutes*, which had been created by the Spring Lake community during 1984. Both organizations have undertaken lake-oriented programs of community involvement, education, and lake management, and participate in the Wisconsin Department of Natural Resources Self-Help Monitoring Program.

This report sets forth a lake protection plan for Spring and Willow Spring Lakes, and represents part of the ongoing commitments of the Spring Brook Watershed Lake Management District and the Spring Lake of Waukesha County Property Owners Association, Inc., in partnership with the Town of Mukwonago, to sound planning with respect to the Lakes. This plan was prepared during 2000 through 2003 by the Southeastern Wisconsin Regional Planning Commission, in cooperation with the two lake organizations and includes the results of field surveys conducted by the Commission during 2000 and 2001. The planning program was funded, in part, by a Wisconsin Department of Natural Resources Lake Management Planning Grant awarded to the

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[1]*See Waukesha County,* Waukesha County Land and Water Resource Management Plan: 1999-2002, *January 1999: "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.*

Spring Brook Watershed Lake Management District under the Chapter NR 190 Lake Management Planning Grant program.

The scope of this report is limited to a consideration of those management measures which potentially are determined to be effective in the protection of lake water quality and lake uses based upon available data. This plan is intended to form an integral part of any future comprehensive lake management plan for Spring Lake or Willow Spring Lake. However, the preparation of a comprehensive lake management plan for the Lakes will require additional water quality and biological data collection and analysis, and consideration of additional issues of concern that are beyond the scope of this current planning program.

The lake protection planning goals for Spring and Willow Spring Lakes were developed in consultation with the Spring Brook Watershed Lake Management District, the Spring Lake of Waukesha County Property Owners Association, Inc., and the Town of Mukwonago. These goals include:

1. The protection and maintenance of public health, and promotion of the public comfort, convenience, necessity, and welfare, through the environmentally sound management of vegetation, fisheries, and wildlife populations in and around Spring and Willow Spring Lakes and within the Spring Creek corridor connecting the two waterbodies;

2. The provision of high-quality, water-oriented recreational and aesthetic opportunities for residents and visitors within the urban residential setting of the Spring Lake and Willow Spring Lake communities, through management of the Lakes in an environmentally sound manner; and,

3. The effective maintenance of the water quality of the Spring Lake and Willow Spring Lake so as to better facilitate the conduct of water-related recreation, improve the aesthetic values of the resource to the communities, and enhance the resource value of the waterbodies.

This plan, which conforms to the requirements and standards set forth in the relevant *Wisconsin Administrative Codes*,[2] should serve as a guide to achieving these objectives over time.

[2]*This plan has been prepared pursuant to the standards and requirements set forth in the* Wisconsin Administrative Code*: Chapter NR 1, "Public Access Policy for Waterways;" Chapter NR 103, "Water Quality Standards for Wetlands;" Chapter NR 107, "Aquatic Plant Management;" and Chapter NR 109, "Aquatic Plants Introduction, Manual Removal and Mechanical Control Regulations."*

Chapter II

INVENTORY FINDINGS

INTRODUCTION

Spring Lake and Willow Spring Lake are located in the north central portion of the Town of Mukwonago, Waukesha County, as shown on Map 1. The Lakes are separated by an extensive area of wetland. Spring Lake is a spring-fed, drained lake which, along with the wetland complex west of the lake, forms the headwaters of the Spring Creek. Spring Lake discharges through Spring Creek to the north, into Willow Spring Lake. Willow Spring Lake is a through-flow or drainage lake, constructed as an impoundment of Spring Creek during 1967. Spring Creek enters Willow Spring Lake through a perennial inlet located on the southwestern shore of the Lake. Outflow from Willow Spring Lake is discharged to Spring Creek through fixed crest, "morning-glory spillway" outlet structure. The structure is owned and operated by the Spring Brook Watershed Lake Management District pursuant to a Wisconsin Department of Natural Resources permit issued under Chapter 31 of the *Wisconsin Statutes*. Spring Creek continues in a generally northerly and easterly direction to its confluence with Genesee Creek immediately upstream of the Saylesville Millpond. Genesee Creek ultimately discharges to the Fox River at the Vernon Marsh, south of the City of Waukesha.

The total drainage area tributary to the Spring Lake and Willow Spring Lake, located within the Town of Mukwonago in Waukesha County, is approximately 3,510 acres in areal extent, as shown on Map 1. The drainage area directly tributary to Spring Lake is about 3,155 acres, while the drainage area directly tributary to Willow Spring Lake encompasses a further approximately 355 acres. The direct drainage areas are comprised of those lands and their associated minor tributaries that drain directly to each waterbody without passing through a major upstream waterbody. In the case of Spring Lake and Willow Spring Lake, these drainage areas are contiguous and collectively form the total tributary drainage area to Willow Spring Lake.

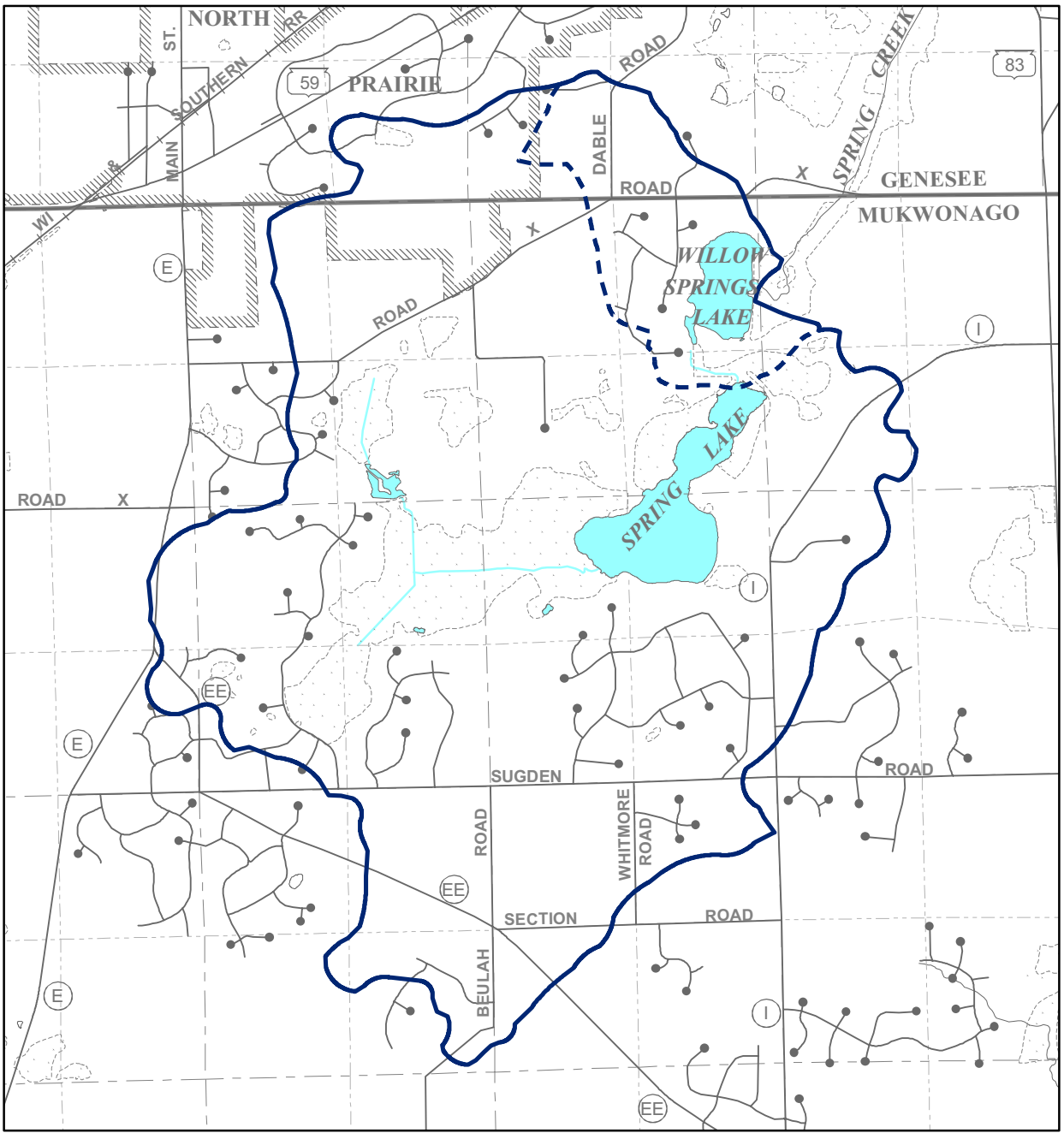
WATERBODY CHARACTERISTICS

Spring Lake is a 105-acre drained waterbody, which is primarily spring-fed with some contribution of water from localized surface runoff. It drains to the north, through a short section of Spring Creek, into Willow Spring Lake. Spring Lake is roughly circular lake with an elongated northerly bay. The Lake has a maximum depth of 22 feet, a mean depth of five feet, and a volume of 553 acre-feet.

Willow Spring Lake is a 46-acre drainage waterbody, which receives most of its water from Spring Lake and Spring Creek, and from surface runoff from the immediate area surrounding the Lake. Willow Spring Lake drains through Spring Creek in a northerly and easterly direction to Genesee Creek. The Lake is roughly oval in shape and has one large basin. Willow Spring Lake has a maximum depth of 13 feet, a mean depth of five feet, and a volume of 230 acre-feet.

Map 1

LOCATION MAP OF SPRING AND WILLOW LAKES



Surface Water

Total Tributary Boundary

Direct Tributary Boundary

N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

The hydrographic characteristics are shown in Table 1, and the bathymetry of the two Lakes is shown on Maps 2 and 3, for Spring and Willow Spring Lakes, respectively.

GROUNDWATER RESOURCES

Groundwater resources constitute an extremely valuable element of the natural resource base related to Spring and Willow Spring Lakes, both as a source of water, especially to Spring Lake, and as a component of the surface water system. Groundwater in the vicinity of Spring and Willow Spring Lakes is available from three aquifers.[1] From the land surface downward, they are the sand and gravel aquifer, of approximately 150 feet in thickness in the vicinity of the Lakes; the dolomite aquifer, of approximately 200 feet in thickness; and, the sandstone aquifer, of approximately 1,600 feet in thickness, comprising the deep artesian system. The sand and gravel aquifer, consisting of water-bearing sand and gravel, and the dolomite aquifer are commonly referred to as the "shallow aquifer," and are underlain by the Maquoketa shale layer of approximately 200 feet in thickness and the deep sandstone aquifer. The shallow sand and gravel aquifer is the most significant in terms of its relationship with the Lakes and their tributary surface waters and adjacent wetlands. The groundwater in that aquifer flows from west to east across the Lakes, toward the Fox River, as shown on Map 4. This groundwater flow has a direct affect on water quality and lake levels, and is especially important to the water budget of Spring Lake, which, as a drained lake, has no defined stream inflow. Groundwater inflow, direct precipitation onto the Lake surface and runoff from the lands immediately surrounding Spring Lake comprise the water sources to this waterbody.[2]

LAND USE AND SHORELINE DEVELOPMENT

Population

As of the year 2000, there were approximately 2,900 persons residing in approximately 880 housing units located within the drainage area tributary to Spring Lake and Willow Spring Lake. The population of this drainage area has increased in the decade since 1990, when approximately 2,300 persons were reported be to residing in about 650 housing units. Urban density development within this drainage area consists primarily of low density residential development. Such development has largely occurred since 1970, as shown on Map 5.

Land Use

The human presence upon the landscape within the drainage area tributary to Spring and Willow Spring Lakes is manifested primarily as residential development on the lake shore, considered to be an urban land use, and, historically, as agricultural use of uplands, considered to be a rural land use Notwithstanding, the density of residential development on the shores of the lakes occurs at relatively low densities. Indeed, the residents of the Spring Lake community have described their residential experience as having "far more in common with a typical Northwoods lake than other lakes in the...Metropolitan [Milwaukee] region...," noting that "Spring Lake...remains nearly unchanged since the 1920s." This low level of development is reflected in the apparent historic lack of urban growth around the Lake, as illustrated on Map 5.

While urban density residential development forms the principal urban feature of the drainage area tributary to Spring Lake and Willow Spring Lake, the majority of the lands within this drainage area remain in primarily rural use, including wetlands, woodlands, open lands, and some agricultural lands, as shown on Map 6. Residential land uses occupy almost all of the upland portions of the shorelands of Spring Lake and Willow Spring Lake.

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[1] *An aquifer is a water-bearing stratum of rock, sand or gravel.*

[2] *A Regional groundwater study and modeling program is currently ongoing, the outcome of which may provide further insights into the hydrologic balance and influence the water quality of Spring and Willow Spring Lakes; see SEWRPC Technical Report No. 37,* op. cit. *The program is designed to permit the localized refinement of the modeling to address issues of a more site-specific nature, such as the interaction between surface and ground waters within the Town of Mukwonago.*

Table 1

HYDROGRAPHIC CHARACTERISTICS OF SPRING LAKE AND WILLOW SPRING LAKE

Parameter	Spring Lake	Willow Spring Lake
Surface Area	105 acres	46 acres
Volume	525 acre-feet	230 acre-feet
Maximum Depth	22 feet	13 feet
Mean Depth	5 feet	5 feet
Direct Drainage Area	3,160 acres	356 acres
Total Drainage Area	- -	3,516 acres

Source: SEWRPC.

Additional urban residential development within the watershed draining to Spring Lake is occurring to the southwest of the Lake as a result of conversion and subdivision of former agricultural lands. Much of the remaining shoreland area riparian to both Lakes is occupied by wetlands, which limit the extent of urban development in these areas. About 1,250 acres, or about 36 percent of the total tributary drainage area, were devoted to urban uses. Residential uses encompassed about 1,000 acres, or about 80 percent of the area in urban use. About 2,270 acres, or about 64 percent of the drainage area tributary to Spring Lake and Willow Spring Lake, were still devoted to rural land uses. Of these rural land uses, agricultural and open land uses accounted for approximately 1,280 acres, or about 57 percent of the rural land area. Woodlands, wetlands, and surface waters, including the surface areas of Spring and Willow Spring Lakes, as shown on Map 6, comprised approximately 985 acres, or about 43 percent of the rural land area. The existing 2000 land use pattern in the drainage areas tributary to Spring Lake and Willow Spring Lakes is quantified in Tables 2 and 3, respectively.

Under year 2020 conditions, additional urban-density residential development is expected to occur. Infilling of existing platted lots and limited additional low-density, single-family residential development within the drainage area tributary to the Lakes is expected is envisioned in the adopted Waukesha County development plan, as shown on Map 7.[3] Much of this development is anticipated to occur in the northern and northwestern portions of the drainage area, west of Willow Spring Lake. Within the drainage area tributary to Spring Lake, about 280 acres of primarily agricultural lands are expected to be converted to urban land uses, primarily for urban density residential uses, which are expected to increase from about 800 acres to about 980 acres by the year 2020. Within the drainage area directly tributary to Willow Spring Lake, urban land uses are expected to increase from about 120 acres to about 185 acres, with the largest portion of this increase being in urban density residential development, which is forecast to increase from about 100 acres to about 150 acres by the year 2020. Much of this development, as has been noted, will occur on agricultural and other open lands, which are expected to decline in acreage during this period. The forecast 2020 land use pattern in the drainage areas tributary to Spring and Willow Spring Lake are quantified in Tables 2 and 3, respectively.

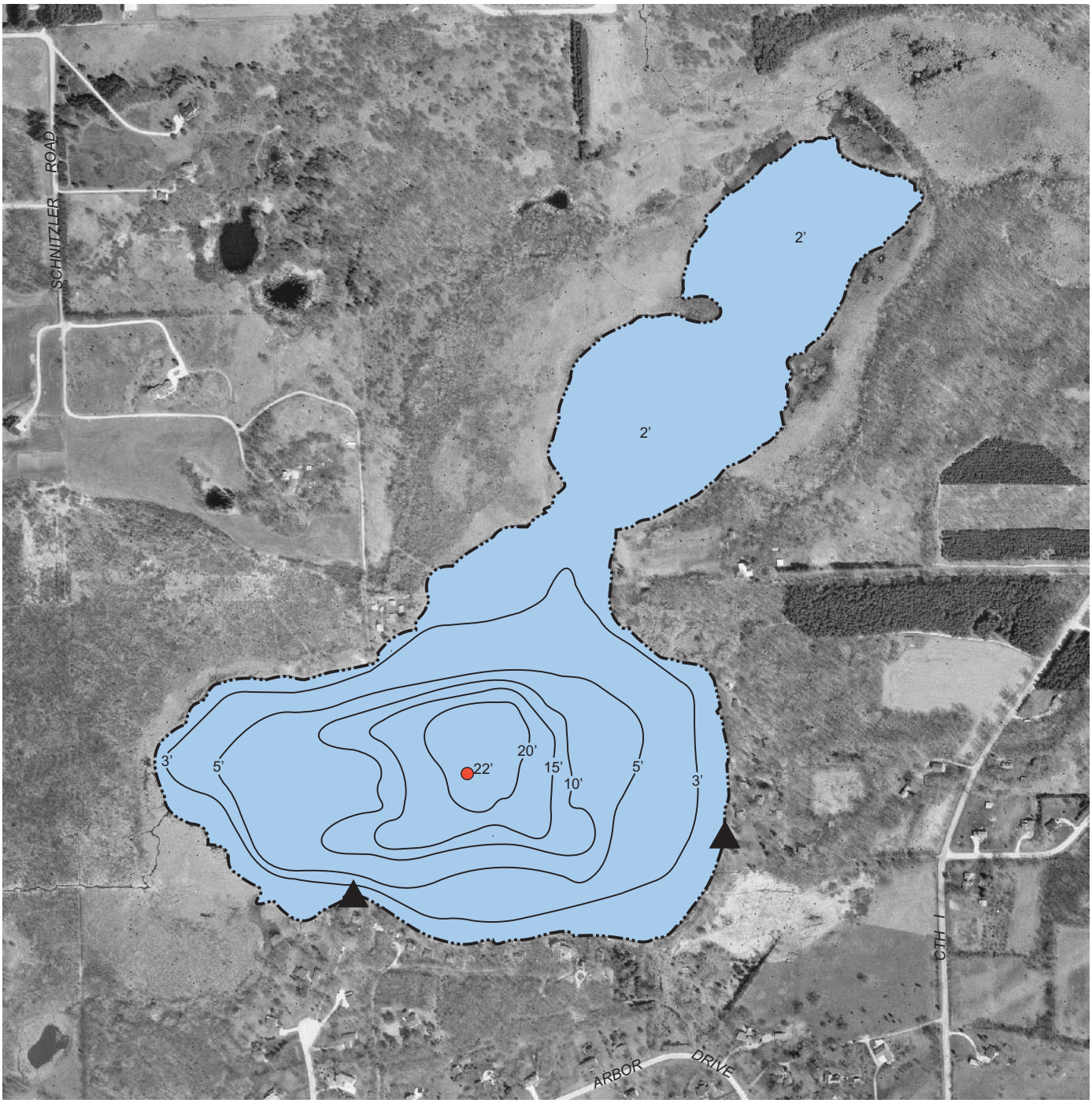
Public Recreational Boating Access

Public recreational boating access to Spring Lake is provided through a walk-in access located along CTH I located at the southeastern corner of the Lake and at Lakecrest Court on the southern shore of the Lake. Parking facilities are not provided at these launch sites, which do not provide adequate public recreational boating access pursuant to the standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*.

[3]*SEWRPC Planning Report No. 40,* A Regional Land Use Plan for Southeastern Wisconsin: 2010, *January 1992; SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

Map 2

BATHYMETRIC MAP OF SPRING LAKE



DATE OF PHOTOGRAPHY: MARCH 2000

—20'— WATER DEPTH CONTOUR IN FEET

MONITORING SITE

PUBLIC RECREATIONAL BOATING ACCESS SITE

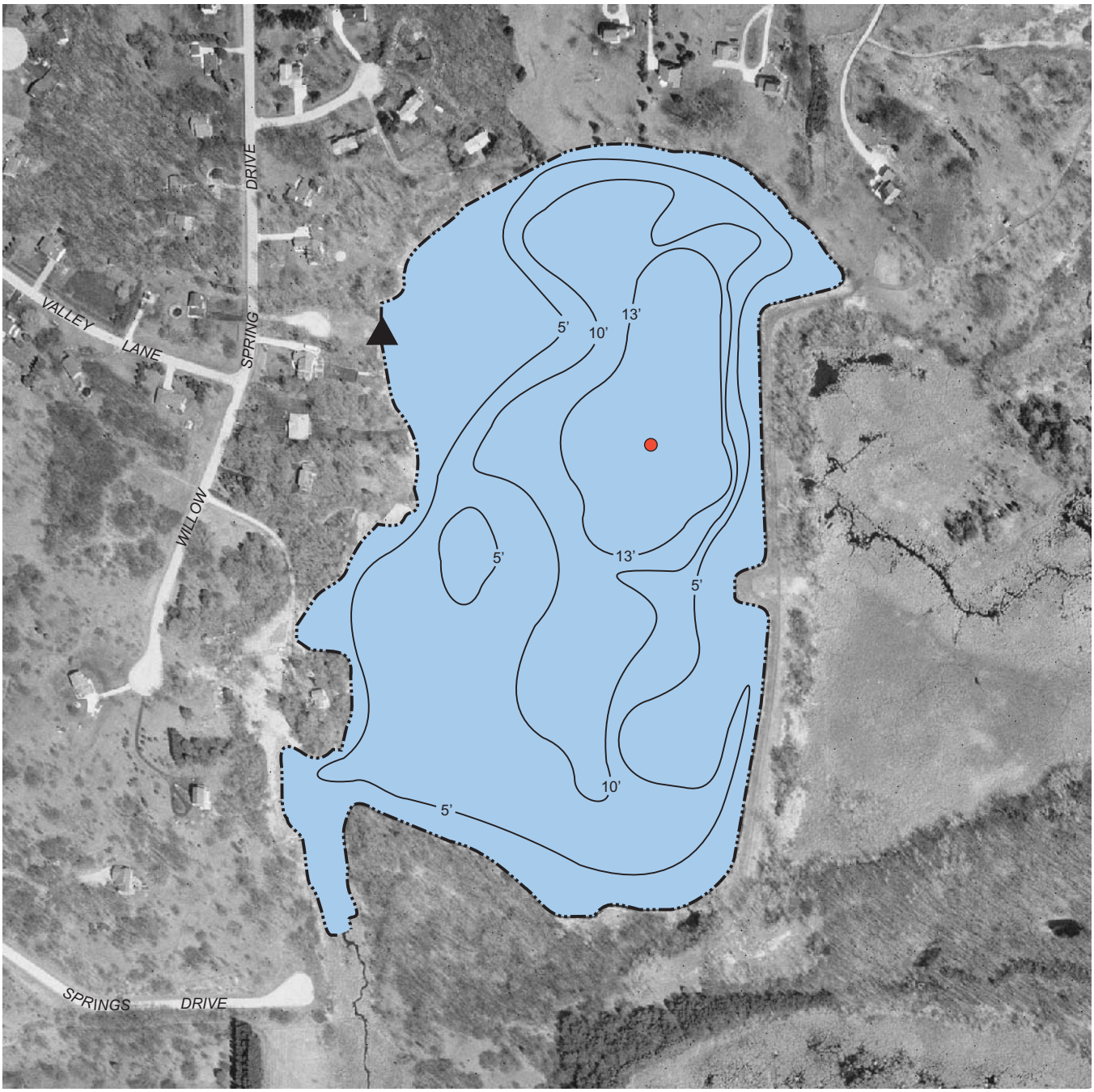
Source: U.S. Geological Survey and SEWRPC.

GRAPHIC SCALE

0 350 700 FEET

Map 3

BATHYMETRIC MAP OF WILLOW SPRING LAKE



DATE OF PHOTOGRAPHY: MARCH 2000

—20′— WATER DEPTH CONTOUR IN FEET

MONITORING SITE

PUBLIC RECREATIONAL BOATING ACCESS SITE

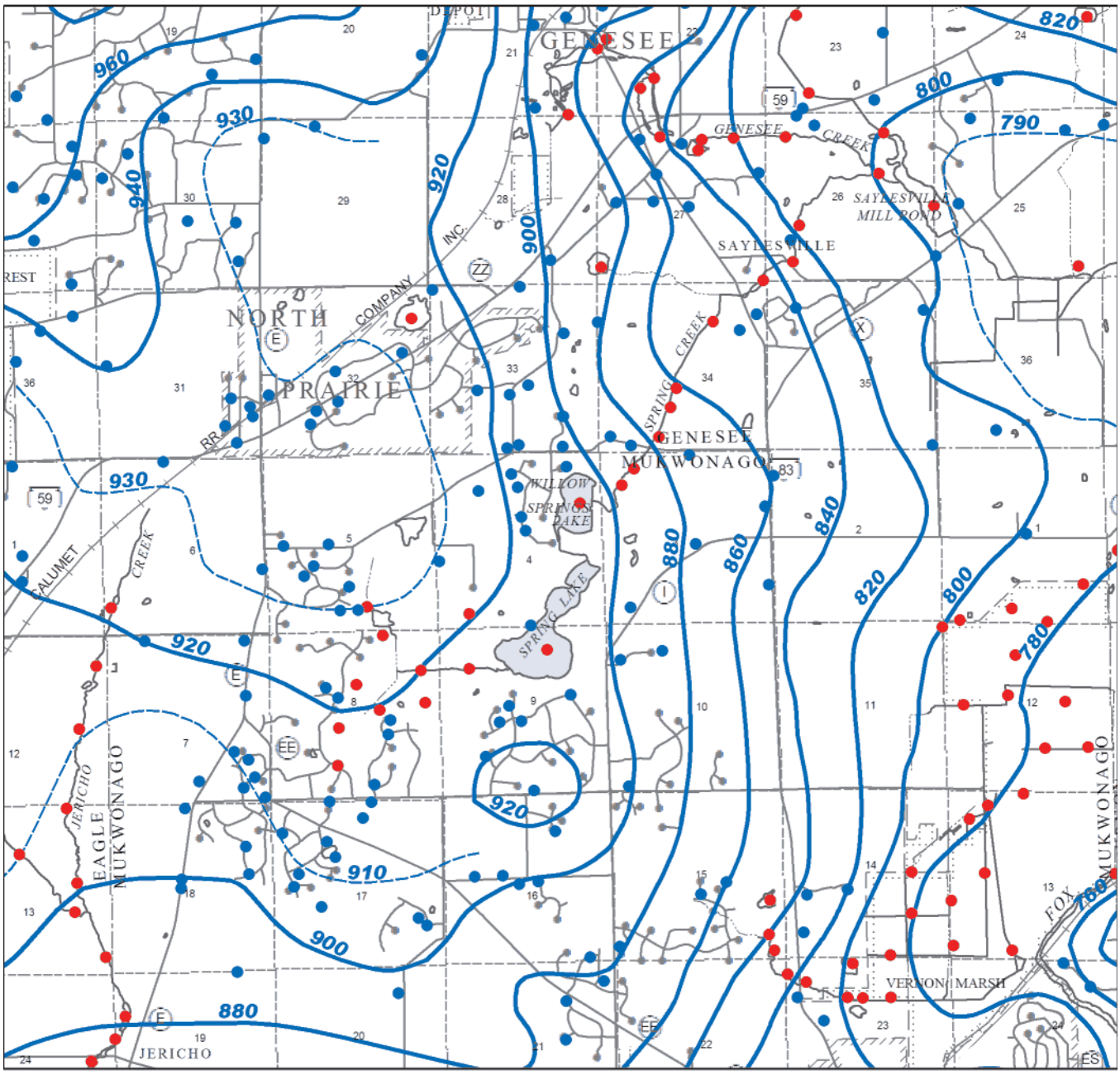
Source: U.S. Geological Survey and SEWRPC.

GRAPHIC SCALE

0 200 400 FEET

Map 4

DIRECTION OF GROUNDWATER FLOW IN THE SPRING AND WILLOW SPRING LAKES AREA



AVERAGE WATER-TABLE ELEVATION (FEET ABOVE MEAN SEA LEVEL)

SUPPLEMENTAL CONTOUR

SURFACE WATER POINT

WELL DATA POINT

N

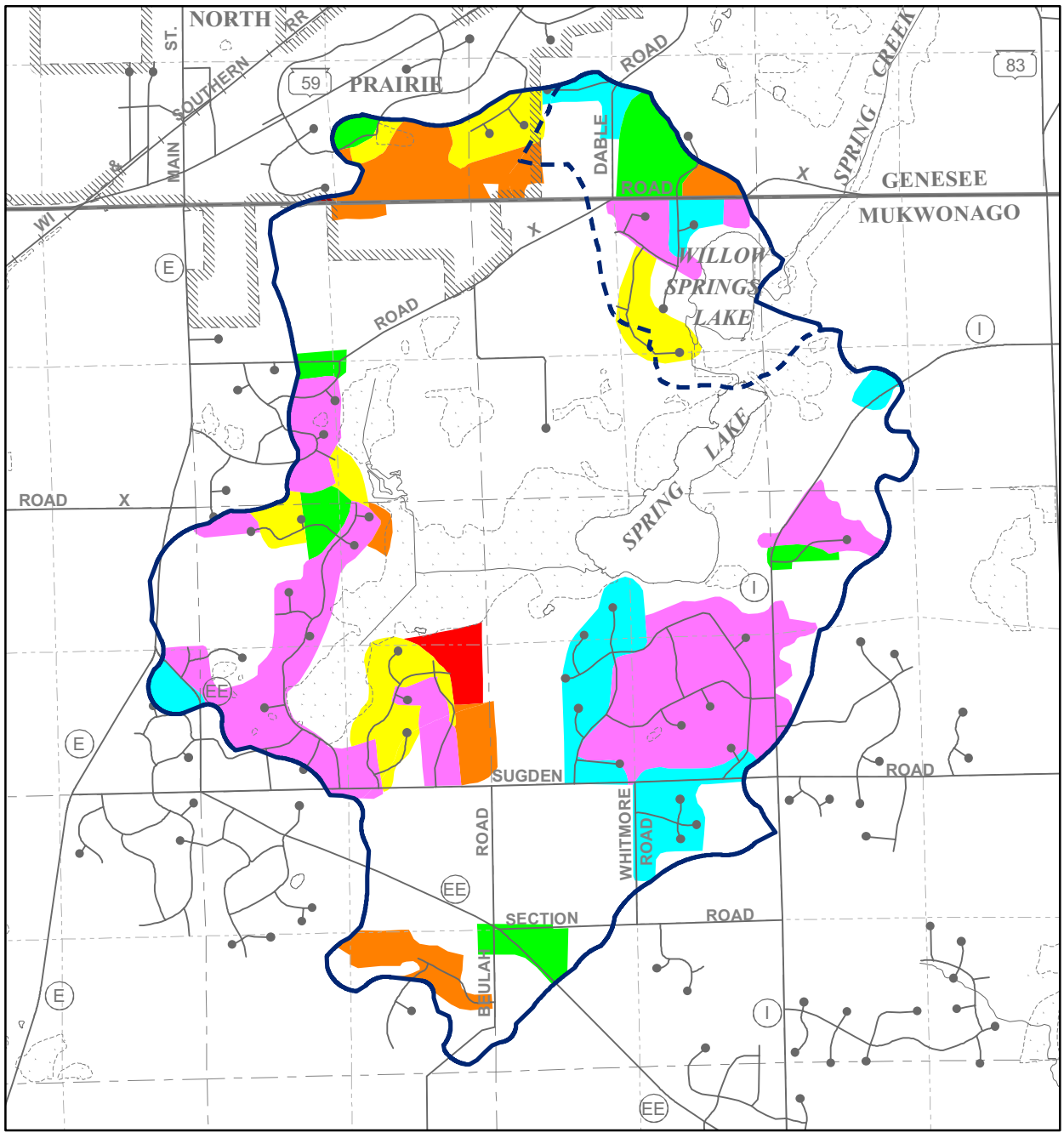
GRAPHIC SCALE

0 2,500 5,000 7,500 Feet

Source: U.S. Geological Survey and SEWRPC.

