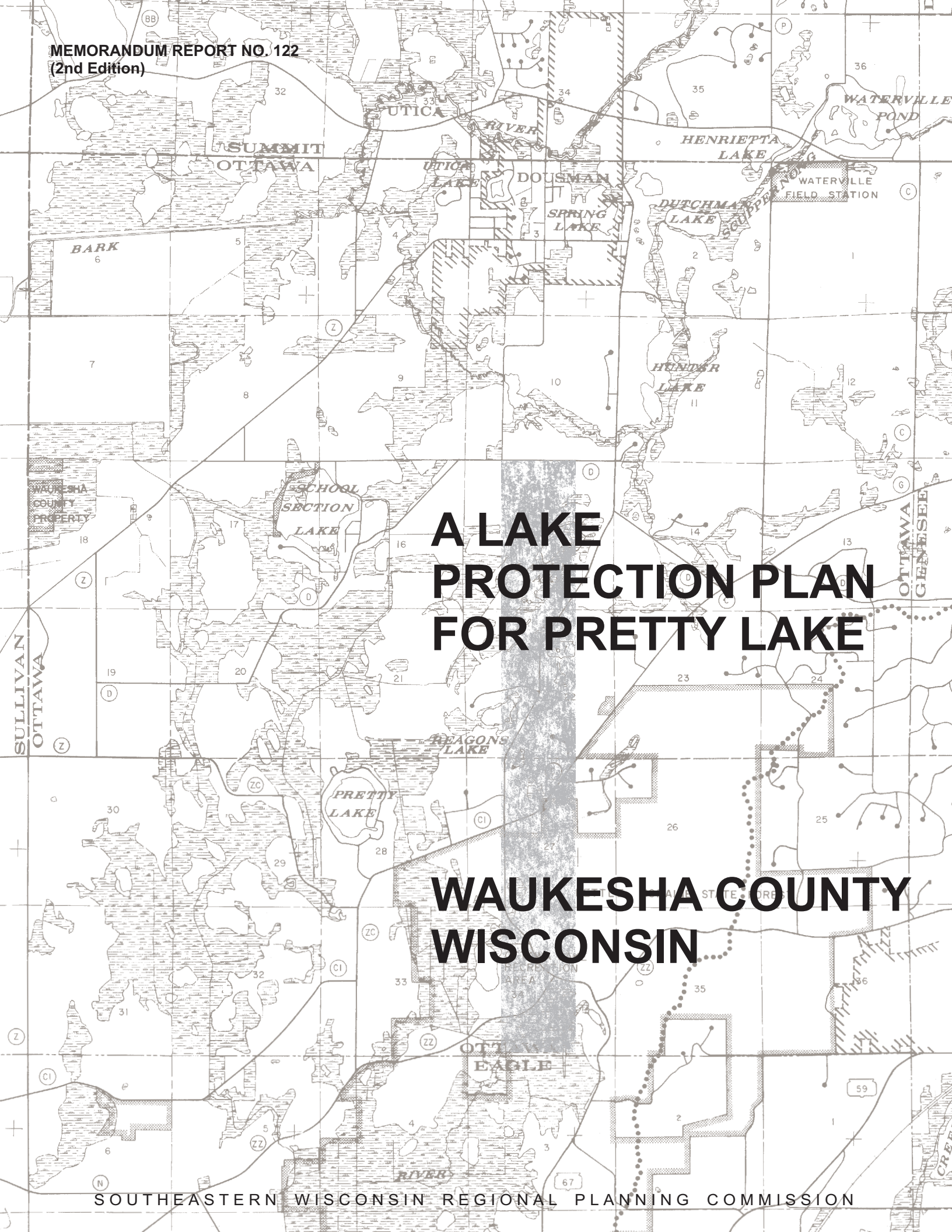
MEMORANDUM REPORT NO. 122
(2nd Edition)



A LAKE PROTECTION PLAN FOR PRETTY LAKE

WAUKESHA COUNTY WISCONSIN

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Special acknowledgement is due to Dr. Jeffrey A. Thornton, CLM, PH, and Dr. Thomas M. Slawski, SEWRPC Principal Planners; Ms. Rachel E. Lang, former SEWRPC Senior Biologist; Mr. Edward J. Schmidt, SEWRPC GIS Planning Specialist; and Ms. Sara Wilder Teske and Mr. Michael A. Borst, SEWRPC Interns, for their contributions to the conduct of this study and the preparation of this report.

MEMORANDUM REPORT
NUMBER 122, 2nd Edition

A LAKE PROTECTION PLAN FOR PRETTY LAKE WAUKESHA COUNTY, WISCONSIN

Prepared by the

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TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

Chapter I

INTRODUCTION

Pretty Lake, located within the Town of Ottawa, Waukesha County, Wisconsin, is a valuable natural resource offering a variety of recreational and related opportunities to the resident community and its visitors. The Lake is an integral part of this lake-oriented community. However, the recreational and visual value of the Lake is perceived to be threatened by changing land use conditions in the area tributary to the Lake.

Seeking to improve the usability and to prevent deterioration of the natural assets and recreational potential of Pretty Lake, the riparian residents formed a Chapter 33, *Wisconsin* Statutes, public inland lake protection and rehabilitation district. Consequently, the Pretty Lake Protection and Rehabilitation District was duly created to undertake an ongoing program of community involvement, education, and management. One of the activities undertaken by the District was the completion of a lake protection plan for Pretty Lake during 1995 and 1996 in cooperation with the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and with funding provided in part by the Wisconsin Department of Natural Resources (WDNR) through the Chapter NR 190 lake management planning grant program.[1] That plan recommended a series of actions be implemented by the Pretty Lake Protection and Rehabilitation District including, among other actions, limited aquatic plant management action, including selected manual removal and surveillance activities in the cases where Eurasian water milfoil and purple loosestrife were present.

This report sets forth a refined lake protection plan for Pretty Lake, which plan includes consideration of the studies and surveys completed by the Pretty Lake Protection and Rehabilitation District since the publication of the aforereferenced lake protection plan, including an inventory of aquatic plant communities conducted in 2002. This plan represents part of the ongoing commitment of the Pretty Lake Protection and Rehabilitation District, and the Town of Ottawa, to sound planning with respect to the Lake and forms a logical complement to the earlier study conducted by the Commission in 1998. The current plan was prepared by SEWRPC, in cooperation with the Pretty Lake Protection and Rehabilitation District, and incorporates the data and analyses developed in the aforementioned lake protection plan as well as other data gathered by the U.S. Geological Survey and the WDNR. This planning project was funded, in part, through a WDNR Lake Management Planning Grant awarded to the Pretty Lake Protection and Rehabilitation District under Chapter NR 190 of the *Wisconsin Administrative Code*.

AQUATIC PLANT MANAGEMENT AND RECREATIONAL USE OBJECTIVES

The objectives of this aquatic plant management and lake protection plan for Pretty Lake were developed in consultation with the Pretty Lake Protection and Rehabilitation District, and are as follows:

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[1]*SEWRPC Memorandum Report No. 122,* A Lake Protection Plan for Pretty Lake, Waukesha County, Wisconsin, *April 1998.*

1. To protect and maintain the public health, convenience, necessity and welfare, and promote public comfort, through the environmentally sound management of the vegetation, fish, and wildlife populations in and around Pretty Lake;

2. To provide a high-quality, water-oriented urban residential setting with recreational and aesthetic opportunities for residents and visitors to Pretty Lake, and manage the Lake in an environmentally sound manner; and,

3. To maintain the water quality of Pretty Lake so as to better facilitate the conduct of water-related recreation, improve the aesthetic value of the resource to the community, and enhance the resource value of the waterbody.

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

OVERVIEW OF PLAN REFINEMENTS

The scope of this report is limited to a consideration of those management measures that can be determined to be effective in the protection of lake water quality and lake use based upon the available data. This second edition plan incorporates additional information on the following issues, which was recommended to be acquired in the adopted lake protection plan for Pretty Lake: the groundwatershed and groundwater flows into Pretty Lake, the aquatic plant community and the application of aquatic herbicides to control the growth of Eurasian water milfoil in portions of the Lake, and the role of the high-capacity well used to augment lake levels in the transport of calcium carbonate (marl) into the Lake. Other issues of importance are discussed to the extent relevant to managing aquatic plant habitat and communities; the movement of contaminants into the Lake, including groundwater-borne materials; and, the management of wastewaters from the urban density development surrounding the Lake, including institutional development implications for the public inland lake protection and rehabilitation district.

This refined lake protection plan for Pretty Lake complements the data and analyses set forth in the aforereferenced, adopted lake protection plan for Pretty Lake. Consequently, readers are referred to the initial plan for further details on issues relating to the lake protection objectives established for Pretty Lake.

[2]*This plan has been prepared pursuant to the standards and requirements set forth in the following chapters of 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

The physical characteristics of a lake and its watershed are important factors in any evaluation of existing and likely future water quality conditions and lake uses, including recreational uses. Characteristics, such as watershed topography, lake morphometry, and local hydrology, ultimately influence water quality conditions and the composition of plant and fish communities within the lake. Therefore, these characteristics must be considered during the lake management planning process. Accordingly, this chapter provides pertinent information on the physical characteristics of Pretty Lake and its tributary drainage area, land use conditions, the chemical and biological environments of the Lake, as well as past and present management practices and the recreational uses and facilities of Pretty Lake. Subsequent chapters deal with issues of concern relative to Pretty Lake and alternative and recommended lake protection practices.

WATERBODY CHARACTERISTICS

Pretty Lake is located southwest of the Village of Dousman, and northwest of the Kettle Moraine State Forest-Southern Unit and Ottawa Lake Recreational Center, in the Town of Ottawa, in western Waukesha County, as shown on Map 1. The Lake is considered to be a groundwater flow-through, or seepage, lake. As such, the Lake's water level is dependent upon the regional groundwater table as shown in Figure 1. Pretty Lake has little surface inflow and no defined surface outflow, although groundwater enters the Lake from the south and drains from the Lake in a generally northerly direction toward School Section Lake. Agricultural drainage systems create the surface drainage in this subbasin of the Scuppernong Creek, a tributary stream to the Rock River, influencing the movement of water through Pretty Lake toward School Section Lake.[1] However, as noted, there are no direct outlets from Pretty Lake.

Pretty Lake is a 64-acre waterbody, roughly oval in aspect, with the major axis of the Lake lying in a north-south direction. The Lake has one small bay in the southeastern quadrant of the basin. This waterbody has a maximum depth of about 35 feet, a mean depth of 12 feet, and a volume of 752 acre-feet. The lake shoreline is approximately 1.25 miles long, with a shoreline development factor of 1.1, indicating that the Lake is roughly circular in aspect, its shoreline being about 1.1 times longer than that of a circular lake of the same area. The hydrographical and morphometric characteristics are set forth in Table 1 and the bathymetry of the Lake is shown on Map 2.

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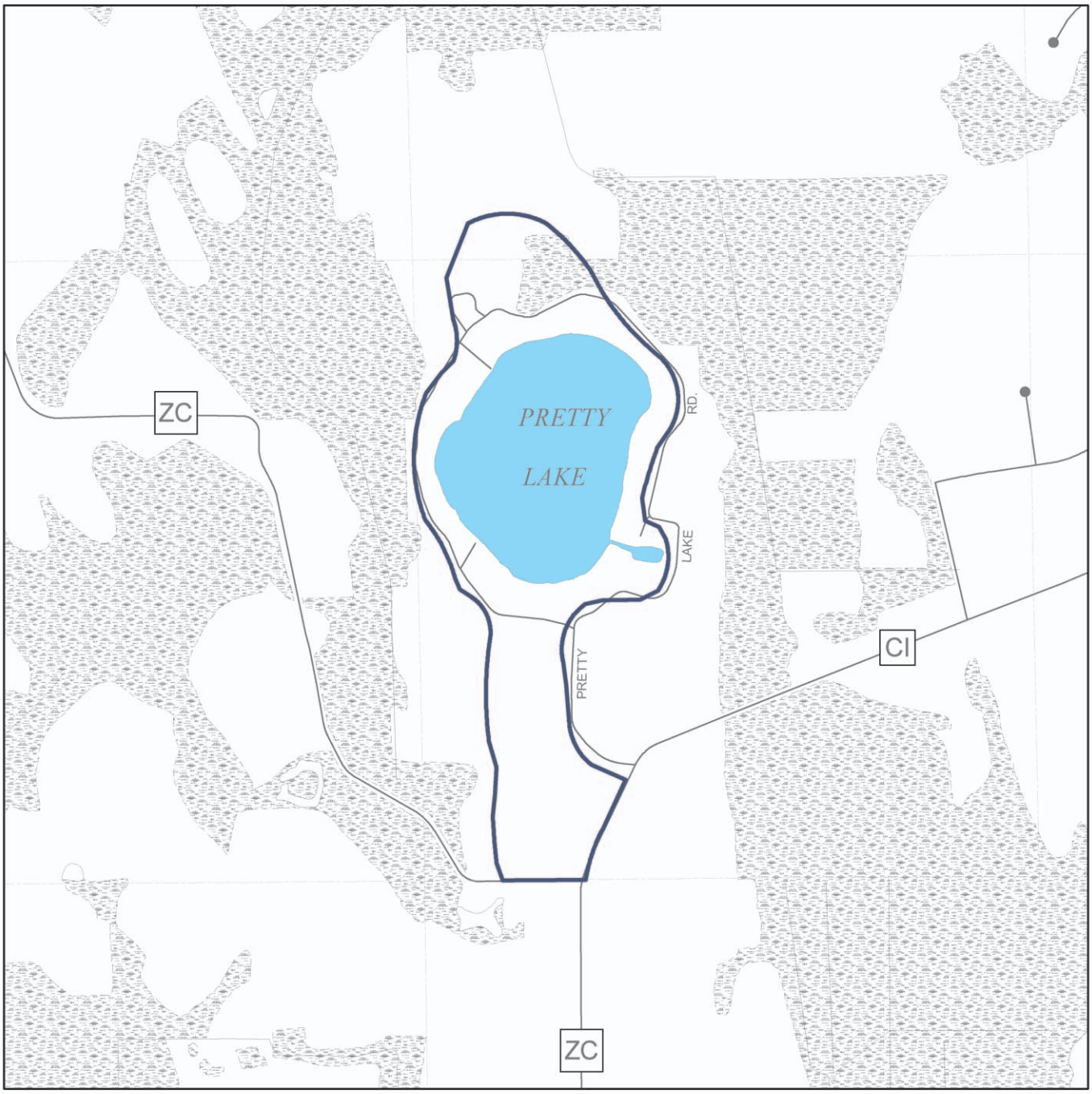
[1]*Randy J. Hunt and James T. Krohelski, "The Application of an Analytic Element Model to Investigate Groundwater-Lake Interactions at Pretty Lake, Wisconsin,"* Journal of Lake and Reservoir Management, *Volume 12(4), pages 487-495, 1996.*

Map 1

LOCATION MAP OF THE DRAINAGE AREA TRIBUTARY TO PRETTY LAKE



SURFACE WATER

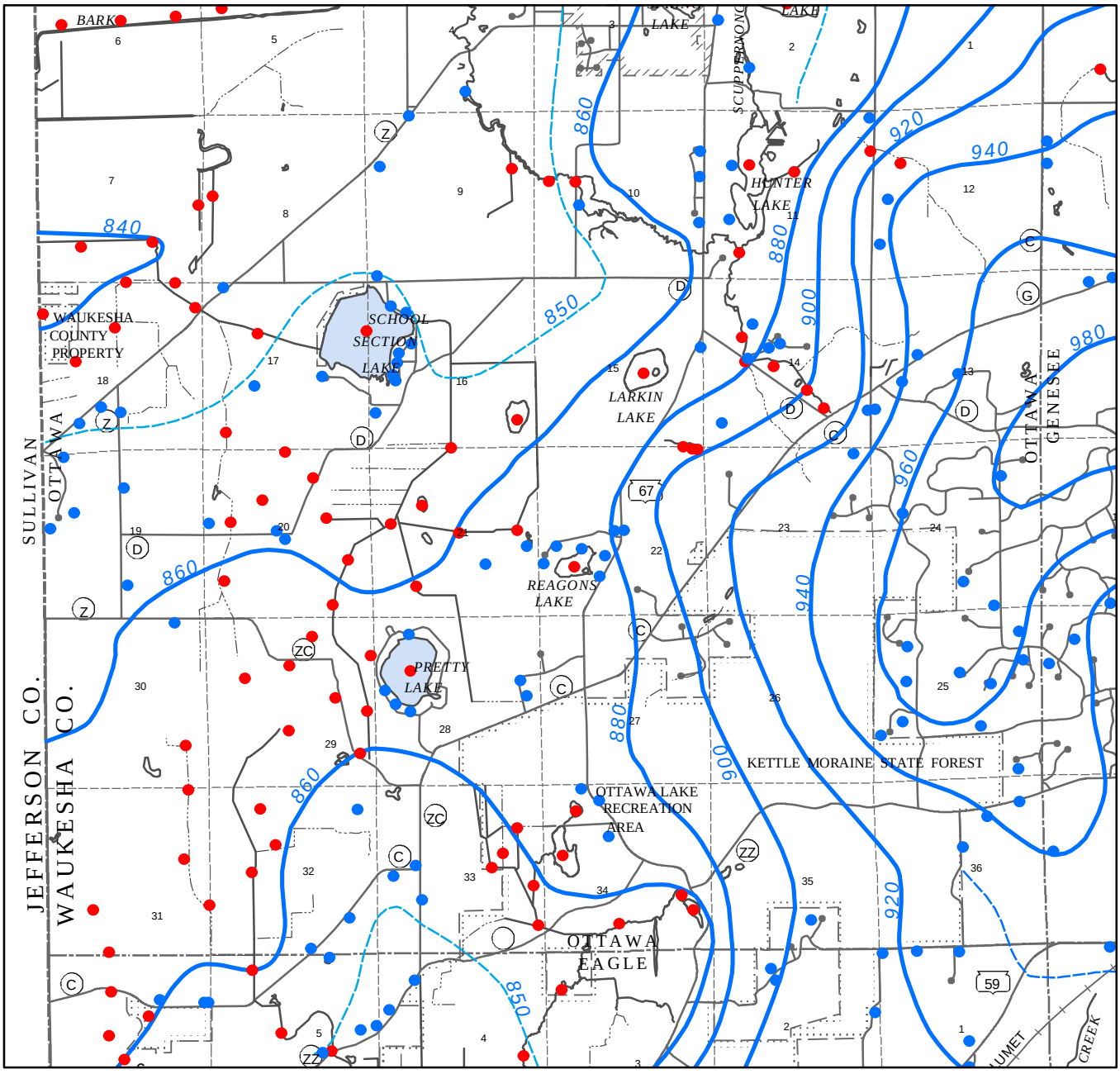
DRAINAGE AREA TRIBUTARY TO PRETTY LAKE

Source: SEWRPC.