Map 5

HISTORIC URBAN GROWTH WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES: 1970-2000



2000
1995
1990
1985
1980
1975
1970
Total Tributary Boundary
Direct Tributary Boundary

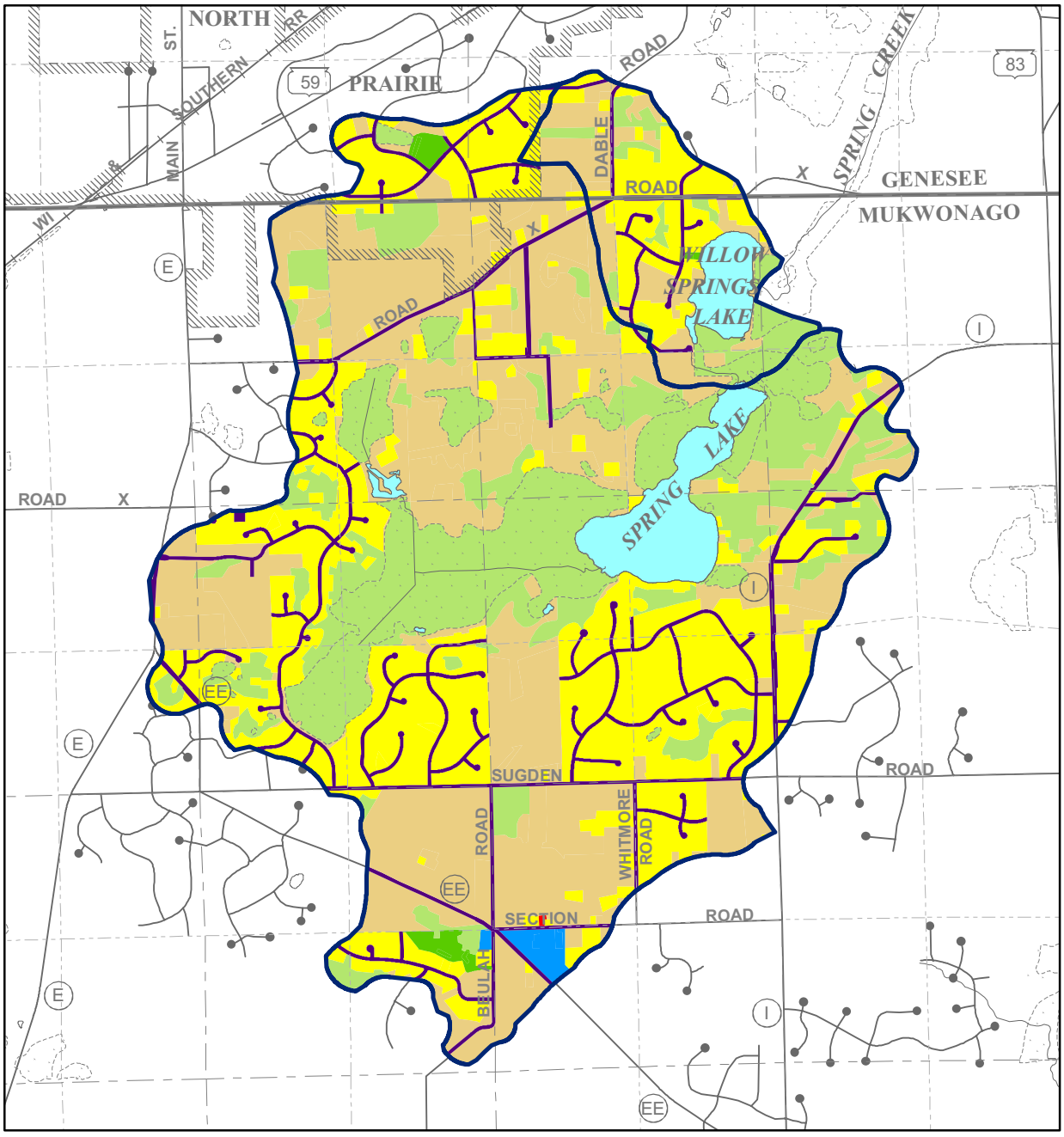
N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

Map 6

GENERALIZED LAND USE WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES: 2000



- Single-Family Residential
- Commercial
- Industrial
- Transportation, Communications and Utilities
- Governmental and Institutional
- Recreation
- Surface Water
- Wetlands and Woodlands
- Agricultural, Unused and Other Open Lands

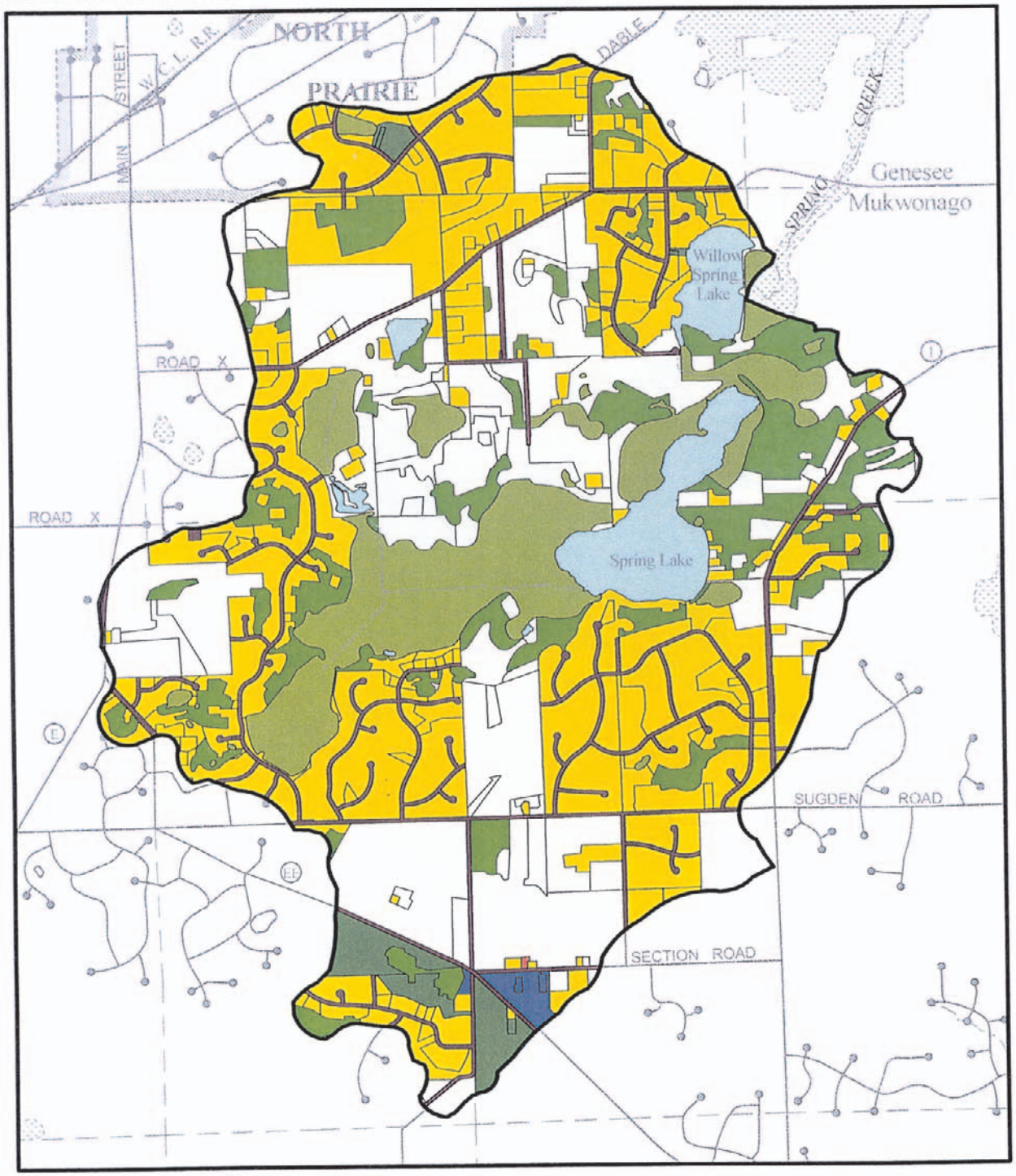
N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

Map 7

PLANNED LAND USE WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES: 2020



Source: SEWRPC.

Table 2

EXISTING AND PLANNED LAND USE WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING LAKE: 2000 AND 2020

Land Use Categories[a]	2000		2020	
	Acres	Percent of Total Tributary Drainage Area	Acres	Percent of Total Tributary Drainage Area
Urban				
Residential	883	28.0	981	31.1
Commercial and Industrial	<1	0.0	1	0.0
Governmental and Institutional	16	0.5	18	0.6
Transportation, Communication, and Utilities	189	6.0	227	7.2
Recreational	18	0.6	71	2.2
Subtotal	1,106	35.1	1,298	41.1
Rural				
Agricultural and Other Open Lands	1,175	37.2	986	31.3
Wetlands	388	12.3	380	12.0
Woodlands	364	11.5	369	11.7
Water	123	3.9	123	3.9
Subtotal	2,050	64.9	1,858	58.9
Total	3,156	100.0	3,156	100.0

[a]*Parking included in associated use.*

Source: SEWRPC.

Table 3

EXISTING AND PLANNED LAND USE WITHIN THE TOTAL DRAINAGE AREA AND DRAINAGE AREA DIRECTLY TRIBUTARY TO WILLOW SPRING LAKE: 2000 AND 2020

Land Use Categories[a]	2000		2020		2000		2020	
	Acres	Percent of Direct Tributary Drainage Area	Acres	Percent of Direct Tributary Drainage Area	Acres	Percent of Direct Tributary Drainage Area	Acres	Percent of Direct Tributary Drainage Area
Urban								
Residential	117	33.0	97	27.2	1,001	28.5	1,132	32.2
Commercial and Industrial	- -	- -	- -	- -	<1	<1.0	1	<1.0
Governmental and Institutional	- -	- -	- -	- -	16	0.5	18	0.5
Transportation, Communication, and Utilities	23	6.5	23	6.5	212	6.1	264	7.5
Recreational	<1	0.2	1	0.3	18	0.5	72	2.1
Subtotal	141	39.7	121	34.0	1,247	35.6	1,487	42.3
Rural								
Agricultural and Other Open Lands	103	28.7	123	34.5	1,282	36.5	1,041	29.7
Wetlands	25	7.1	25	7.0	414	11.8	405	11.5
Woodlands	43	12.2	43	12.1	402	11.6	412	11.7
Water	44	12.3	44	12.4	167	4.5	167	4.8
Subtotal	215	60.3	235	66.0	2,265	64.4	2,025	57.7
Total	356	100.0	356	100.0	3,512	100.0	3,512	100.0

[a]*Parking included in associated use.*

Source: SEWRPC.

At Willow Spring Lake, public recreational boating access is provided through a Town of Mukwonago launch site on the western side of Willow Spring Lake. Parking facilities are provided at this launch site. The Willow Spring Lake recreational boating access site is considered to be adequate pursuant to the public recreational boating access standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*.

WATER QUALITY

Few water quality data on Spring and Willow Spring Lakes are available. Spring Lake is served by a WDNR Self-Help Monitoring Program volunteer, and has been sampled regularly during the summer months since 1989. Willow Spring Lake is served by an Adopt-A-Lake volunteer monitoring team, and has been sampled regularly during the summer months since 1999. These volunteers collect Secchi-disc transparency data, and temperature, dissolved oxygen concentration, Secchi-disc transparency, and phosphorus concentration data, respectively, during the open water period. The phosphorus concentration data are obtained using test kits with a limited range of sensitivity that, in the case of Willow Spring Lake, resulted in very few phosphorus concentration data being above the level of detection of the analytical technique. Nevertheless, these few data have allowed validation of the total phosphorus loading estimates, as set forth below.

Based upon the Secchi-disc transparency measurements obtained by volunteer monitors on Spring Lake, water quality in the Lake ranges from poor to good. Secchi-disc transparencies ranged from four feet to 10 feet during the period of record, with the lowest readings being obtained during mid- to late-summer and early autumn. Based on these data, Spring Lake has a Wisconsin Trophic State Index (WTSI) value of between about 44 and 57, indicating that the Lake is a meso-eutrophic waterbody.[4]

Based upon the Secchi-disc transparency measurements obtained by the volunteer monitors in Willow Spring Lake, water quality in the Lake ranges from poor to good. Secchi-disc transparencies ranged from four feet to nine feet during this period, with the lowest readings being obtained during late summer and early autumn—August 2000 and September 2001. Based on these data, Willow Spring Lake has a Wisconsin Trophic State Index (WTSI) value of between about 45 and 57, indicating that this Lake is a meso-eutrophic waterbody. Mesotrophic lakes are moderately fertile lakes that support abundant aquatic plant growths and may support productive fisheries. Nuisance growths of algae and plants are usually not exhibited by mesotrophic lakes.

Eutrophic lakes are fertile lakes that support abundant aquatic plant growths and may support productive fisheries. Nuisance growths of algae and plants are common in eutrophic lakes, and may occur in meso-eutrophic lakes. Many of the lakes in Southeastern Wisconsin are classified as mesotrophic or meso-eutrophic.[5]

The Adopt-A-Lake data suggest that Willow Spring Lake remains well-mixed during the summer months. Neither significant thermal nor significant dissolved oxygen concentration stratification with depth was reported during the study period. While many lakes within the Region do exhibit depletion of hypolimnetic or lake bottom water oxygen, especially in mesotrophic and eutrophic waterbodies,[6] a more homogenous water column is not unusual in shallow lakes in the Region.

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[4]*R.A. Lillie, S. Graham, and P. Rasmussen, "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes,"* Research and Management Findings, *Wisconsin Department of Natural Resources Publication No. PUBL-RS-735 93, May 1993.*

[5]*See R.A. Lillie, and J.W. Mason,* Limnological Characteristics of Wisconsin Lakes, *Wisconsin Department of Natural Resources Technical Bulletin No. 138, 1983; also see SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

[6]*R.G. Wetzel,* Limnology, *Saunders, Philadelphia, 1975.*

SOIL TYPES AND CONDITIONS

Soil type, land slope, and land use and management practices are among the more important factors determining lake water quality conditions. Soil type, land slope, and vegetative cover are also important factors affecting the rate, amount, and quality of stormwater runoff. The soil texture and soil particle structures influence the permeability, infiltration rate, and erodibility of soils. Land slopes are also important determinants of stormwater runoff rates and of susceptibility to erosion.

The U.S. Natural Resources Conservation Service, under contract to the Southeastern Wisconsin Regional Planning Commission, completed a detailed soil survey of the Spring Creek tributary drainage area in 1966.[7] Using the regional soil survey, an assessment was made of the hydrologic characteristics of the soils in the drainage area tributary to the Spring and Willow Spring Lakes. Soils within the drainage area tributary to the Spring and Willow Spring Lakes were categorized into four main hydrologic soil groups, as well as an "other" category, which included disturbed and filled lands, as shown on Map 8. Approximately 0.5 percent of the total tributary drainage area is covered by well-drained soils, about 80 percent of the total tributary drainage area by moderately drained soils, about 2 percent of the tributary drainage area by poorly drained soils, and about 10 percent is covered with very poorly drained soils, with the remaining areas of the watershed being surface waters or disturbed lands for which no classification could be determined.

This regional soil survey also contained interpretations of the suitability of soils for urban development with conventional onsite disposal systems and with alternative onsite sewage disposal systems, based upon the then current soils requirements for the use of such onsite sewage disposal systems, as shown on Map 9.[8] About one-half of the lands within the drainage area tributary to Spring and Willow Spring Lakes were considered suitable for urban-density residential development with onsite sewage disposal facilities; about one-quarter was covered by soils for which no interpretation was possible. About one-eighth of the drainage area tributary to the Lakes was covered by soils determined to be unsuitable for urban-density residential development using onsite sewage disposal systems under the then-prevailing administrative code provisions. The balance of the lands were either not classified or were covered by surface water. At present, all riparian residential lands and adjacent lands in the tributary drainage area are served by such private onsite sewage disposal systems. However, based upon the data presented on Map 8, there appears to be little likelihood of significant contamination to the Lake from these sources if such private onsite sewage disposal systems are regularly and properly managed and maintained.

POLLUTANT LOADINGS

Pollutant loads to a lake are generated by various natural processes and human activities that take place in the drainage area tributary to a lake. These loads are transported to the lake through the atmosphere, across the land surface, and by way of inflowing streams. Pollutants transported by the atmosphere are deposited onto the surface of the lake as dry fallout and direct precipitation. Pollutants transported across the land surface enter the lake as direct runoff and, indirectly, as groundwater inflows. Pollutants transported by streams enter a lake as surface water inflows. In drained lakes, like Spring Lake, pollutants are transported across the land surface directly

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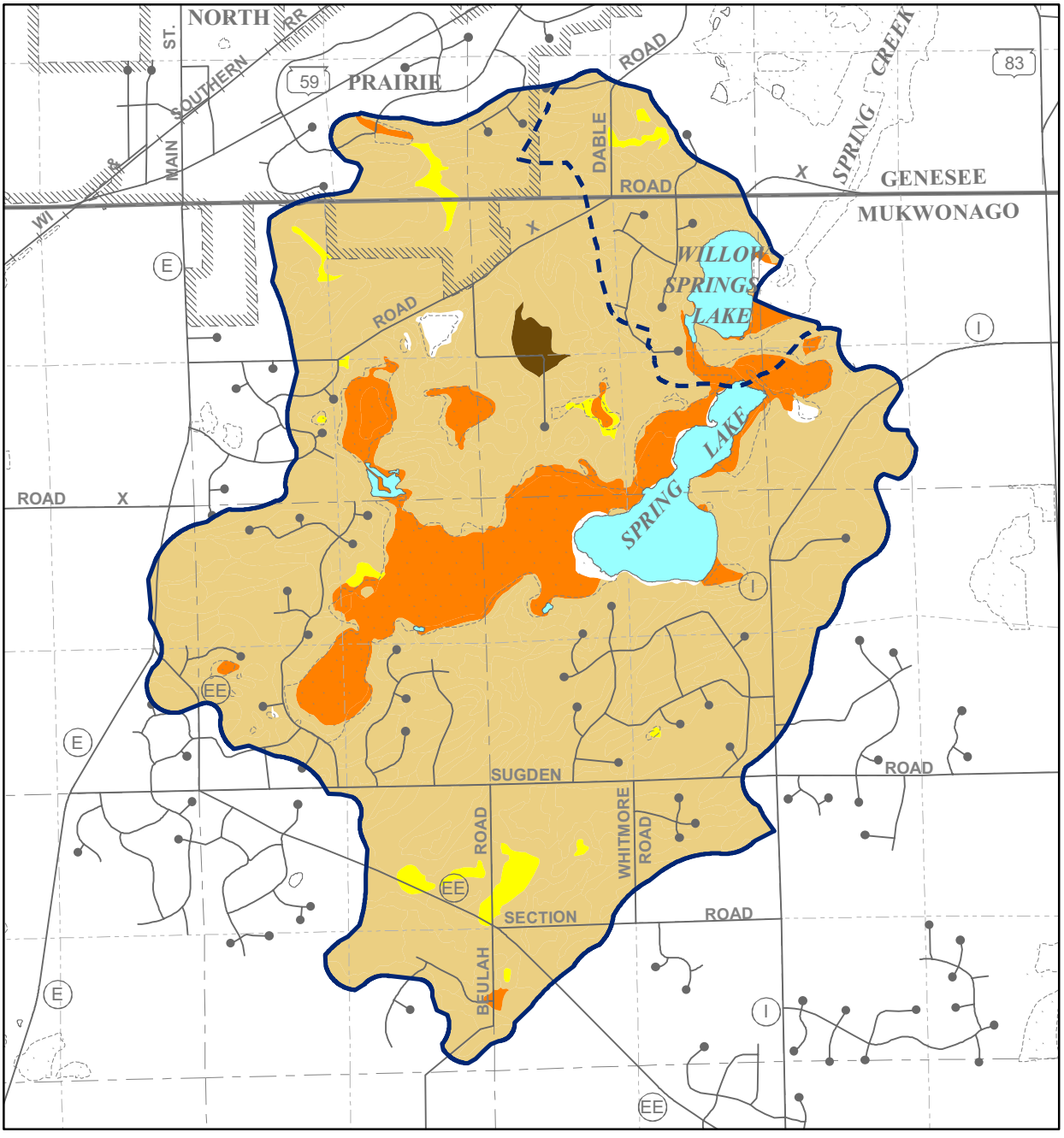
[7] *SEWRPC Planning Report No. 8,* The Soils of Southeastern Wisconsin, *June 1966.*

[8] *The soil ratings for onsite sewage disposal systems presented on Map 9 reflect the requirements of Chapter Comm 83 of the* Wisconsin Administrative Code *governing onsite sewage disposal systems as it existed early in the year 2000. During 2000, the Wisconsin Legislature amended Chapter Comm 83 and adopted new rules governing onsite sewage disposal systems. These rules, which had an effective date of July 1, 2000, increased the number of types of onsite sewage disposal systems that legally could be used from four to nine. The Wisconsin Department of Commerce envisions that other systems also will be approved in the future. These new rules significantly alter the existing regulatory framework, and will increase the area in which onsite sewage disposal systems may be utilized.*

Map 8

HYDROLOGIC SOIL GROUPS WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES



GROUP A: Well-drained

GROUP B: Moderately drained soil

GROUP C: Poorly drained soil

GROUP D: Very poorly drained soil

Hydrologic Soil Group Not Determined

Surface Water

Total Tributary Boundary

Direct Tributary Boundary

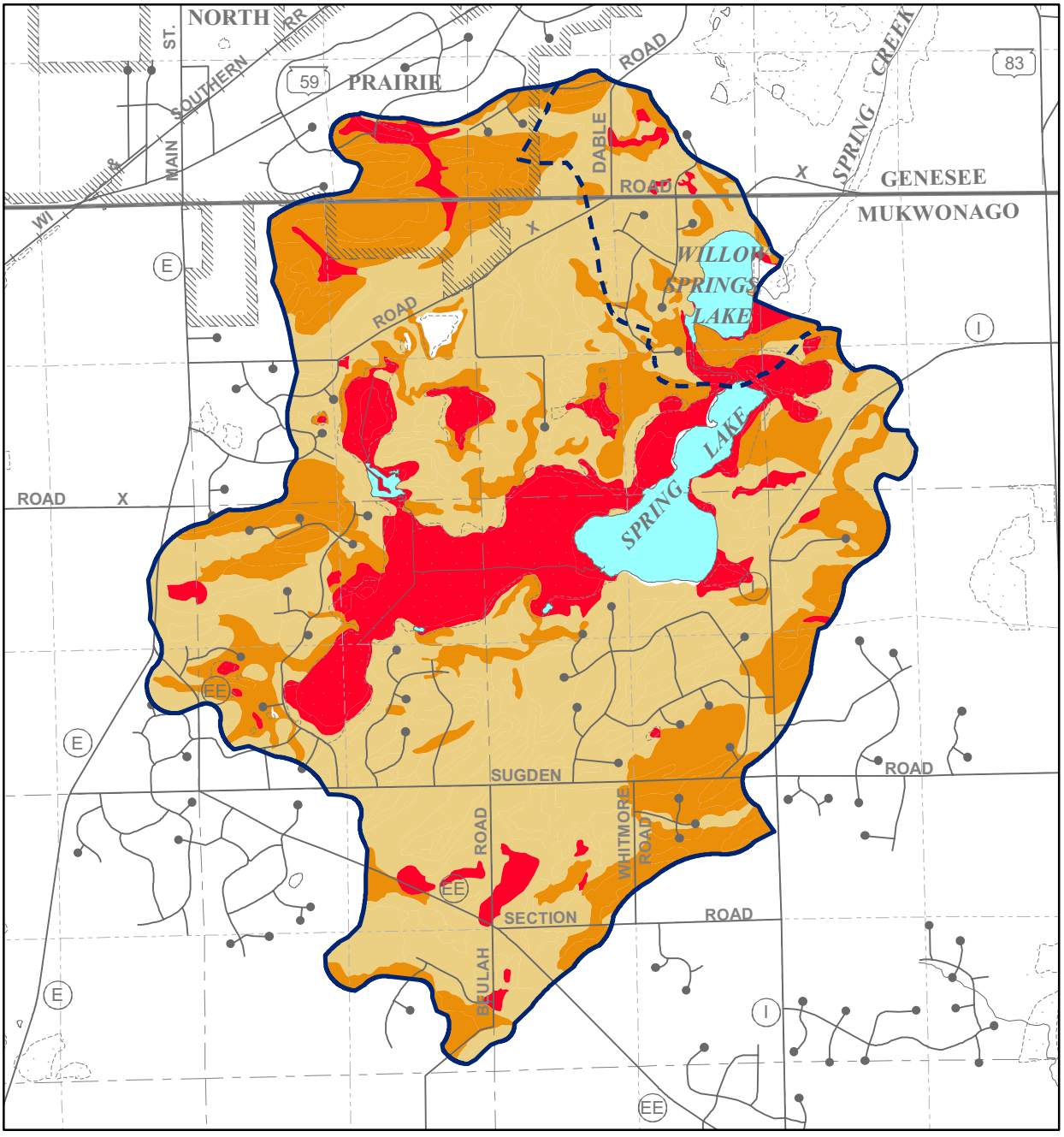
N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

Map 9

SUITABILITY OF SOILS WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES FOR CONVENTIONAL ONSITE SEWAGE DISPOSAL SYSTEMS



UNSUITABLE: Areas covered by soils which have a high probability of not meeting the June 2000 criteria of Chapter Comm. 83 of the *Wisconsin Administrative Code* governing conventional onsite sewage disposal systems

UNDETERMINED: Areas covered by soils having a range of characteristics and or slopes which span the June 2000 criteria of Chapter Comm. 83 of the *Wisconsin Administrative Code* governing conventional onsite sewage disposal systems so that no classification can be assigned

SUITABLE: Areas covered by soils having a high probability of meeting the June 2000 criteria of Chapter Comm. 83 of the *Wisconsin Administrative Code* governing conventional onsite sewage disposal systems

OTHER: Areas consisting for the most part of disturbed land for which no interpretive data are available

SURFACE WATER

Total Tributary Boundary

Direct Tributary Boundary

N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

tributary to the lake, and in the absence of point source discharges from industries or wastewater treatment facilities, comprise the principal route by which contaminants enter a waterbody.[9] Similarly, in drainage lakes, like Willow Spring Lake, pollutants enter the waterbody in runoff from across the land surface directly tributary to the lake and from runoff collected by tributary streams from within a larger tributary watershed. There are no known point sources of water pollutants within the total drainage area tributary to Spring and Willow Spring Lakes.[10] Residential lands within the total tributary drainage area are served by onsite sewage disposal systems. For this reason, the discussion that follows is based upon nonpoint source pollutant loadings to Spring and Willow Spring Lakes.

The nonpoint source pollutant loads to Spring and Willow Spring Lakes were estimated on the basis of land use inventory data and unit area load coefficients determined for Southeastern Wisconsin. Annual contaminant loads entering Spring Lake under existing land use conditions were calculated to be approximately 310 tons of sediment; 1,460 pounds of phosphorus; and 1.5 pounds and 24 pounds of copper and zinc, respectively, as shown in Table 4. The annual contaminant loads entering Willow Spring Lake under year 1995 conditions were calculated to be approximately 345 tons of sediment; 1,620 pounds of phosphorus; and 1.5 pounds and 25 pounds of copper and zinc, respectively, also as shown in Table 4. Copper and zinc were used in this analysis as surrogates for metals and other pollutants that are contributed primarily from urban sources. The annual total phosphorus loads to the Lakes were also estimated using the Wisconsin Lake Model Spreadsheet (WILMS). Under year 1995 land use conditions, phosphorus loads to Spring Lake were estimated to be within the range of 645 pounds and 3,125 pounds, with a most likely total phosphorus loading rate of about 1,600 pounds per year. Loadings to Willow Spring Lake were estimated using the WILMS model to be between 710 pounds and 3,400 pounds of phosphorus annually, with a similar contribution from onsite sewage disposal systems.

Under future land use conditions, these nonpoint source loadings are anticipated to reflect the greater level of urban-density residential development in the drainage areas tributary to the Lakes, as shown in Table 5. Under year 2020 conditions, it is anticipated that the annual sediment and total phosphorus loadings to Spring Lake will decrease, to about 250 tons of sediment and 1,300 pounds of phosphorus, but that annual heavy metals loadings will remain constant or even increase slightly, to about 1.5 pounds of copper and about 26 pounds of zinc. Likewise, the sediment and phosphorus loadings to Willow Spring Lake also are expected to decrease slightly, to about 270 tons of sediment and 1,400 pounds of phosphorus, with concomitant increases in copper and zinc loadings to about 1.5 pounds and 27 pounds, respectively. It should be noted, however, that the phosphorus loads may remain static or even increase, depending, in part, upon the lawn care practices adopted within the urban portions of the watershed. Recent evidence provided by the U.S. Geological Survey from the Lauderdale Lakes in Walworth County, suggest that phosphorus loads from urban lawns receiving fertilization treatments may be up to two-times greater than lawns not treated with chemical additives.[11] Similarly, as onsite sewage disposal systems may contribute up to about 15 percent of the phosphorus loads to the Lakes, ongoing maintenance of these systems to ensure their satisfactory operation is important to the protection of water quality in these Lakes.

To validate the estimated contaminant loads to the Lakes, Commission staff estimated the in-lake total phosphorus concentrations using the Vollenweider-type OECD phosphorus budget model. These calculations resulted in estimated annual average phosphorus concentrations, under current land use conditions, of about 37 μg/l and about 40 μg/l in Spring and Willow Spring Lakes, respectively. The value for Willow Spring Lake

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[9] *S.-O. Ryding and W. Rast,* The Control of Eutrophication of Lakes and Reservoirs, *Unesco Man and the Biosphere Series, Volume 1, Parthenon Press, Carnforth, 1989.*

[10] *SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

[11] *U.S. Geological Survey Water-Resources Investigations Report No. 02-4130,* Effects of Lawn Fertilizer on Nutrient Concentration in Runoff from Lakeshore Lawns, Lauderdale Lakes, Wisconsin, *July 2002.*

Table 4

ESTIMATED ANNUAL POLLUTANT LOADINGS TO SPRING AND WILLOW SPRING LAKES BY LAND USE CATEGORY: 1995

Land Use Category	Pollutant Loads							
	Spring Lake				Willow Spring Lake			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban								
Residential	7.8	160	0.0	8.0	8.7	179	0.0	9.0
Commercial	0.4	1	0.2	1.5	0.4	1	0.2	1.5
Transportation	0.9	20	0.0	0.0	1.0	22	0.0	0.0
Institutional	4.6	24	1.2	14.4	4.6	24	1.3	14.4
Park and Open Space	0.2	5	0.0	0.0	0.2	5	0.0	0.0
Subtotal	13.9	210	1.4	23.9	14.9	231	1.5	24.9
Rural								
Agricultural	284.4	1,087	- -	- -	312.1	1,193	- -	- -
Wetlands	0.7	15	- -	- -	0.8	16	- -	- -
Woodlands	0.7	15	- -	- -	0.8	17	- -	- -
Subtotal	285.8	1,117	- -	- -	313.7	1,226	- -	- -
Onsite Sewage Disposal Systems	- -	110	- -	- -	- -	120	- -	- -
Atmosphere	11.6	16	- -	- -	15.7	22	- -	- -
Total	311.3	1,453	1.4	23.9	344.3	1,599	1.5	24.9

Source: SEWRPC.

Table 5

ESTIMATED ANNUAL POLLUTANT LOADINGS TO SPRING AND WILLOW SPRING LAKES BY LAND USE CATEGORY: 2020

Land Use Category	Pollutant Loads							
	Spring Lake				Willow Spring Lake			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban								
Residential	9.6	196	0.0	9.8	11.0	226	0.0	11.3
Commercial	0.4	1	0.2	1.5	0.4	1	0.2	1.5
Transportation	1.1	25	0.0	0.0	1.2	29	0.0	0.0
Institutional	4.6	24	1.3	14.4	4.6	24	1.3	14.4
Park and Open Space	0.9	19	0.0	0.0	0.9	19	0.0	0.0
Subtotal	16.6	265	1.5	25.7	18.1	299	1.5	27.2
Rural								
Agricultural	221.9	848	- -	- -	234.2	895	- -	- -
Wetlands	0.7	15	- -	- -	0.8	16	- -	- -
Woodlands	0.7	15	- -	- -	0.8	16	- -	- -
Subtotal	223.3	878	- -	- -	235.8	927	- -	- -
Onsite Sewage Disposal Systems	- -	140	- -	- -	- -	150	- -	- -
Atmosphere	11.6	16	- -	- -	15.7	22	- -	- -
Total	251.5	1,299	1.5	25.7	269.6	1,398	1.5	27.2

Source: SEWRPC.

corresponds to the observed in-lake phosphorus concentration reported by the Adopt-A-Lake volunteers of about 40 μg/l. This agreement would suggest that the estimated contaminant loads are a reasonable representation of the loads entering Willow Spring Lake, and that other pollutant sources, including internal loading, to the Lakes, are relatively small compared to the loading from external sources. These in-lake total phosphorus concentrations are expected to remain reasonably constant for the foreseeable future, based upon estimated year 2020 total phosphorus loadings to the two Lakes.

Tables 4 and 5 shows the relative contributions of the various land uses to the pollutant loads to Spring and Willow Spring Lakes under year 1995 and planned year 2020 land use conditions, respectively. These data indicate that, based on 1995 land use conditions in the drainage area tributary to the Lakes, about 75 percent of the phosphorus load to Spring and Willow Spring Lakes is contributed from agricultural and open lands within the tributary drainage area; about 5 percent from wetlands, woodlands, and surface waters; and about 10 percent from residential areas. The balance of the phosphorus load is contributed from other urban sources.

Based upon 2020 land use conditions in the drainage areas tributary to the Lakes, about 65 percent of the phosphorus load to the Lakes is contributed from agricultural and open lands within the tributary drainage area; about 5 percent from wetlands, woodlands, and surface waters; and about 20 percent from residential areas, with the balance being contributed from other urban sources, as set forth in Table 5.

During both current and planned land use conditions, rural agricultural lands are forecast to contribute the largest portion of the sediment loads to the Lakes, accounting for about 90 percent of the loadings under both land use scenarios. In contrast, urban lands contribute the entirety of the heavy metals loads to the Lakes during both current and planned land use conditions.

Of the controllable pollutant sources, the most significant sources under existing land use conditions are rural agricultural lands and urban residential lands. Urban lawn care practices and onsite sewage disposal system maintenance have already been identified as controllable factors affecting lake water quality in the Spring Creek chain of lakes. Control of contaminants from these various sources can be effected through a variety of measures as set forth in Chapter IV.

AQUATIC PLANTS, DISTRIBUTION, AND MANAGEMENT AREAS

The Wisconsin Department of Natural Resources conducted an aquatic plant survey on Spring Lake during July 1967, and reported eight submergent, two floating-leaf, and two emergent aquatic plant species.[12] Aquatic plant species identified during the survey included muskgrass, *Chara* spp.; sedges, *Carex* spp.; water milfoil, *Myriophyllum* sp.; nitella, *Nitella* spp.; yellow water lily, *Nuphar* sp.; white water lily, *Nymphaea* sp.; smartweed, *Polygonum* sp.; variable pondweed, *Potamogeton gramineus*; Sago pondweed, *P. pectinatus*; soft-stem bulrush, *Scirpus validus*; cattail, *Typha* sp.; and bladderwort, *Utricularia* sp. The dominant species were reported to be muskgrass, sedges, nitella, white water lily, and bulrush.

The Commission staff conducted a survey of the aquatic plants within Spring Lake and Willow Spring Lake during June 2001, utilizing the modified Jesson and Lound, transect-based survey method.[13] The results of these surveys are tabulated in Tables 6 and 7, and a tabulation of the ecological significance of the plants determined to be present in each of the Lakes is presented in Table 8. The frequency of occurrence, relative density, and importance value of the various plant species recorded from Spring and Willow Spring Lakes, shown in Tables 6

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[12]*Brian J. Belonger,* Aquatic Plant Survey of Major Lakes in the Fox River (Illinois) Watershed, Research Report No. 39, *Wisconsin Department of Natural Resources, 1969.*

[13]*R. Jesson and R. Lound, Minnesota Department of Conservation Game Investigational Report No. 6,* An Evaluation of a Survey Technique for Submerged Aquatic Plants, *1962.*

Table 6

FREQUENCY OF OCCURRENCE AND DENSITY RATINGS OF SUBMERGENT PLANT SPECIES IN SPRING LAKE: JUNE 2001

Aquatic Plant Species Present	Sites Found	Frequency of Occurrence (percent)	Relative Density	Importance Value
Ceratophyllum demersum (coontail)	1	1.3	2.00	0.03
Chara vulgaris (muskgrass)	26	34.2	2.39	0.82
Elodea canadensis (waterweed)	1	1.3	1.00	0.01
Myriophyllum sp. (native water milfoil)	1	1.3	1.00	0.01
Myriophyllum spicatum (Eurasian water milfoil)	50	65.8	2.20	1.45
Najas flexilis (bushy pondweed)	3	3.9	2.31	0.04
Potamogeton gramineus (variable pondweed)	7	9.2	1.57	0.14
Potamogeton illinoensis (Illinois pondweed)	8	10.5	1.38	0.14
Potamogeton natans (floating-leaf pondweed)	1	1.3	1.00	0.01
Potamogeton pectinatus (Sago pondweed)	21	27.6	1.67	0.46
Potamogeton robbinsii (Robbins pondweed)	1	1.3	1.00	0.01
*Scirpus subterminalis (*water bulrush*)*	3	3.9	1.67	0.07
Utricularia sp. (bladderwort)	1	1.3	0.77	0.03
Vallisneria americana (eel grass or water celery)	2	2.6	1.00	0.03
Zosterella dubia (water stargrass)	7	9.2	1.43	0.13

NOTE: There were 76 sample sites during the June 2001 survey.

Source: SEWRPC.