0 1/8 1/4
MILES

Figure 1

DIRECTION OF GROUNDWATER FLOW IN THE SCHOOL SECTION AND PRETTY LAKES AREA



Source: U.S. Geological Survey and SEWRPC.

Table 1

HYDROLOGY AND MORPHOMETRY OF PRETTY LAKE

Parameter	Measurement
Surface Area	64 acres
Drainage Area	173 acres
Volume (total)	752 acre-feet
Length of Shoreline	1.25 miles
Mean Depth	12 feet
Maximum Depth	35 feet
Residence Time[a] (1984 USGS study period)	3.3 years
Shoreline Development Factor[b]	1.1

[a]*Residence Time: Time required for a volume equivalent to the full volume of the Lake to flow into the Lake.*

[b]*Shoreline Development Factor: Ratio of shoreline length to that of a circular lake of the same area.*

Source: Wisconsin Department of Natural Resources and SEWRPC.

The riparian shoreline of Pretty Lake is developed mostly for residential use. The Lake is served by four public access sites, including three boat launches, and one walk-in access site, as shown on Map 2, and is considered to have adequate public recreational boating access pursuant to Chapter NR 1 of the *Wisconsin Administrative Code.*

SHORELINE PROTECTION STRUCTURES

Erosion of shorelines results in the loss of land, damage to shoreline infrastructure, and interference with lake access and use. A survey of the Pretty Lake shoreline, conducted by Commission staff during August 2002, identified an abundance of areas with natural shorelines, including both vegetated shorelands and natural beaches, and areas protected by structural shoreline protection measures, such as riprap and bulkheads, as shown on Map 3. Much of the shoreline of Pretty Lake is generally maintained in a natural state or as lawn abutting a natural beach, such that shoreline erosion is not a major problem. Some structures have been built to protect the Lake's shoreline. These structures were generally well maintained when inspected by Commission staff during 2002.

TRIBUTARY DRAINAGE AREA AND LAND USE CHARACTERISTICS

The drainage area directly tributary to Pretty Lake is approximately 170 acres in areal extent, as shown on Map 1. Consequently, Pretty Lake has a watershed-to-lake surface area of about 2.7:1, which is typical for seepage lakes. The surrounding land uses in the drainage area were primarily agricultural in nature through the 1950s, with the balance being wetland or woodland areas, and scattered single-family residential development. In recent years, the agricultural activities have given way to residential land uses and supporting recreational land uses in the vicinity of the Lake, to the extent that current land uses within that portion of the drainage basin tributary to Pretty Lake are largely urban, with medium-density permanent and seasonal homes. These evolving land uses have the potential to alter the current levels and types of recreational uses of the lake and its drainage area, introducing additional pressures on the natural resource base underlying the land and water resources of this lake-focused community.

Existing land uses for the drainage area tributary to Pretty Lake, as of 2000, are shown on Map 4. Changes in land use within the drainage area tributary to the Lake include limited further development, infilling or already platted lots, and possible redevelopment of existing properties. Details of planned year 2020 land use conditions are set forth in the adopted lake protection plan for Pretty Lake and summarized in Table 2.

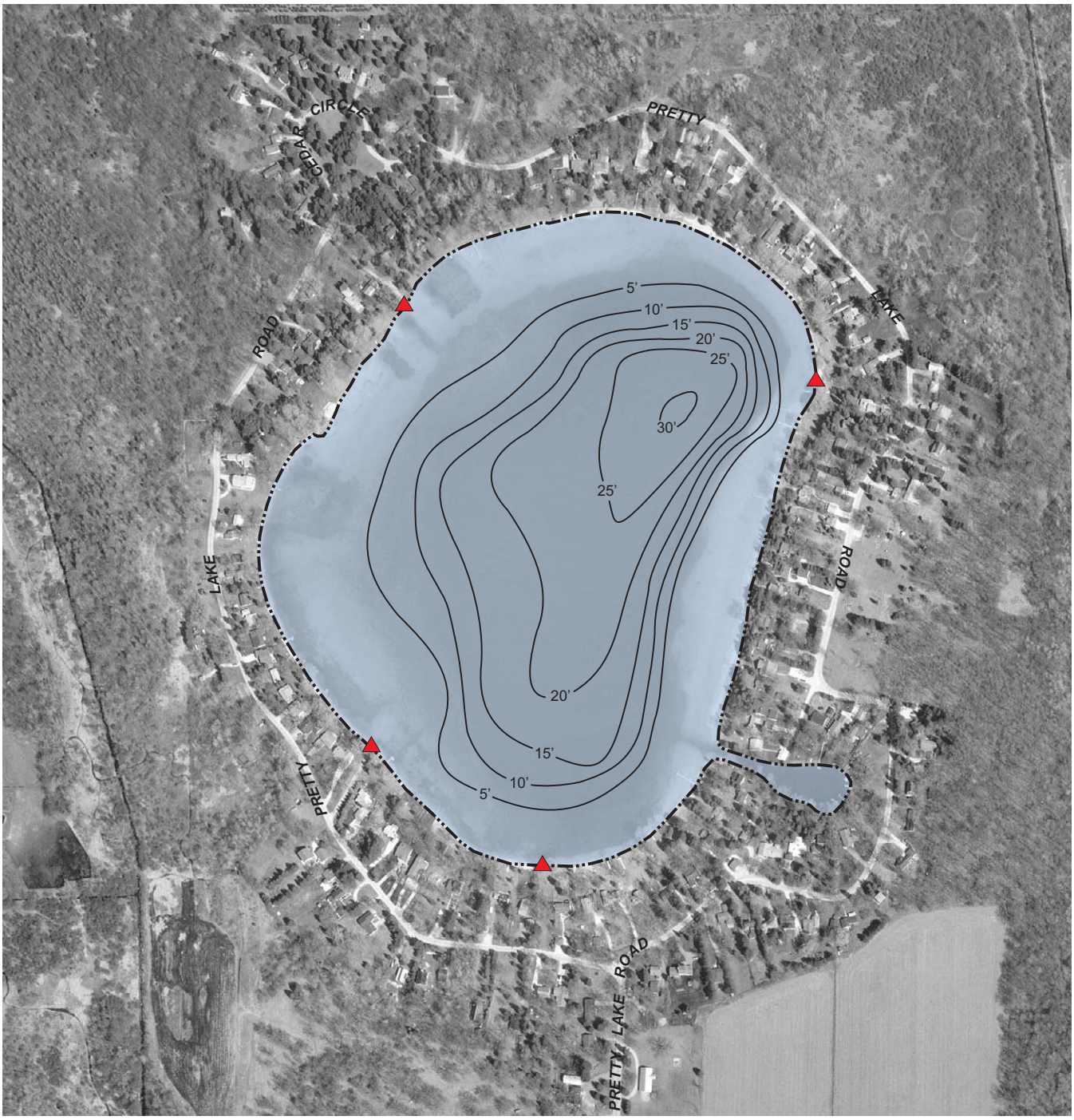
WATER QUALITY

Water quality measurements on Pretty Lake were conducted by the U.S. Geological Survey (USGS) with Phase 1 Chapter NR 190 Lake Management Planning Grant funding from 1993 through 1995 and reported in the initial plan. Pretty Lake had good to excellent water quality, as shown in Figure 2. The Lake had a Wisconsin Trophic State Index of 46, based upon total phosphorus, indicating the Lake to be a mesotrophic waterbody.[2] Total

[2]*See 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.*

Map 2

BATHYMETRIC MAP OF PRETTY LAKE



DATE OF PHOTOGRAPHY: MARCH 2000

—20'— WATER DEPTH CONTOUR IN FEET

▲ PUBLIC ACCESS SITE

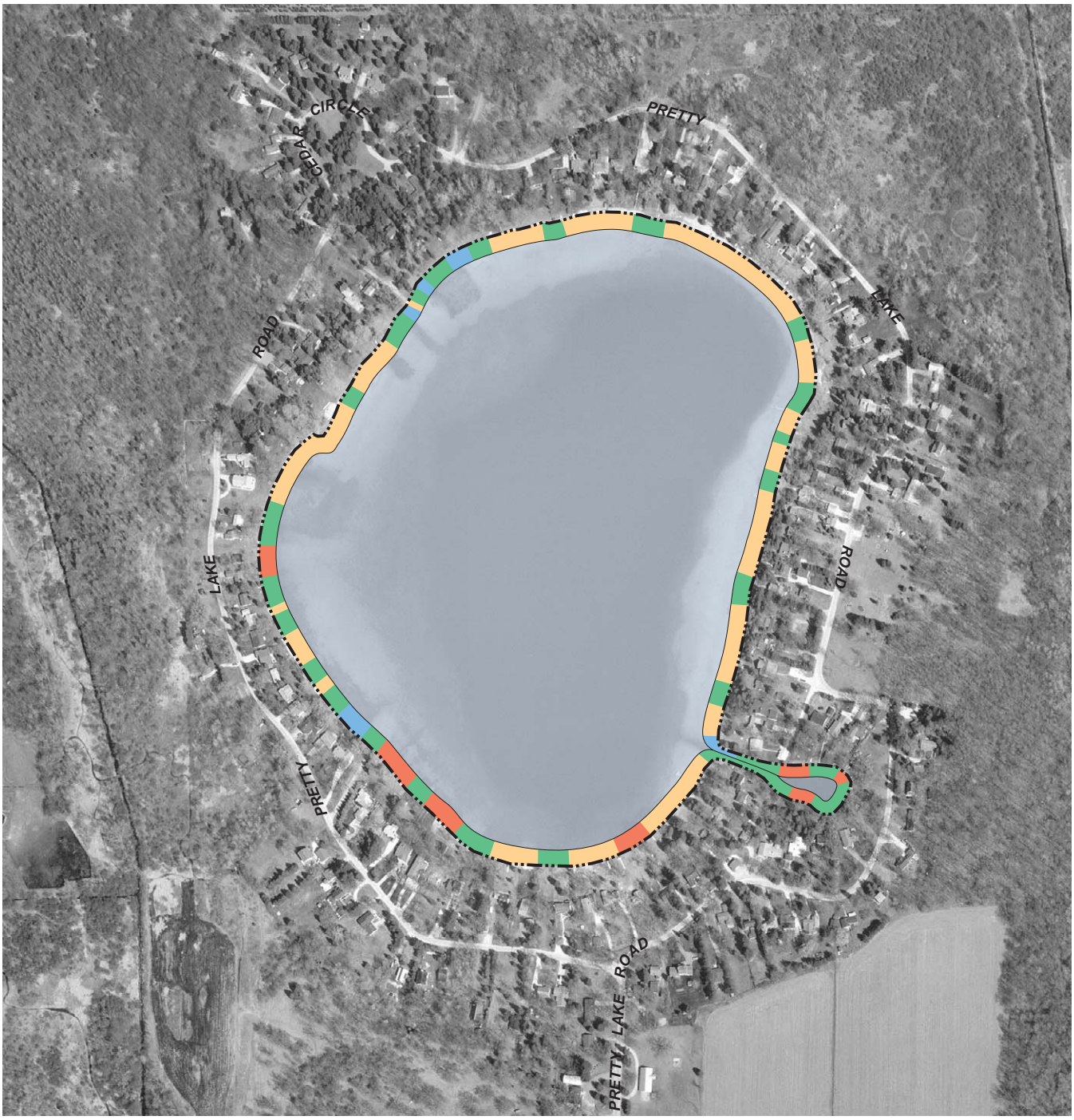
Source: SEWRPC.

GRAPHIC SCALE

0 250 500 FEET

Map 3

SHORELINE PROTECTION STRUCTURES ON PRETTY LAKE: 2002



DATE OF PHOTOGRAPHY: MARCH 2000

RIPRAP

BEACH

NATURAL

BULKHEAD

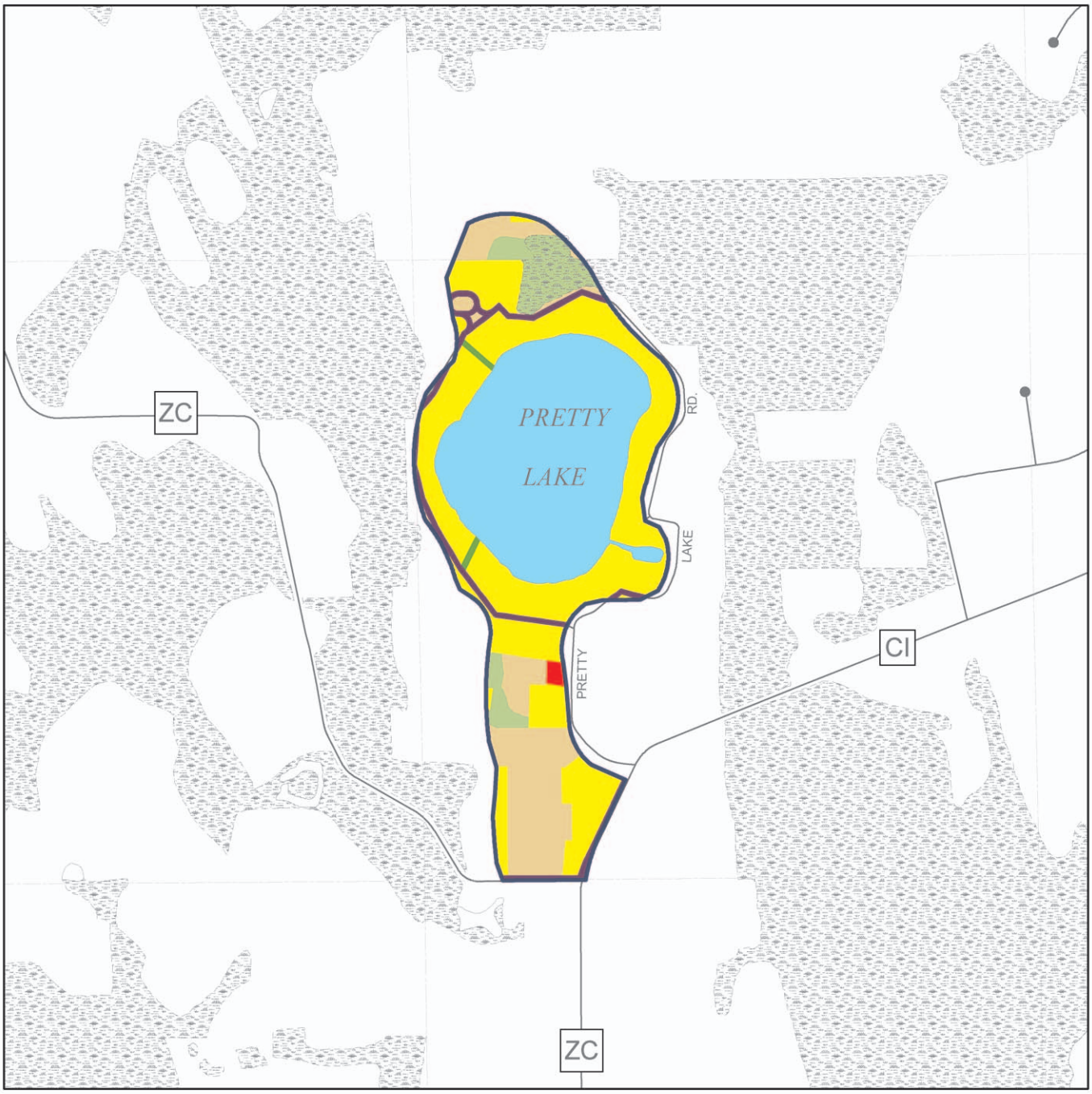
GRAPHIC SCALE

0 250 500 FEET

Source: SEWRPC.

Map 4

EXISTING LAND USE WITHIN THE DRAINAGE AREA TRIBUTARY TO PRETTY LAKE: 2000



SINGLE-FAMILY RESIDENTIAL

COMMERCIAL

TRANSPORTATION, COMMUNICATIONS, AND UTILITIES

RECREATION

WETLANDS AND WOODLANDS

SURFACE WATER

AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS

0 1/8 1/4
MILES

Source: SEWRPC.

Table 2

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

Land Use Categories[a]	2000		2020	
	Acres	Percent of Tributary Drainage Area	Acres	Percent of Tributary Drainage Area
Urban				
Residential	63	36.8	64	37.5
Commercial	1	0.6	1	0.6
Industrial	- -	- -	- -	- -
Governmental and Institutional	- -	- -	- -	- -
Transportation, Communication, and Utilities	8	4.7	8	4.7
Recreational	1	0.6	1	0.6
Subtotal	73	42.7	74	43.4
Rural				
Agricultural and Other Open Lands	24	14.0	23	13.3
Wetlands	6	3.5	6	3.5
Woodlands	4	2.3	4	2.3
Water	64	37.5	64	37.5
Extractive	- -	- -	- -	- -
Subtotal	98	57.3	97	56.6
Total	171	100.0	171	100.0

[a]*Parking included in associated use.*

Source: SEWRPC.

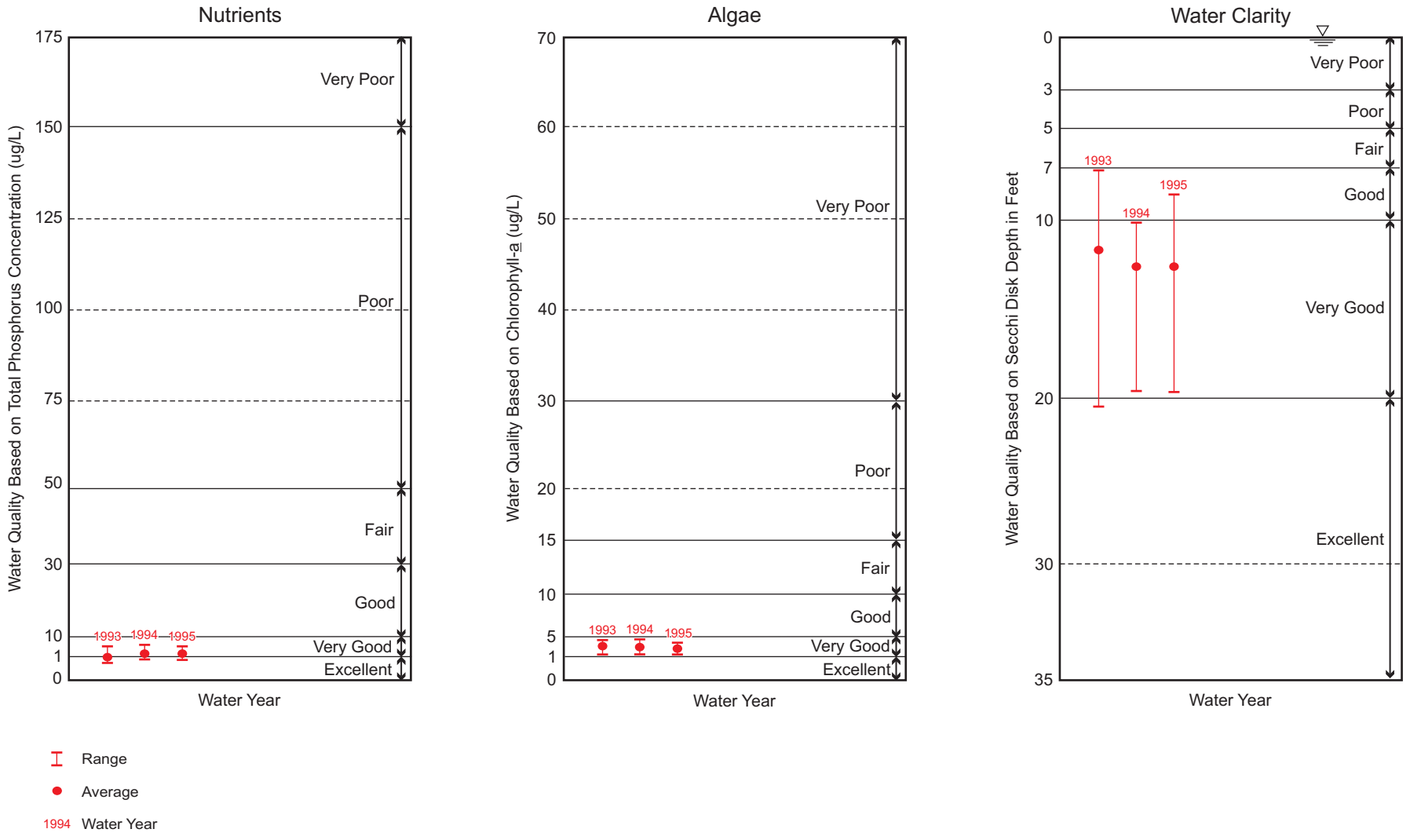
phosphorus concentrations in the surface waters of Pretty Lake were equal to or less than the 20 micrograms per liter (μg/l) recommended by the Regional Planning Commission as the level below which nuisance algal and macrophyte growths are unlikely to occur.[3] Wisconsin Trophic State Indices determined on the basis of reported Secchi-disc transparency values of between 16.4 feet and 20.6 feet in spring, and between 7.2 feet and 18.4 feet in summer, in the initial study, are indicative of a clear water lake with little algal growth. These data suggested that Pretty Lake is an oligotrophic to mesotrophic waterbody. Oligo-mesotrophic lakes have relatively low fertility and typically support a balanced, but not abundant, aquatic plant community and fishery. Nuisance growths of algae and plants are generally not exhibited by oligo-mesotrophic lakes. Many of the "cleanest" lakes in Wisconsin are classified as oligo-mesotrophic.

Secchi-disc transparency values obtained since the initial study, between 2001 and 2005, as part of the Wisconsin Department of Natural Resources (WDNR) Self-Help Monitoring Program, have largely been consistent with the earlier reported values, as shown in Figure 2, but marginally lower, varying from 7.3 feet to 19.5 feet in spring, and from 4.3 feet to 13.5 feet in summer. The lowest transparency values were reported during 2001, during both spring and summer, which may reflect the increased runoff during this wetter than normal year. Secchi disc transparency values subsequent to 2001 have returned to values not dissimilar to those reported during the initial study, suggesting little change in water quality in Pretty Lake over the period of record.

[3]*SEWRPC Planning Report No. 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin—2000. *Volume Two.* Alternative Plans, *February 1979, as refined by SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

Figure 2

PRETYY LAKE PRIMARY WATER QUALITY INDICATORS: 1993-1995



Source: U.S. Geological Survey and SEWRPC.

PAST AND PRESENT LAKE MANAGEMENT PRACTICES

In a broad sense, previous lake management actions applied to Pretty Lake focused on lake level management. Given that Pretty Lake is a groundwater-fed lake, limited alternatives exist in regard to managing or moderating fluctuating water levels. Historically, water levels in Pretty Lake have been subject to intermittent drawdowns, especially during periods of below average precipitation. Thus, remedial measures have focused on augmenting water levels to maintain sufficient depth to support water-based recreational activities, including swimming and boating. Concern over water level fluctuations in early 1989 prompted the District to initiate a study of groundwater flows through Pretty Lake. This study determined that the Lake is directly influenced, both in terms of water quantity and water quality, by activities in the Lake's watershed. In 1991, the Pretty Lake Protection and Rehabilitation District, in cooperation with the WDNR and the USGS, installed a groundwater pumping system designed to augment the lake levels with water drawn from the sandstone aquifer.[4] The District monitors the lake level and manually regulates the water inflow by starting and stopping the pump as lake levels fluctuate. The pump remains the most consistent means of maintaining a relatively constant lake level. Lake levels are currently maintained within the limits prescribed by the WDNR.

In addition to the negative impacts on recreational lake use, extensive declines in lake level can affect the water quality of the Lake. A fluctuation in water level can impair aquatic plant communities on the shorelines by exposing the plants to alternating cycles of inundation and desiccation. Under these conditions, many plant species lack the chance to establish and maintain themselves. Table 3 represents the species of aquatic plants most likely to be affected by changes in the water level. Those plants that do thrive under such conditions are generally those that are considered to impede recreational use of the waterbody. Further, a shortage of aquatic plants at shallower depths reduces the availability of sheltered areas where smaller fish can hide from predators, and may eliminate fish spawning areas. Thus, it is desirable, from the point of view of aquatic habitat, that water levels be maintained.

The apparent accumulation of calcium carbonate (marl) flocculent in portions of the Lake has prompted some Pretty Lake Protection and Rehabilitation District electors to express concern regarding the impact of aquifer pumpage and surface drainage on the levels of Pretty Lake. The latter concern was considered further by USGS staff using available groundwater data which were applied in the groundwater flow modeling program, G-FLOW.[5] The groundwater modeling program provided analyses demonstrating a variety of possible short- and long-term effects dependent upon different ecological circumstances. These concerns include quantitative concerns related to the overdraughting of the sandstone aquifer, from which many municipal supplies are being drawn,[6] as well as concerns regarding loss of lake depth as a result of marl deposition.

Deposition of marl can result in the loss of lake depth. This can have an impact on the rooting substrate of most aquatic plants and could potentially change the composition of plant communities within Pretty Lake. When the amount of carbonate (CO_3) is high enough, it reacts with the calcium in water to form calcium carbonate ($CaCO_3$, or marl). When marl precipitates, it leaves a white substance in the sediment and can often be observed as a white precipitate on plant leaves. Plants can speed up marl deposition by using carbon dioxide (CO_2). In addition to these physical-chemical impacts, marl can also change an aquatic ecosystem by locking up phosphorus which can limit aquatic plants' growth and thereby modify the plant communities within the Lake. Plants like muskgrass (*Chara* sp.) and naiads, like bushy pondweed (*Najas flexilis*) and spiny naiad (*Najas marina*), are known to use more $CaCO_3$ in their growth process than many other native aquatic plants in Wisconsin.

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[4] *Randy J. Hunt and James T. Krohelski,* op cit.

[5] *Vic Kelson and Henk Haitjema, GFLOW Analytic Element Groundwater Flow Modeling Program, Version 1.1, 1995*

[6] *See SEWRPC Technical Report No. 37,* Groundwater Resources of Southeastern Wisconsin, *June 2002.*

Table 3

AQUATIC PLANTS AFFECTED BY LAKE DRAWDOWN

Common Name	Scientific Name
Coontail	*Ceratophyllum demersum*
Muskgrass	*Chara* sp.
Elodea	*Elodea* sp.
Milfoil	*Myriophyllum* spp.
American Lotus	*Nelumbo lutea*
Yellow Water Lily	*Nuphar* sp.
White Water Lily	*Nymphaea odorata*
White Water Lily	*Nymphaea tuberose*
Clasping-Leaf Pondweed	*Potamogeton robinsii*
Large-Leaf Pondweed	*Potamogeton amplifolius*
Bladderwort	*Utriculara vulgaris*
Wild Celery or Eel Grass	*Vallisneria americana*

Source: U.S. Environmental Protection Agency and SEWRPC.

Conversely, $CaCO_3$ can also be limiting to other species of aquatic plants including Eurasian water milfoil (*Myriophyllum spicatum*).

In order to address the issue of marl deposition within the Lake, and to partially quantify the rate of deposition of marl within the lake basin, Regional Planning Commission staff applied a similar analysis to that utilized at Silver Lake in Washington County.[7] Based upon calcium carbonate concentrations and groundwater flow rates reported by the USGS, Commission staff computed the calcium carbonate loading to the Lake. In-lake calcium carbonate concentrations reported by the USGS are about 150 mg/l $CaCO_3$ measured as alkalinity.[8] Surfacial groundwater calcium carbonate concentrations, reported by the Wisconsin Geological and Natural History Survey (WGNHS),[9] are somewhat higher than these in-lake concentrations, being approximately 265 mg/l $CaCO_3$ measured as alkalinity. It can be assumed that the difference between the groundwater and surface water values reflects deposition within the Lake, as the Lake has no surface water outflow. Based upon these concentrations and the geohydrological data developed by the USGS as part of the G-FLOW modeling, the annual flux of calcium carbonate into Pretty Lake can be estimated at approximately 76,400 pounds per year. Assuming that this mass is distributed evenly across the lakebed, or over some approximately 64 acres (= 2.8 million ft^2), with a dry weight density of between approximately 40 pounds per cubic foot (lb/ft^3) and 80 lb/ft^3, the approximate annual accumulation of calcium carbonate on the lakebed would be between about 0.004 and 0.005 inch per year.[10] Over geological time, since the creation of the lake during the Wisconsin stage of glaciation which occurred some 10,000 years before present,[11] this rate of accumulation would result in approximately four to five feet of deposition, which estimate is consistent with the diver-reported volume of flocculent sediment observed in the lake basin.

The foregoing marl deposition rate estimate reflects that input of calcium carbonate to Pretty Lake that is the result of natural groundwater inflows entering the lake basin. In addition to these natural inflows of groundwater, groundwater is periodically pumped into Pretty Lake to augment water levels, as has been noted above. This pumping system artificially augments the rate of groundwater inflow, and of marl formation and flocculation, in the Lake. Assuming a pumping rate of between 40 and 70 million gallons per year, as reported by the Pretty Lake

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[7]*See SEWRPC Memorandum Report No. 123, 2nd Edition,* A Lake Protection and Recreational Use Plan for Silver Lake, Washington County, Wisconsin, *December 2005.*

[8]*U.S. Geological Survey Open-File Report No. 95-190,* Water-Quality and Lake-Stage Data for Wisconsin Lakes, Water Year 1994, *1995.*

[9]*Joseph B. Gonthier,* Ground-Water Resources of Waukesha County, Wisconsin, *Wisconsin Geological and Natural History Survey Information Circular No. 29, 1975.*

[10]*It should noted that marl deposition is not the sole contributor to sedimentation in Pretty Lake; disposal of yard waste and leaf litter as well as natural leaf falls into the near shore area also contribute to the accumulation of organic and inorganic materials within this littoral zone, as does runoff from building sites and from the roadway system. The contributions from these sources are less well quantified as they are more site and practice specific. Application of the recommended plan actions to control contaminants in runoff from the watershed, therefore, remains an appropriate lake management measure.*

[11]*N.M. Fenneman,* Lakes of Southeastern Wisconsin, *State of Wisconsin, 1910.*

Protection and Rehabilitation District, and assuming a calcium carbonate concentration of between 250 and 300 mg/l $CaCO_3$ measured as alkalinity, as reported by the WGNHS,[12] this pumping can introduce between 100,000 pounds and 150,000 pounds of marl to the Lake annually, all of which can be assumed to be deposited into the lake basin in order to maintain the ambient in-lake alkalinity of approximately 150 mg/l $CaCO_3$. This load translates to a deposition rate of between 0.005 inch and 0.020 inch per year, which rate is on the same order as the natural rate of marl deposition within the lake basin. This transport of calcium carbonate into the Lake represents a discretionary action on the part of the lake district. Consequently, when this is added to the deposition of other particulates within the Lake over which the District does not have control, the potential impact of pump operations on lake depth becomes an issue of concern to be considered in managing water levels within the Lake.

AQUATIC PLANTS

Aquatic Plant Management

The aquatic plant community in Pretty Lake is somewhat sparse, but appears to be diverse and healthy with increased diversity from previous surveys. A notable change within the last few years included an increase in the frequency of occurrence of Eurasian water milfoil (*Myriophyllum spicatum*) in the Lake, a State-designated nonnative invasive species.[13] This species is continuing to be increasingly frequent in many Wisconsin lakes, especially in the Southeastern Wisconsin Region, and, as a nonnative species, has the potential to out compete the native aquatic vegetation in lakes, leading to decreased biodiversity, degradation of the quality of fish and wildlife habitat, and often reduced recreational use potentials in the affected lakes. Common aquatic plants found in Pretty Lake are illustrated in Appendix A.

Despite the increased frequency of occurrence of Eurasian water milfoil, the aquatic plant survey data obtained from Pretty Lake within the last 20 years indicate a relatively stable aquatic plant community. Few other changes are apparent during this period. The Lake generally supports a healthy and diverse aquatic macrophyte community, although extensive stands of Eurasian water milfoil now occur throughout the waterbody. Consequently, as set forth in the adopted lake protection plan, an active aquatic plant management program has not been carried out in Pretty Lake. Given that aquatic plant growth historically has been relatively sparse in the Lake, the early aquatic plant control program conducted on Pretty Lake can be categorized as a monitoring program. Active aquatic plant management was limited to the manual removal of nuisance growths of aquatic plants by individual riparian landowners. More recently, however, the Lake Management District electors have voiced concerns that a more active aquatic plant management program may be required to manage and control the Eurasian water milfoil.

The wetland areas surrounding the lake support a diverse wetland flora. The open bog, located in the southeast and northeast one-quarter sections of U.S. Public Land Survey Section 28 and the southeast one-quarter of U.S. Public Land Survey Section 21, Township 6 North, Range 17 East, Town of Ottawa, is a rare occurrence in southeastern Wisconsin. Nevertheless, no state or federal rare, threatened or endangered species were reported. The wetland invasive species, purple loosestrife (*Lythrum salicaria, L. virgatum,* and their hybrids), has not been observed in the shoreland areas of Pretty Lake, but is known to occur in the general vicinity of southwestern Waukesha County and ongoing vigilance should be maintained to control any infestations that might be discovered. In this regard, the use of biological control agents (*Hylobius transversovittatus*, *Galerucella calmariensis* and *G. pusilla*, and *Nanophyes marmoratus*) has proven an effective management measure in Wisconsin and has been used effectively in the Rock River drainage area.[14]

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[12]*Joseph B. Gonthier,* op. cit.*; the average calcium carbonate concentration reported for the dolomitic Niagara aquifer was 307 mg/l $CaCO_3$ measured as alkalinity, and, for the sandstone aquifer, 247 mg/l $CaCO_3$.*

[13]*Wisconsin Department of Natural Resources,* Eurasian Water Milfoil in Wisconsin: A Report to the Legislature, *1992.*

[14]*See SEWRPC Memorandum Report No. 120,* A Lake Protection and Recreational Use Plan for Hunters Lake, Waukesha County, Wisconsin, *May 1997.*

Aquatic Plant Species Distribution

The initial survey of aquatic plant species within the lake basin was conducted by the WDNR staff in 1982 as part of a feasibility study that examined lake management alternatives for the protection and rehabilitation of Pretty Lake.[15] The currency of that previous study was confirmed by an aquatic plant community reconnaissance conducted by Regional Planning Commission staff during September of 1997. The results of the September 1997 survey were summarized in the previous lake protection plan for Pretty Lake. These findings were again reviewed on the basis of the aquatic plant survey conducted during the present study, in August of 2002, the results of which were reviewed during the August 2005 reconnaissance survey. The 2002 aquatic plant survey was conducted by Commission staff using the modified Jesson and Lound[16] transect methodology employed by the WDNR. The 2005 reconnaissance utilized a similar but abbreviated transect-based methodology, with only two samples being collected from each transect site instead of the four samples at each site obtained during 2002. The results of the 1982, 1997, 2002 and 2005 macrophyte surveys are set forth in Table 4, and the results of the 2002 and 2005 surveys are graphically depicted on Maps 5 and 6, respectively.

The 1982 survey identified seven species of aquatic plants, many of which were reported to be common to abundant. Five more plant species were observed during the 1997 survey, but, overall, little change in the aquatic plant community composition was noted during this period. Two additional plant species were observed during the 2002 and 2005 surveys, bringing the total species count of aquatic plants observed in Pretty Lake to 14, or double the number of plant species observed during the initial survey in 1982. Aquatic plants occurred throughout the Lake, but diversity was greatest in the vicinity of the western shoreline.

During 2002, muskgrass (*Chara vulgaris*) was the most abundant species. The 2005 survey indicated that bushy pondweed (*Najas flexilis*) was the most abundant aquatic plant species. Both plants are low-growing and generally are considered to pose few problems for recreational lake users. Water celery or eel grass (*Vallisneria americana*) and several species of pondweeds (*Potamogeton* spp.) also occurred throughout the Lake and were generally widely distributed throughout the lake basin.

During the 2005 aquatic plant survey of Pretty Lake, 14 species of aquatic plants were identified, all of which were submergent species. The results of this survey are set forth in Table 5 and are shown graphically on Map 6. The number of aquatic plants suggests a more diverse and abundant aquatic plant community than previously recorded from the Lake. As noted above, both previous surveys reported no more than 13 species of aquatic plants as being present in the Lake. Nevertheless, there have been few substantive changes in the composition of the aquatic plant community previously recorded in Pretty Lake, which might indicate that the greater number of species observed during the 2002 survey reflects the more rigorous aquatic plant sampling protocol employed. These differences may also reflect seasonal variations in plant community composition. It is noteworthy, however, that the absence of elodea (*Elodea canadensis*), noted during the 1997 survey, was confirmed during the 2002 survey. Most of the additional species observed during the 2002 survey, not previously reported from Pretty Lake, were comprised of various species of pondweeds, including variable pondweed (*Potamogeton gramineus*), small pondweed (*Potamogeton pusillus*), clasping leaf pondweed (*Potamogeton richardsonii*), and curly-leaf pondweed (*Potamogeton crispus*), the majority of which fill similar biological and ecological niches in the lake environment.[17] The appearance of these diverse pondweeds is generally considered to be a positive sign. The other species not previously reported from the Lake was coontail (*Ceratophyllum demersum*). Table 6 outlines the positive ecological significance of the aquatic plant species found in Pretty Lake during these recent surveys.

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[15]*Wisconsin Department of Natural Resources,* Pretty Lake, Waukesha County Feasibility Study Results; Management Alternatives, *1982.*

[16]*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.*

[17]*The exception to this generalization is curly leaf pondweed which, together with Eurasian water milfoil, is a designated nonnative invasive aquatic plant pursuant to Chapter NR 109 of the* Wisconsin Administrative Code.