Table 7

FREQUENCY OF OCCURRENCE AND DENSITY RATINGS OF SUBMERGENT PLANT SPECIES IN WILLOW SPRING LAKE: JUNE 2001

Aquatic Plant Species Present	Sites Found	Frequency of Occurrence (percent)	Relative Density	Importance Value
Ceratophyllum demersum (coontail)	37	78.7	2.5	1.98
Chara vulgaris (muskgrass)	5	10.6	2.6	0.28
Elodea canadensis (waterweed)	6	12.8	1.2	0.15
Myriophyllum sp. (native water milfoil)	9	19.1	1.7	0.32
Myriophyllum spicatum (Eurasian water milfoil)	44	93.6	3.3	3.13
Najas flexilis (bushy pondweed)	36	76.6	2.2	1.68
Potamogeton crispus (curly-leaf pondweed)	13	27.7	1.2	0.34
Potamogeton illinoensis (Illinois pondweed)	14	29.8	1.9	0.57
Potamogeton natans (floating-leaf pondweed)	3	- -[a]	- -[a]	- -[a]
Potamogeton pectinatus (Sago pondweed)	4	8.5	1.8	0.15
Potamogeton zosteriformis (flat-stemmed pondweed)	6	12.8	1.5	0.19
Utricularia sp. (bladderwort)	1	2.1	1.0	0.02

NOTE: There were 47 total sample sites during the June 2001 survey.

[a]*Floating leaf pondweed was observed but not reported from the samples obtained using the adopted Jesson and Lound aquatic plant sampling technique; therefore, it was not included in the analysis of density and frequency of occurrence.*

Source: SEWRPC.

Table 8

ECOLOGICAL SIGNIFICANCE OF AQUATIC PLANTS IN SPRING LAKE AND WILLOW SPRING LAKES

Aquatic Plant Species Present	Ecological Significance
Ceratophyllum demersum (coontail)	Provides good shelter for young fish and supports insects as food for fish and ducklings
Chara vulgaris (muskgrass)	Excellent producer of fish food, especially for young trout, bluegills, and small and largemouth bass; stabilizes bottom sediments, and has softening effect on the water by removing lime and carbon dioxide
Elodea canadensis (waterweed)	Provides shelter and support for insects which are valuable as fish food
Lemna minor (lesser duckweed)	A nutritious food source for ducks and geese, also provides food for muskrat, beaver and fish; rafts of duckweed provide shade and cover for insects, in addition extensive mats of duckweed can inhibit mosquito breeding
Myriophyllum sp. (native water milfoil)	Provides valuable food and shelter for fish; fruits are eaten by many wildfowl
Myriophyllum spicatum (Eurasian water milfoil)	None known
Najas flexilis (bushy pondweed)	Stems, foliage, and seeds important wildfowl food and produces good food and shelter for fish
Nuphar variegatum (yellow water lily)	Leaves, stems, and flowers are eaten by deer; roots eaten by beaver; seeds eaten by wildfowl; leaves provide harbor to insects, in addition to shade and shelter for fish
Nymphaea tuberosa (white water lily)	Provides shade and shelter for fish; seeds eaten by waterfowl; rootstocks and stalks eaten by muskrat; roots eaten by beaver, deer, moose, and porcupine
Potamogeton crispus (curly-leaf pondweed)	Provides food, shelter, and shade for some fish and food for wildfowl
Potamogeton gramineus (variable pondweed)	Provides habitat for fish and food for waterfowl, in addition to muskrat, beaver, deer, and moose
Potamogeton illinoensis (Illinois pondweed)	Provides shade and shelter for fish; harbor for insects; seeds are eaten by wildfowl
Potamogeton natans (floating-leaf pondweed)	Provides food and shelter for fish and food for wildfowl
Potamogeton pectinatus (Sago pondweed)	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish
Potamogeton robbinsii (Robbins pondweed)	Provides habitat for invertebrates, in addition to providing good cover and foraging opportunities for fish
Potamogeton zosteriformis (flat-stemmed pondweed)	Provides some food for ducks
Scirpus acutus (hard-stem bulrush)	Provides habitat for invertebrates and shelter for young fish; nutlets are eaten by waterfowl; stems and rhizomes are eaten by geese and muskrat; provide nesting materials for waterfowl, marsh birds, and muskrat
Scirpus subterminalis (water bulrush)	Provides shelter for fish and supports insects
Utricularia sp. (bladderwort)	Provides good food and cover for fish
Vallisneria americana (eel grass or water celery)	Provides good shade and shelter, supports insects, and is valuable fish food
Zosterella dubia (water stargrass)	Provides food and shelter for fish, locally important food for waterfowl

Source: SEWRPC.

and 7, were determined using the methodology of Dr. Stan Nichols from forestry assessment techniques.[14] The results of the surveys also are depicted graphically on Maps 10 and 11, and illustrations of the common aquatic plants found in Spring Lake and Willow Spring Lake are included in Appendix A. Of the submergent species reported by the Wisconsin Department of Natural Resources, muskgrass, milfoil, pondweeds, and bladderwort were recorded during the current survey, with Eurasian water milfoil being amongst the dominant species in both Lakes. Nitella was not reported during the 2001 survey.

Fifteen submergent aquatic plant species were recorded within Spring Lake during the 2001 survey, as shown in Table 6. In addition, two floating-leaf aquatic plants—yellow and white water lilies—and two emergent aquatic plants—cattail and bulrush—were also observed, but not included in the statistical analysis of the submergent aquatic plant community set forth in the table. The northwestern and western areas of Spring Lake contained the most abundant and diverse flora in the Lake. The flora was dominated by Eurasian water milfoil, *Myriophyllum spicatum*, which can pose recreational use problems when it is abundant, especially if it grows to the water surface. Eurasian water milfoil was found throughout Spring Lake in varying densities depending upon location and water depth. However, dense stands of Eurasian water milfoil occurred throughout the Lake, creating the potential for this plant to spread further as a consequence of wind action, boat propeller action, or similar mechanism that would fragment the plant into pieces that could re-root elsewhere in the Lake.

Eurasian water milfoil, one of the eight milfoil species found in Wisconsin, is an exotic, or nonnative species, known to have an incredible ability to regenerate. This exotic species often outcompetes the native aquatic vegetation of lakes in Southeastern Wisconsin, reducing the biodiversity of the lakes, and degrading the quality of fish and wildlife habitats.[15] It has also been known to cause severe recreational use problems in lakes in the Southeastern Wisconsin Region.

Other dominant aquatic plant species in Spring Lake included muskgrass, *Chara vulgaris*, and Sago pondweed, *Potamogeton pectinatus*. These species are considered to pose few problems for recreational uses for the waterbody and act as ground cover, stabilizing the lakebed. Filamentous algae also were found to be present in the Lake. Purple loosestrife, *Lythrum salicaria*, was present at three locations. Purple loosestrife, another nonnative nuisance plant, was found invading important wetland areas. Like Eurasian water milfoil, purple loosestrife is known to spread profusely, outcompeting native plant growth and reducing the quality of fish and wildlife habitat, while adding little significant ecological benefit. Purple loosestrife is a declared weed in the State of Wisconsin and is subject to an ongoing eradication program.

Twelve submergent aquatic plant species were recorded within Willow Spring Lake, as shown on Table 7. In addition, two floating-leaf aquatic plants, yellow and white water lilies, and two emergent aquatic plants, cattail and bulrush, were also observed, but not included in the statistical analysis of submergent aquatic plants set forth in Table 7. The most abundant and diverse flora were found in the southern one-half of Willow Spring Lake. The Lake was dominated by Eurasian water milfoil, *Myriophyllum spicatum*, and coontail, *Ceratophyllum demersum*, both of which can pose recreational use problems when they are abundant and where they grow to the water surface. Bushy pondweed, *Najas flexilis*; curly-leaf pondweed, *Potamogeton crispus*; and, Illinois pondweed, *P. illinoensis*, were all common in Willow Spring Lake. Though not a dominant plant species, floating-leaf pondweed, *P. natans*, occurred in dense stands along the southern shoreline of the Lake. Like Spring Lake,

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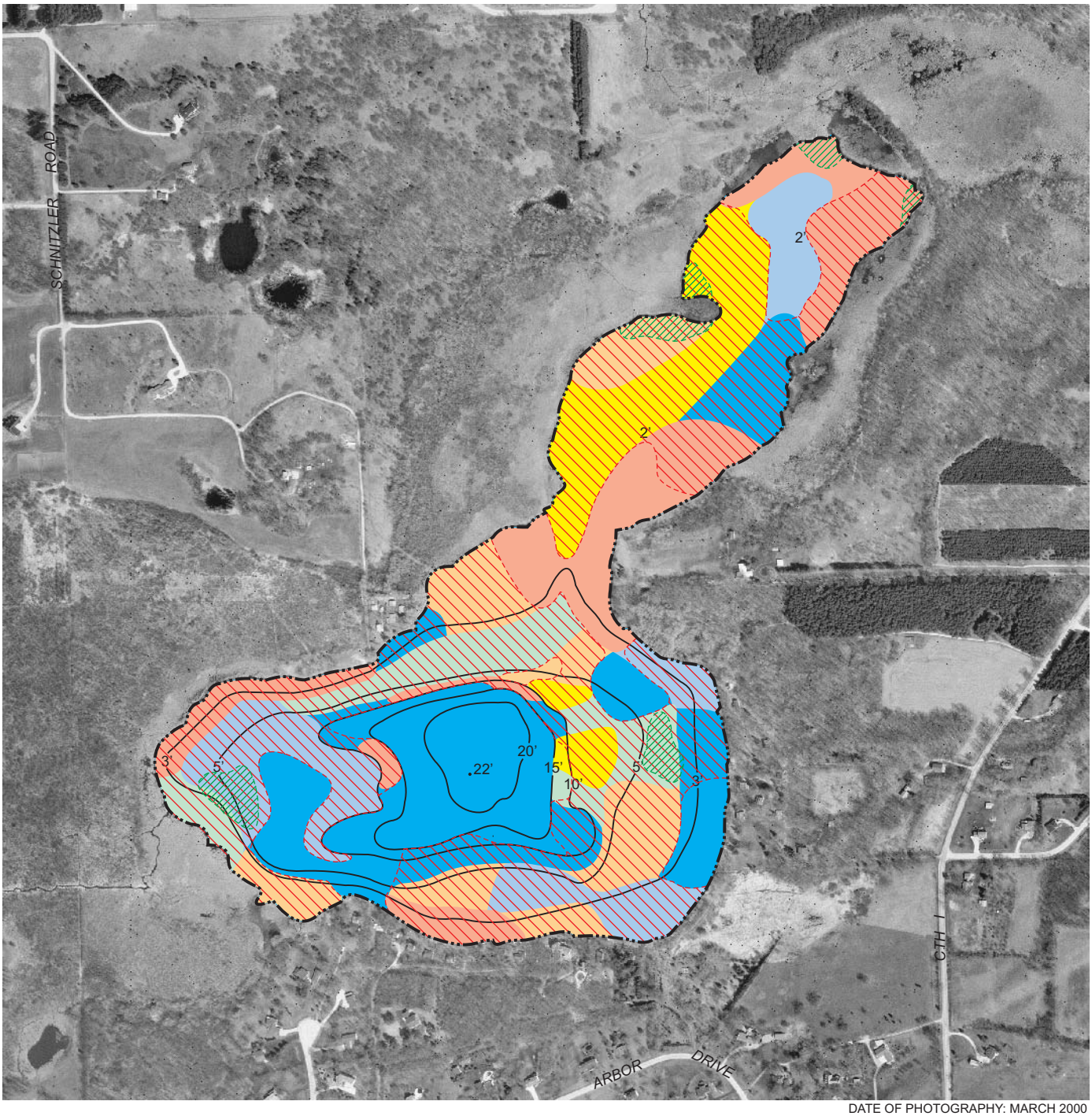
[14]*Memo from Stan Nichols, to J. Bode, J. Leverence, S. Borman, S. Engel, D. Helsel, entitled "Analysis of macrophtye data for ambient lakes-Dutch Hollow and Redstone Lakes example," Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension, February 4, 1994; see also SEWRPC Memorandum Report No. 134,* An Aquatic Plant Management Plan for Fowler Lake, Waukesha County, Wisconsin, *October 2000.*

[15]*Wisconsin Department of Natural Resources,* Eurasian Water Milfoil in Wisconsin: A Report to the Legislature, *1993.*

Map 10

AQUATIC PLANT COMMUNITY DISTRIBUTION IN SPRING LAKE: 2001



DATE OF PHOTOGRAPHY: MARCH 2000

—20′— WATER DEPTH CONTOUR IN FEET

OPEN WATER

WATER LILIES

EURASIAN WATER MILFOIL

MUSKGRASS

SAGO PONDWEED

COONTAIL; WATER STAR GRASS; AND SAGO, ILLINOIS, AND VARIABLE PONDWEEDS

MUSKGRASS; WATER STAR GRASS; NATIVE WATER MILFOIL; AND SAGO, ILLINOIS, VARIABLE, AND ROBBINS PONDWEEDS

MUSKGRASS; WATERWEED; WILD CELERY; BLADDERWORT; WATER BULRUSH; AND ILLINOIS, VARIABLE, BUSHY, AND FLOATING-LEAF PONDWEEDS

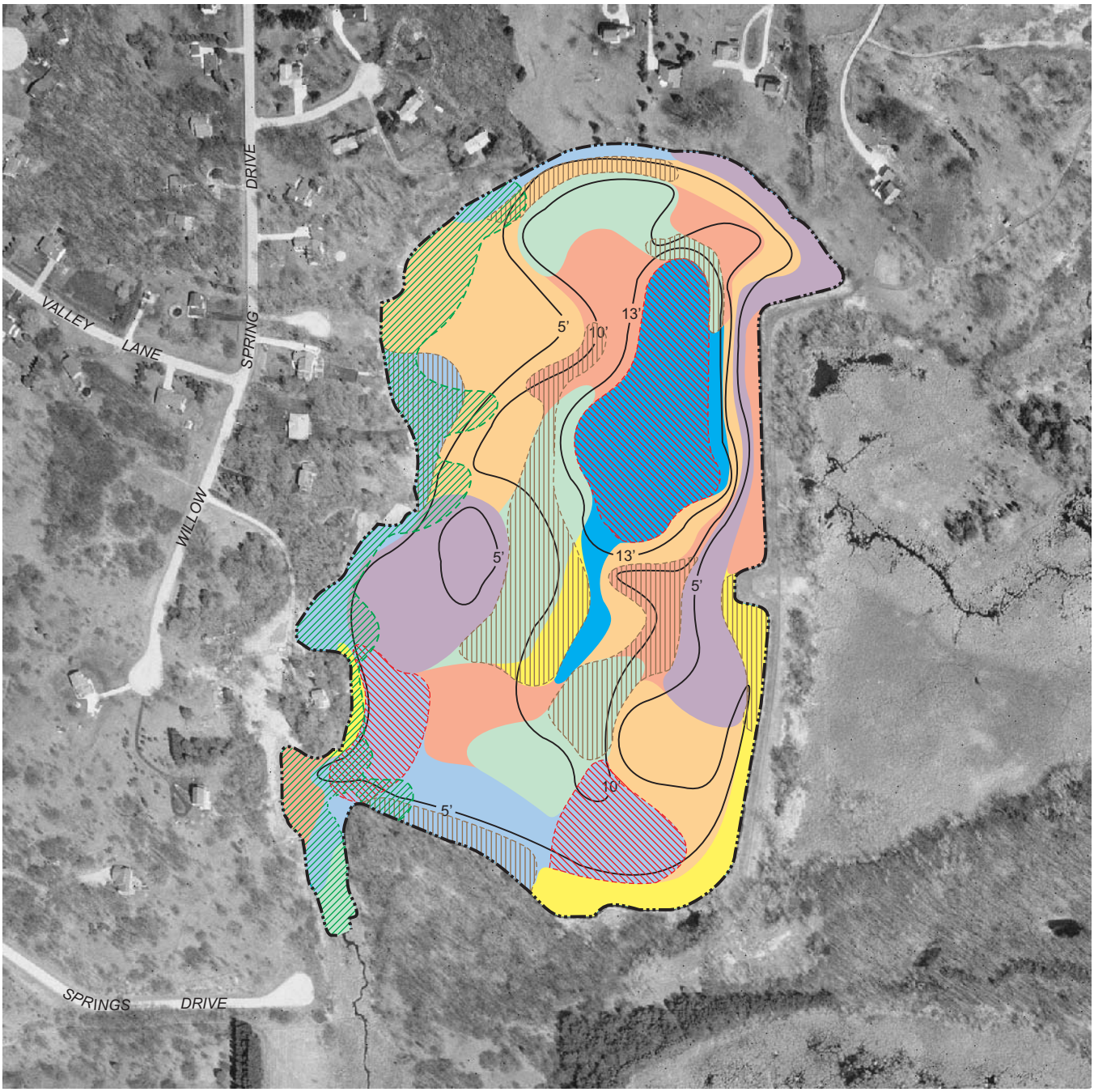
GRAPHIC SCALE

0 350 700 FEET

Source: SEWRPC.

Map 11

AQUATIC PLANT COMMUNITY DISTRIBUTION IN WILLOW SPRING LAKE: 2001



DATE OF PHOTOGRAPHY: MARCH 2000

—10′— WATER DEPTH CONTOUR IN FEET

OPEN WATER

WATER LILIES

CURLY-LEAF PONDWEED

AREA WHERE EURASIAN WATER MILFOIL IS NOT PRESENT IN WILLOW SPRING LAKE

COONTAIL, BUSHY, AND ILLINOIS PONDWEEDS

COONTAIL, BLADDERWORT, AND BUSHY PONDWEED

COONTAIL, WATERWEED, NATIVE WATER MILFOIL, AND BUSHY PONDWEED

COONTAIL, WATERWEED, MUSKGRASS, NATIVE WATER MILFOIL, AND ILLINOIS PONDWEED

COONTAIL; WATERWEED; MUSKGRASS; NATIVE WATER MILFOIL; WATER STAR GRASS; AND BUSHY, FLAT-STEM, SAGO, FLOATING-LEAF, AND ILLINOIS PONDWEEDS

WATERWEED; MUSKGRASS; NATIVE WATER MILFOIL; WATER STAR GRASS; AND SAGO, BUSHY, AND ILLINOIS PONDWEEDS

GRAPHIC SCALE

0 200 400 FEET

Source: SEWRPC.

filamentous algae were found to be present in Willow Spring Lake at the time of the survey, but the invasive wetland plant, purple loosestrife, was not reported. Nevertheless, since the plant has been observed at Spring Lake and in the adjacent wetland areas, volunteers are currently taking steps to eradicate the plant around both Lakes.

The aquatic flora of both Spring and Willow Spring Lakes is representative of eutrophic lakes. Eutrophic lakes can exhibit high levels of aquatic plant growth, and usually are dominated by a few, often nuisance, species. This condition may be maintained or accelerated as a consequence of the phosphorus loadings discussed above.

WETLAND PLANTS, DISTRIBUTION, AND MANAGEMENT AREAS

Wetlands are defined by the Regional Planning Commission as, "areas that have a predominance of hydric soils and that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions." This definition, which is also used by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency, is essentially the same as the definition used by the U.S. Natural Resource Conservation Service.[16] The Wisconsin Department of Natural Resources defines wetlands pursuant to Chapter 23 of the *Wisconsin Statutes*. Wetlands are "an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation, and which has soils indicative of wet conditions." In practice, the Department definition differs from the Regional Planning Commission definition in that the Department considers very poorly drained, poorly drained, and some of the somewhat poorly drained soils as wetland soils meeting the Department "wet condition" criterion. The Commission definition only considers the very poorly drained and poorly drained soils as meeting the "hydric soil" criterion. Thus, the State definition as actually applied is more inclusive than the Federal and Commission definitions in that the Department may include some soils that do not show hydric field characteristics as wet soils capable of supporting wetland vegetation, a condition that may occur in some floodlands.[17]

As a practical matter, experience has shown that application of the Wisconsin Department of Natural Resources, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, and the Regional Planning Commission definitions, produce reasonably consistent wetland identifications and delineations in the majority of situations within the Southeastern Wisconsin Region. That consistency is due in large part to the provision in the Federal wetland delineation manual that allows for the application of professional judgment in cases where satisfaction of the three criteria for wetland identification is unclear.

Wetlands in Southeastern Wisconsin are classified predominantly as deep marsh, shallow marsh, southern sedge meadow, fresh (wet) meadow, shrub carr, alder thickets, low prairie, fens, bogs, southern wet- and wet-mesic hardwood forest, and conifer swamp. Wetlands form an important part of the landscape in and adjacent to Spring and Willow Spring Lakes in that they perform an important set of natural functions which make them ecologically and environmentally invaluable resources. Wetlands affect the quality of water by acting as a filter or a buffer zone allowing silt and sediments to settle out. They also influence the quantity of water by providing water during periods of drought and holding it back during periods of flood. When located along shorelines of lakes and

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[16]*Lands designated as prior converted cropland, that is, lands that were cleared, drained, filled, or otherwise manipulated to make them capable of supporting a commodity crop prior to December 23, 1985, may meet the criteria of the U.S. Natural Resource Conservation Service wetland definition, but they would not be regulated under Federal wetland programs. If such lands are not cropped, managed, or maintained for agricultural production, for five consecutive years, and in that time the land reverts back to wetland, the land would then be subject to Federal wetland regulations.*

[17]*Although prior converted cropland is not subject to Federal wetland regulations unless cropping ceases for five consecutive years and the land reverts to a wetland condition, the State may consider prior converted cropland to be subject to State wetland regulations if the land meets the criteria set forth in the State wetland definition before it has not been cropped for five consecutive years.*

streams, wetlands help protect those shorelines from erosion. Wetlands also may serve as groundwater discharge and recharge areas, in addition to being important resources for overall ecological health and diversity by providing essential breeding and feeding grounds, shelter, and escape cover for many forms of fish and wildlife.

Wetlands are poorly suited to urban use. This is due to the high soil compressibility and instability, high water table, low load-bearing capacity, and high shrink-swell potential of wetland soils, and, in some cases, to the potential for flooding. In addition, metal conduits placed in some types of wetland soils may be subject to rapid corrosion. These constraints, if ignored, may result in flooding, wet basements and excessive operation of sump pumps, unstable foundations, failing pavements, broken sewer and water lines, and excessive infiltration of clear water into sanitary sewerage systems. In addition, there are significant onsite preparation and maintenance costs associated with the development of wetlands, particularly as they relate to roads, foundations, and public utilities.

Wetlands in the Spring Lake and Willow Spring Lake Area

Between 1971 and 2001, Commission staff have conducted a number of surveys of wetlands located in the vicinity of Spring and Willow Spring Lakes within the Town of Mukwonago. The major wetland plant species identified during these vegetation surveys are summarized in Table 9, and the detailed survey reports are set forth in Appendix B. Some of the areas surveyed appeared to have been subject to prior disturbances, including ditching, clear-cutting, filling, vegetation removal, agricultural activity, and dumping. This historic disturbance of wetlands in the drainage areas tributary to Spring and Willow Spring Lakes was generally associated with agricultural activities and subsequent urban development. Within the areas surveyed, these disturbances were centered on the area in the vicinity of the Laitsch Dam, forming Willow Spring Lake, as noted in Appendix B.

Of the species present, up to about 20 percent were considered to be exotic species, further indicating that the wetlands were moderately to heavily disturbed in the past. The surveyed wetland parcels contained a variety of wetland types, with a number of Federal- or State-designated rare, threatened, or endangered species being present. Federal- or State-designated rare, threatened, or endangered species reported include the lesser fringed gentian, Ohio goldenrod, and prickly wild lettuce, as documented in the wetland survey reports set forth in Appendix B. All of the wetlands in the vicinity of the Lakes appear to have the potential to be restored to a higher level of ecosystem function through management interventions.

The Regional Planning Commission maintains an inventory of wetlands within the Region, which is updated every five years. As shown on Map 12, wetlands covered about 415 acres, or about 10 percent of the drainage area tributary to Spring and Willow Spring Lakes. About 25 acres are within the drainage area directly tributary to Willow Spring Lake, and about 390 acres are in the drainage area directly tributary to Spring Lake. The amount and distribution of wetlands in the area is expected to remain relatively constant if the recommendations contained in the adopted regional land use and county development plans are followed.

FISHERIES

The fish species reported from Spring and Willow Spring Lakes by the Wisconsin Department of Natural Resources are shown in Table 10.[18]

Wisconsin Department of Natural Resources staff conducted an electrofishing survey on Spring Lake during 1995. The 1995 survey results indicated that panfish were common in the Lake, with largemouth bass, smallmouth bass, and northern pike being present. As a result of this survey, the Wisconsin Department of Natural Resources recommended promoting a voluntary program of catch and release bass fishing. It was further noted that the adoption of special regulations, including a total closure of the bass harvest to keep panfish growth rates up and carp numbers down, may be considered in the future.

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[18]*D. Fago, Wisconsin Department of Natural Resources Research Report No. 148,* Retrieval and Analysis used in Wisconsin's Statewide Fish Distribution Survey, *Second Edition, December 1988; see also Wisconsin Department of Natural Resources, PUB-FH-800,* Wisconsin Lakes, 2001.

Table 9

MAJOR EMERGENT WETLAND PLANT SPECIES PRESENT IN THE SPRING LAKE AND WILLOW SPRING LAKE AREA AND THEIR POSITIVE ECOLOGICAL IMPORTANCE[a]

Emergent Wetland Plant Species Present	Ecological Significance[b]
Asclepias incarnata (marsh milkweed)	Seeds provide food for ducks, roots may be eaten by muskrats, and plant fiber are use by birds for nesting materials, used as a host plant for Monarch butterfly caterpillars
Asclepias syriaca (common milkweed)	Seeds provide food for ducks, roots may be eaten by muskrats, and plant fiber are use by birds for nesting materials
Aster lucidulus (swamp aster)	Flowers attract insects
Bidens coronata (tall swamp marigold)	Fruit provides food for waterfowl and submerged portions of the plant provide shade shelter and forage for fish
Carex comosa (bristly sedge)	Nutlets are eaten by waterfowl while the dense growth form of the plant provides valuable shoreline stabilization, and in shallow water the plant provides spawning habitat
Carex aquatilis (aquatic sedge) and *Carex stricta* (tussock sedge)	Sedges are an essential food source for wildfowl and marsh birds; large sedge meadows provide nesting for Sandhill cranes
Cornus amomum (silky dogwood)	Berries are eaten by upland game birds, songbirds, waterfowl, deer and beaver; shrub provides habitat and nesting for songbirds
Decodon verticillatus (water-willow)	Seeds provide food for ducks and food and cover for muskrats
Eupatorium maculatum (Joe-pye weed) and *Eupatorium perfoliatum* (boneset)	Fruits and leaves provide food for Mallards and Ruffed grouse
Impatiens biflora (jewelweed)	Flowers attract hummingbirds and insects; plants may be eaten by grazers
Iris versicolor (blue-flag iris)	Provides food for waterfowl and muskrats; and persists as good cover for wildlife and waterfowl
Leersia oryzoides (rice cut grass)	Seeds can be a locally important food for waterfowl, and occasionally eaten by muskrats
Lycopus americanus (cut-leaf bugleweed)	Used by upland game birds, waterfowl and muskrats
Lythrum salicaria (purple loosestrife)[c]	Provides minimal value for wildlife; flowers attract insects; crowds out valuable native vegetation
Phalaris arundinacea (reed canary grass)[c]	Low food value for grazers; offers some summer shelter to waterfowl in disturbed areas; crowds out valuable native vegetation
Polygonum amphibum (water smartweed) and *Polygonum pensylvanicum* (pinkweed)	Nutlets eaten by wildfowl, upland game birds, shorebirds, songbirds, deer and muskrats, and provides habitat for invertebrates
Potentilla fruiticosa (shrubby cinquefoil)	- -
Rumes orbiculatus (great water dock)	Nutlets eaten by waterfowl; grazed by deer and muskrats

Table 9 (continued)

Emergent Wetland Plant Species Present	Ecological Significance[b]
Salix spp. (willows)	Attracts marsh birds, wildfowl, songbirds and upland game birds, leaves eaten by muskrats, browsed by deer, and important for beaver habitat
Sambucus canadensis (elderberry)	Thickets provide shelter; berries are eaten by songbirds and ruffed grouse
Scirpus atrovirens (green bulrush)[d] and *Scirpus validus* (soft-stemmed bulrush)[d]	Nutlets and tubers are eaten by ducks, plants and roots eaten by geese and swans; attracts marsh birds, waterfowl and songbirds
Sagittaria latifolia (common arrowhead)	Provides food for ducks, muskrats, porcupines, beavers and fish, and provides shelter for young fish
Solidago gigantea (giant goldenrod)	Flowers attract insects
Typha latifolia (broad-leaved cattail), *Typha angustifolia* (narrow-leaved cattail)	Supports insects; stalks and roots important food for muskrats and beavers; attracts marsh birds, wildfowl, and songbirds, in addition to being used as spawning grounds by sunfish and shelter for young fish
Verbena hastata (blue vervain)	Seeds eaten by ducks
Vitis riparia (riverbank grape)	Berries eaten by songbirds

[a]*See Appendix B for a comprehensive list of wetland and emergent aquatic plants in and around Spring Lake and Willow Spring Lake.*

[b]*Information obtained from* Wetland Plants and Plant Communities of Minnesota and Wisconsin*, Second Edition, by Steve D. Eggers and Donald M. Reed;* A Manual of Aquatic Plants *by Norman C. Fassett; and* Through the Looking Glass…A Field Guide to Aquatic Plants*, by Wisconsin Lakes Partnership.*

[c]*Nonnative plant species.*

[d]*Considered a high value aquatic plant species known to offer important values in specific aquatic ecosystems under Section NR 107.08 (4) of the* Wisconsin Administrative Code*.*

Source: SEWRPC.

The Wisconsin Department of Natural Resources also conducted a fisheries survey of Willow Spring Lake. The results showed that northern pike, largemouth bass, panfish, green sunfish, pumpkinseed, warmouth, carp, gold shiner, fathead minnow, grass pickerel, and the black bullhead were present, while bluegill, black crappie, and yellow perch were abundant.

Lake chubsucker were reported to be present downstream of the Lakes in the waters of Genesee Creek.

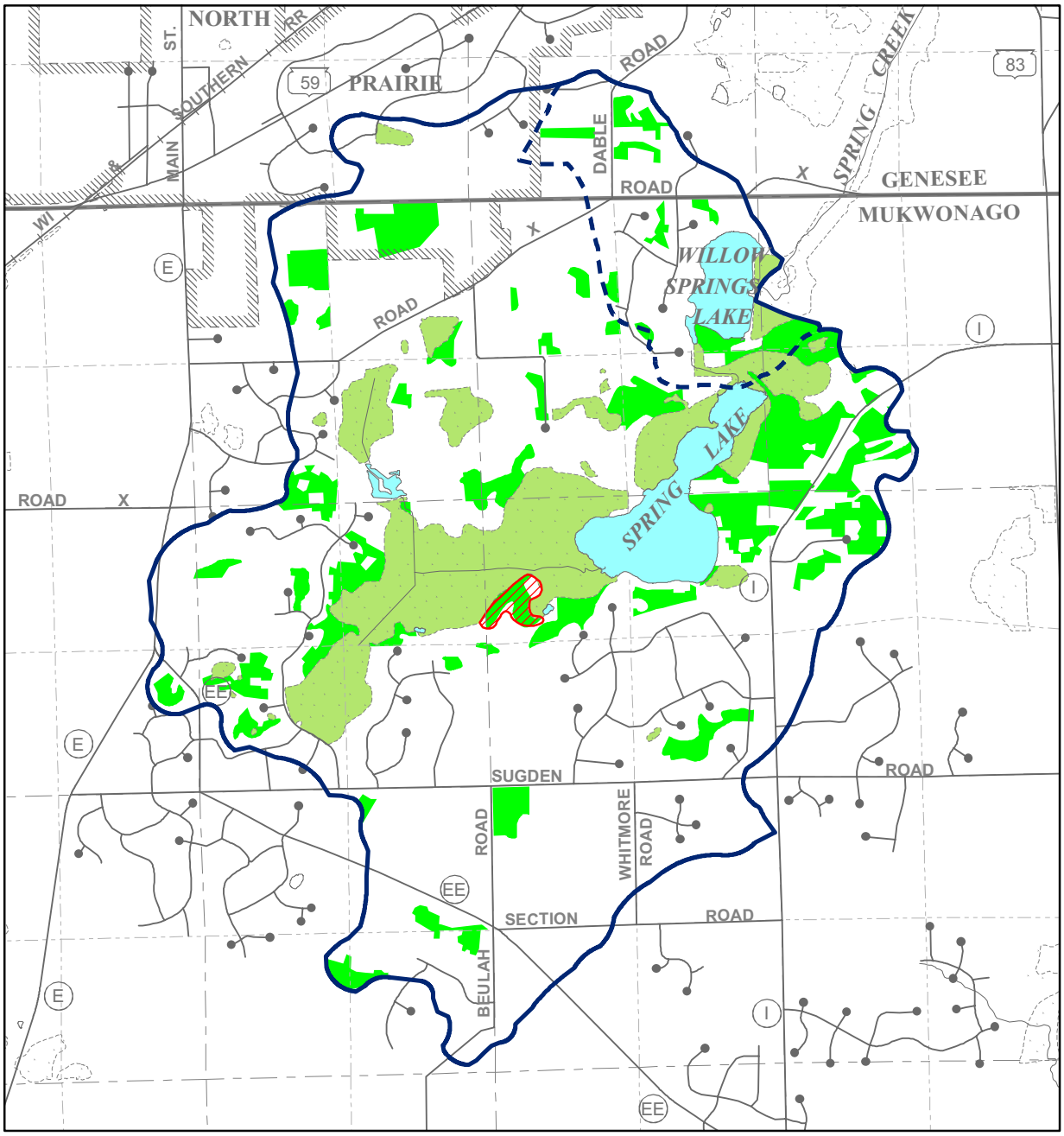
WILDLIFE HABITAT AREAS AND ENVIRONMENTAL CORRIDORS

Wildlife

Although a quantitative field inventory of amphibians, reptiles, birds, and mammals was not conducted as a part of the Lake studies, lists of amphibians, reptiles, birds, and mammals which may be expected to be found in the area under existing conditions were compiled by polling naturalists and wildlife managers familiar with the area. These lists of amphibians, reptiles, birds, and mammals known to exist, or known to have existed, in the Spring

Map 12

WOODLANDS, WETLANDS, AND CRITICAL SPECIES HABITAT AREAS WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES: 2000



Woodlands
Wetlands
Surface Water
Critical Species Habitat
Total Tributary Boundary
Direct Tributary Boundary

N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

Table 10

FISH SPECIES OCCURRING IN SPRING AND WILLOW SPRING LAKES

Species	Family	Scientific Name	Relative Abundance
White Sucker	Catostomidae	*Catostomus commersoni*	Present
Lake Chubsucker	Catostomidae	*Erimyon sucetta*	Present
Green Sunfish	Centrarchidae	*Lepomis cyanellus*	Present
Pumpkinseed	Centrarchidae	*Lepomis gibbosus*	Present
Warmouth	Centrarchidae	*Lepomis gulosus*	Present
Bluegill	Centrarchidae	*Lepomis macrochirus*	Abundant
Largemouth Bass	Centrarchidae	*Micropterus salmoides*	Common
Smallmouth Bass	Centrarchidae	*Micropterus dolomieui*	Present[a]
Black Crappie	Centrarchidae	*Pomoxis nigromaculatus*	Abundant
Common Carp	Cyprinidae	*Cyprinus carpio*	Present
Golden Shiner	Cyprinidae	*Notemigonus crysoleucas*	Present
Fathead Minnow	Cyprinidae	*Pimephales promelas*	Present
Grass Pickerel	Esocidae	*Esox americanus vermiculatus*	Present
Northern Pike	Esocidae	*Esox lucius*	Present
Black Bullhead	Ictaluridae	*Ictalurus melas*	Present
Yellow Perch	Percidae	*Perca flavescens*	Abundant

[a]*Spring Lake only.*

Source: Wisconsin Department of Natural Resources and SEWRPC.

Lake area, were associated with the historic and remaining habitat areas in the Spring Lake and Willow Spring Lake area as inventoried, and projecting the appropriate amphibian, reptile, bird, and mammal species into the Spring and Willow Spring Lakes area. The net result of the application of this technique is a listing of those species which were probably once present in the drainage area, those species which may be expected to still be present under currently prevailing conditions, and those species which may be expected to be lost or gained as a result of urbanization within the area.

Given the low-density, single-family residential nature of the immediate shorelands of the Spring and Willow Spring Lakes, and the surrounding woodlands and wetlands in the vicinity, it is likely that the wildlife community is comprised of small upland game animals, such as rabbit and squirrel; predators, such as fox and raccoon; marsh furbearers, such as muskrat; migratory and resident song birds; marsh birds, such as redwing blackbird and great blue heron; raptors, such as great horned owl and red-tailed hawk; and waterfowl. Wild turkeys have been reported in the area. Tables 11 through 13 provide an inventory of amphibians and reptiles, mammals, and birds likely or known to occur in the vicinity of Spring and Willow Spring Lakes, respectively.

Wildlife Habitat

The character of wildlife species, along with the nature of the habitat present in the planning area has undergone significant change since the time of European settlement and the subsequent clearing of forests, plowing of the prairie, and draining of wetlands for agricultural purposes. Modern practices that adversely affect wildlife and wildlife habitat include: the excessive use of fertilizers and pesticides, road salting, heavy traffic, the introduction of domestic animals, and the fragmentation and isolation of remaining habitat areas for urban and agricultural uses.

As shown on Map 13, wildlife habitat areas in the drainage area tributary to Spring and Willow Spring Lakes generally occur in association with existing surface water, wetland, and woodland resources located along the Lakes shores or within the tributary drainage areas. Such areas covered about 1,380 acres, or about 40 percent of the study area. Of this total habitat acreage within the drainage area tributary to Spring and Willow Spring Lakes,

Table 11

AMPHIBIANS AND REPTILES OF THE SPRING AND WILLOW SPRING LAKES AREA

Scientific (family) and Common Name	Scientific Name	Species Reduced or Dispersed with Full Area Urbanization	Species Lost with Full Area Urbanization
Amphibians			
Proteidae			
Mudpuppy	*Necturus maculosus maculosus*	X	- -
Ambystomatidae			
Blue-Spotted Salamander	*Ambystoma laterale*	- -	X
Spotted Salamander	*Ambystoma maculatum*		
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*	X	- -
Salamandridae			
Central Newt	*Notophthalmus viridescens louisianensi*	X	- -
Bufonidae			
American Toad	*Bufo americanus americanus*	X	- -
Hylidae			
Western Chorus Frog	*Pseudacris triseriata triseriata*	X	- -
Blanchard's Cricket Frog[a,b]	*Acris crepitans blanchardi*	X	- -
Northern Spring Peeper	*Hyla crucifer crucifer*	- -	X
Cope's Gray Tree Frog	*Hyla chrysocelis*	- -	X
Gray Tree Frog	*Hyla versicolor*	- -	X
Ranidae			
Bull Frog[c]	*Rana catesbeiana*	- -	X
Green Frog	*Rana clamitans melanota*	X	- -
Northern Leopard Frog	*Rana pipiens*	- -	X
Reptiles			
Chelydridae			
Common Snapping Turtle	*Chelydra serpentina serpentina*	X	- -
Kinosternidae			
Musk Turtle (stinkpot)	*Sternotherus odoratus*	X	- -
Emydidae			
Western Painted Turtle	*Chrysemys picta belli*	X	- -
Midland Painted Turtle	*Chrysemys picta marginata*	X	- -
Blanding's Turtle[d]	*Emydoidea blandingii*	- -	X
Trionychidea			
Eastern Spiny Softshell	*Trionyx spiniferus spiniferus*	X	- -
Colubridae			
Northern Water Snake	*Nerodia sipedon sipedon*	X	- -
Midland Brown Snake	*Storeria dekayi wrightorum*	X	- -
Northern Red-Bellied Snake	*Storeria occipitomaculata occipitomaculata*	X	- -
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*	X	- -
Chicago Garter Snake	*Thamnophis sirtalis semifasciata*	X	- -
Eastern Hognose Snake	*Heterodon platyrhinos*	- -	X
Smooth Green Snake	*Opheodrys vernalis vernalis*	- -	X
Eastern Milk Snake	*Lampropeltis triangulum triangulum*	- -	X
Western Fox Snake	*Elaphe vulpina vulpina*	- -	X

[a]*Likely to be extirpated from the watershed.*

[b]*State-designated endangered species.*

[c]*State-designated special concern species.*

[d]*State-designated threatened species.*

Source: Gary S. Casper, Geographical Distribution of the Amphibians and Reptiles of Wisconsin*, 1996, Wisconsin Department of Natural Resources, and SEWRPC.*

Table 12

MAMMALS OF THE SPRING AND WILLOW SPRING LAKES AREA

Scientific (family) and Common Name	Scientific Name
Didelphidae	
Virginia Opossum	*Didelphis virginiana*
Soricidae	
Cinereous Shrew	Sorex cinereus
Short-Tailed Shrew	*Blarina brevicauda*
Least Shrew	*Cryptotis parva*
Vespertilionidae	
Little Brown Bat	*Myotis lucifugus*
Silver-Haired Bat	*Lasisoncteris octivagans*
Big Brown Bat	*Eptesicus fuscus*
Red Bat	*Lasiurus borealus*
Hoary Bat	*Lasiurus cinereus*
Leporidae	
Cottontail Rabbit	*Sylvilgus floridanus*
Sciuridae	
Woodchuck	*Marmota monax*
Thirteen-lined Ground Squirrel (gopher)	*Spermophilus tridencemilineatus*
Eastern Chipmunk	*Tamias striatus*
Grey Squirrel	*Sciurus carolinensis*
Western Fox Squirrel	*Sciurus niger*
Red Squirrel	*Tamiasciurus hudsonicus*
Southern Flying Squirrel	*Glaucomys volans*
Castoridae	
American Beaver	*Castor canadensis*
Cricetidae	
Woodland Deer Mouse	*Peromyscus maniculatus*
Prairie Deer Mouse	*Peromyscus leucopus bairdii*
White-Footed Mouse	*Microtus pennsylvanicus*
Meadow Vole	*Microtus ochrogaster*
Common Muskrat	*Ondatra zibethicus*
Muridae	
Norway Rat (introduced)	*Rattus norvegicus*
House Mouse (introduced)	*Mus musculus*
Zapodidae	
Meadow Jumping Mouse	*Zapas hudonius*
Canidae	
Coyote	*Canis latrans*
Eastern Red Fox	*Vulpes vulpes*
Gray Fox	*Urocyon cinereoargenteus*
Procyonidae	
Raccoon	*Procyon lotor*
Mustelidae	
Least Weasel	*Mustela nivalis*
Short-Tailed Weasel	*Mustela erminea*
Long-Tailed Weasel	*Mustela frenata*
Mink	*Mustela vison*
Badger (occasional visitor)	*Taxidea taxus*
Striped Skunk	*Mephitis mephitis*
Otter (occasional visitor)	*Lontra canadensis*
Cervidae	
White-Tailed Deer	*Odecoileus virginianus*

Source: H.T. Jackson, Mammals of Wisconsin*, 1961, U.S. Department of Agriculture Integrated Taxonomic Information System, National Museum of Natural History, Smithsonian Institute, and SEWRPC.*

about 545 acres, or about 15 percent of the total drainage area, were rated as Class I, high-value habitat; about 535 acres, or 15 percent, were rated as Class II, moderate-value habitat; and about 300 acres, or about 10 percent, were rated as Class III, good-value habitat. Of these areas, a 14-acre parcel known as the Spring Lake woods, and shown on Map 12, has been identified as critical species habitat in the adopted regional natural areas and critical species habitat protection and management plan for Southeastern Wisconsin. Critical species habitat is defined as "those tracts of lands or water which support Federal- or State-listed rare, threatened, and/or endangered plant or animal species...[including]...the abiotic and biotic factors necessary for the long-term support of the critical species population." The habitat areas shown on Maps 12 and 13 are largely coincident with the Commission-delineated environmental corridors in this watershed, as shown on Map 14.

Environmental Corridors

The environmental corridors, shown on Map 14, extended over approximately 900 acres, or about 25 percent, of the drainage area tributary to Spring and Willow Spring Lakes. Primary environmental corridors covered about 780 acres, or 22 percent of the total tributary drainage area, while isolated natural resource features covered a further area of about 125 acres, or about 3 percent of the total tributary drainage area. The Commission recommends that, to the extent practicable, environmental corridor lands be considered for preservation as the process of development proceeds within the Region. Such preservation can range from outright purchase of critical lands, as in the case of the recent acquisition of the former Dunlop property adjacent to Willow Spring Lake by Waukesha County, to the incorporation of such lands into urban open space features such as stormwater retention basins, associated drainageways, and neighborhood parks.[19]

RECREATIONAL USES AND FACILITIES

Spring and Willow Spring Lakes are multi-purpose recreational use waterbodies serving many forms of recreation, including boating, swimming, and fishing during the summer months, and cross-country skiing,

[19]*SEWRPC Planning Report No. 45,* A Regional Land Use Plan for Southeastern Wisconsin: 2020, *December 1997.*

Table 13

BIRDS KNOWN OR LIKELY TO OCCUR IN THE SPRING AND WILLOW SPRING LAKES AREA

Scientific (family) and Common Name	Breeding	Wintering	Migrant
Gaviidae			
Common Loon[a]	- -	- -	X
Podicipedidae			
Pied-Billed Grebe	X	- -	X
Horned Grebe	- -	- -	X
Phalacrocoracidae			
Double-Crested Cormorant	- -	- -	X
Ardeidae			
American Bittern[a]	X	- -	X
Least Bittern[a]	X	- -	X
Great Blue Heron[a]	X	R	X
Great Egret[b]	- -	- -	X
Cattle Egret[a,c]	- -	- -	R
Green Heron	X	- -	X
Black-Crowned Night Heron[a]	- -	- -	X
Anatidae			
Tundra Swan	- -	- -	X
Mute Swan[c]	- -	- -	X
Snow Goose	- -	- -	X
Canada Goose	X	X	X
Wood Duck	X	- -	X
Green-Winged Teal	- -	- -	X
American Black Duck[a]	- -	X	X
Mallard	X	X	X
Northern Pintail[a]	- -	- -	X
Blue-Winged Teal	X	- -	X
Northern Shoveler	- -	- -	X
Gadwall	- -	- -	X
American Wigeon[a]	- -	- -	X
Canvasback[a]	- -	- -	X
Redhead[a]	- -	- -	X
Ring-Necked Duck	- -	- -	X
Lesser Scaup[a]	- -	- -	X
Greater Scaup	- -	- -	R
Common Goldeneye[a]	- -	X	X
Bufflehead	- -	- -	X
Red-Breasted Merganser	- -	- -	X
Hooded Merganser[a]	R	- -	X
Common Merganser[a]	- -	- -	X
Ruddy Duck	- -	- -	X
Cathartidae			
Turkey Vulture	X	- -	X
Accipitridae			
Osprey[a]	- -	- -	X
Bald Eagle[a,d]	- -	- -	R
Northern Harrier[a]	X	R	X
Sharp-Shinned Hawk	- -	X	X
Cooper's Hawk[a]	X	X	X

Table 13 (continued)

Scientific (family) and Common Name	Breeding	Wintering	Migrant
Accipitridae (continued)			
Northern Goshawk[a]	- -	R	X
Red-Shouldered Hawk[b]	R	- -	X
Broad-Winged Hawk	R	- -	X
Red-Tailed Hawk	X	X	X
Rough-Legged Hawk	- -	X	X
American Kestrel	X	X	X
Merlin[a]	- -	- -	X
Phasianidae			
Ring-Necked Pheasant[c]	X	X	- -
Wild Turkey	X	X	- -
Rallidae			
Virginia Rail	X	- -	X
Sora	X	- -	X
Common Moorhen	X	- -	X
American Coot	X	R	X
Gruidae			
Sandhill Crane	X	- -	X
Charadriidae			
Black-Bellied Plover	- -	- -	X
Semi-Palmated Plover	- -	- -	X
Killdeer	X	- -	X
Scolopacidae			
Greater Yellowlegs	- -	- -	X
Lesser Yellowlegs	- -	- -	X
Solitary Sandpiper	- -	- -	X
Spotted Sandpiper	X	- -	X
Upland Sandpiper[a]	R	- -	X
Semi-Palmated Sandpiper	- -	- -	X
Pectoral Sandpiper	- -	- -	X
Dunlin	- -	- -	X
Common Snipe	R	- -	X
American Woodcock	X	- -	X
Wilson's Phalarope	- -	- -	X
Laridae			
Ring-Billed Gull	- -	- -	X
Herring Gull	- -	X	X
Common Tern[e]	- -	- -	R
Caspian Tern[e]	- -	- -	R
Forster's Tern[e]	- -	- -	R
Black Tern[a]	- -	- -	X
Columbidae			
Rock Dove[c]	X	X	- -
Mourning Dove	X	X	X
Cuculidae			
Black-Billed Cuckoo	X	- -	X
Yellow-Billed Cuckoo[a]	X	- -	X
Strigidae			
Eastern Screech Owl	X	X	- -
Great Horned Owl	X	X	- -
Snowy Owl	- -	R	- -
Barred Owl	R	R	- -
Long-Eared Owl[a]	- -	X	X
Short-Eared Owl[a]	- -	R	X
Northern Saw-Whet Owl	- -	- -	X

Table 13 (continued)

Scientific (family) and Common Name	Breeding	Wintering	Migrant
Caprimulgidae			
Common Nighthawk	X	- -	X
Whippoorwill	- -	- -	X
Apodidae			
Chimney Swift	X	- -	X
Trochilidae			
Ruby-Throated Hummingbird	X	- -	X
Alcedinidae			
Belted Kingfisher	X	X	X
Picidae			
Red-Headed Woodpecker[a]	X	R	X
Red-Bellied Woodpecker	X	X	- -
Yellow-Bellied Sapsucker	- -	R	X
Downy Woodpecker	X	X	- -
Hairy Woodpecker	X	X	- -
Northern Flicker	X	R	X
Tyrannidae			
Olive-Sided Flycatcher	- -	- -	X
Eastern Wood Pewee	X	- -	X
Yellow-Bellied Flycatcher[a]	- -	- -	X
Acadian Flycatcher[b]	R	- -	X
Alder Flycatcher	R	- -	X
Willow Flycatcher	X	- -	X
Least Flycatcher	R	- -	X
Eastern Phoebe	X	- -	X
Great Crested Flycatcher	X	- -	X
Eastern Kingbird	X	- -	X
Alaudidae			
Horned Lark	X	X	X
Hirundinidae			
Purple Martin[a]	X	- -	X
Tree Swallow	X	- -	X
Northern Rough-Winged Swallow	X	- -	X
Bank Swallow	X	- -	X
Cliff Swallow	X	- -	X
Barn Swallow	X	- -	X
Corvidae			
Blue Jay	X	X	X
American Crow	X	X	X
Paridae			
Tufted Titmouse	R	R	- -
Black-Capped Chickadee	X	X	X
Sittidae			
Red-Breasted Nuthatch	- -	X	X
White-Breasted Nuthatch	X	X	- -
Certhiidae			
Brown Creeper	- -	X	X
Troglodytidae			
Carolina Wren	- -	- -	R
House Wren	X	- -	X
Winter Wren	- -	- -	X
Marsh Wren	X	- -	X

Table 13 (continued)

Scientific (family) and Common Name	Breeding	Wintering	Migrant
Regulidae			
Golden-Crowned Kinglet	- -	X	X
Ruby-Crowned Kinglet[a]	- -	- -	X
Blue-Gray Gnatcatcher	X	- -	X
Eastern Bluebird	X	- -	X
Veery[a]	X	- -	X
Gray-Cheeked Thrush	- -	- -	X
Swainson's Thrush	- -	- -	X
Hermit Thrush	- -	- -	X
Wood Thrush[a]	X	- -	X
American Robin	X	X	X
Mimidae			
Gray Catbird	X	- -	X
Brown Thrasher	X	- -	X
Bombycillidae			
Bohemian Waxwing	- -	R	- -
Cedar Waxwing	X	X	X
Laniidae			
Northern Shrike	- -	X	X
Loggerhead Shrike[e]	- -	- -	R
Sturnidae			
European Starling[c]	X	X	X
Vireonidae			
Bell's Vireo	- -	- -	R
Solitary Vireo	- -	- -	X
Yellow-Throated Vireo	X	- -	X
Warbling Vireo	X	- -	X
Philadelphia Vireo	- -	- -	X
Red-Eyed Vireo	X	- -	X
Parulidae			
Blue-Winged Warbler	X	- -	X
Golden-Winged Warbler[a]	- -	- -	X
Tennessee Warbler[a]	- -	- -	X
Orange-Crowned Warbler	- -	- -	X
Nashville Warbler[a]	- -	- -	X
Northern Parula	- -	- -	X
Yellow Warbler	X	- -	X
Chestnut-Sided Warbler	- -	- -	X
Magnolia Warbler	- -	- -	X
Cape May Warbler[a]	- -	- -	X
Black-Throated Blue Warbler	- -	- -	X
Yellow-Rumped Warbler	- -	R	X
Black-Throated Green Warbler	- -	- -	X
Cerulean Warbler[b]	R	- -	X
Blackburnian Warbler	- -	- -	X
Palm Warbler	- -	- -	X
Bay-Breasted Warbler	- -	- -	X
Blackpoll Warbler	- -	- -	X
Black-and-White Warbler	- -	- -	X
Prothonotary Warbler[a]	- -	- -	R
American Redstart	X	- -	X
Ovenbird	X	- -	X
Northern Waterthrush	- -	- -	X

Table 13 (continued)

Scientific (family) and Common Name	Breeding	Wintering	Migrant
Parulidae (continued)			
Connecticut Warbler[a]	- -	- -	X
Mourning Warbler	R	- -	X
Common Yellowthroat	X	- -	X
Wilson's Warbler	- -	- -	X
Kentucky Warbler[b]	- -	- -	R
Canada Warbler	- -	- -	X
Hooded Warbler[b]	R	- -	R
Thraupidae			
Scarlet Tanager	X	- -	X
Cardinalidae			
Northern Cardinal	X	X	- -
Rose-Breasted Grosbeak	X	- -	X
Indigo Bunting	X	- -	X
Emberizidae			
Dickcissel[a]	R	- -	X
Eastern Towhee	X	- -	X
American Tree Sparrow	- -	X	X
Chipping Sparrow	X	- -	X
Clay-Colored Sparrow	R	- -	X
Field Sparrow	X	- -	X
Vesper Sparrow[a]	X	- -	X
Savannah Sparrow	X	- -	X
Grasshopper Sparrow[a]	X	- -	X
Henslow's Sparrow[b]	R	- -	X
Fox Sparrow	- -	R	X
Song Sparrow	X	X	X
Lincoln's Sparrow	- -	- -	X
Swamp Sparrow	X	X	X
White-Throated Sparrow	- -	R	X
White-Crowned Sparrow	- -	- -	X
Dark-Eyed Junco	- -	X	X
Lapland Longspur	- -	R	X
Snow Bunting	- -	R	X
Icteridae			
Bobolink[a]	X	- -	X
Red-Winged Blackbird	X	X	X
Eastern Meadowlark[a]	X	R	X
Western Meadowlark[a]	R	- -	X
Yellow-Headed Blackbird	R	- -	X
Rusty Blackbird	- -	R	X
Common Grackle	X	X	X
Brown-Headed Cowbird	X	R	X
Orchard Oriole[a]	R	- -	R
Baltimore Oriole	X	- -	X
Fringillidae			
Purple Finch	- -	X	X
Common Redpoll	- -	X	X
Pine Siskin[a]	- -	X	X
American Goldfinch	X	X	X
House Finch	X	X	X
Evening Grosbeak	- -	X	X
Passeridae			
House Sparrow[c]	X	X	- -

Table 13 (continued)

NOTE: Total number of bird species: 219
Number of alien, or nonnative, bird species: 7 (3 percent)

Breeding: Nesting species
Wintering: Present January through February
Migrant: Spring and/or fall transient

X - Present, not rare
R - Rare

[a]*State-designated species of special concern. Fully protected Federal and State laws under the Migratory Bird Act.*

[b]*State-designated threatened species.*

[c]*Alien, or nonnative, bird species.*

[d]*Federally designated threatened species.*

[e]*State-designated endangered species.*

Source: *Samuel D. Robbins, Jr.,* Wisconsin Birdlife, Population & Distribution, Past and Present*, 1991; John E. Bielefeldt, Racine County Naturalist; Wisconsin Department of Natural Resources; and SEWRPC.*

ice fishing, and ice skating during the winter months. The Lakes are used year round as visual amenities—walking, bird-watching, and picnicking being popular passive recreational uses of the waterbodies. Typical recreational usage of the Lakes is summarized in Table 14. In addition, observers at Willow Spring Lake report up to 20 anglers, within a range of between 2 and 20 individuals, present on the Lake during the winter ice fishing season, with the highest numbers being reported on weekend afternoons.

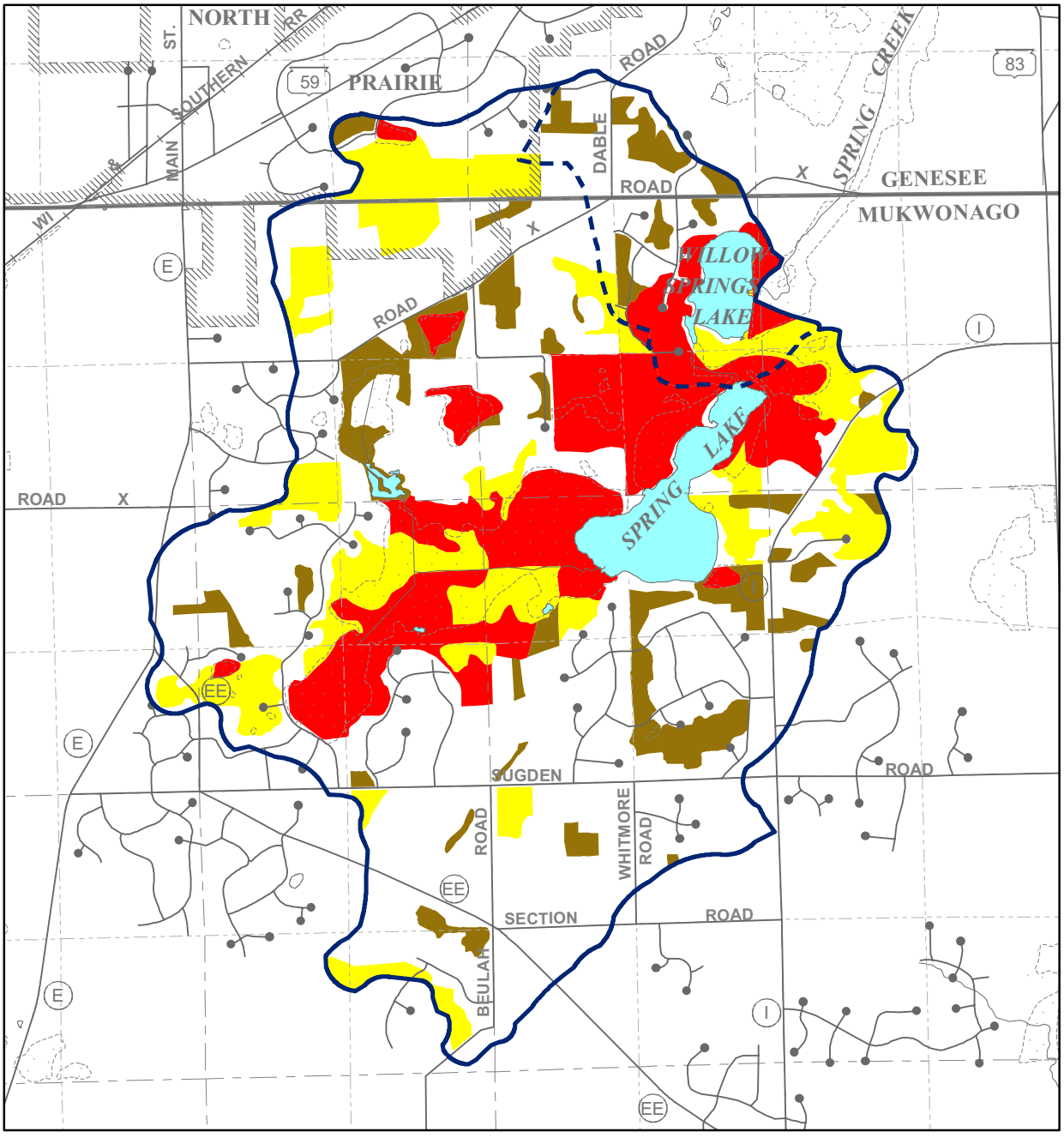
Public recreational boating access is available at Willow Spring Lake. The public recreational boating access site, owned by the Town of Mukwonago, is located on the western side of the Lake, off of Willow Springs Drive, as shown on Map 3. Public parking currently provided at this site, and the access is considered to be consistent with the access standards established by the Wisconsin Department of Natural Resources pursuant to Chapter NR 1 of the *Wisconsin Administrative Code*. In contrast, Spring Lake has two walk-in public access points on its southern and southeastern shores. Walk-in access to Spring Lake is available from a grassed parking area located off of CTH I, as shown on Map 2. An additional access site exists at Lakecrest Court. This site, too, is an unimproved, walk-in access site. These access points are not considered as meeting the Chapter NR 1 public recreational boating access standards.

A boat survey was conducted by Commission staff during June 2001, as summarized in Table 15. This survey indicated that 53 boats were either moored in the water or stored on land adjacent to Spring Lake. The types of boats included pontoons, paddleboats, fishing boats, canoes, and sailboats. On Willow Spring Lake, eighteen watercraft were either moored in the water or stored on land adjacent to the Lake. The types of boats included paddleboats, rowboats, canoes, and a kayak. Willow Spring Lake is a nonmotorized boating lake. A boating ordinance restricts the use of motors on Willow Spring Lake to electric trolling motors.[20]

[20]*Section 30.635,* Wisconsin Statutes*, generally prohibits operation of motorboats in excess of slow-no-wake speed on lakes of 50 acres or less in areal extent having public access. The provisions of this Section is applicable on Willow Spring Lake.*

Map 13

WILDLIFE HABITAT AREAS WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES: 1985



Class I, High Value Habitat

Class II, Medium Value Habitat

Class III, Good Value Habitat

Surface Water

Total Tributary Boundary

Direct Tributary Boundary

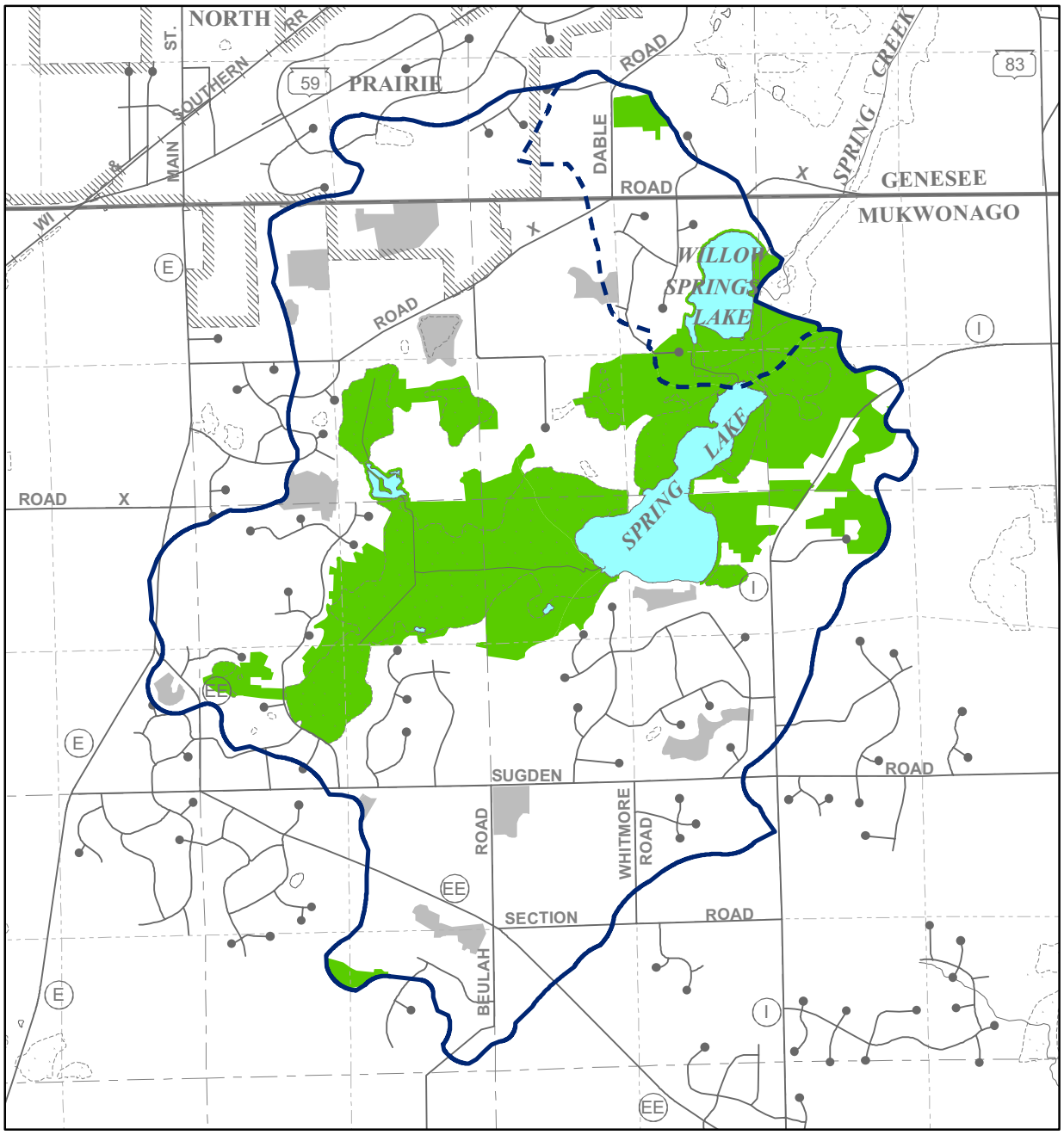
N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

Map 14

ENVIRONMENTALLY VALUABLE AREAS WITHIN THE DRAINAGE AREA TRIBUTARY TO SPRING AND WILLOW SPRING LAKES: 2000



Primary Environmental Corridor
Secondary Environmental Corridor
Isolated Natural Resource Area
Surface Water
Total Tributary Boundary
Direct Tributary Boundary

N

0 0.25 0.5 0.75 1 Miles

Source: SEWRPC.

Table 14

RECREATIONAL USE SURVEY ON SPRING AND WILLOW SPRING LAKES: 2001

Spring Lake								
	Weekday Participants							
Date and Time	Fishing	Pleasure Boating	Skiing	Sailing	Swimming	Canoeing	Other	Total
June 22, 2001								
10:00 a.m. to 11:00 a.m.	1	0	0	0	0	0	0	1
1:30 p.m. to 2:30 p.m.	2	0	0	0	4	0	0	6
Total	3	0	0	0	4	0	0	7
Percent	43	0	0	0	57	0	0	100

	Weekend Participants							
Date and Time	Fishing	Pleasure Boating	Skiing	Sailing	Swimming	Canoeing	Other	Total
July 28, 2001								
10:00 a.m. to 11:00 a.m.	0	0	0	0	0	3	1	4
1:30 p.m. to 2:30 p.m.	0	2	0	0	2	3	1	8
Total	0	2	0	0	2	6	2	12
Percent	0	17	0	0	17	50	17	100

Willow Spring Lake							
	Weekday Participants						
Date and Time	Fishing	Rowing/ Boating	Sailing	Swimming	Canoeing	Other	Total
July 17, 2001							
10:00 a.m. to 11:00 a.m.	0	0	0	0	1	0	1
2:00 p.m. to 3:00 p.m.	0	1	0	1	0	0	2
Total	0	1	0	1	1	0	3
Percent	0	33	0	33	33	0	100

	Weekend Participants						
Date and Time	Fishing	Rowing/ Boating	Sailing	Swimming	Canoeing	Other	Total
July 8, 2001							
10:30 a.m. to 11:30 a.m.	7	0	0	3	0	2	12
12:10 p.m. to 1:10 p.m.	2	1	0	0	0	0	3
Total	9	1	0	3	0	2	15
Percent	60	7	0	20	0	13	100

Source: SEWRPC.

Table 15

WATERCRAFT ON SPRING AND WILLOW SPRING LAKES: JUNE 2001

Waterbody	Type of Watercraft								
	Power Boat	Fishing Boat	Pontoon Boat	Canoe	Paddle Boat	Sailboat	Kayak	Personal Watercraft	Total
Spring Lake	- -	17	11	10	10	5	- -	- -	53
Willow Spring Lake	- -	11	- -	4	4	1	1	- -	21

Source: SEWRPC.