Table 4

AQUATIC PLANT SPECIES IN PRETTY LAKE: 1982 THROUGH 2005

Plant Species	1982	1997	2002	2005
Ceratophyllum demersum (coontail)	- -	- -	X	X
Chara vulgaris (musk grass)	X	X	X	X
Elodea canadensis (elodea)	X	- -	- -	- -
Myriophyllum spicatum (Eurasian water milfoil)	X	X	X	X
Myriophyllum sp. *(*native water milfoil)	- -	X	- -	X
Najas flexilis (slender naiad or bushy pondweed)	X	X	X	X
*Najas marina (*spiny naiad)	- -	X	X	X
Potamogeton amplifolius (large-leaf pondweed)	- -	X	- -	- -
Potamogeton crispus (curly-leaf pondweed)	- -	- -	X	X
Potamogeton gramineus (variable pondweed)	- -	- -	X	X
Potamogeton illinoensis (Illinois pondweed)	- -	X	- -	- -
Potamogeton nodosus (long-leaved pondweed)	- -	X	- -	- -
Potamogeton pectinatus (Sago pondweed)	X	X	X	X
Potamogeton praelongus (white-stem pondweed)	X	X	X	X
Potamogeton pusillus (small pondweed)	- -	- -	X	X
Potamogeton richardsonii (clasping-leaf pondweed)	- -	- -	X	X
Potamogeton zosterformis (flat-stemmed pondweed)	- -	X	X	X
Vallisneria Americana (eel grass or water celery)	X	X	X	X

Source: Wisconsin Department of Natural Resources and SEWRPC.

Several species that were present during the 1997 survey were not found during the 2002 and 2005 surveys. Species not present that had been previously recorded included: native water milfoil (*Myriophyllum* spp.), large leaf pondweed (*Potamogeton amplifolius*), Illinois pondweed (*Potamogeton illinoiensis*), and long leaf pondweed (*Potamogeton nodosus*). Differences in the plant community from year-to-year could be due to seasonal fluctuations in the species composition and an artifact of the time of year at which the surveys were done rather than reflective of significant variations in species and their abundance. It is also possible that these plants may be less common or rare in the lake, and less readily sampled. In this case, the plants still may be present in the lake but simply were not seen during these surveys because of their scarcity.

Aquatic Plant Community Composition

During 2002, the aquatic plant survey of Pretty Lake was conducted using the modified Jesson and Lound transect method adopted by the WDNR as noted above. This methodology, when utilized in successive aquatic plant surveys, will allow the statistical evaluation of changes in the aquatic plant community within the Lake. [18] The statistics include:

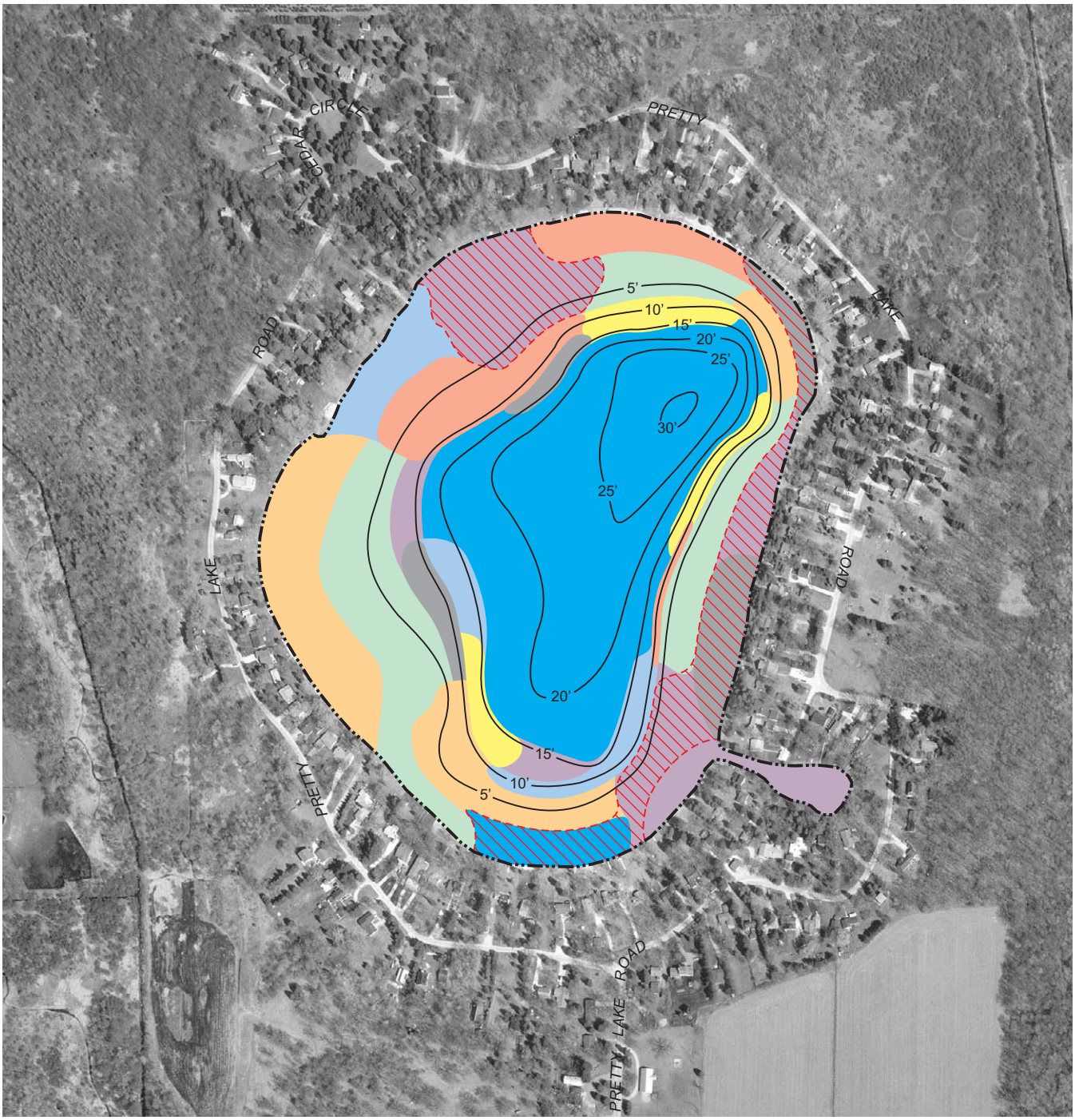
1. The frequency of occurrence (FREQ) is the number of occurrences of a species divided by the number of samples with vegetation, expressed as a percentage. It is the percentage of times a particular species occurred when there was aquatic vegetation present, and is analogous to the Jesson and Lound point system.

2. The relative frequency of occurrence (RFREQ) is the frequency of a species divided by the total frequency of all species. The sum of the relative frequencies should equal 100 percent. This statistic presents an indication of how the plants occur throughout a lake in relation to each other. It is used in the calculation of the Importance Value and Simpson Diversity Index set forth below.

[18] *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.*

Map 5

AQUATIC PLANT COMMUNITY DISTRIBUTION IN PRETTY LAKE: 2002



DATE OF PHOTOGRAPHY: MARCH 2000

—20'— WATER DEPTH CONTOUR IN FEET

OPEN WATER

AREA WHERE EURASIAN WATER MILFOIL IS NOT PRESENT IN PRETTY LAKE

MUSKGRASS AND SAGO PONDWEED

MUSKGRASS, SPINY NAIAD, BUSHY PONDWEED, AND SAGO PONDWEED

MUSKGRASS, BUSHY PONDWEED, WILD CELERY, SMALL PONDWEED, AND WHITE STEM PONDWEED

BUSHY PONDWEED, SAGO PONDWEED, COONTAIL, SPINY NAIAD, WILD CELERY, AND SMALL PONDWEED

BUSHY PONDWEED, SAGO PONDWEED, MUSKGRASS, COONTAIL, SPINY NAIAD, WILD CELERY, VARIABLE PONDWEED, AND SMALL PONDWEED

BUSHY PONDWEED, SAGO PONDWEED, MUSKGRASS, SPINY NAIAD, VARIABLE PONDWEED, CURLY LEAF PONDWEED, WHITE STEM PONDWEED, AND WILD CELERY

BUSHY PONDWEED, SAGO PONDWEED, MUSKGRASS, SPINY NAIAD, CLASPING LEAF PONDWEED, SMALL PONDWEED, FLAT STEM PONDWEED, WILD CELERY, AND WHITE STEM PONDWEED

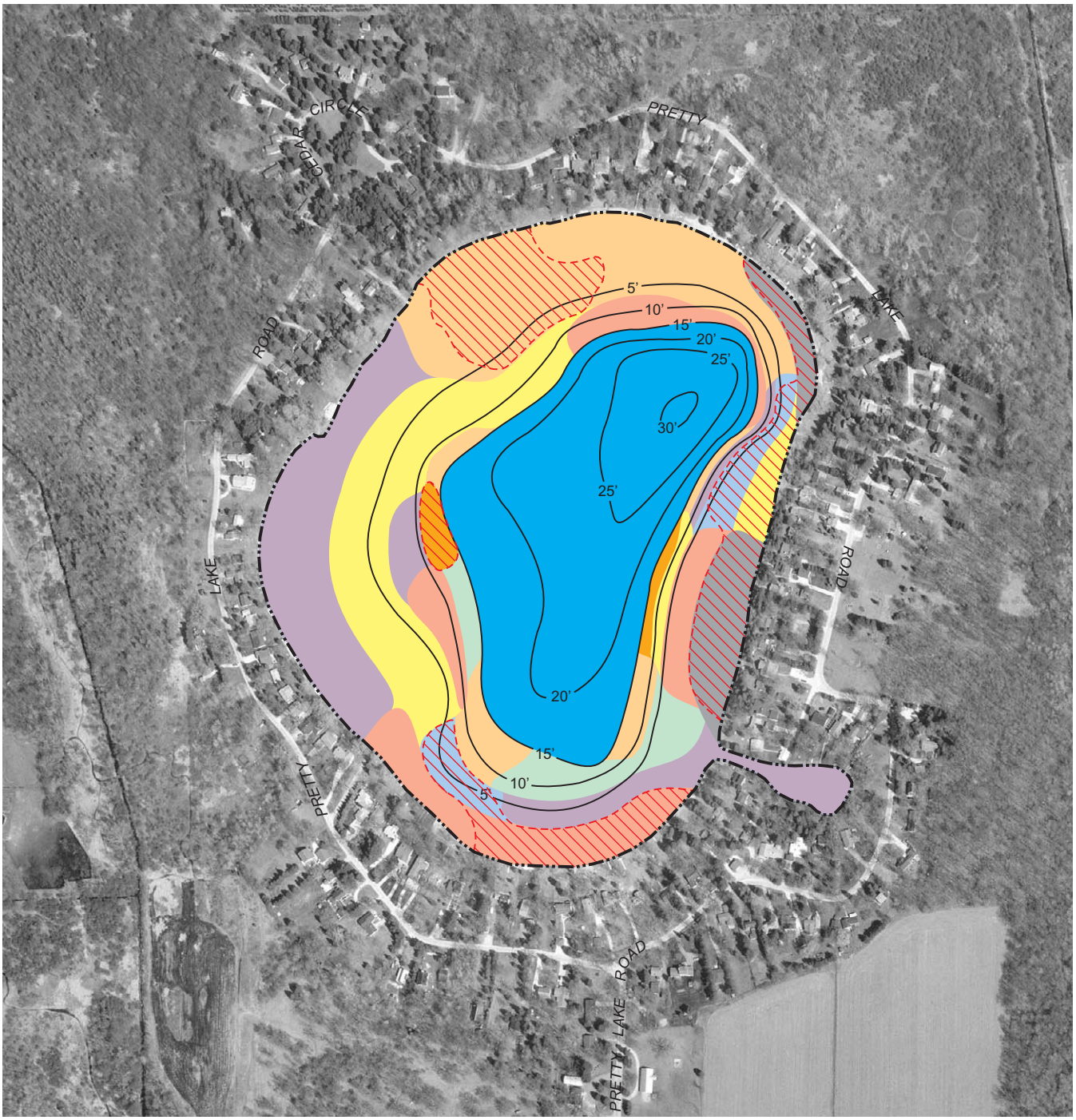
GRAPHIC SCALE

0 250 500 FEET

Source: SEWRPC.

Map 6

AQUATIC PLANT COMMUNITY DISTRIBUTION IN PRETTY LAKE: 2005



DATE OF PHOTOGRAPHY: MARCH 2000

—20' — WATER DEPTH CONTOUR IN FEET

OPEN WATER

AREA WHERE EURASIAN WATER MILFOIL IS NOT PRESENT IN PRETTY LAKE

NATIVE WATER MILFOIL

MUSKGRASS

MUSKGRASS, NATIVE WATER MILFOIL, BUSHY PONDWEED, SAGO PONDWEED, VARIABLE PONDWEED, AND WILD CELERY

MUSKGRASS, NATIVE WATER MILFOIL, BUSHY PONDWEED, SAGO PONDWEED, SPINY NAIAD, AND VARIABLE PONDWEED

MUSKGRASS, NATIVE WATER MILFOIL, BUSHY PONDWEED, COONTAIL, SAGO PONDWEED, AND WILD CELERY

MUSKGRASS, NATIVE WATER MILFOIL, BUSHY PONDWEED, SPINY NAIAD, SAGO PONDWEED, VARIABLE PONDWEED, WILD CELERY, AND WHITE STEM PONDWEED

MUSKGRASS, NATIVE WATER MILFOIL, BUSHY PONDWEED, COONTAIL, SPINY NAIAD, SAGO PONDWEED, FLAT STEM PONDWEED, WILD CELERY, WHITE STEM PONDWEED, AND SMALL PONDWEED

MUSKGRASS, NATIVE WATER MILFOIL, BUSHY PONDWEED, COONTAIL, SAGO PONDWEED, CURLY LEAF PONDWEED, CLASPING LEAF PONDWEED, VARIABLE PONDWEED, WILD CELERY AND WHITE STEM PONDWEED

GRAPHIC SCALE

0 250 500 FEET

Source: SEWRPC.

Table 5

FREQUENCY OF OCCURRENCE AND DENSITY RATINGS OF SUBMERGENT PLANT SPECIES ON PRETTY LAKE: AUGUST 2002

Aquatic Plant Species Present[a]	Sites Found	Frequency of Occurrence (percent)	Relative Density[b]	Importance Value
Bushy Pondweed	37	80.4	3.4	269.6
Coontail	9	19.6	1.3	26.1
Clasping Leaf Pondweed	1	2.2	1.0	2.2
Curly-Leaf Pondweed	1	2.2	1.0	2.2
Eel Grass	24	52.2	2.0	104.4
Eurasian Water Milfoil	38	82.6	2.9	241.3
Flat-Stemmed Pondweed	2	4.3	1.5	6.5
Muskgrass	34	73.9	2.8	204.4
Native Milfoil	19	41.3	1.7	71.7
Sago Pondweed	26	56.5	2.6	148.0
Small Pondweed	5	10.9	2.6	28.3
Spiny Naiad	5	10.9	2.2	23.9
Variable Pondweed	13	28.3	1.7	47.8
White-Stem Pondweed	16	34.8	1.1	39.1

NOTE: There were 94 total sample sites during the August 2002 survey.

[a]*Information obtained from* A Manual of Aquatic Plants *by Norman C. Fassett, University of Wisconsin Press;* Guide to Wisconsin Aquatic Plants*, Wisconsin Department of Natural Resources; and,* Through the Looking Glass...A Field Guide to Aquatic Plants*, Wisconsin Lakes Partnership, University of Wisconsin-Extension.*

[b]*Species relative density for all sample points including sample points where a particular species did not occur in Pretty Lake: Abundant (density rating = 4 to 5). Common (density rating = 2 to 3), Scarce (density rating = 1), and - = Absent (density rating = 0).*

Source: SEWRPC.

3. The average or relative density (ADEN) is the sum of the density ratings for a species divided by the number of sampling points with vegetation. The maximum density rating of 4.0 is assigned to plants that occur at all points sampled at a given depth, the modified Jesson and Lound protocol adopted by the WDNR uses four sampling points per depth sampled. The average density presents an indication of how abundant the growth of a particular plant is throughout the lake. This measure, along with the percent occurrence, gives a good indication of the distribution of aquatic plant communities in a lake.

4. The Simpson Diversity Index (SDI) is defined as one minus the sum of the relative frequencies squared, and is expressed in equation form as:

$$SDI = 1 - \sum(RFREQ)^2$$

where SDI is the Simpson Diversity Index and RFREQ is the relative frequency value defined above. Based upon this index of community diversity, the closer the SDI value is to one, the greater the diversity between the communities being compared.

5. The importance value (IV) is defined as the product of the relative frequency and the average density, expressed as a percentage:

$$IV = (RFREQ)\ (ADEN)\ (100)$$

Table 6

PRETTY LAKE AQUATIC PLANT ECOLOGICAL SIGNIFICANCE

Aquatic Plant Species Present	Ecological Significance
Ceratophyllum demersum (coontail)	Provides good shelter for young fish and supports insects valuable as food for fish and ducklings
Chara vulgaris (muskgrass)	Excellent producer of fish food, especially for young trout, bluegills, 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
Myriophyllum spicatum (Eurasian water milfoil)	None known
Myrionphyllum sp. (native water milfoil)	Provides valuable food and shelter for fish; fruits eaten by many waterfowl
Najas flexilis (bushy pondweed)	Stems, foliage, and seeds important wildfowl food and produces good food and shelter for fish
Najas marina (spiny naiad)	Provides good food and shelter for fish and food for ducks
Potamogeton amplifolius (large-leaf pondweed)	Provides food, shelter, and shade for some fish and food for some wildfowl. Provides shelter and support for insects, which are valuable as fish food
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, and deer
Potamogeton illinoensis (Illinois pondweed)	Provides shade and shelter for fish, harbor for insects, seeds are eaten by wildfowl
Potamogeton nodosus (long-leaved pondweed)	Provides food for ducks, geese, muskrat, beaver, deer, moose, and provides shelter for invertebrates foraged by fish
Potamogeton pectinatus (Sago pondweed)	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish
Potamogeton praelongus (white-stem pondweed)	Provides food and shelter for some fish such as trout; is also a valuable food source for ducks, geese, muskrat, beaver, deer, and moose
Potamogeton pusillus (small pondweed)	Provides food for ducks, geese, muskrat, beaver, and deer, and provides food and shelter for fish
Potamogeton richardsonii (clasping-leaf pondweed)	Provides food, shelter and shade for some fish, food for some wildfowl, and food for muskrat. Provides shelter and support for insects, which are valuable as fish food
Potamogeton zosteriformis (flat-stem pondweed)	Provides some food for ducks
Vallisneria americana (water celery)	Provides good shade and shelter, supports insects, and is valuable fish food

[a]*Information obtained from* A Manual of Aquatic Plants *by Norman C. Fassett, University of Wisconsin Press;* Guide to Wisconsin Aquatic Plants*, Wisconsin Department of Natural Resources; and,* Through the Looking Glass...A Field Guide to Aquatic Plants*, Wisconsin Lakes Partnership, University of Wisconsin-Extension.*

Source: SEWRPC.

where IV is the importance value, RFREQ is the relative frequency, and ADEN is the average density. This number provides an indication of the dominance of a species within a community based upon both frequency and density. It also somewhat addresses the problem of difference in stature between different plant species.