Shoreline Protection Structures

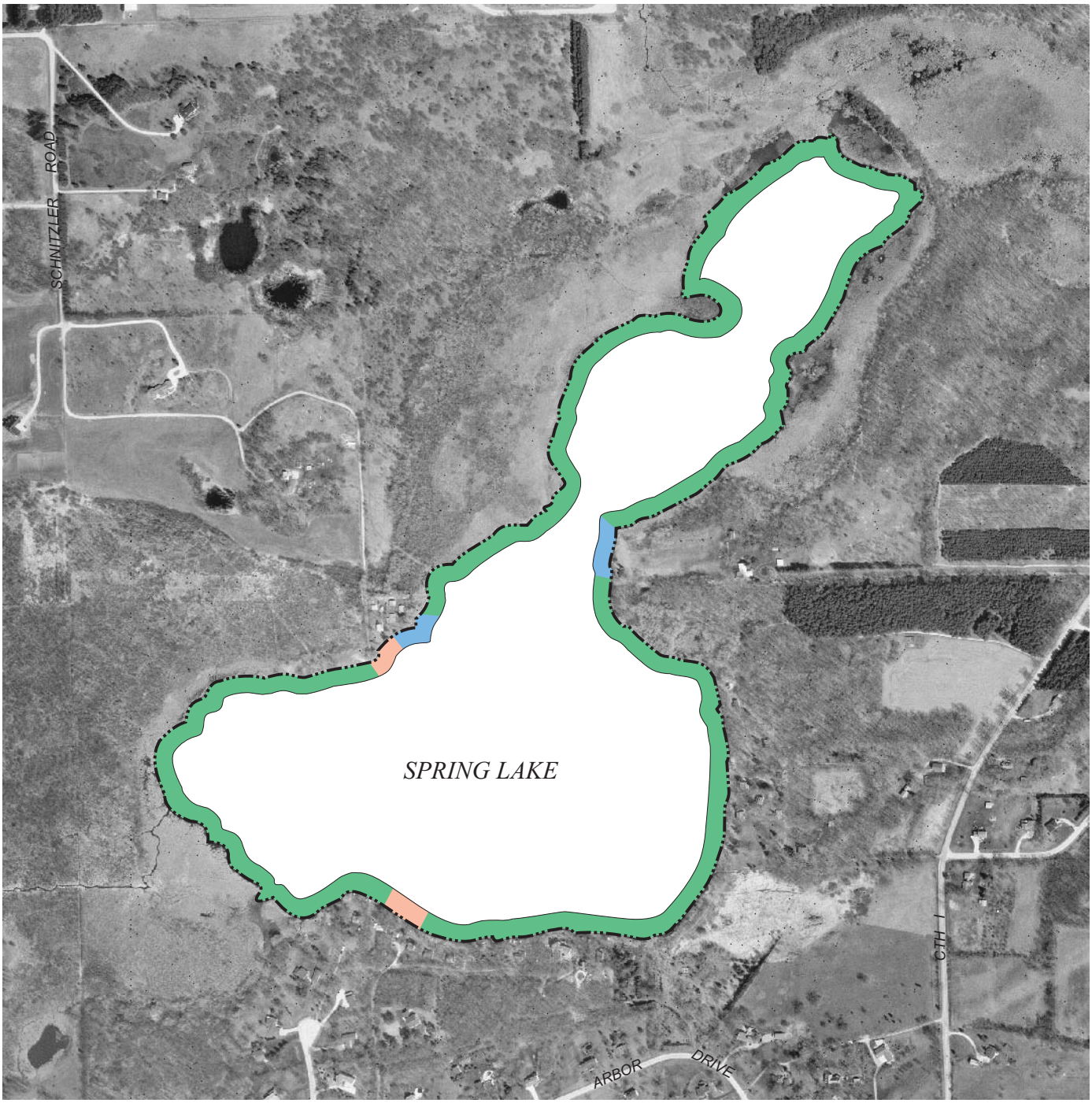
Erosion of shorelines results in the loss of land, damage to shoreland infrastructure, and interference with lake access and use. Wind-wave erosion, ice movement, and motorized boat traffic usually cause such erosion. A survey of the Spring Lake and Willow Spring Lake shorelines, conducted by Commission staff during June 2001, indicated that a majority of the Spring Lake and Willow Spring Lake shorelines remain in a natural condition, without shoreline protection structures. Small sections of the shoreline of Spring Lake are protected with riprap or bulkheads, as shown on Map 15, while the shoreline of Willow Spring Lake is almost completely natural with the exception of the earthen dam, which is grassed, as shown on Map 16. Typical shoreland protection structures are illustrated in Figure 1. Shoreline erosion is not considered a problem on Spring and Willow Spring Lakes.

Local Ordinances

Boating traffic on both Lakes is governed by state law as set forth in Chapter 30, *Wisconsin Statutes*. Based upon the surface area of Spring Lake, the Lake supports motorized boating traffic. Motorized boating traffic is further regulated by Town of Mukwonago ordinance, which is reproduced as Appendix C. No motorized vessels are allowed to be operated on Willow Spring Lake.

Map 15

SHORELINE PROTECTION STRUCTURES ON SPRING LAKE: 2001



DATE OF PHOTOGRAPHY: MARCH 2000

RIPRAP

BULKHEAD

NATURAL

GRAPHIC SCALE

0 350 700 FEET

Source: SEWRPC

Map 16

SHORELINE PROTECTION STRUCTURES ON WILLOW SPRING LAKE: 2001

DATE OF PHOTOGRAPHY: MARCH 2000

BEACH

RIPRAP

NATURAL

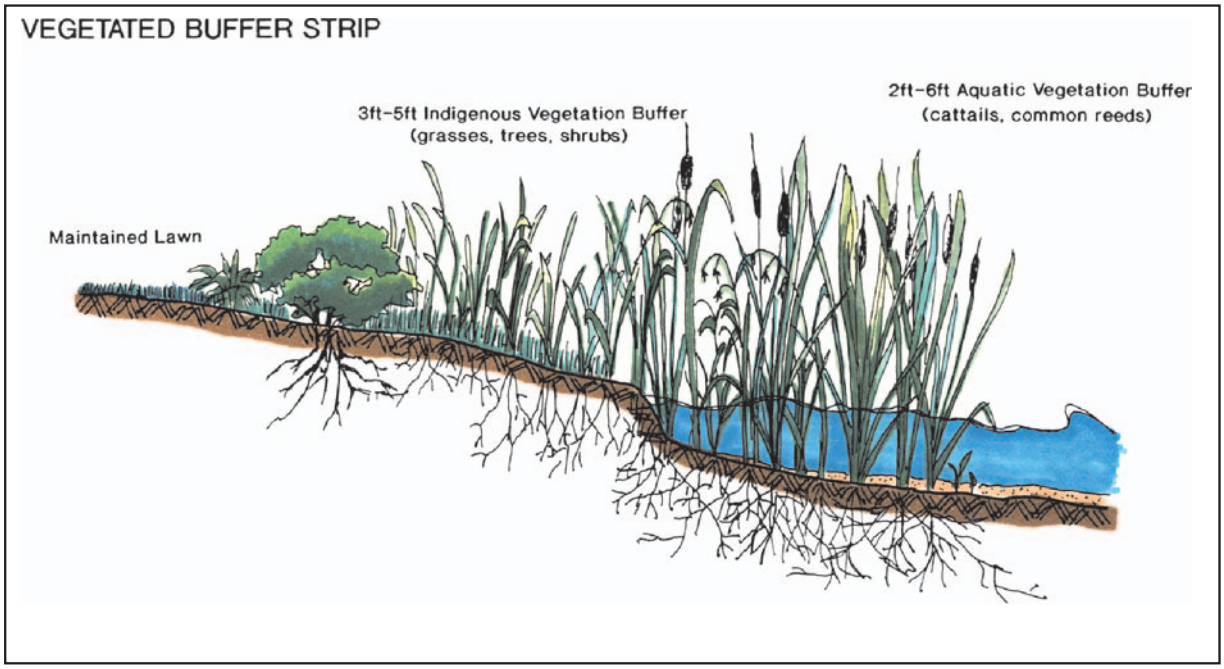
GRAPHIC SCALE

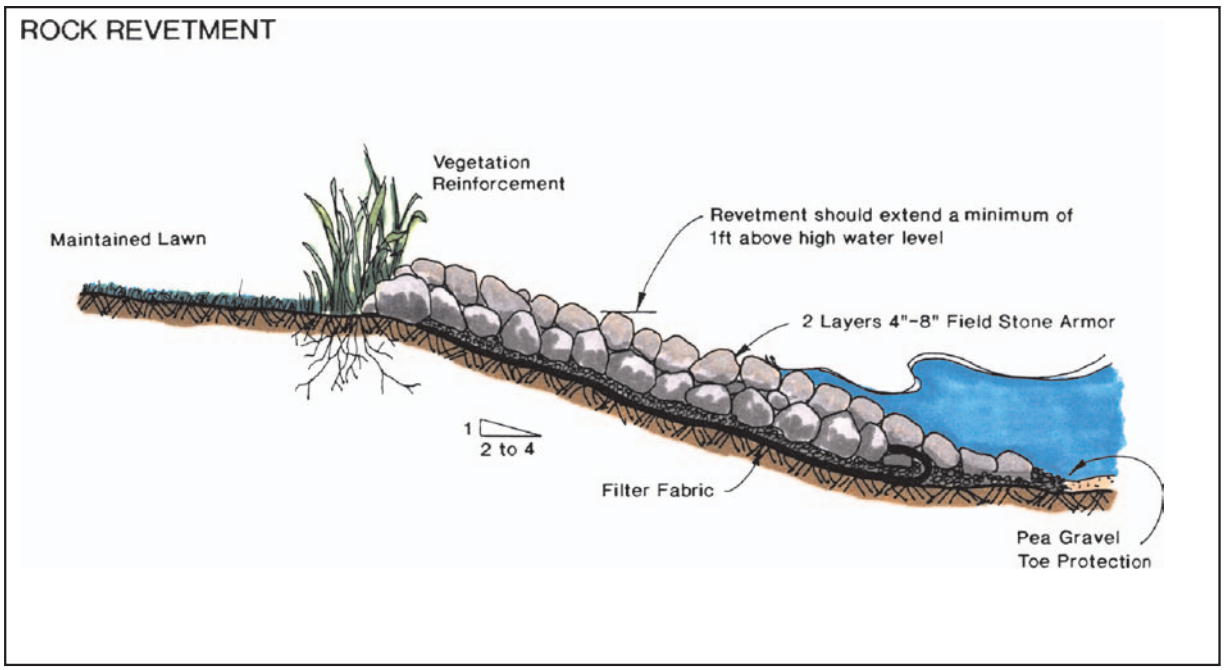
0 200 400 FEET

Source: SEWRPC.

Figure 1

RECOMMENDED ALTERNATIVES FOR SHORELINE EROSION CONTROL FOR SPRING AND WILLOW SPRING LAKES





NOTE: Design specifications shown herein are for typical structures. The detailed design of shoreline protection structures must be based upon analysis of local conditions.

Source: SEWRPC.

Chapter III

LAKE USE PROBLEMS AND ISSUES

INTRODUCTION

Although the Spring Lake and Willow Spring Lake are in relatively good condition and are capable of supporting a variety of water uses, there are a number of existing and potential future problems and issues that should be addressed in this lake protection plan. These problems, or issues of concern, include protection of ecologically valuable areas, management of aquatic plant communities and fisheries, control of nonpoint source pollution and construction site erosion, protection of lake water quality, and promotion of public recreational use and boating access to the Lakes. While the organizational structures currently exist within the community to support lake management initiatives, some consideration should also be given to extension of the Spring Brook Watershed Lake Management District to Spring Lake in the event that significant, ongoing lake management actions are considered (see Chapter IV). For this reason, organizational issues are considered as an element of this plan.

PROTECTION OF ECOLOGICALLY VALUABLE AREAS

The ecologically valuable areas within the drainage area tributary to Spring Lake and Willow Spring Lake, as documented in Chapter II, include wetlands, woodlands, and wildlife habitat. Most of these areas are included in the lands designated as environmental corridor lands or isolated natural resource features that create much of the ambience of Southeastern Wisconsin.[1] The environmental corridors in the drainage area tributary to Spring and Willow Spring Lakes, together with the isolated natural resource features, contain almost all of the best remaining woodlands, wetlands, and wildlife habitat in the Region. The wetlands of the Spring and Willow Spring Lakes area, as noted in Chapter II, contain a diverse plant community that provide important habitat for wildlife in addition to contributing to the scenic vistas that characterize these Lakes. The wetlands help to absorb floodwaters, and serve as nutrient filters and buffers by retaining sediments and nonpoint source pollutants that protect the Lakes from urban runoff. Thus, the protection of these resources from additional intrusion by incompatible land uses, which degrade and destroy the environmental values of these sites, and the preservation of the corridors, are important issues that should be considered.

Within the Lake basins, critical sites include the fish-spawning habitat, macrophyte beds, especially those containing a diverse flora, and the shoreline areas supporting productive aquatic habitat. Protection of these areas also is an important issue that should be considered.

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[1]*The range of benefits to be derived from a sound natural resources bases within Southeastern Wisconsin is summarized in SEWRPC Planning Report No. 42,* A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, *September 1997.*

AQUATIC PLANT AND FISHERIES MANAGEMENT

Aquatic Plants

Excessive aquatic plant growth in Spring and Willow Spring Lakes can impede boating traffic and other in-lake uses, such as swimming. At various sites around Spring Lake and Willow Spring Lake, as shown in Tables 6 and 7, growths of Eurasian water milfoil, coontail, and muskgrass equaled or exceeded a density rating of two indicating moderate to high densities of these aquatic plants. With the exception of muskgrass, these plants can grow to the surface of the water, restricting boating, angling, and swimming opportunities. In addition, the abundance of plants can adversely affect riparian property values,[2] as well as the aesthetic enjoyment of the residents of and visitors to the Lakes.[3]

The presence of Eurasian water milfoil in Spring and Willow Spring Lakes represents an important consideration with respect to aquatic plant management in the Lakes. Eurasian water milfoil often outcompetes native aquatic plants and dominates the plant communities of lakes in Southeastern Wisconsin, to the detriment of fish and wildlife populations, and native plant species. The dominance of Eurasian water milfoil in aquatic ecosystems in Southeastern Wisconsin also degrades the natural resource base and commonly interferes with human recreational and aesthetic use of the natural resources. As discussed in Chapter II, this aquatic plant is widespread in Spring Lake and Willow Spring Lake and, therefore, its monitoring and management is an issue that should be considered. Periodic aquatic plant surveys should be considered as a means of monitoring the distribution of nuisance species.

Fisheries

Based upon the fisheries surveys conducted by the Wisconsin Department of Natural Resources as well as on the recreational use surveys conducted by Commission staff, and set forth in summary form in Chapter II, it would appear that the fishery in Willow Spring Lake is healthy and diverse. Few data have been reported for Spring Lake. As angling is a popular recreational activity on both Lakes, identification of the current state of the fishery on the Lakes is an important issue that should be considered.

NONPOINT SOURCE POLLUTION AND CONSTRUCTION SITE EROSION CONTROL

Erosion during construction and delivery of nonpoint sourced pollutants associated with new urban development in the drainage area tributary to Spring Lake and Willow Spring Lake represents potentially significant threats to the Lakes' water quality. Based upon recommendations set forth in the adopted county development plans, future development of open lands within the drainage area tributary to the Spring Lake and Willow Spring Lake is expected to occur. Additionally, unplanned development or redevelopment of existing lots may occur and potentially result in impacts on lake water quality. Hence, control of nonpoint source pollution and construction site erosion remains an important issue to be considered.

SURFACE WATER QUALITY PROTECTION

As of 2002, the surface water quality of Spring Lake and Willow Spring Lake was reported to be poor to good, depending upon the water quality indicators and period of analysis. As described in Chapter II, both Spring Lake and Willow Spring Lake were within the mesotrophic to eutrophic range, indicating that nuisance growths of algae and plants can be expected. The enriched nature of these Lakes have led citizens within the Spring Brook

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[2] *H.J. Michael, K.J. Boyle, and R. Bouchard,* Water Quality Affects Property Prices: A Case Study of Selected Maine Lakes, *Maine Agricultural and Forest Experiment Station Miscellaneous Report 398, University of Maine, Orono, 1996.*

[3] *J.A. Thornton, "Perceptions of Public Waters: Water Quality and Water Usage in Wisconsin," In: T. van Valey, S.R. Krull and L. Walker,* The Small City and Regional Community: Volume 10, Proceedings of the 1992 Conference, Western Michigan University, *Foundation Press, Stevens Point, pp. 469-478, 1993.*

Watershed Lake Management District and members of the Spring Lake of Waukesha County Property Owners Association, Inc., to express concerns regarding water quality in the Lakes, principally related to water clarity and excessive aquatic plant growth. These concerns are documented in Appendix D, which sets forth the results of a community survey conducted as part of this planning program, and which highlights the central aspect of water quality among community concerns, with a plurality of respondents indicating that water quality had deteriorated during their period of residence on the Lakes. Consequently, protection of water quality and stormwater management are important issues to be considered.

PUBLIC RECREATIONAL USE AND PROVISION OF BOATING ACCESS

Overcrowding and excessive recreational boating use create problems in many lakes in the Southeastern Wisconsin Region, especially those offering high-quality recreational opportunities within a one- to two-hour drive of the Chicago-Milwaukee metropolitan area. Given the relatively small surface areas of Spring Lake and Willow Spring Lake, and limited parking at, and the nature of, the access sites, the potential for the occurrence of problems due to increased or inappropriate boating pressure is considered to be slight. Nevertheless, local use of the Lakes for water-based recreation could result in potentially significant boating pressure should the locations of these Lakes become better known.

Current public recreational boating standards as set forth in Sections NR 1.91(4) and NR 1.91(5) of the *Wisconsin Administrative Code*, establish minimum and maximum standards for public boating access development, respectively, to qualify waters for resource enhancement services provided by the Wisconsin Department of Natural Resources. Based upon these standards, Willow Spring Lake would be required to have one carry-in access site with parking for five vehicles, for lakes of less than 50 open water acres, the minimum and maximum standards are the same, plus one handicapped accessible unit. Spring Lake would be required to have a minimum of five car-trailer units and a maximum of seven car-trailer units, plus one handicapped accessible unit. Where exceptional circumstances exist, Section NR 1.91(6) of the *Wisconsin Administrative Code* does provide procedures for determining alternative public access standards which may differ from the minimum and maximum standards set forth in Sections NR 1.91(4) and NR 1.91(5). Such alternative standards are determined on a site-specific basis, in cases where unusual environmental or development factors preclude provision of access within the standards.

As noted in Chapter II, Willow Spring Lake has been determined by the Wisconsin Department of Natural Resources to have adequate public recreational boating access. This access is provided through an access site on the western shore of Willow Spring Lake. Spring Lake has two carry-in access sites: one on the southern side of the Lake and one at the southeastern corner of the Lake. Parking at the Spring Lake sites is limited. Consequently, Spring Lake currently fails to conform to current State standards. Hence, provision of adequate public recreational boating access to the Spring Lakes is an issue to be considered.

In addition to public recreational boating access, Waukesha County recently has acquired the former Dunlop and Neubert properties and portions of the Smart property, located to the east of Willow Spring Lake, as an element in their natural area holdings. These lands include those wetland and upland areas situated along the eastern and southeastern shoreline of Willow Spring Lake, including lands riparian to both the Lake and Spring Creek draining from Willow Spring Lake. These lands are situated within a primary environmental corridor delineated by the Southeastern Wisconsin Regional Planning Commission. In addition, these lands include a portion of the lands, adjacent to Willow Spring Lake, that have been designated as Class I, high-value wildlife habitat by the Commission. The lands are currently vacant lands zoned as C-1 conservancy by Waukesha County. The properties are intended to serve as a focal point to encourage public knowledge and understanding of shoreland ecosystems through the development of public informational programming, focused primarily on youth both within the educational systems of the Towns of Genesee and Mukwonago, and through the active participation of nongovernmental organizations. Waukesha County proposes to catalyze this programming in consultation with relevant institutions and agencies. Thus, public informational and educational programming also are important issues to be considered.

INSTITUTIONAL DEVELOPMENT

As the Spring and Willow Spring Lakes community seeks a more active role in the management of the Lakes, it is essential that an adequate institutional base to support such activities be developed. To this end, a Chapter 33, *Wisconsin Statutes*, public inland lake protection and rehabilitation district has been created to encompass lands riparian to Willow Spring Lake, and an incorporated lake association, the Spring Lake of Waukesha County Property Owners Association, Inc., exists, encompassing an active membership that includes citizens from the Spring Lake community. Community-based lake management activities on the Lakes are being carried out by the Spring Lake of Waukesha County Property Owners Association, Inc., and the Spring Brook Watershed Lake Management District. As part of the civic discussion at the time of its formation, the Spring Brook Watershed Lake Management District was structured in such a way as to facilitate its expansion to ultimately service Spring Lake should landowners riparian to Spring Lake determine to petition for attachment to the District. While this eventuality is not expected to occur in the immediate future, the development of an adequate institutional structure to serve Spring and Willow Spring Lakes is a long-term issue of concern.

Chapter IV

ALTERNATIVE AND RECOMMENDED LAKE PROTECTION MEASURES

INTRODUCTION

Chapter III described six issues of concern to be considered as part of this lake protection and recreational use plan. These issues are related to: 1) ecologically valuable areas; 2) aquatic plants and fisheries; 3) construction site erosion and nonpoint source pollution; 4) surface water quality; 5) public recreational use and boating access; and 6) institutional development. Following a brief summary of the ongoing lake management program activities, alternatives and recommended measures to address each of these issues and concerns are described in this chapter.

PAST AND PRESENT LAKE MANAGEMENT ACTIONS

The residents of the Spring Lake and Willow Spring Lake, in conjunction with the Town of Mukwonago, have long recognized the importance of informed and timely action in the management of Spring and Willow Spring Lakes. The initial action in this regard was the formation of the Spring Lake of Waukesha County Property Owners Association, Inc., a Chapter 181 nonstock, not-for-profit Wisconsin corporation, during 1984. This Association provides a forum for many of the lake management activities of the Spring Lake residents. Subsequently, during 1998, the Willow Spring Lake community petitioned Waukesha County for the formation of a Chapter 33 public inland lake protection and rehabilitation district, a special purpose unit of government, which was duly created to encompass properties riparian to Willow Spring Lake.

The Lake Management District and the Association are currently enrolled in the water-quality monitoring program conducted under the auspices of the Wisconsin Department of Natural Resources Self-Help Monitoring Program, and volunteers from the Willow Spring Lake community are participating in the University of Wisconsin-Extension Adopt-A-Lake Program. Presently, both the Association and District are actively pursuing public participation opportunities relating to land use and stormwater management in the vicinity of the Lakes.

Members and directors of the Spring Lake of Waukesha County Property Owners Association, Inc., regularly attend meetings of the Town of Mukwonago Plan Commission and Town Board regarding the development of plans and lands within the drainage area tributary to the Lakes. The Association was an active participant in the planning process with respect to the establishment of the Whitetail Meadows Subdivision within the Town, working cooperatively with the Town and the developer in developing plans to ensure that nonpoint source pollutants and construction impacts from that development would not negatively impact Spring Lake. In like manner, the Association is currently an active participant in the public process relating to the preparation of a "smart growth" plan for the Town of Mukwonago. The Spring Lake of Waukesha County Property Owners Association, Inc., also maintains an active public information program, holding an annual membership meeting open to all Spring Lake community residents and interested parties, to answer questions and provide information

to persons interested in Spring Lake and its watershed. Members of the Board of Directors of the Association also regularly attend meetings of the Spring Brook Watershed Lake Management District Board of Commissioners.

The Spring Brook Watershed Lake Management District also maintains an active engagement with the Town of Mukwonago, as the municipality with the largest percentage of the equalized valuation of the District, through the Town-appointed Commissioner. Similarly, the District maintains a close liaison with Waukesha County. Since its inception in 1998, the District has worked closely with Waukesha County in the acquisition of lands east of Willow Spring Lake, the former Dunlop and Neubert properties, and has obtained ownership of the Laitsch Dam, impounding Willow Spring Lake. The District, with the assistance of the Boy Scouts of America and local landowners, has collaborated with the Town of Mukwonago in improving and landscaping the public recreational boating access site, which is owned and operated by the Town on Willow Spring Lake. Volunteers from within the Willow Spring Lake community are active participants in volunteer lake monitoring programs, as described above, and the District includes an active informational program as part of its regular agenda. Water clarity reports are a regular feature of the annual membership meetings of the District.

ECOLOGICALLY VALUABLE AREAS AND AQUATIC PLANTS

Spring Lake and Willow Spring Lake, and their tributary drainage areas, contain ecologically valuable areas, including diverse aquatic and wetland vegetation and substrates suitable for fish spawning, located within and immediately adjacent to the Lakes. As described in Chapter III, the potential problems associated with ecologically valuable areas in and near the Spring Lake and Willow Spring Lake include the potential loss of wetlands and other important ecologically valuable areas due to urbanization or other encroachments; and the degradation of wetlands and aquatic habitat due to the presence of invasive species, including Eurasian water milfoil and purple loosestrife.

Array of Protection Measures

Three measures to protect and maintain the biodiversity of the Spring Lake and Willow Spring Lake and their direct tributary drainage area have been identified as potentially viable: 1) land management measures, 2) in-lake management measures, and 3) citizen informational and educational measures.

Land Management Measures

The recommended future land use plan for the drainage area tributary to Spring Lake and Willow Spring Lake is set forth in the adopted regional land use plan and, for those portions of the drainage area located within Waukesha County, in the county development plan.[1] Those plans recommend the preservation of environmental corridor lands in essentially natural, open uses. Within the drainage area tributary to the Spring and Willow Spring Lakes, these lands consist of primary environmental corridors and isolated natural resource features.

In addition to the recommendations set forth in the adopted regional land use plan, the Waukesha County development plan specifically recommends that, with respect to environmental corridor lands and isolated natural resource features such as those that occur within the drainage area tributary to Spring Lake and Willow Spring Lake, protections be afforded through placement of these lands in appropriate zoning districts, depending on the type and character of the natural resource to be preserved and protected. The County development plan further recommends incorporation of environmental corridor lands into the urban stormwater management systems, including associated detention basins and drainageways, and neighborhood parks where possible and feasible.

Currently, most of the wetlands and other ecologically valuable lands adjacent to the Spring Lake and Willow Spring Lake and within the tributary drainage area are included in primary environmental corridors and isolated

[1] *SEWRPC Planning Report No. 45,* A Regional Land Use Plan for Southeastern Wisconsin: 2020*, December 1997; and SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

natural resource features. Many of the wetlands, however, have a history of prior or current disturbance that, to varying extents, could affect the structure and functioning of these valuable areas.

The existing zoning of the lands within the total tributary drainage area to the Spring and Willow Spring Lakes is generally consistent with the recommended future land use plan set forth in the regional land use and county development plans. Notwithstanding, the recent public acquisition of wetlands and uplands east of Willow Spring Lake by Waukesha County in cooperation with the Spring Brook Watershed Lake Management District and Waukesha Land Conservancy have protected these areas, which provide much of the ambience of the Willow Spring Lake community setting. In addition to these sites, the adopted regional natural areas and critical species habitat protection and management plan recommends the public and/or private acquisition of the Spring Lake sedge meadow and fens, located on the northeastern shorelands of Spring Lake, and Spring Lake woods, located adjacent to the eastern boundary of the wetland complex that forms the headwaters of Spring Lake, shown as critical species habitat on Map 12, respectively, the former being considered a natural area of countywide or regional significance. Acquisition of the 104-acre Spring Lake sedge meadow and fens by Waukesha County also is recommended in the adopted county park and open space plan. The natural areas and critical species habitat protection and management plan recommends that the Waukesha Land Conservancy acquire the 14-acre Spring Lake woods.

In-Lake Management Measures

The presence of nonnative and nuisance aquatic plant species within the Lakes and along their shorelines is indicative of a further loss of ecosystem integrity and function, affecting submergent and emergent lacustrine vegetation. Various in-lake management actions may be considered to mitigate and manage the consequences of aquatic habitat degradation in Spring and Willow Spring Lakes. Generally, aquatic plant management measures, designed to minimize the environmental and recreational impacts of degraded habitat, are classed into four groups: physical measures, which include lake bottom coverings and water level management; mechanical measures which include harvesting and manual removal; chemical measures, which include the use of aquatic herbicides; and biological control measures, which include the use of various organisms, including insects. All of these controls are regulated and require a State permit.[2] Costs range from minimal for manual removal of plants using rakes and hand-pulling to upwards of $100,000 for the purchase of a mechanical plant harvester, for which the operational costs can approach $12,500 to $15,000 per year depending on staffing and operating policies. Harvesting is probably the measure best suited to large areas of open water, while chemical controls may be best suited for use in confined areas and for the initial control of invasive plants. Controlling Eurasian water milfoil by planting native plant species or by introducing the milfoil weevil, *Eurhychiopsis lecontei*, is largely experimental and subject to State permitting. The use of other biological controls, such as Grass carp, *Ctenopharyngodon idella*, is prohibited in Wisconsin. The other alternatives are discussed further below.

Aquatic Herbicides

Chemical treatment with aquatic herbicides is a short-term method of controlling heavy growths of aquatic macrophytes and algae. Chemicals are applied to the growing plants in either liquid or granular form. The advantages of using chemical herbicides to control aquatic macrophyte growth are the relatively low cost and the ease, speed, and convenience of application. However, the disadvantages associated with chemical control include unknown long-term effects on fish, fish food sources, and humans; a risk of increased algal blooms due to the eradication of macrophyte competitors; an increase in organic matter in the sediments, possibly leading to increased plant growth, as well as anoxic conditions which can cause fish kills; adverse effects on desirable aquatic organisms; loss of desirable fish habitat and food sources; and, finally, a need to repeat the treatment the following summer due to existing seed banks and/or plant fragments. To minimize the collateral impacts of deoxygenation, loss of desirable plant species, and contribution of organic matter to the sediments, early spring or late fall applications should be considered. Such applications also minimize the concentration and amount of chemicals used due to the colder water temperatures that enhance the herbicidal effects. Use of chemical herbicides in aquatic environments is subject to State permitting requirements. Because of the widespread growth

[2]*See Chapters NR 107 and NR 109 of the* Wisconsin Administrative Code.

of Eurasian water milfoil in the Lakes, limited, periodic chemical treatment is recommended to be considered as a means of controlling the growth of this plant.

Aquatic Plant Harvesting

Aquatic macrophytes may be mechanically harvested with specialized equipment consisting of a cutting apparatus, which cuts up to five feet below the water surface, and a conveyor system that picks up the cut plants and hauls them to shore. Mechanical harvesting appears to be a practical and efficient means of controlling plant growth as it removes the plant biomass and nutrients from a lake. Because some plant fragments are lost during the harvesting process due to the hydrodynamic design of the harvester, the addition of a shoreline cleanup program to remove the plant fragments from the Lake should be considered.

The advantages of aquatic plant harvesting are that the harvester typically leaves enough plant material in the lake to provide shelter for fish and other aquatic organisms, and to stabilize the lake bottom sediments. The disadvantages of mechanical harvesting are that the harvesting operation may cause fragmentation and facilitate the spread of some plants, including Eurasian water milfoil, and may disturb loosely consolidated bottom sediments increasing turbidity and smothering fish breeding habitat and nesting sites. Disrupting the bottom sediments by plant removal also could increase the risk that an exotic species, such as Eurasian water milfoil, may colonize the disturbed area. Operation of a harvester requires managerial oversight and a secure financial basis,[3] and is subject to State permitting requirements. Nevertheless, if done correctly and carefully, harvesting has been shown to be of benefit in ultimately reducing the regrowth of nuisance plants. The extension of the public inland lake protection and rehabilitation district around the Spring Lake also could be considered as one means of providing an appropriate organizational basis.

Manual Harvesting

Mechanical harvesting requires a minimum depth of water in which to operate the harvesting equipment. When the water depth is inadequate, as in shoreline areas, manual harvesting provides a reasonable alternative technique. Manual harvesting involves the use of specially designed rakes to remove aquatic plants. The advantage of the rakes is that they are relatively inexpensive, easy and quick to use, and immediately remove the plant material from the lake, without a waiting period. Removal of the plants from the lake avoids the accumulation of organic matter on the lake bottom, which adds to the nutrient pool that favors further plant growth. There is currently no State permitting requirement for manual aquatic plant harvesting provided the harvested material is removed from the lake. Manual harvesting is recommended for use in small areas of Spring Lake and Willow Spring Lake around piers and docks where aquatic plants are perceived as a severe nuisance.

Biological Controls

An alternative approach to controlling nuisance plants, particularly Eurasian water milfoil and purple loosestrife, is biological control. Classical biological control techniques have been successfully used to control both nuisance plants and herbivorous insects.[4] Recent studies have shown that *Eurhychiopsis lecontei*, an aquatic weevil, has potential as a biological control agent for Eurasian water milfoil.[5] These studies, however, suggest that the weevil is extremely susceptible to disturbances and wash-off by recreational watercraft, limiting its application to low traffic areas of lakes. In contrast, the use of beetles to control purple loosestrife infestations has proven very successful. Consequently, given the relatively low level of boating traffic in Spring Lake and the nonmotorized

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[3] *Wisconsin Lakes Partnership Publication No. FH-205-97,* Your Aquatic Plant Harvesting Program: A How-to Field Manual*, 1997.*

[4] *C.B. Huffacker, D.L. Dahlsen, D.H. Janzen, and G.G. Kennedy,* Insect Influences in the Regulation of Plant Population and Communities*, 1984, pp. 659-696; and C.B. Huffacker and R.L. Rabb, editors,* Ecological Entomology, *John Wiley, New York, New York, USA.*

[5] *Sally P. Sheldon, "The Potential for Biological Control of Eurasian Water Milfoil (*Myriophyllum spicatum*) 1990-1995 Final Report," Department of Biology Middlebury College, February 1995.*

boating regulations applicable to Willow Spring Lake, the use of biological controls such as the Eurasian water milfoil weevil and purple loosestrife beetles are recommended to be considered for the control of Eurasian water milfoil and purple loosestrife in and around these Lakes.[6]

Lake Bottom Covering

Lake bottom covers and screens provide limited control of rooted plants by creating a physical barrier which reduces or eliminates the amount of sunlight available to the plants. Placement of bottom covers on the beds of inland lakes is subject to State permitting requirements. Due to the bathymetry of the Lakes, lake bottom coverings are not considered a viable plant management option.

Citizen Information and Education

In addition to these in-lake management measures, an ongoing campaign of community information will support the aquatic plant management program by encouraging the use of shoreland buffer strips, responsible use of household and garden chemicals, and adoption of environmentally friendly household and garden practices to minimize the input of nutrients from these riparian areas. Aquatic plant management usually centers on the eradication of nuisance aquatic plants for the improvement of recreational lake use. The majority of the public views all aquatic plants as "weeds" and residents often spend considerable time and money removing desirable plant species from a lake without considering the environmental impacts. Thus, public information is an important component of an aquatic plant management program. Posters and pamphlets are available from the University of Wisconsin-Extension and Wisconsin Department of Natural Resources that provide information about and illustrations of aquatic plants, detailing their importance in providing habitat and food resources in aquatic environments, and explaining the need to control the spread of undesirable and nuisance plant species.

Recommended Protection Measures

The following actions are recommended for the management of ecologically valuable areas and aquatic plants:

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[6]*Dr. John Lammers, President, Spring Lake of Waukesha County Property Owners Association, Inc., reported by electronic mail, dated August 29, 2003, to Ms. Heidi Bunk of the Wisconsin Department of Natural Resources a "crash" in the population of Eurasian water milfoil in Spring Lake. Based upon samples of the plant material provided on August 26, 2003, to Dr. Richard Lillie, formerly of the Wisconsin Department of Natural Resources staff and currently retired, the precipitous decline in the Eurasian water milfoil population in the Lake demonstrated "conclusive evidence of weevil damage to the Spring Lake milfoil." Dr. Lillie further reported by electronic mail dated August 26, 2003, that he had "found few weevil larvae (3) and further signs of weevil damage in the form of hollowed-out and decaying apical meristems (classical conditions)." He noted that the paucity of weevils found was likely to reflect that fact, "that this late in the season, many of the adult weevils have emigrated towards shore in their attempt to search for over-wintering sites in the leaf-litter and duff." These findings are consistent with observations elsewhere in the Southeastern Wisconsin Region and suggest that the recommended use of biological control agents have a high probability of success, provided that adequate population levels can be maintained in Spring Lake to effect an ongoing level of control equal to that provided naturally during the summer of 2003. Without supplemental stocking of the weevils, it is likely that population peaks and "crashes" may continue to occur at approximately seven- to 11-year intervals, given the "lag time" during which the predator populations seek to achieve a density commensurate with the density of the prey organism that precipitates the observed periodic crashes in Eurasian water milfoil populations in the Lake. In response to these observations, Dr. Jeffrey A. Thornton of the Commission staff responded to Dr. Lammers by electronic mail on August 29, 2003, noting that 1) an annual inoculation of weevils during the year immediately following the "crash" would not be needed as the density of the weevil population is likely to remain high for a year or two following the current year, 2) an inoculation would probably be required in the third or fourth year following the "crash" to maintain an artificially high density of weevils in the Lake, and 3) a volunteer monitor from within the community should be trained to recognize the weevils and evidence of weevil damage to monitor this predator-prey cycle and trigger inoculations of the biological control agents at an appropriate time.*

1. The Spring Brook Watershed Lake Management District and the Spring Lake of Waukesha County Property Owners Association, Inc., should **support the preservation of the primary and secondary environmental corridor lands and isolated natural resource features within the drainage area tributary to Spring and Willow Spring Lakes**. These lands, and especially their associated wetland areas, are recommended to be protected and preserved to the extent practicable by incorporation into site plans as local parks, recreational trails, or open spaces, and through the restoration and reestablishment of their natural structure and function within the landscape.[7] Such preservation and rehabilitation also should be promoted through the existing regulations and programs intended to protect such natural resources, and by monitoring and commenting to the Town Board and Plan Commission on proposed land use activities within the Town of Mukwonago that affect these important landscape features.