6. The similarity index (SI) is a means of comparing two communities by estimating the degree to which the communities share common components. The index is calculated as:

$$SI = 2W / (A + B)$$

where SI is the similarity index value, W is the amount two communities have in common or the lowest relative frequency of a species pair, and A plus B is the sum of the relative frequency for both communities, which should always be about 200 since the relative frequency of each community should equal 100 percent. This index could be calculated based upon average density or the importance values. However, relative frequency is a better measure since it does not change much during the growing season so the results remain comparable, even if the timing of sampling is not exactly the same, and, given that there are several methods for assigning average density, use of average density may yield a result that is not directly comparable. Use of relative frequency avoids such interpretation problems. It should be noted that, although a 100 percent similarity is theoretically possible, repeated sampling studies from the same community has shown that a similarity index of 85 percent or higher should be considered indicative of no community change.

7. The p-value, or Pearson chi-squared test, is calculated using a statistical program for personal computers.[19] The p-values are calculated based upon a two by two frequency table. A p-value of less than or equal to 0.05 is the limit used to identify a significant difference between two populations. This means that, at $p = 0.05$, there is a 95 percent probability that two populations are different, or that, after comparing 100 mean values from each data set, 95 would be different and five would overlap.

Where these indices could be calculated based upon available data collected during the year 2002 aquatic plant survey, the values are given in Table 5. These data indicate that, during 2002, bushy pondweed was the dominant aquatic plant in the Lake, closely followed by Eurasian water milfoil and muskgrass. Sago pondweed and eel grass were also important components of the aquatic plant community in the Lake during 2002.

During 2002 and 2005, Eurasian water milfoil (*Myriophyllum spicatum*) was abundant in most of the Lake. Areas where it did not exist included shallow areas along the southern and eastern shorelines and a portion of the northwestern shoreline. Eurasian water milfoil is one of eight milfoil species found in Wisconsin and the only one known to be exotic or nonnative. Because of its nonnative nature, Eurasian water milfoil has few natural enemies that can inhibit its explosive growth under suitable conditions. The plant exhibits this characteristic growth pattern in lakes with organic-rich sediments, or where the lake bottom has been disturbed. In such cases, the Eurasian water milfoil populations displace native plant species and interfere with the aesthetic and recreational use of the waterbodies. This plant has been known to cause severe recreational use problems in lakes within the Southeastern Wisconsin Region.

Eurasian water milfoil reproduces by the rooting of plant fragments. Consequently, some recreational uses of lakes can result in the expansion of Eurasian water milfoil communities, especially when boat propellers fragment Eurasian water milfoil plants. These fragments, as well as fragments that occur for other reasons such as wind-induced turbulence or fragmentation of the plant by fishes, are able to generate new root systems, allowing the plant to colonize new sites. The fragments also can cling to boats, trailers, motors, and/or bait buckets, and can stay alive for weeks contributing to the transfer of milfoil to other lakes. For this reason, it is very important to

[19] *Statistics for Windows, General Conventions and Statistics, 1995, Statsoft, Inc., Tulsa, Oklahoma.*

remove all vegetation from boats, trailers, and other equipment after removing them from the water and prior to launching in other waterbodies.

Native water milfoil (*Myriophyllum sp*.) also was observed and found to be common throughout Pretty Lake during the most recent survey. Native water milfoil causes few recreational use problems in lakes. However, hybridization between the native and Eurasian water milfoils is becoming more common, making it harder to distinguish the two,[20] and the hybrid plants do interfere with recreational water usage. Nevertheless, in late fall, native milfoil is easily identified by the presence of a winter bud.

FISHERIES

The WDNR reports that the fish population of Pretty Lake includes walleyed pike, rock bass, yellow perch, black crappie, warmouth, brown and yellow bullhead, brook silverside, pumpkinseed, green sunfish, bluegill, bluntnose minnow, white sucker, channel catfish, northern pike, and largemouth bass. Areas along the less steeply sloping shores of the Lake present suitable habitats for the spawning of bass and northern pike. Through 2002, Pretty Lake had a regulated minimum size limit for bass of 16 inches, promulgated under Section NR 20.20(68) of the *Wisconsin Administrative Code*. This restriction was designed to increase the number of large bass and thin out the numbers of panfish in the Lake in order to encourage the remaining panfish population to grow to a larger size. The measure was repealed during 2002, and the Lake is currently subject to the statewide general limits, summarized in Table 7.

RECREATIONAL USES AND FACILITIES

Pretty Lake is a multi-purpose waterbody serving a variety of recreational uses including boating, waterskiing, swimming, and fishing during the summer months, and snowmobiling, and ice-fishing during the winter. Pretty Lake is well-served by four public access sites, including three boat launches, and one walk-in access, as shown on Map 2.

The Lake is used year around as a visual amenity; walking, bird watching and picnicking are popular passive recreational uses of the waterbody, and is utilized during open water periods for a variety of recreational activities, as shown in Table 8. Recreational boating is a popular active recreational use of the Lake. The types of watercraft found on the Lake include powered or ski boats, fishing boats, paddleboats, canoes, sailboats, and personal watercraft ("jetskis"), as shown in Table 9. The Lake is considered by the WDNR to have adequate public recreational boating access, as defined in Section NR 1.91 of the *Wisconsin Administrative Code*.

LOCAL ORDINANCES

Pretty Lake is subject to a boating ordinance promulgated by the Town of Ottawa as Chapter 20, "Lakes and Beaches," of the Town of Ottawa Code of Ordinances. This ordinance provides generally applicable rules for all waters within the jurisdiction of the Town, as set forth in Appendix B. These rules limit the times during which boats may operate and allow for the enactment and enforcement of boating restrictions and limitations. This ordinance requires power boats operated within the Town to proceed in a counter-clockwise direction, in addition to requiring motorized boats to operate at slow-no-wake speeds between the hours of 6:00 p.m. and 11:00 a.m. daily, and within a shoreland zone defined as within 100 feet of the shoreline. Rules specifically applicable to Pretty Lake are the prohibition of parking on both sides of Pretty Lake Road, and limitation of parking at the Pretty Lake public access sites to four vehicles between the hours of 6:00 a.m. and 10:00 p.m. daily. The ordinance conforms to State of Wisconsin boating and water safety laws as set forth in Chapter 30, *Wisconsin Statutes*.

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[20]*Michael L. Moody and Donald H. Les, "Evidence of Hydridity in Invasive Watermilfoil (*Myriophyllum*) Populations,"* PNAS, *Volume 99(23), Pages 14867-14871, November 2002.*

Table 7

WISCONSIN STATE FISHING REGULATIONS: 2005-2006

Species	Open Season	Daily Limit	Minimum Size
Northern Pike	May 7 to March 5	2	26 inches
Walleyed Pike	May 7 to March 5	5	15 inches
Largemouth and Smallmouth Bass	May 7 to March 5	5	14 inches
Bluegill, Pumpkinseed (sunfish), Crappie, and Yellow Perch	Open all year	None	None
Bullhead and Rough Fish	Open all year	None	None

Source: Wisconsin Department of Natural Resources Publication No. PUB-FH-301 2005, Guide to Wisconsin Hook and Line Fishing Regulations 2005-2006, *2005, and SEWRPC.*

In 2005, Waukesha County adopted a stormwater management and erosion control ordinance that applies to all unincorporated areas of the County, including the Town of Ottawa.[21] That ordinance was developed to be consistent with the provisions of Chapter NR 151, "Runoff Management," of the *Wisconsin Administrative Code*, and in some instances it imposes more stringent requirements for control of runoff than does NR 151.

[21]*Waukesha County Code, Chapter 14, Article VIII,* Storm Water Management and Erosion Control Ordinance, *adopted by the Waukesha County Board on March 22, 2005.*

Table 8

RECREATIONAL USE SURVEY OF PRETTY LAKE: 2002

Date and Time	Weekday Participants									
	Fishing from Shoreline	Pleasure Boating	Skiing	Sailing	Personal Watercraft	Swimming	Fishing Boat	Paddleboat	Other	Total
August 1, 2002										
9:15 a.m. to 10:15 a.m.	0	0	- -[a]	0	- -	5	0	0	0	5
12:45 p.m. to 1:45 p.m.	4	1	1	1	2	10	0	1	0	23
Total	4	1	1	1	2	15	0	1	0	28
Mean	2	1	2	1	1	7	0	1	0	14

Date and Time	Weekend Participants									
	Fishing from Shoreline	Pleasure Boating	Skiing	Sailing	Personal Watercraft	Swimming	Fishing Boat	Paddleboat	Canoe	Total
August 3, 2002										
8:00 a.m. to 9:00 a.m.	0	0	- -	0	- -	0	1	0	1	2
1:45 p.m. to 2:45 p.m.	4	2	3	0	0	24	1	0	0	34
Total	4	2	3	0	0	24	2	0	1	36
Percent	2	1	1	0	0	12	1	0	1	18

[a]*Nonexistent data is due to a regulation that prohibits boat traffic at a speed above a slow-no-wake from a period of 6:00 pm to 11:00 am.*

Source: SEWRPC.

Table 9

WATERCRAFT ON PRETTY LAKE: 2002

Type of Watercraft								
Power Boat	Fishing Boat	Pontoon Boat	Canoe	Paddleboat	Sailboat	Personal Watercraft	Other	Total
30	47	53	22	45	9	12	2	220

Source: SEWRPC.

Chapter III

LAKE USE PROBLEMS AND ISSUES

INTRODUCTION

Although Pretty Lake is in relatively good condition and is capable of supporting a variety of recreational water uses, there are a number of existing and potential future problems and issues that should be addressed in this lake protection plan. These issues of concern include: potential changes in ecologically valuable areas and the aquatic plant and fisheries communities, nonpoint source pollution and lake water quality, public recreational water use, and protection of the shoreline.

ECOLOGICALLY VALUABLE AREAS, AQUATIC PLANTS AND FISHERIES

The ecologically valuable areas within the tributary drainage area of Pretty Lake include wetlands, woodlands, and wildlife habitat. Critical sites within the Lake include the fish spawning habitat, macrophyte beds, especially those containing a diverse flora, and the shoreline areas supporting productive aquatic habitat. Each of these major ecosystem elements are discussed below as issues of concern facing the Pretty Lake community.

Protection of Ecologically Valuable Areas

The environmental corridor lands within the drainage area tributary to Pretty Lake, together with the isolated natural resource features, contain almost all of the best remaining woodlands, wetlands, and wildlife habitat in the area. The wetland areas adjacent to Pretty Lake provide important habitat for wildlife. These wetland areas contribute to the scenic vistas which characterize the Pretty Lake watershed, and provide a broad range of natural resource and aesthetic benefits for southeastern Wisconsin.[1] Thus, the preservation of the corridor and protection of these lands from additional intrusion by incompatible land uses which degrade and destroy the environmental values of these sites are important issues that should be considered.

Aquatic Plant Management

The presence of Eurasian water milfoil in the Pretty Lake basin, and the potential for the presence of purple loosestrife in the wetlands and shorelands adjoining the Lake, represent other important issues; namely, the invasion of native plant communities by nonnative, competing species. The invasive Eurasian water milfoil often outcompetes native aquatic plants and, without management, frequently dominates the plant communities in the lakes of southeastern Wisconsin, to the detriment of native plant species, and fish and wildlife populations. Further, there is increasing evidence that Eurasian water milfoil will hybridize with native or northern water

[1]*The range of benefits to be derived from a sound natural resources base 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.*

milfoil, increasing the invasive nature of this genus.[2] The recent aquatic plant surveys conducted on Pretty Lake by Commission staff suggest that this aquatic plant has achieved sufficient abundance within the Lake and that it is beginning to interfere with human recreational and aesthetic use of the Lake's natural resources. As discussed in Chapter II, this aquatic plant is widespread in Pretty Lake and, therefore, its management is an issue that should be considered.

Fisheries Management

Based upon the fisheries survey conducted by the Wisconsin Department of Natural Resources (WDNR), and set forth in summary form in Chapter II, it would appear that the fishery in Pretty Lake has achieved a level of balance not present at the time of drafting of the current lake protection plan.[3] The recent aquatic plant surveys and reconnaissance conducted by the Commission staff indicate a continuing diversity of aquatic plant species that can provide good habitat and structure for fishes. The abundances and distribution of Eurasian water milfoil threatens this diversity. As angling is a popular recreational activity on Pretty Lake, identification of the current state of the fishery on the Lake is an important issue that should be considered.

WATER QUANTITY AND QUALITY

Surface Water Quantity

Pretty Lake, being a groundwater-fed seepage lake, has a history of fluctuating water levels. These fluctuations generally have involved a diminution of lake depth, resulting in large variations in shoreland area, especially in the more gradually sloping areas of the Lake. These fluctuations have seriously inconvenienced recreational watercraft users. To address such concerns, the Pretty Lake Protection and Rehabilitation District, in cooperation with the WDNR and the U.S. Geological Survey (USGS), installed a high-capacity well in 1991. The District has continued to operate this well periodically during the intervening period, augmenting the lake level with groundwater drawn from the sandstone aquifer. Recent investigations into the groundwater resources of the Region have highlighted the fact that this aquifer is being over-draughted.[4] In addition, District electors have expressed concerns regarding the impact of aquifer pumpage and surface drainage on water levels in Pretty Lake. These concerns have, in part, been investigated by the USGS utilizing the analytic element model, GFLOW, which evaluated groundwater flow regimes in the vicinity of the Lake.[5] While the concerns regarding water quantity impacts were determined to be largely unfounded, with the drainage system located to the north and west of Pretty Lake, as shown on Map 7, having only a minimal impact of the lake levels in its present state of disrepair,[6] consideration of the potential impact of pumpage on the deposition of marl within the lake basin would

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[2]*Michael L. Moody and Donald H. Les, "Evidence of Hybridity in Invasive Watermilfoil (*Myriophyllum*) Population,"* PNAS, *Volume 99, No. 23, pages 14867-14871, November 2002.*

[3]*SEWRPC Memorandum Report No. 122,* A Lake Protection Plan for Pretty Lake, Waukesha County, Wisconsin, *April 1998.*

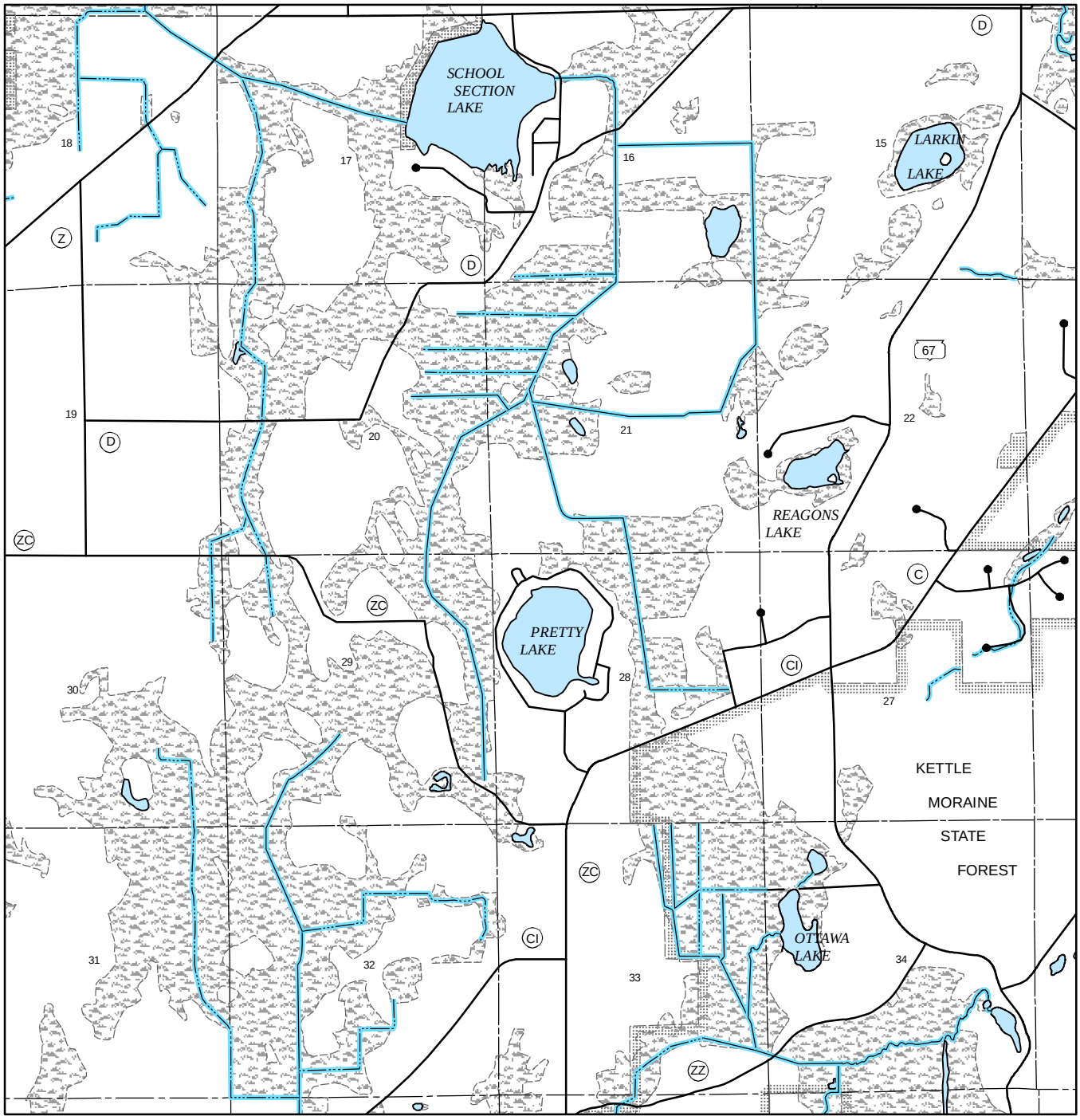
[4]*SEWRPC Technical Report No. 37,* Groundwater Resources of Southeastern Wisconsin, *June 2002.*

[5]*Randy J. Hunt and James T. Krohelski, "The Application of an Analytic Element Model to Investigate Groundwater-Lake Interactions at Pretty Lake, Wisconsin,"* Journal of Lake and Reservoir Management, *Volume 12(4), pages 487-495, 1996.*

[6]*See SEWRPC Memorandum Report No. 122, page 32: based upon modeling undertaken by the USGS, the drain tile to the west of Pretty Lake was determined to have a significant potential impact on the level of Pretty Lake, although that impact was considered to be negligible at the time of writing of the initial lake protection plan due to the low head difference that then existed as a consequence of the lack of maintenance of the drainage ditch system. It was noted, however, that should this system be restored to its design depth, the lake water levels in Pretty Lake could be reduced by up to 18 inches, as documented by Hunt and Krohelski,* loc. cit.

Map 7

SURROUNDING DRAINAGE DITCHES WITHIN THE PRETTY LAKE AREA AS REPRESENTED BY THE GFLOW MODELING PROGRAM



DRAINAGE DITCH

Source: U.S. Geological Survey and SEWRPC.

appear to be an issue of concern. This concern could be exacerbated should the need for increased water level augmentation be created as a result of any future restoration of the drainage channels to the north of Lake.

Associated with these concerns is the fact that fluctuating water levels can influence the aquatic plant communities within the Lake. As was noted in the current lake protection plan, fluctuating water levels can frequently disadvantage certain aquatic plants, although, conversely, other aquatic species can be benefited. In the short term, however, fluctuating water levels generally contribute to a lack of vegetation in the drawdown zone, which limits the lake fishery as a result of the lack of habitat in the littoral zone. From the limited perspective of overcoming this concern, use of the high-capacity well to augment lake levels appears warranted. On the other hand, as demonstrated in Chapter II, use of the high-capacity well has the potential to enhance marl deposition in the Lake as a result of the additional and higher rates of flow of groundwater into the system. Consequently, the ongoing operation of the high-capacity well would appear to be an issue of concern.

Surface Water Quality

Human activities upon the land surface result in the generation and mobilization of contaminants that are transported to lakes by rainfall, wind, and runoff. Where such activities involve the exposure of the soil surface, larger contaminant loads result. Thus, erosion during construction and generation of nonpoint source pollutants associated with new urban development in the drainage area tributary to Pretty Lake represent potentially significant threats to water quality. Even though future development of open lands within the area tributary to Pretty Lake is expected to be limited, unplanned development may occur and impacts on lake water quality could potentially result. Thus, while surface water quality in Pretty Lake is currently reported to be generally good, some water quality problems may occur in future as the area tributary to the Lake is further developed. Consequently, control of nonpoint source pollution and lake water quality is an important issue to be considered.

Groundwater Quantity and Quality

As noted above, fluctuations in the level of Pretty Lake have led to the installation and operation of a high-capacity well to augment lake levels since 1991. The well is located in the deep sandstone aquifer, and, to a minor degree, its operation contributes to the over-draughting of this aquifer. As many municipal water supplies utilize this aquifer, and given that recharge is slow relative to the surfacial groundwater systems, the volume of groundwater available for lake level maintenance is an issue to be considered.

In addition, water supplies and wastewater treatment systems within the Pretty Lake community are dependent upon groundwater resources. In the former case, domestic water supplies are drawn from the surfacial aquifer. Consequently, the proximity of onsite sewage disposal systems to the surfacial aquifer suggests cause for concern of groundwater contamination from wastewater. A number of homesteads within the community, portions of which were situated on soils that, prior to changes in the *Wisconsin Administrative Code* in June 2000, were unsuitable for urban density residential development utilizing conventional onsite sewage disposal systems, have installed alternative onsite sewage disposal systems such as mound systems and holding tanks. Consequently, measures to minimize groundwater quality degradation within the Pretty Lake groundwatershed is an issue to be considered. In this regard, recent proposals to extend public sanitary sewerage services to this community also form an issue to be considered, not only from the water quality perspective—diverting contaminants from the groundwater system being generally a positive action—but also from the water quantity point of view—diverting water, abstracted from the local groundwater system, from the groundwatershed being potentially a negative action.

The protection of groundwater recharge remains a further issue to be considered. While the presence of the Ottawa Lake Recreation Area within the Southern Unit of the Kettle Moraine State Forest forms a protected natural area located partially within the groundwatershed of the Lake, other portions of the Lake's groundwatershed may be subject to future developmental pressures which could influence groundwater quantity and quality. For this reason, conservation of wetlands and other habitat areas within the groundwatershed of Pretty Lake in their natural state is an issue to be considered. Protection of such lands from urban density development will contribute to the protection of the groundwater resources within the Pretty Lake area.

WASTEWATER MANAGEMENT

Appendix F of the current lake protection plan for Pretty Lake sets forth an analysis of the potential costs and benefits of providing public water borne sewerage services to the Pretty Lake community.[7] This analysis assumed that any future public water borne sanitary sewerage system would potentially serve both Pretty Lake and School Section Lake, with the sewage being conveyed to the Village of Dousman wastewater treatment plant for processing. The analysis examined the likely costs of providing either community with sanitary sewerage services, of providing both communities with sanitary sewerage services, and of maintaining the *status quo*, with households being served by a combination of conventional onsite sewage disposal systems, mound systems, and holding tanks over a 20-year planning period. Of the alternatives examined, continuing the use of onsite systems had the lowest present net worth; however, provision of public sewerage had the greatest long term benefit with the potential to provide the greatest flexibility to households, present a positive influence on property values, and protect surface and ground water quality.

Subsequent to the foregoing analysis being completed, an evaluation of the potential impact of installation of a public sewerage system was conducted for the Silver Lake community, Town of Summit, in Waukesha County. This evaluation, building from the groundwater model developed for the Genesee Lakes in the Town of Summit, included an analysis of the impact of a public sanitary sewerage system on groundwater flows into Silver Lake. This analysis suggested that a public sewerage system could have a potentially negative influence on water quantity. In the Silver Lake scenario, the households up-gradient from the Lake within the groundwatershed would continue to rely on groundwater for potable supply, but would be provided with a public sewerage system that would convey wastewater, previously disposed of through onsite wastewater treatment systems, away from the Lake. This proposed system would effectively short-circuit the hydrological balance to this seepage lake by abstracting groundwater up-gradient of the Lake and exporting the water to the Oconomowoc River downstream and downgradient of the waterbody. This net loss of groundwater was estimated by the USGS staff using the GFLOW model to range from negligible to about 0.25 foot in lake surface elevation.

Extrapolating these findings to the Pretty Lake community, and assuming that about one-half of the 55 housing units within the Pretty Lake community are up-gradient of the Lake,[8] it can be estimated that a public sanitary sewerage system would divert about 4 million gallons of groundwater per year to the Village of Dousman wastewater treatment plant—based upon an average consumption rate of 400 gallons per household per day. This volume is equivalent to about 0.2 foot in lake surface elevation, suggesting that provision of public water borne sewerage services to the Pretty Lake community could have a potential negative influence on lake level. Consequently, the provision of public sewer service to the Pretty Lake and School Section Lake communities is an issue to be considered.

SHORELINE PROTECTION AND RECREATIONAL WATER USE

Periodic changes in precipitation and weather patterns between years often result in fluctuation of water loads to the lake. These fluctuations, in turn, can affect lake levels. Riparian residents and local officials have reported such changes in the water levels of Pretty Lake. Many plant and animal species can cope with this level of water surface fluctuation. In contrast, the consequences of artificially manipulating lake water levels can be both beneficial and deleterious. The major deleterious impacts from the riparian owner standpoint is that the fluctuating water levels affect shoreline erosion, interfere with proper height and placement of piers, and affect the placement of shoreline protection structures. Likewise, negative impacts on the natural ecosystem include the affects of flooding and drawdown on fish breeding habitat, amphibian overwintering habitat, and shoreland

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[7] *SEWRPC Memorandum Report No. 122,* A Lake Protection Plan for Pretty Lake, Waukesha County, Wisconsin, *April 1998.*

[8] *U.S. Census Bureau, year 2000 data for Census Blocks 4015 and 4016, Block Group 4, Census Tract 2040.01, Waukesha County, Wisconsin.*

vegetation. Positive impacts relate to suppression of nonnative species, for example. While few areas of natural shoreline appeared to be subject to erosion and undercutting of banks, such shoreland erosion could be expected to increase as lake usage increases, especially during periods of higher water levels. Consequently, maintenance of water levels within natural limits is an issue of concern from the point of view of protecting aquatic habitat and public access to the Lake, and minimizing the impacts of shoreland erosion on the Lake. As noted above, augmentation of water levels utilizing groundwater pumping introduces other concerns relative to lake levels and water quality that should be considered.

Chapter IV

ALTERNATIVE AND RECOMMENDED LAKE PROTECTION PRACTICES

INTRODUCTION

There are a number of issues of concern affecting the recreational use and protection of the Pretty Lake ecosystem. These issues were identified in Chapter III and include: aquatic plant management, fisheries and protection of ecologically valuable areas; control of pollution, wastewater management and the protection of surface and ground water quality; maintenance of lake water levels and concomitant concerns of groundwater recharge; and, protection of shorelines and maintenance of recreational water uses.

In some ways, these issues of concern are interrelated. For example, the deposition of calcium carbonate, or marl, can limit certain recreational uses, and could influence the distribution of plant nutrients in the system, potentially selecting for species that can abstract the nutrient adsorbed to the calcium. Given the distribution of aquatic plants and marl in the Lake, it would appear that, of the aquatic plants recorded as being present within the Lake, musk grass, bushy pondweed and spiny naiad would be capable of exploiting the niche created by marl deposition. While these plants are generally low-growing, their growth can be inhibited by the growth of the nonnative aquatic plant, Eurasian water milfoil. This latter plant typically begins its growth process earlier in the season—when water temperatures are somewhat cooler—and quickly grows to the lake surface where it forms a vegetative canopy that can capture a significant proportion of the ambient sunlight. Consequently, growths of Eurasian water milfoil can potentially outcompete the native aquatic plants, impair the aesthetic quality of the Lake, and degrade in-lake habitat. From a boating standpoint, Eurasian water milfoil interferes with recreational use by restricting propeller movement and clogging cooling-water intakes, snagging paddles, and slowing sailboats by wrapping around keels and control surfaces. The plant also causes concern among swimmers who can become entangled within the plant stalks.

Without control measures, areas of abundant growths of Eurasian water milfoil can become problematic with respect to such recreational uses as boating, fishing, and swimming. Native aquatic plants, generally found at slightly deeper depths, pose fewer potential problems for navigation, swimming, and fishing, especially as the majority of these plants are low-growing and occur at lower densities than the invasive Eurasian water milfoil. In addition, those species of fish that are dependent on native aquatic plants for habitat, food resources, and shelter can be disadvantaged, especially juvenile and young-of-the-year fishes. All of these in-lake processes are dependent upon lake levels that fluctuate within a range of seasonal norms. Extreme fluctuations tend to promote the growths of early colonizing, and, frequently, nonnative invasive, species. In an effort to manage such fluctuations, the Pretty Lake community has installed a high-capacity well to augment lake levels during periods of low water. However, as noted in Chapter II, this measure, too, could modify the lake environment through additional marl deposition within the waterbody.

Based upon the foregoing range of likely future scenarios and concerns, this chapter presents alternative and recommended management measures to address the identified issues. These measures include:

- Land use management measures designed to limit the inputs of contaminants, from both point and nonpoint sources, and to protect ecologically valuable areas and associated biota;

- Aquatic and shoreland plant management measures designed to encourage native plant communities and limit the spread of nonnative species, as well as reduce erosion-related problems and encourage the establishment of natural, native shoreline vegetation where appropriate, inclusive of fisheries management measures designed to mitigate the habitat-related impacts of a changing aquatic flora and maintain an ecologically viable system; and

- Recreational use management measures designed to promote safe boating and boating access, curtail the spread of invasive species of aquatic flora and fauna, and provide the potential for the community to gain access to outside funding sources and lake enhancement services.

Following a brief summary of the ongoing lake management program, alternatives and recommended refinements to the lake protection plan for Pretty Lake are described in this chapter, focusing most specifically on concerns relating to the aquatic plant community, but including the broader range of concerns insofar as they are relevant.[1] Alternative and recommended management measures are described below. The alternatives and recommendations set forth herein focus on those measures which are applicable to the Pretty Lake Protection and Rehabilitation District, but include recommendations applicable to other governmental units having responsibility for land and water resource management in the drainage area tributary to Pretty Lake.

PAST AND PRESENT LAKE MANAGEMENT ACTIONS

The residents of Pretty Lake, in conjunction with the Town of Ottawa and in partnership with the Pretty Lake Protection and Rehabilitation District, have long recognized the importance of informed and timely action in the management of Pretty Lake. The Pretty Lake Protection and Rehabilitation District was created as the principle organ for the conduct of lake management activities within the Pretty Lake basin. As noted in the aforereferenced adopted lake protection plan, this District has undertaken regular water quality and aquatic plant monitoring. Some of these activities were conducted under the auspices of the Wisconsin Department of Natural Resources (WDNR) Self-Help Monitoring Program. The District also operates a water level augmentation system under supervision of the WDNR based on groundwater pumpage during periods of low lake levels. These activities were supplemented by a U.S. Geological Survey water quality investigation which was conducted in 1993 and 1994 with support under the Chapter NR 190 Lake Management Planning Grant Program. Based upon the outcome of these investigations, the Southeastern Wisconsin Regional Planning Commission prepared a lake protection plan for Pretty Lake,[2] which plan has guided the management actions implemented by the Pretty Lake Protection and Rehabilitation District since 1998. While these actions have enhanced the level of understanding about the Lake and its ecosystem within the community, concerns over the lake water quality remain, especially in relation to the control of aquatic plants and deposition of marl within the lake basin. Therefore, this report is designed to supplement and refine the existing Pretty Lake protection plan with respect to the management of water quality and aquatic plant communities in Pretty Lake.

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[1]*SEWRPC Memorandum Report No. 122,* A Lake Protection Plan for Pretty Lake, Waukesha County, Wisconsin, *April 1998.*

[2]Ibid.

LAND MANAGEMENT MEASURES

The drainage area tributary to Pretty Lake and the western portions of the Town of Ottawa contain relatively large tracts of ecologically valuable areas, including significant areas of diverse, native aquatic vegetation suitable for fish spawning. As summarized in Chapter III, the potential problems associated with ecologically valuable areas in and near Pretty 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). In addition, the urban density development surrounding Pretty Lake raises concerns related to stormwater and wastewater management within the lakefront community. Land management measures relate primarily to the generation and transport of pollutants from land use activities, including the management of wastewater. Measures relating to the management of ecologically valuable areas and aquatic plant communities are discussed further below.

Protection of Ecologically Valuable Lands

With respect to urban-density development in the watershed tributary to Pretty Lake, the adopted county development plan envisions the placement of wetlands and ecologically valuable lands, such as primary environmental corridor lands, within appropriate zoning districts that will ensure the integrity of the natural resource base within the drainage area tributary to the Lake.[3] To this end, the citizens from the Pretty Lake community have participated in hearings and informational meetings of the Town of Ottawa relating to land development issues, to urge lake-friendly land management practices.

In addition, the current lake protection plan recommended the purchase of critical properties or the acquisition of conservation easements over specific lands on critical properties within the lake drainage area. As of 2004, the Pretty Lake Protection and Rehabilitation District had acquired 22 acres of land within the groundwatershed tributary to the Lake. Map 8 shows the locations of those lands currently in the protective ownership of the Lake District and Pretty Lake Advancement Association.

Notwithstanding these acquisitions, the recommended land management actions, set forth in the adopted lake protection plan, including the protection of primary environmental corridor lands, maintenance of such lands in essentially open space uses, and implementation of ordinances favoring environmentally friendly land use practices, in addition to promotion of open space land uses, also are endorsed under this plan. Cost share grant funding through the Chapter NR 50/51 Stewardship program or Chapter NR 191 Lake Protection Grant program may be available to assist with such purchases or the acquisition of conservation easements. In addition, the Kettle Moraine Conservation Foundation, Inc., may provide a community-based mechanism to pursue such acquisitions or easements.

Management of Stormwater Runoff

Control of contaminants present in runoff from developed and developing lands, both rural and urban, is recommended in the current lake protection plan for Pretty Lake. For urban areas, reduction of nonpoint source pollutant loads to Pretty Lake by about 25 percent, utilizing urban "good housekeeping practices," was recommended in the regional water quality management plan, and endorsed in the lake protection plan.[4] Measures recommended include selection of appropriate building materials which reduce runoff of metals and other toxic pollutants, limitation of the use of fertilizers and pesticides, improvements in pet waste and litter control, encouragement of proper disposal of motor vehicle fluids, increased leaf collection in autumn, and reduction in

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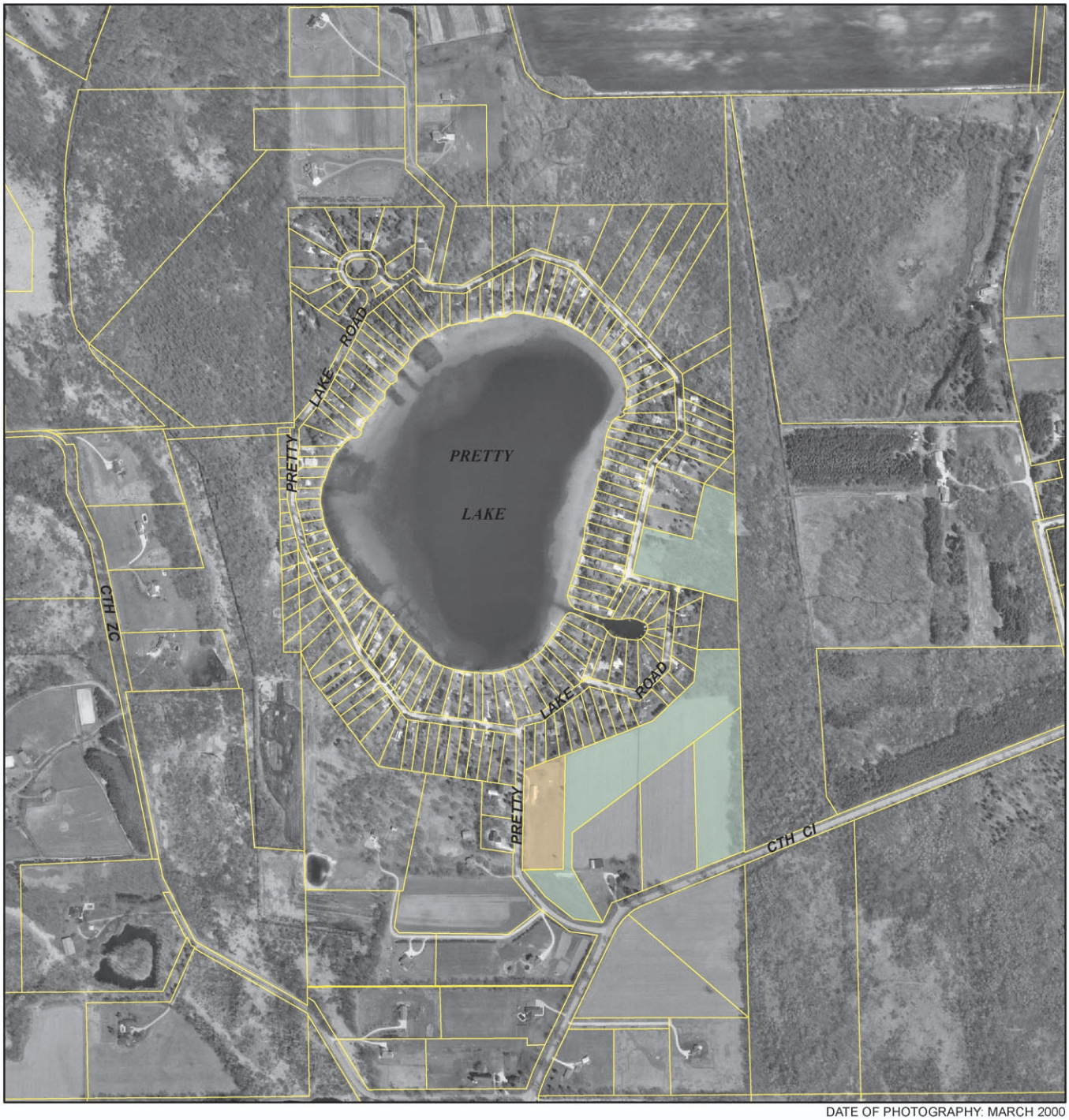
[3] *SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

[4] *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 Memorandum Report No. 122,* op. cit.