2. The Spring Brook Watershed Lake Management District, the Spring Lake of Waukesha County Property Owners Association, Inc., and the Town of Mukwonago should support County acquisition of the wetlands and fens adjacent to Spring Lake, and Conservancy acquisition of the woodlands. Such actions would enhance the ecological value of the Commission-delineated environmental corridor within which the wetland and woodland systems are located. Outright purchase, or the purchase of conservation easements, are possible options.[8]

3. The Spring Brook Watershed Lake Management District and the Spring Lake of Waukesha County Property Owners Association, Inc., should continue to monitor the nuisance aquatic plant growth. Also, monitoring of the Lakes and surrounding wetlands for the presence or spread of nuisance plant species such as Eurasian water milfoil and purple loosestrife should continue. Manual harvesting of plants around piers and docks is the recommended means of controlling milfoil and other nuisance species of plants in those areas given the small size and environmental significance of the Lakes. In this regard, the Lake District and the Association could consider purchasing several specialty rakes designed for the removal of vegetation from shoreline property and make these available to riparian owners. This would allow the riparian owners to use the rakes on a trial basis before purchasing their own. The rakes cost approximately $90 each, and do not require a permit for use.

4. Given the low volume of recreational boating traffic on the Lakes, as well as the nonmotorized restrictions in place on Willow Spring Lake, it is recommended that the Spring Brook Watershed Lake Management District and the Spring Lake of Waukesha County Property Owners Association, Inc., consider the use of the Eurasian water milfoil weevil and purple loosestrife beetle as biological control agents. The Spring Lake of Waukesha County Property Owners Association, Inc., should consider participation in the Wisconsin Department of Natural Resources purple loosestrife beetle rearing program, the application of such biological controls being supplemented as necessary by hand pulling of the purple loosestrife plants in the case of isolated stands.

5. However, should Eurasian water milfoil, curly leaf pondweed, or purple loosestrife be determined to reach nuisance proportions, the use of chemical herbicides may be considered, but should be limited to small areas. Early spring or late fall treatments to control the growth of Eurasian water milfoil have proven effective in other lakes in Southeastern Wisconsin and are recommended. Early spring

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[7] *SEWRPC Community Assistance Planning Report No. 209*, op. cit.

[8] *Public acquisition including outright purchase or purchase of conservation easements may meet the criteria for cost-shared acquisition under the Chapter NR 191 Lake Protection Grant Program administered by the Wisconsin Department of Natural Resources. Monies granted under the auspices of this program provide up to 75 percent of the purchase price, or the cost of acquisition of a conservancy easement, subject to a cap of $200,000 on State share per parcel.*

herbicide treatments reduce the biomass subject to decomposition and limit the accumulation of organic materials on the Lake bottom.

6. It is recommended that an aquatic plant survey be conducted every three to five years in order to track the success of the current aquatic plant management program, as well as any other changes within the tributary drainage area that may affect Spring Lake and Willow Spring Lake.

7. The Spring Brook Watershed Lake Management District and the Spring Lake of Waukesha County Property Owners Association, Inc., through an educational and informational program, **should promote awareness of Lake residents, visitors, and watershed residents of good urban housekeeping practices**, and the invasive nature of such exotic, nonnative species as Eurasian water milfoil and purple loosestrife. Participation in citizen-based control programs coordinated by the Wisconsin Department of Natural Resources and University of Wisconsin-Extension should be encouraged.

FISHERIES

Few data on the fisheries of Spring and Willow Spring Lakes are available. Notwithstanding, as has been noted in Chapter III, fishing is a popular pastime on the Lakes. Available data suggest that the fishery in the Lakes is healthy. Nevertheless, the conduct of a fisheries inventory is recommended.

Recommended Management Measures
It is recommended that the Wisconsin Department of Natural Resources conduct a fisheries survey to develop a baseline and serve as input to determine if more active management measures are required. Implementation of regulatory or remedial measures, such as modified size limits for catches and stocking, in both Lakes should be based upon the findings set forth in the recommended surveys.

NONPOINT SOURCE POLLUTION, CONSTRUCTION SITE EROSION, AND SURFACE WATER QUALITY

Spring Lake and Willow Spring Lake are eutrophic waterbodies. As such, they may be considered, by definition, to be in need of protection and rehabilitation if their current aesthetic and recreational uses are to be maintained and enhanced. Additional urbanization of the watershed anticipated under buildout conditions, as set forth in the aforenoted regional land use and County development plans, especially when viewed in light of the recent U.S. Geological Survey findings regarding the potential impacts of suburban lawn care practices on stormwater runoff in urbanized watersheds in Wisconsin,[9] has heightened concern among lakeshore residents that the water quality of the Lakes may deteriorate further. Thus, consideration is given in this section to those actions that will protect lake water-quality and reduce contaminant loads to the Lakes.

As described in Chapter II, the primary sources of pollutant loadings to the Spring Lake and Willow Spring Lake are nonpoint sources generated from within the drainage area tributary to the Lakes, including discharges from onsite sewage disposal systems. The increase in the area of urban residential lands in the drainage area tributary to the Spring Lake and Willow Spring Lake envisioned in the regional land use plan and Waukesha County development plan has the potential to result in modest increases in loadings of some pollutants associated with urban development and construction sites. While these are anticipated to be relatively small, and while some contaminants are forecast to decrease in concentration, control of such contamination generated by existing and

[9] *U.S. Geological Survey Water-Resources Investigations Report,* Sources of Phosphorus in Stormwater from Two Residential Urban Basins in Madison, Wisconsin: 1994-95*, in press; U.S. Geological Survey Water-Resources Investigations Report No. 02-4130,* Effects of Lawn Fertilizer on Nutrient Concentration in Runoff from Lakeshore Lawns, Lauderdale Lakes, Wisconsin, *July 2002.*

developing urban lands is recommended. In addition, control of pollutant runoff from rural lands should be considered.

The adopted regional water quality management plan nonpoint source pollution abatement plan element for the Fox River watershed generally recommends urban and rural nonpoint source pollution control practices designed to reduce the pollutant loadings from nonpoint sources by about 25 percent for the Spring Lake Tributary.[10] Watershed management measures may be used to reduce nonpoint source pollutant loadings from such rural sources as runoff from cropland and pastureland; from such urban sources as runoff from residential, commercial, transportation, and recreational land uses; and from construction activities. The alternative, nonpoint source pollution control measures considered in this report are based upon the recommendations set forth in the adopted regional water quality management plan,[11] the Waukesha County land and water resource management plan,[12] and information presented by the U.S. Environmental Protection Agency.[13]

Array of Control Measures

To control nonpoint source pollution in Spring Lake and Willow Spring Lake and its tributary drainage area, both urban nonpoint source controls and rural nonpoint source controls are considered viable options, and are discussed further below.

Urban Nonpoint Source Controls

Potentially applicable urban nonpoint source control measures include wet detention basins, grassed swales, and good urban housekeeping practices. Generally, the application of low-cost urban housekeeping practices may be expected to reduce nonpoint source loadings from urban lands by about 25 percent. Public informational programs can be developed to encourage such good urban housekeeping practices, to promote the selection of building and construction materials, which reduce the runoff contribution of metals and other toxic pollutants, and to promote the acceptance and understanding of the proposed pollution abatement measures and the importance of lake water quality protection. Urban housekeeping practices and source controls include restricted use of fertilizers and pesticides; improved pet waste and litter control; the substitution of plastic for galvanized steel and copper roofing materials and gutters; proper disposal of motor vehicle fluids; increased leaf collection; and reduced use of street deicing salt.

Proper design and application of urban nonpoint source control measures such as grassed swales and detention basins requires the preparation of a detailed stormwater management system plan that addresses stormwater drainage problems and controls nonpoint sources of pollution. Such detailed plans have been prepared for recent subdivision construction activities within the drainage area tributary to Spring Lake, namely, the Whitetail

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[10]*SEWRPC Planning Report No. 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, *Volume One,* Inventory Findings, *September 1978; Volume Two,* Alternative Plans, *February 1979; and Volume Three,* Recommended Plan, *June 1979; SEWRPC Planning Report No. 12,* A Comprehensive Plan for the Fox River Watershed, *Volume One,* Inventory Findings and Forecasts, *April 1969; Volume Two,* Alternative Plans and Recommended Plan, *October 1971; see also SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

[11]*SEWRPC Planning Report No. 30,* op. cit.*; and SEWRPC Memorandum Report No. 93,* op. cit.

[12]*Waukesha County,* Waukesha County Land and Water Resource Management Plan: 1999-*2002, January 1999; see also SEWRPC Community Assistance Planning Report No. 159,* Waukesha County Agricultural Soil Erosion Control Plan, *June 1988.*

[13]*U.S. Environmental Protection Agency, Report No. EPA-440/4-90-006,* The Lake and Reservoir Restoration Guidance Manual, *2nd Edition, August 1990; and its technical supplement, U.S. Environmental Protection Agency, Report No. EPA-841/ R-93-002,* Fish and Fisheries Management in Lakes and Reservoirs: Technical Supplement to the Lake and Reservoirs Restoration Guidance Manual, *May 1993.*

Meadows subdivision, and are likely to be required by the Town of Mukwonago for subsequent new urban density development activities. This requirement reflects the significant efforts of the Spring Lake of Waukesha County Property Owners Association, Inc., and town residents in seeking to protect the natural resource base of the Town, and the efforts of the Spring Lake of Waukesha County Property Owners Association, Inc., in providing alternatives for the management of stormwater within the Whitetail Meadows subdivision, generated, in large part, through the participation and financial commitment of the Association membership and committed individuals within the community.

Notwithstanding, based upon a preliminary evaluation, it is estimated that the practices which could be effective in the existing urban areas within the drainage area tributary to Spring and Willow Spring Lakes revolve around the implementation of adequate urban housekeeping practices. These practices include the proper use and disposal of household chemicals, appropriate use of garden chemicals and fertilizers, and use of good lawn care practices. Information on these practices can be found in the University of Wisconsin-Extension publication series, *"Yard Care and the Environment."* Copies of the pamphlets in this series are recommended to be made available to the Spring and Willow Spring Lake communities through the Town of Mukwonago Town Hall, the Town of Genesee Town Hall, the Mukwonago Public Library, and other, similar outlets. Copies also can be distributed at the regular meetings of the Spring Brook Watershed Lake Management District and Spring Lake of Waukesha County Property Owners Association, Inc., as program features at these meetings.

Developing areas can generate significantly higher pollutant loadings than established areas of similar size. These areas include a wide array of activities, including individual site development within the existing urban area and new land subdivision development. As previously noted, additional residential development is presently occurring and/or planned within the drainage area tributary to the Spring Lake and Willow Spring Lake. These construction sites may be expected to produce suspended solids and phosphorus loadings at rates several times higher than established urban lands, and control of sediment loss from construction sites is recommended. Control of nonpoint source pollution from development sites include temporary measures taken to reduce pollutant loadings from construction sites during stormwater runoff events, in a manner consistent with the provisions set forth in the construction site management handbook developed by the Wisconsin Department of Natural Resources in cooperation with the Wisconsin League of Municipalities.[14]

Construction erosion controls may be expected to reduce pollutant loadings from construction sites by about 75 percent. Such practices are expected to have only a modest impact on the total pollutant loading to Spring and Willow Spring Lakes due to the relatively small amount of land being developed at any given time. Nevertheless, such controls are important pollution control measures that can abate localized short-term loadings of phosphorus and sediment from the drainage area and the upstream tributary area, and minimize the cumulative impacts of such loadings. The control measures include such revegetation practices as temporary seeding, mulching, and sodding; such runoff control measures as placement of filter fabric fences, straw bale barriers, storm sewer inlet protection devices, diversion swales, sediment traps, and sedimentation basins; and such site management practices as placement of tracking pads to limit the movement of soils from work sites.

Rural Nonpoint Source Controls

Upland erosion from agricultural and other rural lands is a major contributor of sediment within the tributary drainage area to Spring Lake and Willow Spring Lake, and, while such land uses are expected to diminish somewhat under buildout conditions, sediment and nutrient loadings from rural lands will remain a major part of the contaminant budget of the Lakes for the foreseeable future. Estimated phosphorus and sediment loadings from croplands, woodlots, pastures, and grasslands in the drainage area tributary to the Spring Lake and Willow Spring Lake were presented in Chapter II. These loadings are recommended to be reduced to the target level of agricultural erosion control of three tons per acre per year identified in the Waukesha County agricultural soil erosion control plan as the tolerable levels that can be sustained without impairing productivity. Implementation

[14]*Wisconsin League of Municipalities and Wisconsin Department of Natural Resources,* Wisconsin Construction Site Best Management Practices Handbook, *November 1993.*

of these recommendations, therefore, remains an important water quality management measure for the Spring Lake and Willow Spring Lake.

Until such time as they are converted from agricultural usage, existing farming operations should continue to implement and maintain nonpoint source pollution control measures to reduce current sediment, nutrient, and agri-chemical loading rates to the extent practicable. Thus, detailed farm conservation plans will continue to be required to adapt and refine erosion control and nutrient and pest management practices for individual farm units. Generally prepared with the assistance of staff from the U.S. Natural Resources Conservation Service or County Land Conservation Department, such plans identify desirable tillage practices, cropping patterns, and rotation cycles. The plans also consider the specific topography, hydrology, and soil characteristics of the farm; identify the specific resources of the farm operator; and articulate the operator objectives of the owners and managers of the land. Practices which are considered most applicable within the drainage area tributary to the Spring Creek drainage area tributary to the Lakes include conservation tillage, integrated nutrient and pesticide management, and pasture management. In addition, it is recommended consideration be given to cropping patterns and crop rotation cycles, with attention to the specific topography, hydrology, and soil characteristics for each farm.

The costs of the needed measures will vary depending upon the details of the recommended farm conservation plans. These costs may be expected to be incurred to a large extent for purposes of agricultural land erosion control in any case. As noted above, pending promulgation of Chapters NR 153 and NR 154 of the *Wisconsin Administrative Code*, which become effective during the autumn of 2002, cost-share funding might be available to encourage installation of appropriate land management measures.

Public Informational Programming

In addition to actions designed to directly control the delivery of nonpoint sourced pollutants to Spring and Willow Spring Lakes, additional actions can be undertaken to minimize nutrient loadings from source areas within the tributary drainage area. Based upon the aforereferenced findings of the U.S. Geological Survey, residential lawns form a major source of phosphorus to watercourses in urban areas. In some cases, this phosphorus source is enhanced as a consequence of the lawn care practices employed by householders within the drainage area. For this reason, informational programming directed at alternative and appropriate lawn care practices should be provided within this rapidly urbanizing drainage area. Such programming should be predicated upon the soil chemistry and soil nutrient requirements for urban residential lawns and gardens that can be determined through relatively simple soil testing conducted by the University of Wisconsin-Extension. Soil test results allow householders to apply appropriate levels of fertilization to their gardens, generally saving the householder some level of expense and effort, while providing additional protections to the Lakes. In addition, distribution of lawn care pamphlets within the drainage area, providing information on composting, yard care, and maintenance of the grassed swale stormwater system, would apprise householders of alternative means of maintaining their properties.[15]

In addition, programming should be developed to keep the householders in the Spring Lake and Willow Spring Lake community informed of the current state of their Lakes' water quality. To this end, continued participation in the Wisconsin Department of Natural Resources Self-Help Program and the University of Wisconsin-Extension Adopt-A-Lake Program is recommended as a means of assessing the health of the Spring Lake and Willow Spring Lake on a regular basis. Such programs can provide an early warning of undesirable changes in lake water quality and aquatic species composition and initiate appropriate responses in a timely manner. In addition, data gathered through these programs can supplement and be coordinated with data gathered by the Wisconsin Department of Natural Resources under the current surface water monitoring strategy developed to conduct monitoring activities and to perform basic assessments for each watershed in the Region on an approximately five- to seven-year

[15]*University of Wisconsin-Extension Publication No. GWQ007,* Practical Tips for Home and Yard*, 1993, and related publications in the "Yard Care and the Environment" series.*

rotating cycle.[16] Regular reports on the results of these studies have been featured at the annual meetings of the Spring Brook Watershed Lake Management District, and the Spring Lake of Waukesha County Property Owners Association, Inc., and should be continued as one means of informing residents of the current state of the Lakes.

Recommended Control Measures

The following management actions are recommended for the management of nonpoint source pollution sources and surface water quality:

1. The Spring Brook Watershed Lake Management District, and the Spring Lake of Waukesha County Property Owners Association, Inc., in conjunction with the Towns of Genesee and Mukwonago, should assume the lead in the development of a public educational and informational program for the residents around Spring Lake and Willow Spring Lake and within the drainage area tributary to the Lakes, which encourages the institution of good urban housekeeping practices including, pesticide and fertilizer use management, improved pet waste and litter control, and yard waste management, as well as other lake management-related topics. The Spring Brook Watershed Lake Management District, and the Spring Lake of Waukesha County Property Owners Association, Inc., in cooperation with service clubs and other nongovernmental organizations within the drainage area tributary to the Spring Lake and Willow Spring Lake, should acquire and distribute relevant publications in the University of Wisconsin-Extension *"Yard Care and the Environment"* series to encourage sound yard care practices within the watershed, and encourage their memberships and electorates to participate in the soil testing program offered by the University of Wisconsin-Extension. It is recommended that informational programming related to nonpoint source pollution abatement and other lake management topics be included at the annual meetings of the Spring Brook Watershed Lake Management District, and the Spring Lake of Waukesha County Property Owners Association, Inc.

2. The construction site erosion control and water quality protection ordinances adopted by Waukesha County should be strictly enforced to reduce sediment and contaminant loadings from the urbanizing areas in the tributary drainage area to the Spring Lake and Willow Spring Lake, especially in those areas nearest to the Lakes.

3. The existing grassed swale drainage system within drainage area tributary to Spring and Willow Spring Lakes should be maintained to minimize the nutrient and sediment loads delivered to the Lakes, especially Willow Spring Lake which is directly affected by the quality of water entering the lake through the tributary stream.

4. Detailed farm conservation plans, to adapt and refine erosion control and nutrient and pest management practices for individual farm units, should be prepared with the assistance of federal and county staff, and implemented for those agricultural operations active in the drainage area tributary to Spring and Willow Spring Lakes, identifying, among others, desirable tillage practices, cropping patterns, and rotation cycles.

5. The Spring Brook Watershed Lake Management District, and the Spring Lake of Waukesha County Property Owners Association, Inc., should continue to participate in the Wisconsin Department of Natural Resources Self-Help Monitoring Program and University of Wisconsin-Extension Adopt-A-Lake Program as means of regularly assessing the health of the Lakes and in order to provide an early warning of undesirable changes in lake water quality and aquatic species composition so as to allow timely initiation of appropriate responses. The report of the citizen monitors should continue to be featured at the annual meeting of the Lake Management District and the Association.

[16] *SEWRPC Memorandum Report No. 93,* op. cit.

PUBLIC RECREATION AND BOATING ACCESS

Spring Lake and Willow Spring Lake provide opportunities for water-based recreation to the residents of the Towns of Genesee and Mukwonago, and to the population of the Southeastern Wisconsin Region as a whole. As described in Chapter III, potential recreational use concerns are related to the public recreational boating access opportunities to Spring Lake, which may not currently meet the minimum standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*.

Access Standards

Determination of the amount of recreational boating access that should be accommodated on lakes within Wisconsin is dependent upon the areal extent of the open water lake surface. Spring Lake, with a surface area of 105 acres, falls in the 100- to 499-acre category for recreational use lakes established in Section NR 1.91 of the *Wisconsin Administrative Code*.[17] Within this category, the minimum standard requires at least one access site providing parking for five car-trailer units, while the maximum standard requires provision of parking for one car-trailer unit for every 15 acres of open water lake surface, or parking for seven car-trailer units in the case of Spring Lake; both the maximum and minimum access standards would also require one additional handicapped accessible parking space.

Notwithstanding, Section NR 1.91(6) allows for the development of an alternative public boating access level which may differ from the public recreational boating access standard required under Section NR 1.91(4). Alternative public boat access may be warranted in the case of Spring Lake due to the Lake's classification as an Outstanding Resource Water of the State, pursuant to Chapter NR 102 of the *Wisconsin Administrative Code*. In addition, given the depth limitations pertaining to parts of Spring Lake, smaller craft suitable for slower-speed boating activities appear to be best suited for use of the Lake. Observations by Commission staff, conducted during June 2001, indicated that such watercraft are in operation on Spring Lake. Use of slower speed watercraft also would be consistent with, and support the use of, weevils as an aquatic plant control measure for Eurasian water milfoil on the Lake.

As noted in Chapter II, public recreational boating opportunities on Spring Lake are limited due to the lack of adequate public parking at the two existing access sites on the Lake. This circumstance limits the ability of the Spring Lake of Waukesha County Property Owners Association, Inc., and the Town of Mukwonago, to access State funding for lake enhancement services.[18] Thus provision of adequate parking facilities should be considered.

Willow Spring Lake, with a surface area of 46 acres, falls into the less than 50-acre category for recreational boating lakes established in Section NR 1.91 of the *Wisconsin Administrative Code*. Within this category, the minimum and maximum standards are the same. As previously noted, Willow Spring Lake currently has adequate public recreational boating access, pursuant to the *Wisconsin Administrative Code.* In addition, pursuant to state boating laws set forth in Chapter 30 of the *Wisconsin Statutes*, Willow Spring Lake is a nonmotorized lake.

Array of Options

Two options to provide public recreational boating access and other recreational activities to Spring Lake have been identified; namely, 1) to provide a level of access fully consistent with the standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*, and 2) to provide a level of access consistent with the alternative public recreational boating access provisions of Chapter NR 1 of the *Wisconsin Administrative Code*.

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[17]*The "open water acres" of Spring Lake, as defined in Chapter NR 1 of the* Wisconsin Administrative Code, *are estimated to be 110 acres based upon March 2000 SEWRPC one inch equals 400 feet scale orthophotography (see Map 2).*

[18]*Enhancement services comprise activities such as fish stocking, access to certain State grant funds, and related discretionary services provided by State agencies.*

Recommended Boating Access

1. It is recommended that provision of adequate public parking at the CTH I site, consistent with the alternative public access standard provisions of Section NR 1.91(6), be considered to enhance the existing public recreational boating access to Spring Lake. It is recommended that carry-in access be provided with parking for five vehicles, while one handicapped accessible unit should be considered at the Lakecrest Court right-of-way; limited unimproved parking is currently provided at or near this access site.[19] The proposed parking facilities should conform to the guidance on accessibility contained in the United States Access Board publication, *Accessible Boating Facilities*, published in June 2003. Such access facilities also would provide for greater convenience of the residents of Spring Lake as well as for the convenience and safety of the public at large by providing an improved public launch site with adequate parking facilities.

2. It is also recommended that provision be made at the access sites, on both Spring Lake and Willow Spring Lake, for the posting of such boating regulations as may be adopted by the municipalities and other notices as necessary, including notices regarding the prohibition of transfer of nonnative aquatic plants and other aquatic species into Wisconsin lakes.

INSTITUTIONAL DEVELOPMENT

Both public and private organizational options for the management of lakes in the State of Wisconsin exist.[20] Private lake organizations also have the option to be incorporated, generally as nonstock, not-for-profit corporations under Chapter 181, *Wisconsin Statutes*. Public lake organizations are special purpose units of government that are created generally as public inland lake protection and rehabilitation districts under Chapter 33, *Wisconsin Statutes*, although some sanitary districts and utility districts created pursuant to the municipal statutes also engage in lake management activities. The specific type of organizations created is based upon the decision of the community.

Types of Lake Organizations

Private lake organizations are voluntary. Such organizations have the advantage that there are few restrictions imposed upon the types of activities in which they engage, subject to relevant permits and laws. Incorporated associations generally have a somewhat greater number of restrictions imposed upon them, but may be considered qualified associations for purposes of obtaining State cost-share grants. Because of their voluntary nature, membership levels, and, therefore, income levels, of associations often fluctuate from year-to-year. Thus, when associations take on specific tasks such as aquatic plant management, for example, the community often elects to create a public inland lake protection and rehabilitation, or lake management, district.

Lake districts are public governmental units formed for the specific purpose of managing and protecting lake water quality. Inclusion in the district, once the district is created, is mandatory; registered voters and persons owning property within the district become the electors of the district for purposes of governance. Lake management districts have the capability of raising public funds subject to majority approval of the district budget

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[19]*It should be noted that, since the designation of these access sites by the Town of Mukwonago, both sites have developed an essentially wetland character (see Map 12) that may pose a challenge for the development of a public recreational boating access. This fact should be considered early in the site-specific design process for any public recreational boating access site plan to be developed pursuant to this recommendation. Further, it is strongly recommended that any future site-specific public recreational boating access design process include the active involvement of the Spring Lake community to ensure that such a public recreational boating access site be designed so as to be in harmony with the largely pristine nature of the Lake shoreline and compatible with the surrounding residential community.*

[20]*See University of Wisconsin-Extension Publication No. G3216,* The Lake in Your Community*, 1986.*

at the annual meeting of the district. For this reason, lake management districts can provide a more stable financial base from which to undertake lake management activities. Often, lake associations and lake districts operate in harmony around lakes throughout Wisconsin.

Given that the Spring Lake of Waukesha County Property Owners Association, Inc., during 2003, was considering implementation of an aquatic plant management program to control Eurasian water milfoil and purple loosestrife on the Lake, community consideration of alternative means of lake management organization may be warranted. Currently, the majority of lakeshore householders of the Spring Lake community comprise the dues paying membership of the Association, which serves as a focal point for informational programming and public participation in lake management activities. As of 2004, the Spring Lake of Waukesha County Property Owners Association, Inc., is fully meeting the needs of the community with respect to lake management actions. It should be noted, however, that an ongoing aquatic plant management operation may involve the community in recurring operation and maintenance expenses that can range from relatively modest levels to multiple thousands of dollars, depending upon the methods agreed and extent of treatment applied. Should the community determine that these higher levels of ongoing expenditure be warranted, the formation of a public inland lake protection and rehabilitation district pursuant to Chapter 33, *Wisconsin Statutes*, to serve this community, or extension of the Spring Brook Watershed Lake Management District to encompass the riparian area tributary to Spring Lake, are alternatives that should be considered.

Section 33.25, *Wisconsin Statutes*, provides for the formation of public inland lake protection and rehabilitation districts by petition. In the case of the Spring Lake community, such a petition would be most likely to be directed to the Town of Mukwonago. This petition would have to identify a name for the proposed district, define the boundaries of the district, and contain the signatures of 51 percent of the landowners or those of the owners of 51 percent of the land within the proposed district. In addition, the petition should set forth the necessity for the district, the basis upon which a district is being formed and the reason why a district is necessary, and the purpose that the district will serve, that the district will promote the public health, convenience, necessity, or public welfare and benefit the lands being included within the district.[21]

Pursuant to Section 33.33, *Wisconsin Statutes*, the jurisdiction of the existing Spring Brook Watershed Lake Management District could be extended to encompass the riparian lands tributary to Spring Lake and the reach of Spring Creek linking the two waterbodies. Landowners of the Spring Lake community could petition the District directly for attachment, pursuant to Section 33.33(2)(a), which attachment could be approved by majority vote of the Board of Commissioners of the Spring Brook Watershed Lake Management District, provided that the lands so attached were contiguous with the existing district jurisdiction. Alternatively, the Board of Commissioners of the Spring Brook Watershed Lake Management District could initiate such attachment by motion, pursuant to Section 33.33(2)(b). Such a course of action, however, would necessitate action by the Waukesha County Board of Supervisors prior to such attachment being effective. This latter process would invoke a public hearing, as set forth under Section 33.26(3), and provide affected landowners with the opportunity to address issues of support for the attachment, the necessity of the attachment, the degree to which the public health, comfort, convenience, necessity or the public welfare would be promoted, and the benefit to be derived from the attachment. In this regard, it should be noted that the Spring Brook Watershed Lake Management District, at the time of its formation, indicated their acknowledgement that a watershed-based approach to lake management would be necessary to protect the water quality and aquatic environment of Willow Spring Lake, and, of necessity, provide benefit to Spring Lake in the process.

Other considerations relating to the extension of the public inland lake protection and rehabilitation district to the Spring Creek watershed include the definition of a lake management district boundary. The extent to which the

[21]*Benefit has been defined in terms of the benefit to the district of having particular lands included within the district boundaries, rather than the benefit to the individual landowner. See University of Wisconsin-Extension,* Guide to Wisconsin's Lake Management Law, Tenth Edition, *1996.*

drainage area tributary to a lake is included in a district, and, in the case of a chain of lakes, the numbers of lakes and the conditions under which they are to be included, would be issues to be discussed by the Spring Lake and Willow Spring Lake communities should extension or creation of a lake management district be considered at some future time. It should be noted that it is rarely practical to include a lake's total tributary drainage area within a lake management district. However, based upon guidance provided by the University of Wisconsin-Extension, it is recommended that the entire lakeshore, all riparian property, areas directly affecting the lake and/or which are included in planned service areas, and entire parcels be included.[22]

Given the relatively small sizes of the Lake communities, it may be appropriate to consider including both Lakes within a single district.[23] Pursuant to the guidance provided by the University of Wisconsin-Extension, riparian properties surrounding the Lakes could be included within a proposed district. The establishment of the boundaries of a lake protection and rehabilitation district should be undertaken with caution. As noted, guidance provided by the University of Wisconsin-Extension suggests inclusion within a district of the entire lakeshore, of all riparian properties, of lake-related properties, of as much of the lake's watershed as is logistically and politically feasible, of all lands to be included in proposed service areas, of entire parcels, and of all parcels necessary to avoid holes within the district. While there are sound technical and economic reasons for including the Lakes' watershed or direct tributary drainage area in the district, significant political and social difficulties may arise that limit the ability of the district encompassing the entire drainage area to carry out a program of lake protection and rehabilitation activities.

Recommended Institutional Structure

It is recommended that the Spring Lake community consider forming a public inland lake protection and rehabilitation district around Spring Lake, to include properties riparian to the Lake. Such creation would be best accomplished by petition of the landowners for attachment to the existing Spring Brook Watershed Lake Management District. Extension of a lake management district to Spring Lake would enhance the ability of the Spring Lake community to manage the Lake on a sustainable basis, and provide a sound fiscal base from which to conduct lake management activities. Such extension would be contingent on the agreement of the Spring Brook Watershed Lake Management District Board of Commissioners, and may require the adoption of bylaws to ensure that both lake communities are represented on the Board of Commissioners in an equitable manner. Expansion of the Board to seven members, pursuant to a one-time election as set forth in Section 33. 28(2m), *Wisconsin Statutes*, should be considered at this time.

It is important to note, in terms of this action, that the continuity of the Spring Lake of Waukesha County Property Owners Association, Inc., would be determined by the members of the Association; that the proposed extension or creation of a lake management district would not negate the value or continuity of the Association; and that there are numerous communities in the Southeastern Wisconsin region where both governmental bodies and nongovernmental bodies coexist and cooperate in lake management activities. Such an arrangement is foreseen as likely to occur within the Spring Creek watershed should the expansion or creation of a public inland lake protection and rehabilitation district be implemented in the Spring Lake community.

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[22]*University of Wisconsin-Extension,* Guide to Wisconsin's Lake Management Law, Tenth Edition, *1996.*

[23]*Alternatively, the formation of two contiguous public inland lake protection and rehabilitation districts within the watershed might provide a more acceptable alternative for the communities. The Spring Lake community may wish to consider the formation of a public inland lake protection and rehabilitation district, should the community wish to undertake lake management actions that involve sustained investment beyond that currently available to the community through the Spring Lake of Waukesha County Property Owners Association, Inc. This alternative would address concerns voiced by the Spring Lake community, regarding possible liability with respect to the operation and maintenance of the Laitsch Dam that forms Willow Spring Lake, which may be inherent in the formation of a single lake management district serving the entire Spring Brook Watershed.*

SUMMARY

This plan, which documents the findings and recommendations of a study requested by the Spring Brook Watershed Lake Management District in cooperation with the Spring Lake of Waukesha County Property Owners Association, Inc., examines existing and anticipated conditions and potential management problems of the Spring and Willow Spring Lakes, and presents a recommended plan for the resolution of these concerns.

Spring and Willow Spring Lakes were found to be meso-eutrophic, moderately deep water lakes of average quality, located in close proximity to the Milwaukee metropolitan area and to an increasingly urbanized part of Waukesha County within which their tributary drainage area is entirely located. Surveys indicated that the Lakes and their tributary drainage area contain significant areas of ecological value, including numerous wetlands and high-quality wildlife habitat surrounding the Lakes.

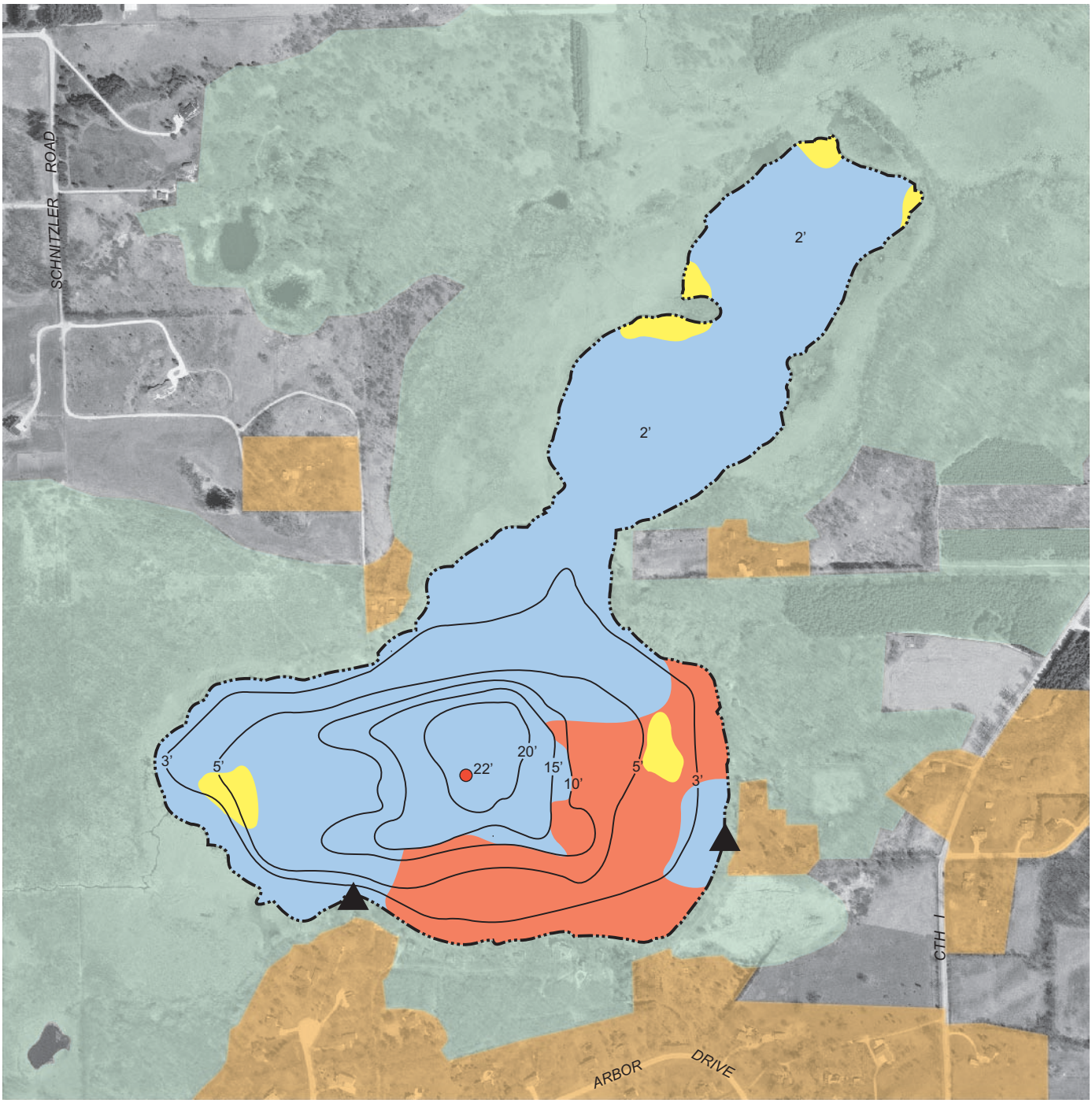
The Spring and Willow Spring Lakes protection and recreational use plan, summarized on Maps 17 and 18 and in Table 16, recommends actions be taken to limit further human impacts on the in-lake macrophyte beds and reduce human impacts on the ecologically valuable areas adjacent to the Lake and in its watershed. The development of adequate public parking to the public recreational boating access sites serving Spring Lake is also recommended. The plan recommends limited aquatic plant management action, including selected manual removal and surveillance activities and biological control in the cases where purple loosestrife and Eurasian water milfoil are present. Limited use of chemical treatment methods should be considered only to treat nonnative invasive species, and only if needed. Consideration of public and/or private acquisition of, or acquisition of conservation easements over, lands within the primary environmental corridors to ensure the protection and preservation of these ecologically valuable areas in a manner consistent with the adopted regional natural areas and critical species habitat protection and management plan and county land and water resource management plan is also recommended.

The recommended plan includes continuation of an ongoing program of public information and education providing riparian residents and lake users. For example, additional options regarding household chemical usage, lawn and garden care, shoreland protection and maintenance, and recreational usage of the Lakes should be made available to riparian householders, thereby providing riparian residents with alternatives to traditional alternatives and activities.

The recommended plan seeks to balance the demand for high-quality residential and recreational opportunities at the Spring and Willow Spring Lakes with the requirements for environmental protection and maintenance of the natural resource base upon which these opportunities rest.

Map 17

RECOMMENDED LAKE MANAGEMENT PLAN FOR SPRING LAKE



DATE OF PHOTOGRAPHY: MARCH 2000

—20'— WATER DEPTH CONTOUR IN FEET

LAND USE MANAGEMENT

- PRESERVE ENVIRONMENTAL CORRIDORS
- PROMOTE GOOD HOUSEKEEPING PRACTICES IN URBAN AREAS

FISHERIES MANAGEMENT

- MONITOR FISH POPULATIONS, MODIFY HARVESTING REGULATIONS AS NECESSARY

RECREATIONAL USE MANAGEMENT

- PUBLIC RECREATIONAL BOATING ACCESS SITE -PROVIDE ADEQUATE PARKING PER NR 1 OF WISCONSIN ADMINISTRATIVE CODE

AQUATIC PLANT AND SHORELINE MANAGEMENT

- PROTECT NATIVE AQUATIC PLANTS
- EURASIAN WATER MILFOIL CONTROL AREA
  - LIMIT BOATING TRAFFIC TO MINIMIZE SPREAD
  - CONSIDER USE OF BIOLOGICAL CONTROL AGENTS
  - LIMITED AQUATIC HERBICIDE USE
  - MANUAL HARVESTING OF PLANTS

WATER QUALITY MANAGEMENT

- CONTINUE PARTICIPATION IN WISCONSIN DEPARTMENT OF NATURAL RESOURCES SELF-HELP MONITORING PROGRAM
- CONTINUE PUBLIC AWARENESS PROGRAM

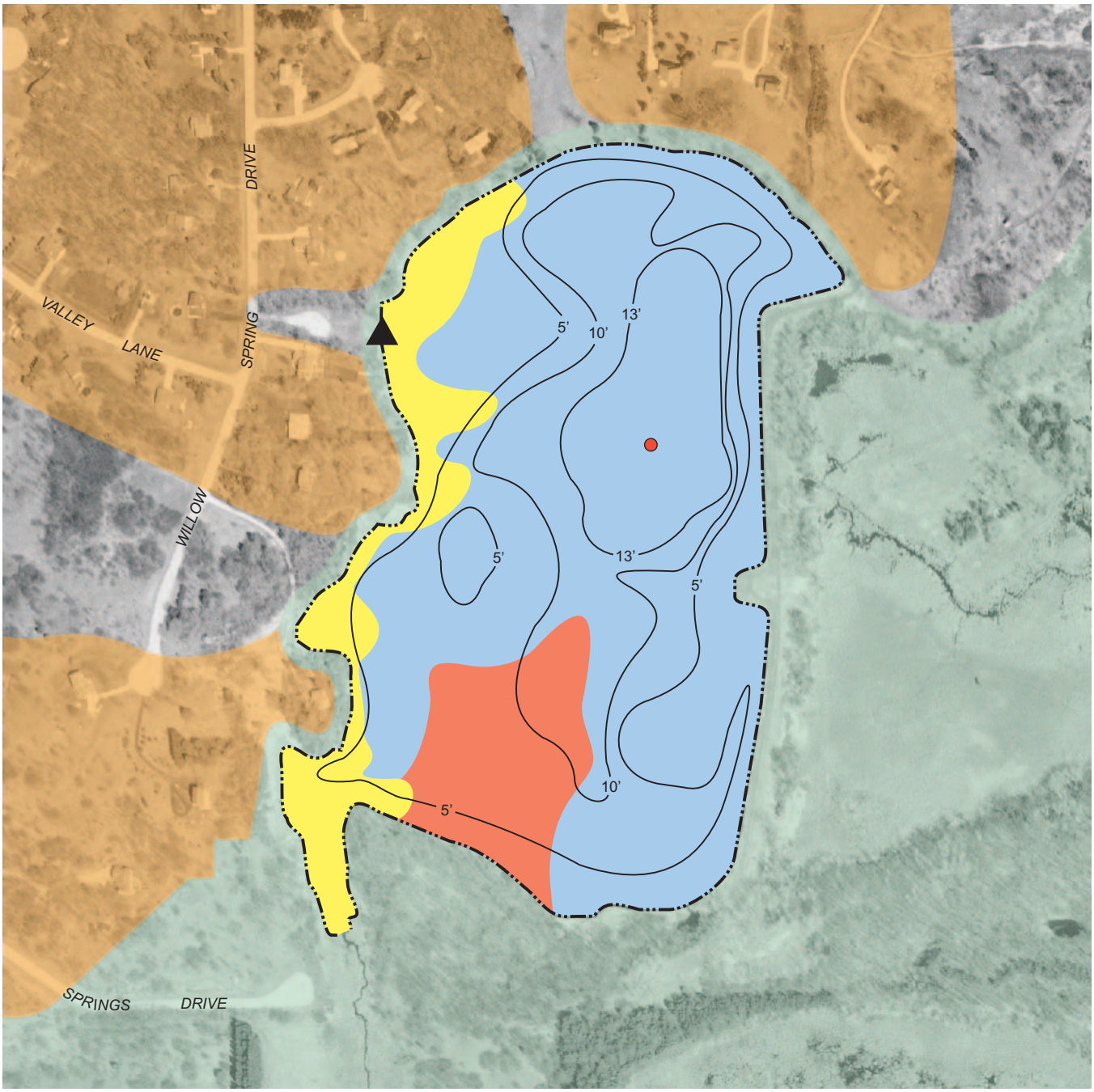
GRAPHIC SCALE

0 350 700 FEET

Source: SEWRPC.

Map 18

RECOMMENDED LAKE MANAGEMENT PLAN FOR WILLOW SPRING LAKE



DATE OF PHOTOGRAPHY: MARCH 2000

—20'— WATER DEPTH CONTOUR IN FEET

LAND USE MANAGEMENT

PRESERVE ENVIRONMENTAL CORRIDORS

PROMOTE GOOD HOUSEKEEPING PRACTICES IN URBAN AREAS

FISHERIES MANAGEMENT

- MONITOR FISH POPULATIONS, MODIFY HARVESTING REGULATIONS AS NECESSARY

RECREATIONAL USE MANAGEMENT

▲ PUBLIC RECREATIONAL BOATING ACCESS SITE -PROVIDE ADEQUATE PARKING PER NR 1 OF WISCONSIN ADMINISTRATIVE CODE

AQUATIC PLANT AND SHORELINE MANAGEMENT

PROTECT NATIVE AQUATIC PLANTS

EURASIAN WATER MILFOIL CONTROL AREA

- LIMIT BOATING TRAFFIC TO MINIMIZE SPREAD
- CONSIDER USE OF BIOLOGICAL CONTROL AGENTS
- LIMITED AQUATIC HERBICIDE USE
- MANUAL HARVESTING OF PLANTS

WATER QUALITY MANAGEMENT

● CONTINUE PARTICIPATION IN WISCONSIN DEPARTMENT OF NATURAL RESOURCES SELF-HELP MONITORING PROGRAM

- CONTINUE PUBLIC AWARENESS PROGRAM

GRAPHIC SCALE

0 200 400 FEET

Source: SEWRPC.

Table 16

RECOMMENDED PROTECTION PLAN ELEMENTS FOR THE SPRING AND WILLOW SPRING LAKES

Issue	Plan Element	Subelement	Location	Management Measures	Management Responsibility
Ecologically Valuable Areas	Land use management	Land use plan implementation	Entire watershed	Support implementation set forth in the regional land use plan and in the development plan for Waukesha County	Town of Mukwonago, Town of Genesee, and Waukesha County
	Watershed land management	Urban nonpoint source controls	Entire watershed	Implement and maintain recommended good urban housekeeping practices, maintenance of grassed swales, and provision for stormwater detention for new subdivision development	Spring Brook Watershed Lake Management District, Spring Lake of Waukesha County Property Owners Association, Inc., Town of Mukwonago, Town of Genesee, and Waukesha County
		Rural nonpoint source controls	Entire watershed	Implement and maintain rural land best management practices; develop and implement farm conservation plans as necessary for integrated nutrient and pest management in the watershed	Spring Brook Watershed Lake Management District, Spring Lake of Waukesha County Property Owners Association, Inc., Town of Mukwonago, Town of Genesee, and Waukesha County
		Construction site erosion control	Entire watershed	Continue to enforce existing erosion control and water quality protection ordinances; refine ordinances where necessary	Waukesha County
		Environmentally sensitive lands protection	Entire watershed	Support preservation and rehabilitation of environmental corridor lands	Spring Brook Watershed Lake Management District, and Spring Lake of Waukesha County Property Owners Association, Inc.
		Wetland and woodland management	Spring Lake wetlands and fens, Spring Lake woods	Acquire wetland and woodland ecosystems, or purchase of conservation easements, as recommended in the natural areas plan	Waukesha County, and Waukesha Land Conservancy
Aquatic Plants	Aquatic plant management	Manual harvesting	Areas of nuisance growth in Spring and Willow Spring Lakes	Harvest nuisance plants, including Eurasian water milfoil and purple loosestrife, as required around docks and piers	Spring Brook Watershed Lake Management District and Spring Lake of Waukesha County Property Owners Association, Inc.
		Biological control	Areas of nuisance growth in Spring and Willow Spring Lakes	Promote the introduction and spread of the Eurasian water milfoil weevil (*Eurhychiopsis lecontei*) and purple loosestrife beetles (*Hylobius transversovittatus, Galerucella calmariensis, G. pusilla, and/or Nanophyes marmoratus*)	Spring Brook Watershed Lake Management District, and Spring Lake of Waukesha County Property Owners Association, Inc.

Table 16 (continued)

Issue	Plan Element	Subelement	Location	Management Measures	Management Responsibility
Aquatic Plants (continued)	Aquatic plant management (continued)	Nuisance species monitoring program	Entire watershed	Monitor lakes and surrounding wetlands for the presence or spread of nuisance species, including Eurasian water milfoil, purple loosestrife, and zebra mussel; limited chemical control may be considered, as necessary	Spring Brook Watershed Lake Management District, and Spring Lake of Waukesha County Property Owners Association, Inc.
Fisheries	Fisheries management	Fisheries survey	Spring and Willow Spring Lakes	Conduct fisheries survey of both lakes to determine the current status of the fishery; review survey data and develop fishing regulations and habitat protection measures for improved fisheries as needed	Wisconsin Department of Natural Resources, Spring Brook Watershed Lake Management District and Spring Lake of Waukesha County Property Owners Association, Inc.
Nonpoint Source Pollution Controls and Surface Water Quality	Water quality management	Water quality control	Entire lake	Incorporate specific actions within their stormwater management plan for the protection of the surface water quality of the Lakes	Waukesha County, Town of Mukwonago, and Town of Genesee
		Water quality monitoring	Entire lake	Continue to participate in the DNR Self-Help Monitoring Program and University of Wisconsin-Extension Adopt-A-Lake Program	Spring Brook Watershed Lake Management District ,and Spring Lake of Waukesha County Property Owners Association, Inc.
Public Recreation and Boating Access	Recreational use management	Public access	Spring Lake	Provide adequate public access and parking facilities; consider adoption of alternative public recreational boating access standards	Town of Mukwonago, Spring Lake of Waukesha County Property Owners Association, Inc., and WDNR
Institutional Development	Institutional development for lake management	Spring Lake of Waukesha County Property Owners Association, Inc.	Riparian area of Spring Lake	Consider formation or extension of a public inland lake protection and rehabilitation district around Spring Lake	Town of Mukwonago, Spring Lake of Waukesha County Property Owners Association, Inc., Spring Brook Watershed Lake Management District, and Waukesha County
	Informational programming	Public informational programming	Entire watershed	Continue public awareness and information programming; encourage householders to adopt environmentally sustainable land management practices and participate in soil testing program offered by UW-Extension	Spring Lake of Waukesha County Property Owners Association, Inc., and Spring Brook Watershed Lake Management District

[a]*Costs to be determined.*

Source: SEWRPC.

APPENDICES

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Appendix A

ILLUSTRATIONS OF COMMON AQUATIC PLANTS FOUND IN SPRING AND WILLOW SPRING LAKES

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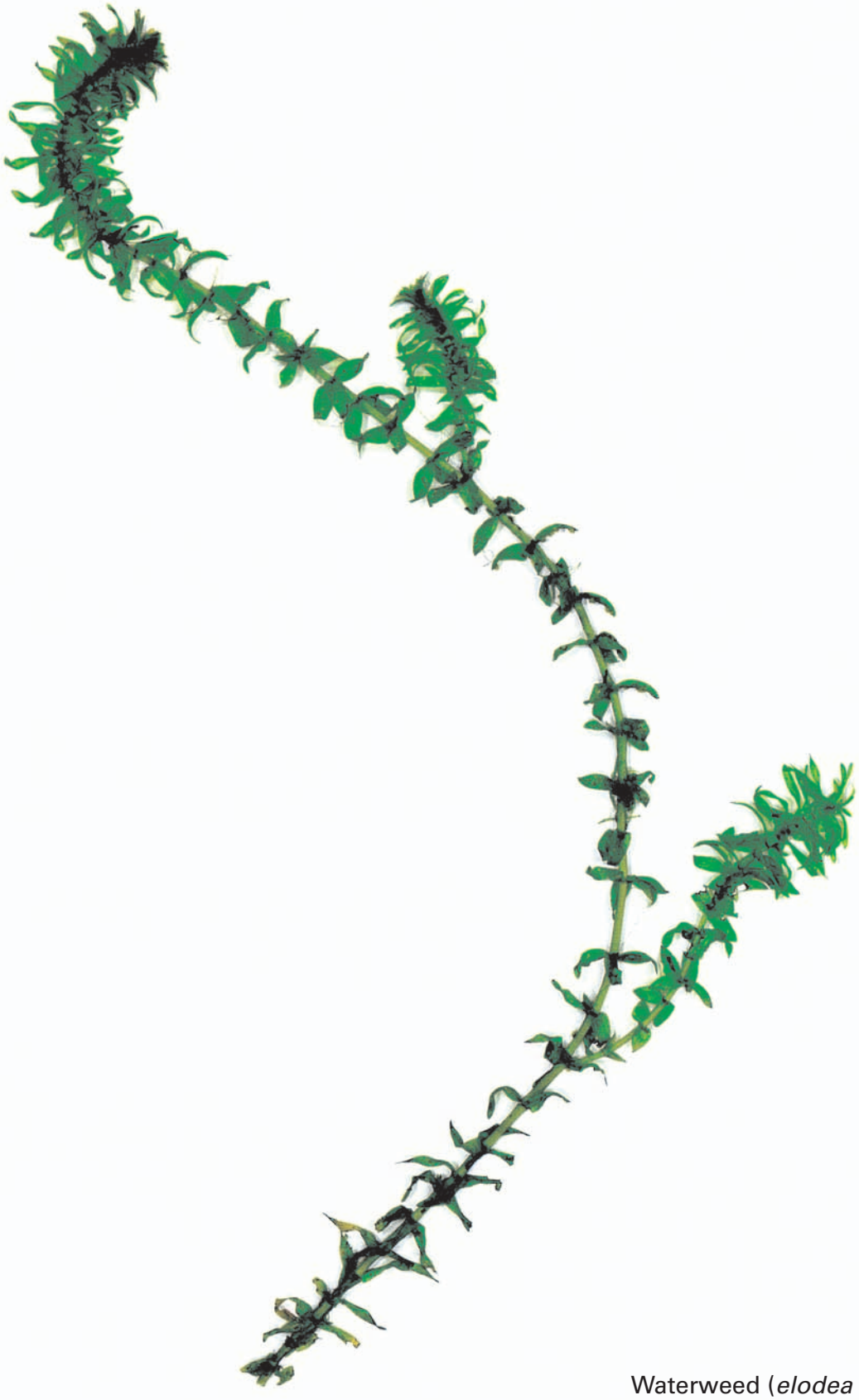
Coontail (*ceratophyllum demersum*)

Muskgrass (*chara vulgaris*)



Waterweed (*elodea canadensis*)

Native Water Milfoil (*myriophyllum* sp.)

Eurasian Water Milfoil (*myriophyllum spicatum*)

Bushy Pondweed (*najas flexilis*)

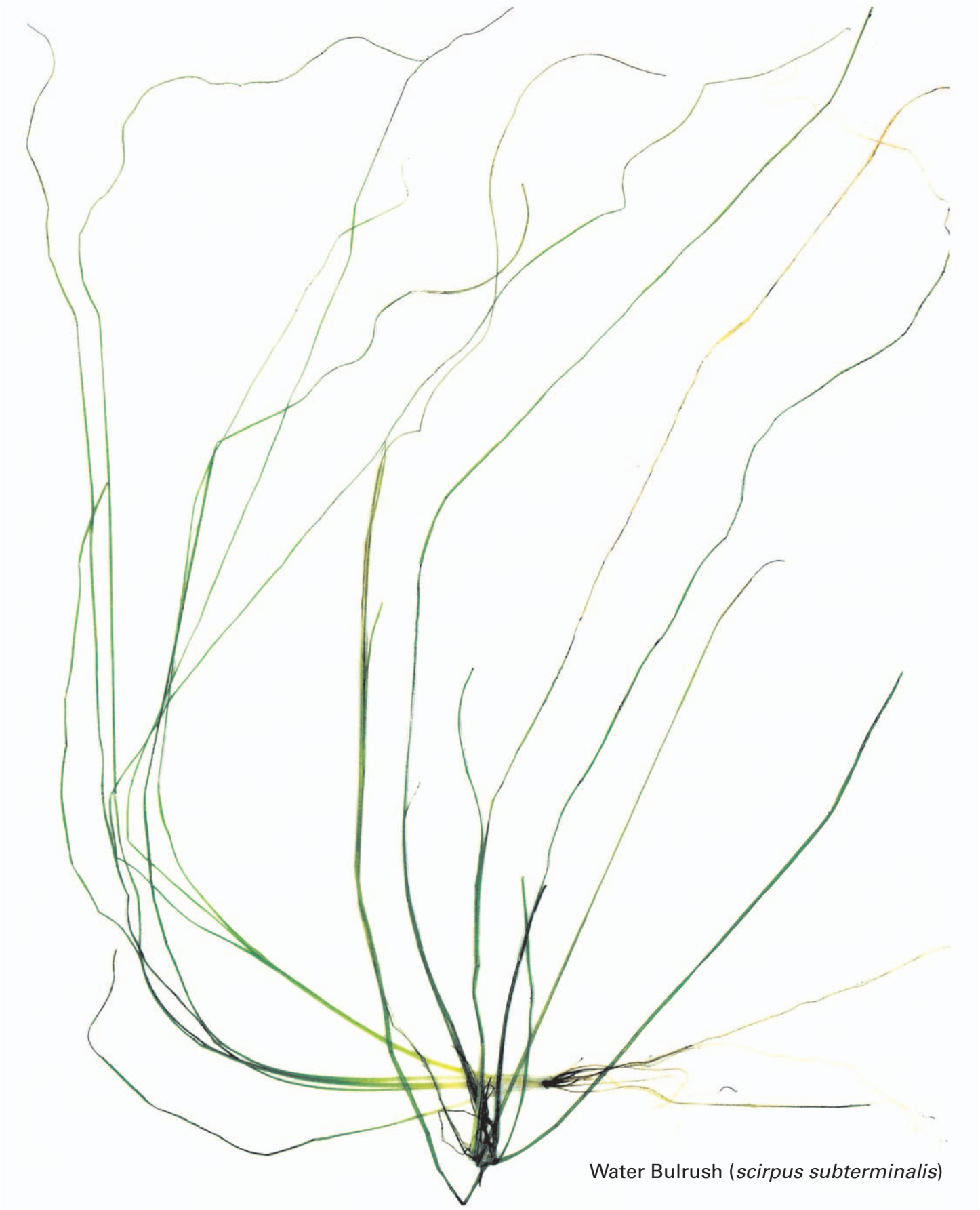
Variable Pondweed (*potamogeton gramineus*)

Illinois Pondweed (*potamogeton illinoensis*)

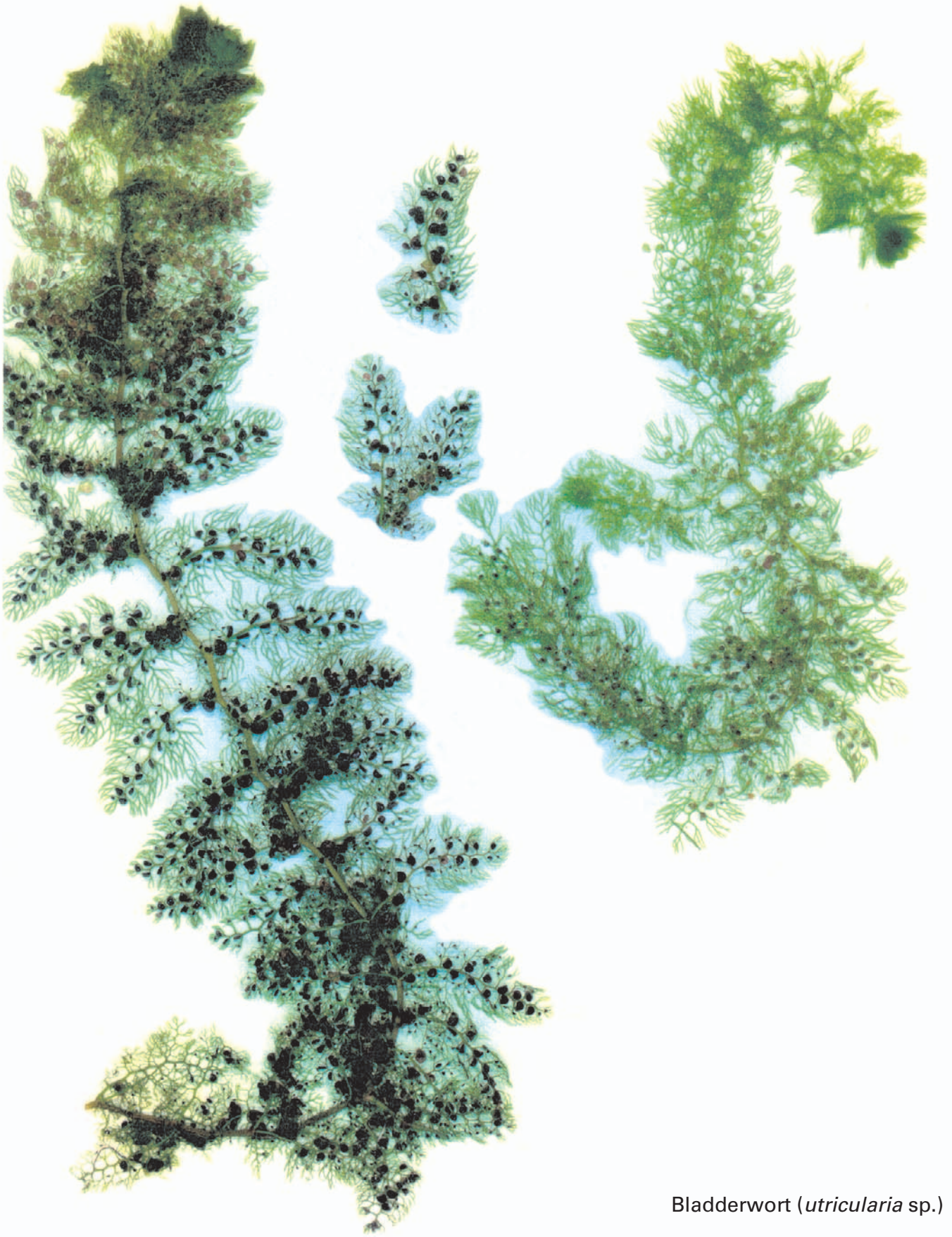
Floating-Leaf Pondweed (*potamogeton natans*)

Sago Pondweed (*potamogeton pectinatus*)

Robbins Pondweed (*potamogeton robbinsii*)



Water Bulrush (*scirpus subterminalis*)



Bladderwort (*utricularia* sp.)

Eel Grass / Wild Celery (*valisneria americana*)

Water Stargrass (*zosterella dubia*)

Curly-Leaf Pondweed (*potamogeton crispus*)

Flat-Stem Pondweed (*potamogeton zosteriformis*)

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Appendix B

PRELIMINARY VEGETATION SURVEYS OF WETLANDS ADJACENT TO SPRING AND WILLOW SPRING LAKES

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SVY2473/#53744
REL

EXHIBIT A

PRELIMINARY VEGETATION SURVEY
SPRING LAKE AND WILLOW SPRING LAKE WETLANDS

Dates: October 22, 1971; April 3, 1982; September 16, 1993; October 13, 1993; April 19,1994; May 16, 1996; July 16, 1996; July 31, 2000; August 24, 2000; & June 20 and 22, 2001

Observers:

Donald M. Reed, Chief Biologist
Lawrence A. Leitner, Ph.D., Principal Biologist
Rachel E. Lang, Senior Biologist
Christopher J. Jors, Research Analyst
Southeastern Wisconsin Regional Planning Commission

Jerry A. Schwarzmeier, Senior Naturalist
Waukesha County

William E. Tans, Botanist
Wisconsin Department of Natural Resources

Location: Town of Mukwonago in parts of the U.S. Public Land Survey
Sections 3, 4, and 9, Township 5 North, Range 18 East,
Waukesha County, Wisconsin.

Species List:

SPHAGNACEAE
- Sphagnum spp.--Sphagnum

EQUISETACEAE
- Equisetum arvense--Common horsetail
- Equisetum hyemale-—Scouring rush

POLYPODIACEAE
- Onoclea sensibilis--Sensitive fern
- Thelypteris palustris--Marsh fern
- Dryopteris cristata--Crested wood fern

PINACEAE
- Larix laricina--Tamarack

TYPHACEAE
- Typha latifolia--Broad-leaved cat-tail
- Typha angustifolia--Narrow-leaved cat-tail

GRAMINEAE
- Bromus ciliatus--Ciliated brome grass
- Phragmities communis--Tall reed grass
- Calamagrostis canadensis--Canada bluejoint
- Agrostis gigantea[1]--Redtop grass
- Muhlenbergia glomerata--Fen muhly grass
- Muhlenbergia mexicana--Leafy satin grass
- Spartina pectinata--Prairie cord grass
- Phalaris arundinacea[1]--Reed canary grass
- Leersia oryzoides--Rice cut grass
- Panicum flexile--Wiry panic grass
- Andropogon gerardi--Big bluestem

CYPERACEAE
- Eleocharis sp.--Spike-rush
- Scirpus validus--Soft-stemmed bulrush
- Scirpus acutus--Hard-stemmed bulrush
- Scirpus cyperinus--Wool-grass
- Scirpus atrovirens--Green bulrush
- Eriophorum angustifolium--Narrow-leaved cotton-grass
- Carex vulpinoidea--Fox sedge
- Carex bebbii—Sedge
- Carex pensylvanica—-Pennsylvania sedge
- Carex (granularis?)--Sedge
- Carex lasiocarpa--Woolly sedge
- Carex buxbaumii—Sedge
- Carex stricta-—Tussock sedge
- Carex aquatilis--Aquatic sedge
- Carex hystericina--Bottlebrush sedge
- Carex comosa--Bristly sedge
- Carex lacustris--Lake sedge
- Carex spp.--Sedge

LEMNACEAE
- Lemna minor--Lesser duckweed

JUNCAEAE
- Juncus sp.--Rush

LILIACEAE
- Smilacina racemosa[2]—-Solomon’s plume

IRIDACEAE
- Iris virginica--Virginia blueflag

ORCHIDACEAE
- Spiranthes cernua--Nodding ladies tresses orchid

SALICACEAE
- Populus tremuloides—-Quaking aspen
- Populus deltoides--Cottonwood
- Salix babylonica[1]--Weeping willow
- Salix nigra--Black willow
- Salix exigua—-Sand-bar willow
- Salix bebbiana--Beaked willow
- Salix discolor—-Pussy willow
- Salix candida--Sage willow
- Salix sp.--Willow

BETULACEAE
- Corylus americana[2]—-Hazel-nut
- Betula pumila--Bog birch

FAGACEAE
- Quercus alba[2]—-White oak
- Quercus macrocarpa[2]--Bur oak
- Quercus rubra[2]—Red oak

ULMACEAE
- Ulmus americana--American elm

URTICACEAE
- Urtica procera--Stinging nettle
- Pilea pumila--Clearweed

POLYGONACEAE
- Rumex orbiculatus--Great water dock
- Polygonum cuspidatum[1]—-Japanese knotweed

RANUNCULACEAE
- Caltha palustris--Marsh marigold
- Ranunculus abortivus—-Small-flowered buttercup
- Thalictrum dasycarpum--Tall meadow rue
- Anemone quinquefolia[2]-—Wood anemone

SAXIFRAGACEAE
- Saxifraga pensylvanica--Swamp saxifrage
- Ribes americanum--Wild black currant
- Ribes cynosbati—-Pasture gooseberry

ROSACEAE
- Fragaria virginiana—-Wild strawberry
- Potentilla simplex[2]-—Old field cinquefoil
- Potentilla fruticosa--Shrubby cinquefoil
- Potentilla palustris—Bog cinquefoil
- Geum canadense--White avens
- Geum aleppicum--Yellow avens
- Rubus occidentalis--Black raspberry
- Rosa multiflora[1]--Multiflora rose
- Prunus serotina[2]-—Black cherry
- Crataegus sp.--Hawthorn
- Spiraea alba--Meadow sweet

FABACEAE
- Lathyrus palustris--Marsh vetchling

BALSAMINACEAE
- Impatiens capensis—-Orange jewelweed

RHAMNACEAE
- Rhamnus cathartica[1]--Common buckthorn
- Rhamnus frangula[1]--Glossy buckthorn

VITACEAE
- Vitis riparia--River-bank grape
- Parthenocissus quinquefolia-—Virginia creeper

HYPERICACEAE
- Triadenum fraseri--Marsh St. Johns wort

VIOLACEAE
- Viola sororia-—Blue violet
- Viola cucullata--Blue marsh violet
- Viola pallens--Smooth white violet

LYTHRACEAE
- Decodon verticillatus--Water willow
- Lythrum alatum--Winged loosestrife
- Lythrum salicaria[1]--Purple loosestrife

ONAGRACEAE
Epilobium leptophyllum--Linear-leaf willow herb
Epilobium coloratum--Willow herb

UMBELLIFERAE
Osmorhiza claytoni—-Sweet cicely
Cicuta bulbifera--Water-hemlock
Cicuta maculata--Spotted water-hemlock
Angelica atropurpurea--Angelica
Oxypolis rigidior--Cowbane

CORNACEAE
Cornus amomum--Silky dogwood
Cornus stolonifera--Red-osier dogwood

PRIMULACEAE
Lysimachia quadriflora--Prairie loosestrife
Lysimachia thyrsiflora--Tufted loosestrife

OLEACEAE
Fraxinus pennsylvanica—-Green ash

GENTIANACEAE
Gentiana procera[3]--Lesser fringed gentian
Gentiana andrewsii--Bottle gentian
Menyanthes trifoliata--Bog bean

ASCLEPIADACEAE
Asclepias incarnata--Marsh milkweed

CONVOLVULACEAE
Cuscuta sp.--Dodder

VERBENACEAE
Verbena hastata--Blue vervain

LABIATAE
Scutellaria lateriflora--Sideflower skullcap
Scutellaria galericulata--Marsh skullcap
Stachys hispida--Marsh hedgenettle
Pycnanthemum virginianum--Mountainmint
Lycopus uniflorus--Northern bugleweed
Lycopus americanus--Cutleaf bugleweed
Mentha arvensis--Wild mint

SCROPHULARIACEAE
Chelone glabra--Turtlehead
Gerardia purpurea--Pink gerardia
Scrophularia lanceolata--Early figwort
Pedicularis lanceolata--Swamp lousewort

LENTIBULARIACEAE
Utricularia sp.--Bladderwort

PLANTAGINACEAE
Plantago major[1]--Common plantain

RUBIACEAE
Galium obtusum--Bedstraw

CAPRIFOLIACEAE
Sambucus canadensis—Elderberry
Lonicera X bella[1,2]-—Hybrid honeysuckle

CAMPANULACEAE
Campanula aparinoides--Marsh bellflower

LOBELIACEAE
Lobelia siphilitica--Great blue lobelia
Lobelia kalmii--Brook lobelia

COMPOSITAE
Helenium autumnale—Sneezeweed
Rudbeckia laciniata-—Green-headed coneflower
Bidens frondosa--Common beggars-ticks
Bidens coronata--Tall swamp-marigold
Bidens sp.--Beggars-ticks
Solidago uliginosa--Bog goldenrod
Solidago patula--Swamp goldenrod
Solidago gigantea--Giant goldenrod
Solidago altissima--Tall goldenrod
Solidago ohioensis[3]--Ohio goldenrod
Solidago riddellii--Riddells goldenrod
Solidago graminifolia--Grassleaf goldenrod
Aster novae-angliae--New England aster
Aster lucidulus--Swamp aster
Aster junciformis--Rush aster
Aster simplex--Marsh aster
Erigeron annus[2]—-Annual fleabane
Eupatorium maculatum--Joe-Pye weed
Eupatorium perfoliatum--Boneset
Cirsium muticum--Swamp thistle
Cirsium arvense[1]--Canada thistle
Taraxacum officinale[1,2]-—Common dandelion
Lactuca serriola[3]—-Prickly wild lettuce

Total number of plant species: 153+
Number of alien, or nonnative, plant species: 12 (8 percent)

This plant community area is part of a larger wetland complex and consists of fresh (wet) meadow, Southern sedge meadow, fen, deep and shallow marsh, and shrub-carr.