Map 8

LANDS WITHIN THE PRETTY LAKE AREA CURRENTLY UNDER PROTECTIVE OWNERSHIP: 2005



DATE OF PHOTOGRAPHY: MARCH 2000

PRETTY LAKE PROTECTION AND REHABILITATION DISTRICT

PRETTY LAKE ADVANCEMENT ASSOCIATION

PARCEL LINE

N

0 450 900 1,350 Feet

Source: Waukesha County and SEWRPC.

the use of deicing fluids. In rural areas, adoption of conservation agricultural techniques designed to achieve "tolerable" soil loss targets as set forth in the county agricultural soil erosion control plan, as well as preparation of farm plans for individual agricultural operations, was recommended. While the number of active agricultural operations has diminished, application of good agricultural management practices remains an appropriate management measure. In addition to control of soil loss from rural lands, soil erosion controls were recommended for application to lands in transition from rural land uses to urban residential and related land uses. These measures, for single- and two-family dwellings, are stipulated in the Town of Ottawa Code of Ordinances, Chapter 10, "Zoning Ordinance."[5] Up to a 75 percent reduction in nonpoint sourced pollution from development sites is recommended in the adopted regional water quality management plan.[6] Control measures include temporary seeding, mulching, sodding, and use of runoff control measures such as filter fabric, straw bales, diversion swales, sediment traps, and sedimentation basins.

Management of Wastewater

With respect to the management of wastewater, the adopted lake protection plan recommended continued reliance on onsite sewage disposal systems, including both mound systems and holding tanks as appropriate. Implementation of an informational and educational campaign to encourage all property owners to have their onsite sewage disposal systems inspected on a regular basis, not just those required to do so pursuant to Chapter Comm 83 of the *Wisconsin Administrative Code*, also was recommended.

Recently, during the year 2005, development proposals for former agricultural lands within the Town were tabled and approved subject to provision of public sanitary sewerage services. These proposals provide an opportunity for the Pretty Lake and School Section Lake communities to acquire access to adequately sized force mains. Such access would entail the cost of up-sizing the diameter of the mains to provide for future connection by either or both of the lake management districts. Such action, if pursued by the public inland lake protection and rehabilitation districts, would require the lake districts to adopt town sanitary district powers as provided pursuant to Section 33.22(3) of the *Wisconsin Statutes*. Adoption of sanitary district powers can be by resolution adopted at the annual meetings of the districts. These actions, adoption of sanitary district powers by the existing lake management districts and up-sizing the sewerage mains, are recommended. Both actions together would allow the communities to either agree to participate in the extension of sewer service at the time of development of the proposed subdivision or agree to participate in the extension of sewer service at some future time.[7]

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[5]*See also, Wisconsin League of Municipalities and Wisconsin Department of Natural Resources,* Wisconsin Construction Site Best Management Practices Handbook, *1989.*

[6]*SEWRPC Planning Report No. 30,* op. cit.

[7]*Alternatives to the adoption of sanitary district powers by the public inland lake protection and rehabilitation districts include the formation of a town sanitary district or of a utility district by the Town of Ottawa. Creation of either of these special purpose units of government would establish a governmental entity that could serve the waste management needs of each community or of both lake communities. The creation of an additional special purpose unit of government to manage wastes may be warranted given the differences between the conduct of waste management and lake management activities; the former potentially requiring larger investments and more rapid responses to failures than typically the case with the latter. In southeastern Wisconsin, the Washington County Silver Lake community has maintained both special purpose units. Other communities, such as Pewaukee Lake and Delavan Lake, have opted to concentrate lake and sanitation management under the auspices of a town sanitary district, while still other communities have utilized public inland lake protection and rehabilitation districts to meet both sanitation and lake management needs. This choice is best made by the Town of Ottawa in consultation with the Pretty Lake and School Section Lake Management Districts, and is dependent upon local conditions and the desires of the electors and property owners in the community. The adoption of sanitary district powers by either or both of the existing lake management districts, however, obviates the need for creating an additional unit of government.*

This recommendation is predicated upon the fact that the incremental cost of up-sizing the pipe required to be placed by the developer as a condition of proceeding with the planned development is relatively small compared with the cost of laying a parallel conduit at a future date, the construction costs being the greater of the cost of providing sewerage services. The eventual extension of sewerage services to the Pretty Lake and School Section Lake communities is indicated in the northwest Waukesha County sewer service area plan.[8] As noted in the current lake protection plan, a new sewage treatment facility to serve the Pretty Lake area is considered to be cost-prohibitive and unlikely to be implemented under current WDNR guidance which discourages the proliferation of new small sewage treatment plants.[9]

Management of Nonpoint Source Contaminants

The primary sources of pollutant loadings to Pretty Lake are from nonpoint sources generated from within the area tributary to the Lake. 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 nonpoint source pollution control measures considered in this report are based upon the recommendations set forth in the regional water quality management plan,[10] the Waukesha County land and water resource management plan,[11] and information presented by the U.S. Environmental Protection Agency.[12] Application of both urban and rural nonpoint source controls is recommended. In addition, measures to control nonpoint source pollution loading during land development activities and consideration of possible increased sedimentation in areas of the lake basin also are recommended.

Nonpoint Source Pollution Control in Developed Urban Areas

Potentially applicable urban nonpoint source control measures include wet detention basins, stormwater infiltration basins, grassed swales, and good urban housekeeping practices. Public informational programs can be developed to encourage good urban housekeeping practices, to promote the selection of building and construction materials that 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. Good 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

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[8]*SEWRPC,* Amendment to the Regional Water Quality Management Plan and Summary Report: Northwestern Waukesha County Sewerage System Plan, *March 2001.*

[9]*Subsequent to the amendment of Chapter Comm 83 of the* Wisconsin Administrative Code *during 2003, innovative wastewater treatment technologies, such as small-scale community-based treatment facilities or so-called "package" treatment plants, can be permitted. While some such plants can be operated with minimal human interaction, the need for a collection system, potentially including pump stations, is likely to require some human attendance, especially with regard to maintenance, and result in costs to the community that exceed or, at least, are not significantly different from those associated with a public sewerage system. Consequently, this alternative is not considered feasible and is not recommended.*

[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, Volume Three,* Recommended Plan, *June 1979; and SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

[11]*Waukesha County,* Waukesha County Land and Water Resource Management Plan: 2006-2010, *February 2006.*

[12]*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 Lake and Reservoirs: Technical Supplement to the Lake and Reservoirs Restoration Guidance Manual, *May 1993.*

materials and gutters; proper disposal of motor vehicle fluids; increased leaf collection; street sweeping; and reduced use of street deicing salt. Generally, the application of low-cost urban housekeeping practices may be expected to reduce nonpoint source loadings from urban lands by about 25 percent.

Particular attention also should be given to reducing pollutant loadings from high pollutant loading areas, such as commercial sites, parking lots, and material storage areas. The Waukesha County stormwater management and erosion control ordinance requires erosion control and stormwater management plans for new development. Ideally, the need for urban runoff and nonpoint source control measures, such as infiltration facilities and detention basins, would be determined through the preparation of detailed stormwater management systems plans that address stormwater drainage problems and control of nonpoint source pollution. The County ordinance allows for the substitution of such plans for individual site-by-site plans.

In residential areas, the use of rain gardens is becoming increasingly popular with these gardens providing an additional landscaping option for homeowners and householders.[13] These facilities can also be installed as communal facilities within conservation subdivisions. Likewise, to the extent practicable, parking lot stormwater runoff should be diverted to areas covered by pervious soils and appropriate vegetation, rather than being directly discharged to surface waters. Material storage areas may be enclosed or periodically cleaned, and diversion of stormwater away from these sites may further reduce pollutant loadings. Street sweeping, increased catch basin cleaning, stream protection, leaf litter and vegetation debris collection, and stormwater storage and infiltration measures can enhance the control of nonpoint source pollutants from urban and urbanizing areas, and, in the case of infiltration facilities, reduce runoff volumes.

It is recommended that Waukesha County continue to enforce the County stormwater and erosion control ordinance. This ordinance, adopted in 2005,[14] requires that sediment loads be reduced by 80 percent over uncontrolled sediment loads estimated to be generated from the construction site; this level of reduction is to be estimated utilizing technical standards developed by the WDNR. A similar level of control of sediment is to be maintained following development, although redevelopment sites need achieve only a 40 percent reduction in suspended solids loss.

Nonpoint Source Pollution Control in Developing Urban Areas

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, only limited additional urban development is anticipated within the drainage area directly tributary to Pretty Lake. 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.

Construction erosion controls are important pollution control measures that can minimize localized loadings of phosphorus and sediment from the drainage 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. Construction site erosion controls may be expected to reduce pollutant loadings from construction sites by about 80 percent.

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[13]*U.S. Environmental Protection Agency, "Urban Runoff Notes,"* Nonpoint Source News-Notes, *Issue No. 42, August/September 1995.*

[14]Waukesha County Code of Ordinances, *Chapter 14, Article VIII, "Stormwater Management & Erosion Control Ordinance," March 2005.*

Where new development or redevelopment is proposed, it is recommended that the provisions of the Waukesha County stormwater and erosion control ordinance be strictly enforced. It is recommended that conservation development principles be applied when rural lands within the area tributary to the Lake are considered for urban residential development. In these areas, it would be desirable to maintain open space areas within the lake tributary area and cluster the development outside the area tributary to the Lake. It is also recommended that the relevant performance standards set forth in the adopted County land and water resource management plan be enforced as necessary.

Rural Nonpoint Source Controls

Upland erosion from agricultural and other rural lands currently is a contributor of sediment and other contaminants within the area tributary to Pretty Lake. Some of the remaining agricultural lands within the tributary area will be replaced, over time, with urban-density residential development. While such development could potentially reduce the agro-chemical loadings to Pretty Lake, this benefit may be offset by the fact that urban lands contribute a wider range of contaminants to surface waters and generally increase rates of surface runoff. Application of the urban nonpoint source pollution control measures, as recommended above, should mitigate the water quality impacts of the conversion of rural lands to urban land uses.

LAKE MANAGEMENT MEASURES

In addition to the implementation of sound land management practices within the surface and subsurface drainage areas tributary to Pretty Lake, consideration and application of certain in-lake management measures is recommended as a means of addressing lake level, water quality, and aquatic plant community concerns identified by the electors of the Pretty Lake Management District. As summarized in Chapter III, the potential problems associated with Pretty Lake include: the potential loss of wetlands and other important ecologically valuable areas due to urbanization or other encroachments, the degradation of wetlands and aquatic habitat due to the presence of invasive species (including Eurasian water milfoil), and the rate of sedimentation associated with marl deposition. In addition, the urban density development surrounding Pretty Lake raises concerns related to stormwater and wastewater management within the lakefront community.

Lake Level Management Measures

Under natural conditions, variations in year-to-year rainfall amounts and the distribution of rainfall and associated runoff within the Region, as well as artificial drainage of lands in the vicinity, will contribute to result in variations in inflows entering Pretty Lake. These variations lead to fluctuations in lake water levels. These fluctuations resulted in the low water levels previously reported, which variations led directly to the use of groundwater to supplement the surface water resources in the Lake.

In addition to natural climatic variability, lake levels are also affected by drainage systems within the western portions of the Town of Ottawa that hydrologically link Pretty Lake and School Section Lake, as suggested in Figure 1. As noted in the current plan, modeling studies suggested that the tile drain and channel system adjacent to Pretty Lake exercises a significant influence on lake levels, especially the tile and channel drain system located to the west of the main lake basin as shown on Map 7 in Chapter III of this report. Should this drainageway be restored to design conditions, a decline in lake level of up to 18 inches below current normal water levels could be foreseen in the absence of any supplemental water source. Therefore, the current plan recommended acquisition of control over this drainageway by the Pretty Lake Protection and Rehabilitation District, either through outright purchase of the lands upon which the channel is situated or through acquisition of a conservation easement that would allow the District to have operational control of the waterway. A further alternative suggested but not recommended was the formation by the Town of Ottawa of a Chapter 88, *Wisconsin Statutes*, drainage district or through the Town adoption of drainage district powers.

As a consequence of the anticipated natural variations in lake level, the Pretty Lake Protection and Rehabilitation District has installed and operated a high-capacity well to augment lake levels using water drawn from the sandstone aquifer. Use of this system has been shown to be able to maintain water levels within the Lake at a more consistent level than would be possible without such augmentation, especially during periods of low

precipitation. While this system has the potential to maintain water levels by supplying additional quantities of water to the Lake, this input of water also carries with it various dissolved constituents, especially calcium carbonate, which upon discharge under ambient atmospheric conditions results in the flocculation of marl. As noted in Chapter II, this deposition has the potential, albeit minimal, to impact lake depth. In addition, and of more serious concern, the location of the source water within the sandstone aquifer is such that recharge of this water bearing stratum is limited and slow, relative to recharge within the surfacial sand and gravel aquifer. This means that water can be pumped from the sandstone aquifer at rates that exceed the ability of rainfall and infiltration to replace the abstracted volume, leading to over-draughting of the aquifer. This phenomenon is already occurring within southeastern Wisconsin as a consequence of numerous municipal supplies being drawn from this source.[15] As a result of this potential conflict between use of groundwater from the sandstone aquifer for recreational uses or public drinking water supply, and in light of the likely enhanced deposition of marl within the Lake basin, it is recommended that use of the high-capacity well be limited.

Further, as recommended in the current plan, it is recommended that acquisition of control over the tile drain system adjacent to the Lake be pursued as a means of ensuring stable water levels within the Lake. Acquisition of these lands adjacent to the Lake not only could address a potentially significant pathway of water loss from the Lake, but also could provide a link between the Ice Age National Scenic Trail, the Glacial Drumlins Trail and the Ottawa Lake State Recreational Area, enhancing recreational opportunities not only for the Pretty Lake and School Section Lake communities but also for the people of Wisconsin. Acquisition of lands for the creation of a Pretty-Section trail by the Pretty Lake Protection and Rehabilitation District and/or the Kettle Moraine Conservation Foundation, Inc., is proposed in the adopted regional bicycle and pedestrian facilities plan,[16] and is endorsed herein. Managing lake levels by controlling outflow of water from the Lake is a preferred alternative to extensive operation of the high-capacity well.

Shoreline Protection Measures

Protection of shorelands can be accomplished using both physical and biological measures. Physical measures involve placing protective barriers along the water line to provide protection to the land immediately behind it. Guidance provided in the Chapter NR 328 of the *Wisconsin Administrative Code* sets forth a methodology for determining appropriate shoreline protection structures for inland lakes based upon wind wave action and fetch, substrate, and likely boat wake action. While shoreline erosion is not a major concern around Pretty Lake, as much of the shoreland surrounding the Lake is kept in a fundamentally natural state, two alternative shoreline erosion control techniques were considered potentially viable: vegetated buffer strips and rock revetments or riprap. Rock revetments and various types of wooden materials are common methods that have been used historically by lakefront property owners across the State. Continued maintenance of existing revetments and other protection structures is of value.

Biological methods primarily involve the planting of natural vegetation. In many areas of southeastern Wisconsin, lakefront property owners are encouraged to use vegetative buffer strips where feasible. Typically, such a method involves planting a three- to five-foot-wide strip of indigenous vegetation along the shore above the water line with an adjoining two- to six-foot-wide strip of native emergent vegetation in the water. There are variations of this basic plan. Such a method serves to act not only as a means of erosion control, but has the added advantages of restoring native flora and thus maintaining habitat value, creating a natural ambiance of the lakeshore, and providing a natural filtering and trapping device for possible pollutant runoff.