Two State-designated Special Concern species, lesser fringed gentian (Gentiana procera) and Ohio goldenrod (Solidago ohioensis), were observed during the field inspection.

_____

[1] Alien or nonnative plant species.
[2] Growing along the wetland edge.
[3] Special Concern plant species.

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#31671 v1-Willow Springs Lake Shoreline
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EXHIBIT A

PRELIMINARY VEGETATION SURVEY
WILLOW SPRINGS LAKE WETLANDS

Date: August 24, 2000

Observer: Rachel E. Lang, Senior Specialist-Biologist
Southeastern Wisconsin Regional Planning Commission

Location: Town of Mukwonago in parts of the Northwest and Northeast one-quarters of U.S. Public Land Survey Sections 3 and 4 respectively, Township 5 North, Range 18 East, Waukesha County, Wisconsin.

Species List:

EQUISETACEAE
- Equisetum arvense--Common horsetail

POLYPODIACEAE
- Thelypteris palustris--Marsh fern

TYPHACEAE
- Typha latifolia--Broad-leaved cat-tail
- Typha glauca X--Hybrid cat-tail

SPARGANIACEAE
- Sparganium eurycarpum--Common bur-reed

ALISMATACEAE
- Sagittaria latifolia--Common arrowhead

GRAMINEAE
- Agrostis gigantea[1]--Redtop grass
- Phalaris arundinacea[1]--Reed canary grass

CYPERACEAE
- Scirpus americanus--Chairmakers rush
- Scirpus validus--Soft-stemmed bulrush
- Scirpus acutus--Hard-stemmed bulrush
- Scirpus fluviatilis--River bulrush
- Scirpus atrovirens--Green bulrush
- Carex stricta--Tussock sedge
- Carex spp.--Sedges

IRIDACEAE
- Iris versicolor--Blue flag iris

ORCHIDACEAE
- Spiranthes cernua--Nodding ladies tresses orchid

SALICACEAE
- Populus deltoides--Cottonwood
- Salix nigra--Black willow
- Salix exigua--Sand-bar willow
- Salix bebbiana--Beaked willow
- Salix discolor--Pussy willow

URTICACEAE
Urtica dioica--Stinging nettle

POLYGONACEAE
Polygonum pensylvanicum--Pinkweed

ROSACEAE
Potentilla fruticosa--Shrubby cinquefoil

BALSAMINACEAE
Impatiens biflora--Jewelweed

RHAMNACEAE
Rhamnus frangula[1]--Glossy buckthorn

VITACEAE
Vitis riparia--River-bank grape

UMBELLIFERAE
Cicuta bulbifera--Water-hemlock

CORNACEAE
Cornus amomum--Silky dogwood

ASCLEPIADACEAE
Asclepias incarnata--Marsh milkweed
Asclepias syriaca[2]--Common milkweed

VERBENACEAE
Verbena hastata--Blue vervain

LABIATAE
Pycnanthemum virginianum--Mountainmint
Mentha arvensis--Wild mint

SCROPHULARIACEAE
Gerardia purpurea--Pink gerardia
Pedicularis lanceolata--Swamp lousewort

CAPRIFOLIACEAE
Sambucus canadensis--Elderberry

COMPOSITAE
Solidago gigantea--Giant goldenrod
Solidago altissima[2]--Tall goldenrod
Solidago riddellii--Riddells goldenrod
Eupatorium maculatum--Joe-pye weed
Eupatorium perfoliatum—Boneset

Total number of plant species: 43+
Number of alien, or nonnative, plant species: 3 (7 percent)

This approximately 5.3-acre plant community area is part of the Willow Springs Lake wetland complex and consists of fresh (wet) meadow, second growth, Southern wet to wet-mesic lowland hardwoods, shallow marsh and Southern sedge meadow. Disturbances to the plant community area include past water level changes due to the placement of a dam. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspection.

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[1] Alien or nonnative plant species.
[2] Growing along the wetland edge.

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#52048
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EXHIBIT A

PRELIMINARY VEGETATION SURVEY
WILLOW SPRING LAKE LAKESHORE

Date: June 18, 2001

Observer: Rachel E. Lang, Senior Specialist-Biologist
Southeastern Wisconsin Regional Planning Commission

Location: Town of Mukwonago in parts of the Northwest and Northeast one-quarters of U.S. Public Land Survey Section 3 and 4 respectively, Township 5 North, Range 19 East, Waukesha County, Wisconsin.

Species List:

POLYPODIACEAE
- *Onoclea sensibilis*--Sensitive fern
- *Thelypteris palustris*--Marsh fern

TYPHACEAE
- *Typha latifolia*--Broad-leaved cat-tail
- *Typha angustifolia*--Narrow-leaved cat-tail
- *Typha glauca* X--Hybrid cat-tail

GRAMINEAE
- *Phalaris arundinacea*[1]--Reed canary grass

CYPERACEAE
- *Scirpus americanus*--Chairmakers rush
- *Scirpus fluviatilis*--River bulrush
- *Scirpus atrovirens*--Green bulrush
- *Carex vulpinoidea*--Fox sedge
- *Carex bebbii*--Sedge
- *Carex lacustris*--Lake sedge

JUNCACEAE
- *Juncus* sp.--Rush

IRIDACEAE
- *Iris versicolor*--Blue flag iris

SALICACEAE
- *Populus tremuloides*[2]--Quaking aspen
- *Populus deltoides*--Cottonwood
- *Salix nigra*--Black willow
- *Salix exigua*--Sand-bar willow
- *Salix bebbiana*--Beaked willow
- *Salix discolor*--Pussy willow

URTICACEAE
- *Urtica dioica*--Stinging nettle

POLYGONACEAE
- *Rumex orbiculatus*--Great water dock
- *Rumex crispus*[1,2]--Curly dock
- *Polygonum amphibium*--Smartweed

ACERACEAE
Acer negundo--Boxelder

BALSAMINACEAE
Impatiens biflora--Jewelweed

VITACEAE
Vitis riparia--River-bank grape
Parthenocissus quinquefolia--Virginia creeper

UMBELLIFERAE
Cicuta bulbifera--Water-hemlock

CORNACEAE
Cornus amomum--Silky dogwood

ASCLEPIADACEAE
Asclepias incarnata--Marsh milkweed

LABIATAE
Lycopus americanus--Cutleaf bugleweed
Mentha arvensis--Wild mint

SOLANACEAE
Solanum dulcamara[1]--Deadly nightshade

CAPRIFOLIACEAE
Sambucus canadensis--Elderberry

COMPOSITAE
Solidago altissima--Tall goldenrod
Aster lucidulus--Swamp aster
Eupatorium perfoliatum--Boneset
Cirsium arvense[1,2]--Canada thistle

Total number of plant species: 39
Number of alien, or nonnative, plant species: 4 (10 percent)

This lakeshore plant community area consists of shallow marsh and fresh (wet) meadow with scattered shrubs and trees. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspection.

_____

[1] Alien or nonnative plant species.
[2] Growing along the wetland edge.

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#51761
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EXHIBIT A

PRELIMINARY VEGETATION SURVEY
SPRING LAKE LAKESHORE AND WETLAND AREAS

Dates: June 20 and 22, 2001

Observer: Rachel E. Lang, Senior Specialist-Biologist
Southeastern Wisconsin Regional Planning Commission

Location: Town of Mukwonago in the Southeast one-quarter of Section 4 and the North one-half of Section 9, of U.S. Public Land Survey, Township 5 North, Range 18 East, Waukesha County, Wisconsin.

Species List: Plant Community Area No. 1

TYPHACEAE
- Typha latifolia--Broad-leaved cat-tail
- Typha angustifolia--Narrow-leaved cat-tail

ALISMATACEAE
- Sagittaria latifolia--Common arrowhead

GRAMINEAE
- Glyceria striata--Fowl manna grass
- Phragmites communis--Tall reed grass
- Phalaris arundinacea[1]--Reed canary grass

CYPERACEAE
- Eleocharis palustris--Great spike-rush
- Scirpus americanus--Chairmakers rush
- Scirpus validus--Soft-stemmed bulrush
- Scirpus acutus--Hard-stemmed bulrush
- Carex vulpinoidea--Fox sedge
- Carex aquatilis--Aquatic sedge

SALICACEAE
- Salix nigra[2]--Black willow

ROSACEAE
- Potentilla fruticosa--Shrubby cinquefoil

RHAMNACEAE
- Rhamnus frangula[1,2]--Glossy buckthorn

LYTHRACEAE
- Lythrum salicaria[1]--Purple loosestrife
- Decodon verticillatus--Water willow

ASCLEPIADACEAE
- Asclepias incarnata--Marsh milkweed

LABIATAE
- Mentha arvensis--Wild mint

SOLANACEAE
- Solanum dulcamara[1]--Deadly nightshade

COMPOSITAE
Eupatorium maculatum--Joe-pye weed
Eupatorium perfoliatum--Boneset

Total number of plant species: 22
Number of alien, or nonnative, plant species: 4 (19 percent)

This approximately lakeshore edge plant community area consists of shallow marsh, and fresh (wet) meadow with scattered trees. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspection.

_____

[1] Alien or nonnative plant species.
[2] Growing along the lakeshore edge.

Plant Community Area No. 2

TYPHACEAE
Typha latifolia--Broad-leaved cat-tail

CYPERACEAE
Scirpus acutus--Hard-stemmed bulrush
Carex aquatilis--Aquatic sedge
Carex spp.--Sedges

SALICACEAE
Salix bebbiana--Beaked willow
Salix spp.--Willows

BETULACEAE
Betula pumila--Bog birch

ROSACEAE
Potentilla palustris--Bog cinquefoil

LYTHRACEAE
Lythrum salicaria[1]--Purple loosestrife

GENTIANACEAE
Menyanthes trifoliata--Bog bean

ASCLEPIADACEAE
Asclepias incarnata--Marsh milkweed

CAMPANULACEAE
Campanula aparinoides--Marsh bellflower

COMPOSITAE
Eupatorium maculatum--Joe-pye weed
Eupatorium perfoliatum--Boneset

Total number of plant species: 14
Number of alien, or nonnative, plant species: 1 (7 percent)

This plant community area is a portion of the northwest wetland and is part of a larger wetland complex consistsing of shallow marsh and good quality Southern sedge meadow. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspection.

_____

[1] Alien or nonnative plant species.

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Appendix C

TOWN OF MUKWONAGO
LAKE USE ORDINANCES

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STATE OF WISCONSIN: COUNTY OF WAUKESHA: TOWN OF MUKWONAGO

ORDINANCE NO. 92-5

An ordinance to repeal and recreate the
BOATING CODE
in the
TOWN OF MUKWONAGO

The Town Board of the Town of Mukwonago, Waukesha County, State of Wisconsin, DO ORDAIN AS FOLLOWS:

SECTION 1: An ordinance to regulate the use or operation of boats, the water traffic and the water sports upon or under all waters except for Lower Phantom Lake lying within the Town of Mukwonago and to restrict or prohibit the use or operation of all motorized vehicles on the surfaces of the frozen waters lying within the Town of Mukwonago and to declare and impose penalties and enforce the same for any violation of such ordinance. All prior ordinances, including but not limited to Ordinance Nos. 97, 82-1 and 88-2 are hereby repealed and recreated to read as follows:

UPPER PHANTOM LAKE

WHEREAS, the Town of Mukwonago has within its corporate boundaries a beautiful spring fed lake known as Upper Phantom Lake; and

WHEREAS, Upper Phantom Lake is surrounded by year round homes whose occupants enjoy the aesthetic beauty and serenity provided by the view; and

WHEREAS, Upper Phantom Lake is heavily used by the anglers, canoists, sailboaters, sailboarders, boaters, campers, picnickers, and waterskiers to such an extent that the watershed suffers from over-use; and

WHEREAS, the Phantom Lakes Management District was given the power to protect and monitor the ecosystem, and it is their conclusion that there should be laws that govern the use of the lake.

THEREFORE, the Town of Mukwonago, in the best interest of the public health, safety, and welfare, deems it necessary that

special regulations be adopted to protect life, property, and environmental quality of Upper Phantom Lake.

SPRING LAKE

WHEREAS, the Town of Mukwonago has within its corporate boundaries a beautiful spring fed lake known as Spring Lake; and

WHEREAS, Spring Lake is a shallow body of water abundant with aquatic vegetation and supporting fish life; and

WHEREAS, Spring Lake is heavily used, mainly by the angler and wildlife enthusiast, and its greatest attribute is as a fishery; and

WHEREAS, the Department of Natural Resources has stated that large portions of Spring Lake are not suited for motor powered boats; and

WHEREAS, Spring Lake's water quality is suited for swimming: the gradual slope of the basin with a gravel and sandy bottom enhances the swimming potential. Due to the shallowness of Spring Lake at the shoreline, swimmers must travel a substantial distance from the shoreline in order to be able to swim; and

WHEREAS, the marsh frontage contiguous with the open water of Spring Lake is a prime pheasant and muskrat habitat; and

WHEREAS, wildlife observation opportunities are ideal as the aesthetic features are rated highly by the Department of Natural Resources.

THEREFORE, the Town of Mukwonago, in the best interest of the public health, safety, and welfare deems it necessary that special regulations be adopted to protect life, property, and environmental quality of Spring Lake.

WILLOW SPRING LAKE

WHEREAS, the Town of Mukwonago has within its corporate boundaries a beautiful spring fed lake known as Willow Spring Lake; and

WHEREAS, Willow Spring Lake is an impoundment of approximately 43 acres situated in an environmentally sensitive area; and

WHEREAS, the majority of lands adjacent to Willow Spring Lake have Houghton muck soils which exhibit a high erosion potential and wakes created by outboard motors could accelerate the erosion problem; and

WHEREAS, the most prevalent macrophyte in Willow Spring Lake is myriophyllum sp. (Parrots Feather). This plant reproduces through fragmentation. Any broken pieces of this plant will sprout and start a new plant. Operation of motor boats through these weed beds will increase weed growth in Willow Spring Lake, decreasing the quality of the lake for sailing, swimming, and other open-water activities; and

WHEREAS, the wetlands surrounding Willow Spring Lake have been classified by the Waukesha County Naturalist, and the survey indicated that the environmental quality of the wetlands around Willow Spring Lake were of exceptional quality and included observations of plant and animal species which would be disturbed by operation of outboard motors. Observation of ospreys, great blue herons, rookeries of little green herons, and pied-billed grebes indicate the importance of maintaining Willow Spring Lake in as natural a state as possible, including minimizing wildlife disturbance by outboard motors; and

WHEREAS, Willow Spring Lake ice conditions are treacherous throughout the winter as numerous springs, Spring Creek, and the Spring Creek outlet modify ice conditions resulting in weakened ice cover and hazardous conditions for vehicular travel.

THEREFORE, the Town of Mukwonago, in the best interest of the public health, safety, and welfare, deems it necessary that special regulations be adopted to protect life, property, and environmental quality of Willow Spring Lake.

CHAPTER 2

BOATING CODE

2.01 APPLICABILITY

The provisions of this ordinance shall apply to the waters of Spring Lake, Willow Spring Lake, Upper Phantom Lake, Rainbow Spring Lakes, Mukwonago County Park Lakes, the Fox River, the Mukwonago River, Spring Creek, and Jericho Creek within the jurisdiction of the Town of Mukwonago. The provisions of this ordinance shall be enforced by the officers of the Water Safety Patrol Unit and police of the jurisdiction of the Town of Mukwonago.

2.02 STATE BOATING AND WATER SAFETY LAWS ADOPTED

Except as otherwise specifically provided in this ordinance, the current and future statutory provisions describing and defining regulations with respect to water traffic, boats, boating, and related water activities in CHAPTERS 30.29, 30.50 up to and including 30.71, 30.81, 23.33(3)(h) and 350.10(9) of the WISCONSIN STATUTES, exclusive of any provisions therein relating to the penalties to be imposed or the punishment for violation of said statutes, are hereby adopted and by reference made a part of this ordinance as if fully set forth herein. Any act required to be performed or prohibited by any current or future statute incorporated herein by reference is required or prohibited by this ordinance. Any future additions, amendments, revisions, or modifications of the statutes incorporated herein are intended to be made part of this ordinance in order to secure uniform state-wide regulation of the waterways of the state.

2.03 DEFINITIONS

A. BOAT: or vessel means every description of watercraft other than a seaplane on the water, used or capable of being used as a means of transportation on water including sailboards and inflatables.

B. DESIGNATED ANCHORAGES: an area of water established and marked as an anchorage by lawful authority.

C. MOTORBOAT: means any boat equipped with propulsion machinery whether in use or not.

D. MOTOR VEHICLE: shall be construed to mean any kind of device or thing designed or utilized for propulsion or movement using a motor, whether internal combustion design or not, and includes all vehicles which are of any type or kind in any way self-propelled, but is not limited to any automobile, mini-bike, go-cart, trail bike, all-terrain vehicle, motorcycle, mo-ped, jeep, motor truck, or snowmobile.

E. OPERATE: or use when used in reference to a motorboat or vessel means to navigate or employ.

F. OPERATE: or use when used in reference to a motor vehicle means to drive or be in actual physical control of a motor vehicle.

G. PUBLIC ACCESS: any access to the water by means of public property.

H. SHORE ZONE: all surface water within 100 feet of any shore.

I. SLOW-NO-WAKE: means that speed at which a boat moves as slowly as possible while still maintaining steerage control.

J. SWIMMING ZONE: an authorized area marked by regulatory markers to designate a swimming area.

K. WATERSKIING: the use of waterskis, surfboard, innertube, or any similar device while being towed.

2.04 GENERAL RULES FOR ALL WATERS

A. RACING PROHIBITED

No person shall operate a motorboat in a race of speed contest with any other motorboat except as provided in properly regulated races, regattas, sporting events, and exhibitions authorized by the Town Board.

B. SWIMMING REGULATIONS

1. SWIMMING FROM BOAT. No person shall swim from any unmanned boat unless such boat is anchored.

2. DISTANCE FROM SHORE OR RAFT. Unless in a designated swimming zone, no person shall swim more than 150 feet from shore or more than 50 feet from a diving raft unless accompanied by a boat for the protection of the swimmer and as an aid to other boats in determining the location of the swimmer, and such swimmer shall not be more than 50 feet from the accompanying boat.

3. HOURS LIMITED. No person shall swim more than 150 feet from the shoreline between sunset and sunrise.

4. SWIMMING ZONES. The Town Board may, by resolution, designate swimming areas and cause such areas to be appropriately marked.

C. WATER SKIING

All skiing shall be done in a counter-clockwise pattern.

D. LITTERING PROHIBITED

No person shall deposit, place, or throw from any boat, raft, pier platform, motorized vehicle, or similar structure or from or on the adjoining shoreline any cans, papers, bottles, debris, refuse, garbage, or solid or liquid waste into the waters or upon the frozen surface.

E. ICEBOUND WATERS

1. SPEED OF VEHICLES. 15 mph for all vehicles licensed for highway travel.

2. NEGLIGENT OPERATION. No person may operate or use a motor vehicle upon the icebound waters in a careless, negligent, or reckless manner so as to endanger his life, property, or person, or the life, property, or person of another.

3. LIABILITY OF LOCAL GOVERNMENT. All traffic on the ice-bound inland waters shall be at the risk of the traveler.

4. OPERATION OF SNOWMOBILES AND ALL TERRAIN VEHICLES. See Sec. 350.10(9) and Sec. 23.33(3)(h) Stats.

F. OPERATION OF MOTOR VEHICLES IN WATER PROHIBITED

Any operation of motor vehicles in navigable waters is prohibited except as provided for in Sec. 30.29(3) Stats.

2.05 AQUA-PLANES AND PARA-SAILING

Aqua-planing and Para-sailing are not allowed at any time.

2.06 SPECIFIC RULES FOR UPPER PHANTOM LAKE

A. CHANNEL WAYS

The Town Board does designate the following channel ways to be "Slow-No-Wake" areas:

1. The portion of the channel that specifically lies between the two points of land which connect Lower and Upper Phantom Lakes and which extends 150 feet into the upper lake in a south-westerly direction as marked by buoys.

B. WATERSKIING

The Town Board does prohibit waterskiing or towing a waterskier during the following hours:

1. No waterskiing any day before 10:00 A.M.

2. No waterskiing after 7:00P.M. on Monday, Tuesday, Wednesday, Thursday, or Friday.

3. No waterskiing after 4:00P.M. on Saturday, Sunday or holidays.

C. SPEED

No person shall operate a boat in excess of 10 mph between the hours of 7:00 P.M. and sunset on Monday, Tuesday, Wednesday, Thursday or Friday, and between the hours of 4:00 P.M. and sunset on Saturday, Sunday and holidays.

2.07 Specific Rules For Spring Lake

A. Speed Restrictions
No person shall operate a motorboat at a speed in excess of slow-no-wake except between the hours of 11:00 A.M. and 2:00 P.M.

B. Waterskiing
The Town Board does designate that no person shall be permitted to waterski and no person shall be permitted to operate a boat while towing another person on waterskis, surfboard, or any similar device between the hours of 2:00 P.M. and 11:00 A.M.

2.08 SPECIFIC RULES FOR WILLOW SPRING LAKE

A. Motor Vehicles prohibited on Icebound Waters
No person shall operate or use a motor vehicle upon the icebound waters of Willow Spring Lake.

B. MotorBoats and/or Motor Vehicles Propelled by an Internal Combustion Engine Prohibited
No person shall operate a motorboat and/or a motor vehicle propelled by an internal combustion engine on the waters of Willow Spring Lake.

C. Speed Restrictions

Pursuant to Section 30.635, Wisconsin Statutes, no person sha operate a motorboat at a speed in excess of slow-no-wake.

2.09 PENALTY

A. STATE BOATING AND WATER SAFETY LAWS AND ALL OTHER VIOLATIONS SET FORTH IN SECTION 2.02 OF THIS ORDINANCE

Any forfeiture for violation of the State Statutes adopted by reference in Section 2.02 of this ordinance shall conform to the forfeiture permitted to be imposed for violation of such statutes as set forth in the Uniform Wisconsin Deposit and Ba Schedule for Conservation, Boating, Snowmobile, and ATV Violations, including any variations or increases for subsequent offenses, which schedule is adopted by reference.

B. LOCAL BOATING LAWS AS SET FORTH IN SECTION 2.04 AND 2.05, 2.0 2.07, AND 2.08 OF THIS ORDINANCE

1. GENERAL PROVISIONS. Any person over 16 years of age or older violating the provisions of this ordinance shall be subject to a forfeiture of not more than $500.00 plus cou costs and penalty assessment for the first offense.

Failure to pay any forfeiture hereunder shall subject the violator to imprisonment in the County Jail until full pay ment is made but not to exceed 90 days.

Any persons 14 or 15 years of age shall be subject to a forfeiture of not less than $10.00 nor more than $25.00 plus court costs and penalty assessment per each offense or referred to the proper authorities as provided in Chapter 48, Wisconsin Statutes. Failure to pay any forfeiture hereunder shall subject the violator to the provisions of Section 48.17(2), Wisconsin Statutes.

Any person under the age of 14 shall be referred to the proper authorities as provided in Chapter 48, Wisconsin Statutes.

2. DEPOSIT SCHEDULE

2.02	Applicable sections of Uniform Wisconsin Deposit and Bail Schedule for Conservation, Boating, Snowmobile, and ATV Violations.
2.04(A)	$50.00 plus court costs and penalty assessment
2.04(B)(1)	$50.00 plus court costs and penalty assessment
2.04(B)(2)	$50.00 plus court costs and penalty assessment
2.04(B)(3)	$50.00 plus court costs and penalty assessment.

2.04(C)	$50.00	plus court costs and penalty assessment
2.04(D)	$50.00	plus court costs and penalty assessment. (except metal and glass)
2.04(D)	$100.00	plus court costs and penalty assessment. (metal and glass only)
2.04(E)	$50.00	plus court costs and penalty assessment.
2.04(F)	$50.00	plus court costs and penalty assessment.
2.05	$50.00	plus court costs and penalty assessment.
2.06(B)	$50.00	plus court costs and penalty assessment.
2.06(C)	$50.00	plus court costs and penalty assessment.
2.07(A)	$50.00	plus court costs and penalty assessment.
2.07(B)	$50.00	plus court costs and penalty assessment.
2.08(A)	$50.00	plus court costs and penalty assessment.
2.08(B)	$50.00	plus court costs and penalty assessment.
2.08(C)	$50.00	plus court costs and penalty assessment.

3. DEPOSIT FOR REPEAT OFFENSES

Any person found guilty of violating this ordinance or any part thereof who was previously convicted of the same section within the last year shall forfeit twice the deposit delineated above plus court costs and penalty assessment.

4. NON-SCHEDULED DEPOSIT

If a deposit schedule has not been established for a specific violation, the arresting officer shall require the alleged offender to deposit not less than the maximum forfeiture permitted hereunder.

2.10 ENFORCEMENT

A. ENFORCEMENT PROCEDURE

The statutory provisions of sections 66.115, 66.119, 66.12, 30.29, 30.50 to 30.71, and Chapter 199, Wisconsin Statutes, are adopted and by reference made a part of this Ordinance as if fully set forth herein. Any act required to be performed or prohibited by any statute incorporated herein by reference is required of prohibited by this Ordinance. Any future amendments, revisions, or modifications of the statutes incorporated herein are intended to be made part of this Ordinance in order to secure uniform state-wide regulation and enforcement of boating ordinance violations. Further, the Town

of Mukwonago specifically elects to use the citation method of enforcement.

B. DEPOSITS

1. SCHEDULE OF DEPOSITS

The schedule of cash deposits shall be as set forth in Section 2.09 of this Ordinance. Also included in the cash deposit will be a current penalty assessment fee and the current court costs if applicable.

2. DEPOSITORY

Deposits should be made in cash, money order, or certified check to the clerk of Circuit Court of Waukesha County, who shall issue a receipt therefore as required by Wisconsin Statute. If the deposit is mailed, the signed statement required by Wisconsin Statute shall be mailed with the deposit.

C. ISSUANCE OF CITATIONS

All sections of this Ordinance shall be enforced by a Town police officer or lake patrol officer.

D. NONEXCLUSIVITY

1. OTHER ORDINANCES

Adoption of this Ordinance does not preclude the Town Board from adopting any other Ordinance or providing for the enforcement of any other law or ordinance relating to the same or other matter.

2. OTHER REMEDIES

The issuance of a citation hereunder shall not preclude the Town Board or any authorized office from proceedings under any other Ordinance of Law or by any other enforcement method to enforce any Ordinance, regulation, or order.

SECTION 2: The several sections of this ordinance are declared to be severable. If any section or portion thereof shall be declared by a decision of a court of competent jurisdiction to be invalid, unlawful, or non-enforceable, such decision shall apply only to the specific section or portion thereof directly specified in the decision and not affect the

validity of all other provisions, sections, or portions thereof of the ordinance, which shall remain in full force and effect. Any other ordinances whose terms are in conflict with the provisions or this ordinance are hereby repealed as to those terms that conflict.

SECTION 3: This ordinance shall take effect immediately upon passage and posting or publication as provided by law.

Passed and adopted this 13th day of July, 1992.

BY ORDER OF THE BOARD OF THE TOWN OF
MUKWONAGO, WAUKESHA COUNTY, WISCONSIN

Gilbert Yerke, Town Chairman

Gilbert Yerke, Town Chairman

ATTEST:

Katherine W. Wilson - Clerk

Katherine W. Wilson - Clerk

Published or posted on the 22nd day of July, 1992.

Appendix D

PUBLIC OPINION OF LAKE USE AND WATER QUALITY OF THE SPRING CREEK CHAIN OF LAKES

I. METHODOLOGY

A. Questionnaire survey using a mail-back survey method conducted during summer 2001.

B. Analysis based upon 42 responses out of 89 possible. This correlates to a 48 percent return of questionnaire surveys by the Willow Spring Lake and Spring Lake residents.

II. RESPONDENT PROFILE

Willow Spring Lake

Collectively 43 questionnaire surveys—16 to electors within the Spring Brook Watershed Lake Management District, and 27 to residents in the adjoining subdivision—were mailed to Willow Spring Lake residents, with 19 responses received. This correlates to a 44 percent return overall; however, six responses were incomplete and are not included in the analysis. This effectively correlates to a 30 percent return.

Spring Lake

Collectively 46 questionnaire survey were mailed to members of the Spring Lake of Waukesha County Property Owners Association, Inc., with 16 responses received. This correlates to a 35 percent return overall.

Spring Creek

One respondent indicated their residence as being on Spring Creek.

Spring Brook Watershed

A. Majority of respondents (64 percent) were year-round residents; 28 percent were summer residents; and 8 percent were weekend residents.

B. Majority of respondents (78 percent) had resided on the Spring Creek Chain of Lakes for more than 10 years.

III. LAKE USE

Collectively, the majority of respondents (56 percent) used these waterbodies with family; 33 percent of respondents used the waterbodies as individual; and 8 percent reported using the waterbodies with friends.

A. Categories of Use
Collectively the most popular activities included: aesthetic viewing/bird and wildlife watching, walking/jogging, and picnicking/barbecuing. Fishing, sailing, rowing/canoeing, and swimming/diving were the most popular active recreational pursuits.

Motorized water sports generally were indicated as the least popular activities; it should be noted in this regard that Willow Spring Lake is a nonmotorized boating waterbody.

B. Types of Use

1. Picnicking, aesthetic viewing/wildlife watching, paddle boating, and hunting were the most important uses, rated as 5.0 on a five-point scale, where 5.0 is the most important use. Sailing, rowing, and walking had an average rating of 4.0; while power boating [on Spring Lake] and swimming, and snowmobiling and cross-country skiing, had an average rating of 3.0.

2. Jet skiing and water skiing were the least important uses, being unrated as uses.

C. Intensity of Use
Collectively 64 percent of respondents felt the Lakes of the Spring Creek watershed to be moderately-used.

D. Frequency of Use
Overall, respondents of this questionnaire/survey live fairly active lifestyles. Some of the most frequented Lake activities of the respondents include: bird watching, walking/jogging, picnicking/barbecuing, power boating, and swimming/scuba/snorkeling. A majority of respondents (61 percent) fish the Lakes.

1. On an annual basis, scenic viewing and wildlife/bird watching were the frequently most engaged-in activities (averaging 350 days per year) including 85 percent of respondents. Walking/jogging uses averaged 225 days per year.

2. During spring and summer, walking/jogging was the most frequently engaged in activity (averaging 89 days), followed by bird watching (averaging 53 days), picnicking (averaging 44 days), swimming (averaging 40 days), and rowing/canoeing (averaging 39 days).

3. During autumn and winter, walking/jogging was the most frequently engaged in activity (averaging 29 days), followed by bird watching (averaging 20 days).

4. On average, 60 percent of respondents spent 23 days per year fishing during open water periods, and 14 percent of respondents spent 7 days ice fishing.

E. Levels of Satisfaction
Collectively, of the anglers responding, 55 percent of respondents rated the fishing quality of these Lakes as fair and 36 percent as good.

A majority of the anglers responding caught panfish (95 percent) and largemouth bass (73 percent). Overall, anglers perceived that these populations have remained the same in these systems; those

indicating a perceived change in the fisheries were evenly divided as to whether it has improved or declined over time. One-third of respondents indicated that carp were perceived as having increased.

F. Concerns

Collectively, the greatest concern among respondents (78 percent) was the general water quality of the Lakes. Other, related concerns included wetland preservation (53 percent), development activities around the Lakes (47 percent), and a perceived decline in the fishery and impact of stormwater from the urbanizing areas of the watershed (each indicated by 30 percent of respondents). Farm runoff and shallow water/sedimentation each were identified as issues by 25 percent of respondents, and lake access and use by nonresidents and shoreline erosion each were identified as issues by 20 percent of respondents.

Respondents were divided as to whether the water quality had deteriorated (44 percent) or remained the same (33 percent). A majority of respondents (72 percent) indicated concerns over excessive aquatic plant growth in the Lakes. A majority of respondents (61 percent) indicated that the Lakes had poor water quality based upon aquatic plant and algae growths.

Notwithstanding, respondents indicated that the Lakes had good water quality based upon water clarity (69 percent) and aesthetics (83 percent).

G. Regulations and Law Enforcement Issues

1. Plurality of respondents (47 percent) indicated satisfaction with law enforcement on the Lakes and River, while 22 percent each indicated either an high level of satisfaction or no opinion.

2. Respondents were split over their level of satisfaction with land use zoning regulations in the Lake watershed, 36 percent indicated satisfaction and 36 percent indicated dissatisfaction.

3. Plurality of respondents (42 percent) indicated satisfaction with sanitation regulations in the Lake watershed, one-third indicated no opinion.

H. Water Quality Issues

1. Based upon water clarity and water testing, the majority of the respondents (69 percent) considered the Lakes and River as having good water quality; 14 percent of the respondents did not consider the Lakes and River as having good water quality.

2. Based upon algal and aquatic plant growth, the majority of respondents (61 percent) did not consider the Lakes and River as having good water quality.

3. Based on aesthetic and wildlife conditions, the majority of respondents (83 percent) considered the Lakes and River as having good water quality.

4. Plurality of respondents (44 percent) perceived the quality of the Lakes and River had deteriorated since they first moved to or visited the area, 33 percent perceived the water quality to have stayed the same.

5. Majority of respondents (72 percent) felt that the Lakes and River had excessive algal and aquatic plant growth. Watershed-based management measures, including restricted fertilizer usage and land development controls, were the preferred options for controlling aquatic plants.

I. Management

1. Plurality of respondents (50 percent) was willing to contribute more money for lake-related improvements.

2. Many respondents (30 percent) felt that local, county, and state funds should be allocated for lake-related improvements.

3. Majority of respondents preferred land-based management measures for nutrient and aquatic plant control, including restricted fertilizer usage (91 percent) and land use development controls (83 percent); a plurality (48 percent) suggested a watershed-based approach. One third of respondents also indicated regular septic pumping as a preferred lake management measure.

4. Lake management measures that respondents indicated a willingness to pay for included restrictions on fertilizer usage and land use development controls to keep runoff from the lakes. Lake water quality monitoring and (continued) motorized boating restrictions were also indicated as desired lake management measures.