These alternatives, shown in Figure 3, were considered potentially viable because: they can be constructed, at least partially, by local residents; most of the construction materials involved are readily available; the techniques,

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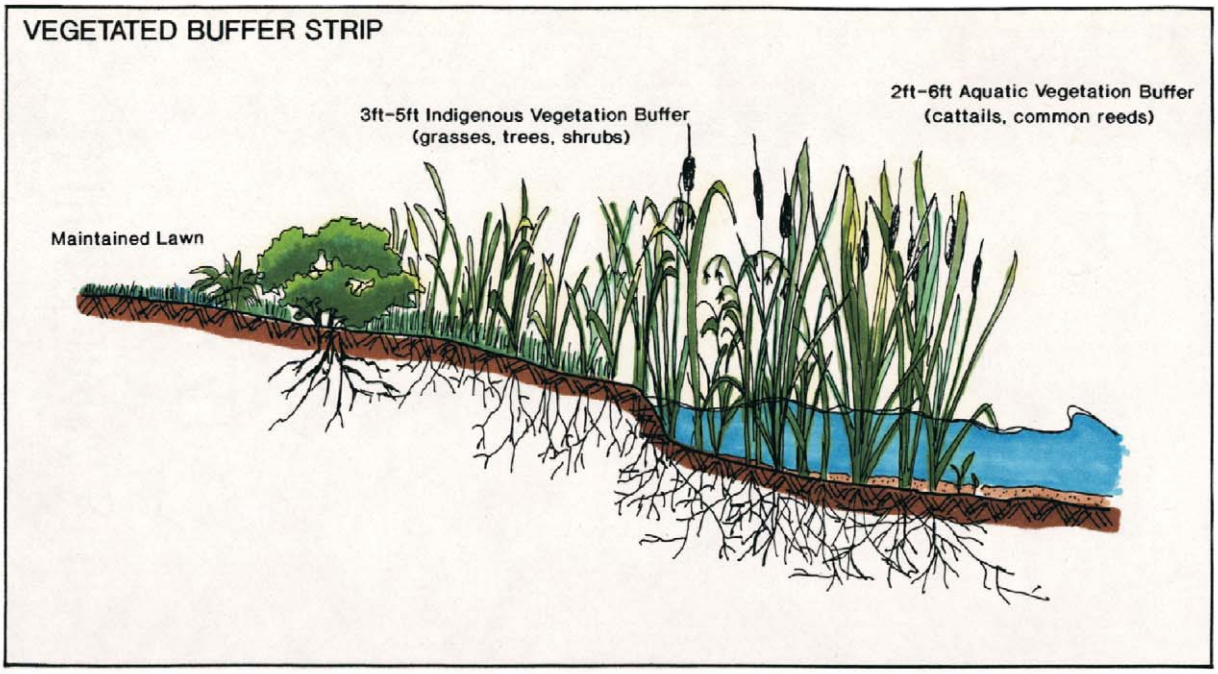
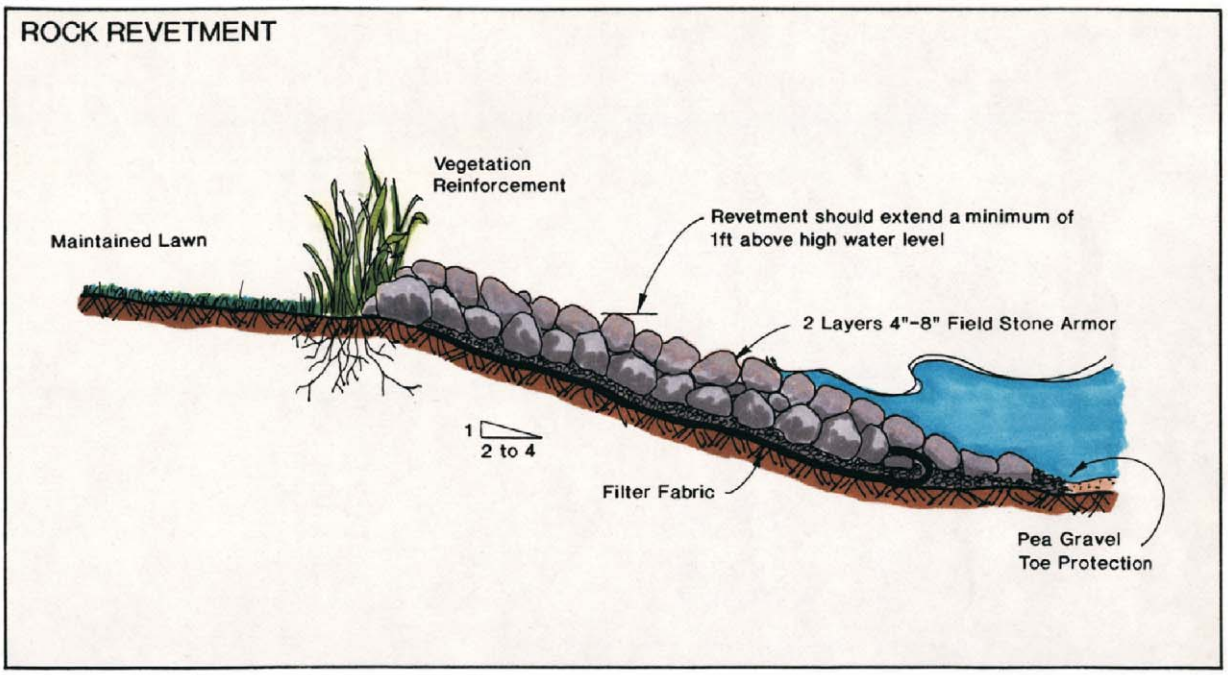
[15]*SEWRPC Technical Report No. 37,* Groundwater Resources of Southeastern Wisconsin, *June 2002.*

[16]*SEWRPC Planning Report No. 43,* A Regional Bicycle and Pedestrian Facilities System Plan for Southeastern Wisconsin: 2010, *December 1994; see also SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

Figure 3

PLAN ALTERNATIVES FOR SHORELINE EROSION CONTROL





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.

in many cases, would enable the continued use of the immediate shoreline; and, the measures are visually "natural" or "semi-natural" and should not significantly affect the aesthetic qualities of the lake shoreline. These measures may be combined with selected regrading of the eroded banks and accumulated soils, designed to facilitate navigation and recreational boating access, on a site-by-site basis. These management measures require permits from the WDNR pursuant to Chapter 30 of the *Wisconsin Statutes*. In addition, homeowners should be encouraged to limit the use of fertilizers and other agricultural chemicals in the shoreland area in order to minimize runoff of contaminants into the waters of the Lake.

Aquatic Plant Management Measures

Aquatic plant management[17] refers to a group of management and restoration measures aimed at both removal of nuisance vegetation and manipulation of species composition in order to enhance and provide for recreational water use and encourage the development of a natural plant community that will result in a healthy lake ecosystem. Generally, aquatic plant management measures are classed into four groups; namely, physical measures which include water level management; manual and mechanical measures which include harvesting and removal; chemical measures which include using aquatic herbicides; and biological controls which include the use of various organisms, including insects. These controls are stringently regulated and require a State permit pursuant to the provisions of Chapters NR 107 and/or NR 109 of the *Wisconsin Administrative Code.*

The costs of aquatic plant management actions range from minimal for manual removal of plants using rakes and hand-pulling to upwards of $120,000 for the purchase of a mechanical plant harvester with operational costs of about $40,000 per year or more, depending on staffing and operating policies. Harvesting is probably the measure best applicable to large areas, while chemical controls may be best suited to confined areas and initial control of invasive plants. Planting of native plant species and control of Eurasian water milfoil by the weevil, *Eurhychiopsis lecontei*, are largely experimental in lakes, but can be considered in specialized shoreland areas.

Of particular concern is the growth and spread of Eurasian water milfoil. Its abundance has increased throughout the lake since the last survey was completed in 1997. The abundance of other aquatic plants, including muskgrass, eel grass, bushy pondweed, and Eurasian water milfoil continue to be perceived as a nuisance by Pretty Lake users. Ongoing aquatic plant management measures have, in part, maintained the abundance and distribution of these plants in such a condition as to minimize user-related concerns. However, localized recreational use problems are experienced in various areas of the Lake. These problems depend on the uses in those portions of the Lake, but generally involve the abundant growths of Eurasian water milfoil and possibly its hybrids. These plants often grow to the surface of the Lake, making certain recreational uses in those areas of the Lake less enjoyable, in addition to impairing the aesthetic quality of the Lake. These plants primarily interfere with recreational boating activities by entangling propellers and clogging cooling water intakes, impairing slow-speed boating activity, and impeding navigation by sailing vessels and human-powered watercraft. Without control measures, this area could become impassable for navigation.

In addition, milfoil occurs at swimming depth, and exists in portions of the Lake having water depths of up to about five feet. Other plants that are found at slightly deeper depths, nine feet to 11 feet, in this area include coontail, muskgrass, and a number of pondweeds. These plants also pose potential problems for swimming and can interfere with angling activities, especially in shoreline areas.

In general, the abundance of aquatic plants throughout the lake basin is perceived as adversely affecting the aesthetic enjoyment of lake residents and visitors to the Lake. Thus, aquatic plant management is an important issue to be considered.

[17] *U.S. Environmental Protection Agency Report No. EPA-440/4-90-006,* The Lake and Reservoir Restoration Guidance Manual, *August 1990.*

Figure 4

DISTRICT CHECKLIST FOR HERBICIDE APPLICATION

- ☐ Nuisance report completed defining areas of potential treatment
- ☐ Permit filed with the Wisconsin Department of Natural Resources
- ☐ Certified applicator hired[a]
- ☐ Required public notice in the newspaper
- ☐ Public informational meeting (required if five or more parties request a meeting)
- ☐ Posting of areas to be treated in accordance with regulations (discussed previously in report)
- ☐ Weather conditions cooperating
  - Wind direction and velocity
  - Temperature

[a]*A licensed applicator will determine the amount of herbicide to be used, based upon discussions with appropriate staff from the Wisconsin Department of Natural Resources, and will keep records of the amount applied.*

Source: SEWRPC.

Aquatic Herbicides

Chemical treatment with aquatic herbicides is a short-term method of controlling heavy growths of aquatic macrophytes and algae. The use of herbicides can contribute to an ongoing aquatic plant problem by increasing the natural rates of accumulation of decaying organic matter, in turn contributing to an increased oxygen demand which may cause anoxia. The use of herbicides can also potentially damage or destroy nontarget plant species that provide needed habitat for fish and other aquatic organisms. As a result, less desirable, invasive, introduced plant species may outcompete the more beneficial, native species. Hence, this is not a feasible management option to be used on a large scale. However, chemical control is often a viable technique for the control of the relatively small-scale infestations of Eurasian water milfoil and certain other plants such as curly-leaf pondweed. Chemicals are applied to the growing plants in either liquid or granular form. Chemical treatment can be administered at a relatively low cost and is, therefore, considered a viable management option to continue. This measure is considered as viable for selected areas in Pretty Lake.

Chemical applications should be conducted in accordance with Chapter NR 107 of the *Wisconsin Administrative Code*, under the authority of a State permit, and by a licensed applicator working under the supervision of WDNR staff. Records accurately delineating treated areas, and the type and amount of herbicide used in each area, should be carefully documented and used as a reference in applying for permits in the following year. A recommended checklist is provided as Figure 4.

Aquatic Plant Harvesting

Mechanical harvesting of aquatic plants appears to be a practical and efficient means of controlling plant growth as it removes the plant biomass and nutrients from the lake. Aquatic macrophytes are 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. Harvesting leaves enough plant material in the lake to provide shelter for fish and other aquatic organisms and to stabilize sediments. Mechanical harvesting does have some potentially negative impacts to fish and other aquatic life, may cause fragmentation and spread of some plants, and could disturb loosely consolidated bottom sediments. However, if done correctly and carefully, it has shown to be of benefit in ultimately reducing the regrowth of nuisance plants. Given the small size of the Lake, mechanical harvesting is not a recommended method to use as a control of aquatic plants in Pretty Lake. Use of mechanical harvesting is regulated pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, and a permit would be required should this alternative be considered further in future.

Manual Harvesting

Manual harvesting, using rakes or other devices, can be effective in limited water depths. Specially designed rakes are available to manually remove aquatic plants from the shoreline area and can be purchased commercially. Should the Lake Management District acquire a number of these specialty rakes, the rakes could be made available for the riparian owners to use on a trial basis to test their operability before purchasing them individually. The advantage of the rake is that it is easy and quick to use, immediately removing the plants from the lakeshore. Using this method also removes the plants from the lake, avoiding the accumulation of organic matter on the lake bottom adding to the nutrients that favor more plant growth. This method is also recommended in place of the mechanical harvester as it is difficult to maneuver between piers and manual methods reduce risk of collateral damage to boats and property. Manual harvesting is considered a feasible aquatic plant management measure for shallow waters around individual piers and docks.

Manual harvesting should be conducted in accordance with Chapter NR 109 of the *Wisconsin Administrative Code*, and under the authority of a State permit. Manual harvesting of an access lane of up to 30 feet in width is allowed as an exempted activity under the provisions of Chapter NR 109 of the *Wisconsin Administrative Code*, provided the harvested plant materials are removed from the Lake. The harvested area should contain any piers or docks placed in the shoreland zone by the riparian owner, the width of which is included within the 30-feet wide corridor.

Biological Controls

Another approach to controlling nuisance aquatic plant conditions, particularly in the case of Eurasian water milfoil, is biological control. Classical biological control has been successfully used to control a variety of aquatic plants.[18] Recent documentation states that *Eurhychiopsis lecontei*, an aquatic weevil species, has potential as a biological control agent for Eurasian water milfoil.[19] However, very few studies have been completed in Wisconsin using *Eurhychiopsis lecontei* as a means of aquatic plant management control, with those studies that have been completed suggesting variable responses by in-lake aquatic plant communities to these aquatic insects. In general, these findings have indicated that the success of aquatic weevils for Eurasian water milfoil control in lakes that experience heavy boating traffic has been limited, with the insects being easily disturbed and washed off the plants by boat-generated wakes. These findings suggest that the use of weevils to control growths of Eurasian water milfoil is unlikely to meet community needs in most cases, especially where there is extensive motorized boating traffic. Thus, use of biological controls is not recommended for use on Pretty Lake. Use of biological control agents is regulated pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, and a

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[18]*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; C.B. Huffacker and R.L. Rabb, editors,* Ecological Entomology, *John Wiley, New York, New York, USA.*

[19]*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.*

permit would be required should this alternative be considered further in future. The use of grass carp, *Ctenopharyngodon idella*, is not permitted in Wisconsin.

Physical Barriers

Lake bottom covers and light screens provide limited control of rooted plants by creating a physical barrier which reduces or eliminates the sunlight available to the plants. They have been used to create swimming beaches on muddy shores, to improve the appearance of lakefront property, and to open channels for motorboating. Sand and gravel are usually readily available and relatively inexpensive to use as cover materials, but plants readily recolonize areas so covered in about a year. Synthetic materials, such as polyethylene, polypropylene, fiberglass, and nylon, can provide relief from rooted plants for several years. However, these structures must be placed and removed annually. Because of the limitations involved, lake bottom covering as a method to control aquatic plant growth is not recommended for Pretty Lake. Use of physical barriers is regulated pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, and a permit would be required should this alternative be considered further in future.

Boating Ordinances

The promulgation of more stringent controls on the use of powered watercraft within Pretty Lake is one means of regulating the conduct of boat traffic which could be harmful to the most important ecologically valuable areas in the Lake. Controls on boat traffic are currently set forth in Chapter 20, "Lakes and Beaches," of the Town of Ottawa ordinances, appended hereto as Appendix B. Additional controls could be put in place by amending the current provisions to further limit boating activity within specific areas of the Lake to defined traffic lanes within the Lake, thereby minimizing new colonization and proliferation of Eurasian water milfoil and the propagation of nuisance plant species by the operation of watercraft. This concept is inherent in the lake access zones previously identified in the adopted lake protection plan, especially as they relate to habitat areas. Should such an alternative be considered, boat traffic lanes must be designated by approved regulatory markers and conform to Section NR 5.09 of the *Wisconsin Administrative Code*.[20] This section requires that restrictions placed on the use of the waters of the State be predicated upon the protection of public health, safety, or welfare. Boating ordinances, enacted in conformity with State law, must be clearly posted at public landings in accordance with the requirements of Section 30.77(4) of the *Wisconsin Statutes*. Given the current level of regulation of public recreational boating traffic on the Lake, no further regulation appears to be warranted at this time on Pretty Lake.

Public Information

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 their environmental impacts. Thus, public information is an important component of an aquatic plant management program for Pretty Lake, and is recommended as an ongoing element of the aquatic plant management program on the Lake. Posters and pamphlets are available from the University of Wisconsin-Extension and WDNR that provide information and illustrations of aquatic plants, their importance in providing habitat and food resources in aquatic environments, and the need to control the spread of undesirable and nuisance plant species.

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[20]*Two general types of buoyage exist: regulatory buoys, such as those used to demarcate slow-no-wake or exclusionary areas; and informational buoys, such as those used to enhance public awareness. Buoys must be white in color, cylindrical in shape, seven or more inches in diameter, and extend 36 or more inches above the water line. Regulatory buoys include buoys used to demarcate restricted areas, prohibit boating or types of boating activities in specific areas, and control the movements of watercraft. Regulatory buoys used to demarcate regulated areas display their instructions in black lettering. Some types of regulatory buoys display an orange diamond with an orange cross inside; others display an orange circle. Informational buoys are similar in construction to the regulatory buoys, but contain an orange square on the white background. Whereas regulatory markers are enforceable, informational buoys are not.*

Recommended Aquatic Plant Management Measures

The goal of the management program is to accommodate a range of recreational uses of the Lake to the extent practicable and to enhance the public perception of the Lake as a centerpiece of the Town of Ottawa, without inflicting irreparable damage to the ecosystem of Pretty Lake and its structure and functioning. To accomplish this goal, specific control measures are recommended to be applied in various areas of the Lake. The refined recommended management plan elements for Pretty Lake are summarized in Table 10. It is recommended that the Pretty Lake Protection and Rehabilitation District continue to take the lead in implementing the refined plan.

The recommended aquatic plant management plan consists of the integrated use of manual harvesting, supplemented if necessary through the limited application of appropriate aquatic herbicides, designed to minimize negative impacts on the ecologically valuable areas of the Lake while providing a level of control needed to facilitate the desired recreational uses of the Lake. In addition, such management measures are recommended to be supplemented by an informational and educational program.

In order to implement the recommended aquatic plant management program, the following management actions are recommended:

1. The control of rooted vegetation between adjacent piers is recommended to be left to the riparian owners concerned. As an alternative, it is recommended that the Pretty Lake Protection and Rehabilitation District obtain informational brochures regarding shoreline maintenance, such as information on hand-held specialty rakes made for this specific purpose, to be made available to these residents.

2. The conduct of shoreline clean-up activities to collect aquatic plant fragments and limit the spread of Eurasian water milfoil in the Lake; consideration should be given to the collection and removal from the Lake of aquatic plant fragments that accumulate in nearshore areas. Fragments should be moved away from shoreline areas to avoid leaching of nutrients back into the lake, and can be used as garden mulch.

3. Special care should be taken to avoid disturbing major spawning areas of bass in Pretty Lake during spring spawning season, approximately May 1st to June 30th, annually.

4. The maintenance of the public boat landings, which should be monitored in such manner as to minimize the potential detrimental effects on the fish and invertebrate communities.

5. The control of State-designated nonnative aquatic plant species, including those currently proposed for specific control measures pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, Eurasian water milfoil and curly-leaf pondweed, using manual harvesting supplemented as appropriate by use of aquatic herbicide treatments throughout the Lake.

6. The use of chemical herbicides should be limited in the Lake, with the exception of those applications indicated for the control of State-designated nonnative invasive species. If found to be necessary, herbicide should only be applied to control nuisance growths of aquatic plants in shallow water around docks and piers. Only herbicides that are selective in their control, such as 2,4-D and fluridone, should be used.[21] Algicides, such as Cutrine Plus, generally are not recommended as algal blooms are rare in the Lake, and valuable macroscopic algae, such as *Chara* and *Nitella*, may be killed by this product. It is recommended that chemical applications, if required, should be made in early spring to maximize their effectiveness on nonnative plant species, minimize their impacts on native plant species, and act as a preventive measure to reduce the development of nuisance conditions.

[21]*As of 2004, the Wisconsin Department of Natural Resources considers the use of fluridone in Wisconsin to be experimental.*

Table 10

RECOMMENDED MANAGEMENT PLAN ELEMENTS FOR PRETTY LAKE

Plan Element	Subelement	Location	Management Measures	Initial Estimated Cost	Management Responsibility
Land Management Measures	Land use development planning	Entire watershed	Observe guidelines set forth in the regional and local land use plans	- -[a]	Waukesha County, Town of Ottawa
	Protection of environmentally sensitive lands	Entire watershed	Establish adequate protection of wetlands, woodlands, shorelands, and other environmental corridor lands and natural features	- -	Waukesha County, Town of Ottawa, Pretty Lake Protection and Rehabilitation District
	Stormwater management	Entire watershed	Enforce the Waukesha County construction site erosion control and stormwater management ordinance	- -	Waukesha County, Town of Ottawa
	Wastewater management	Entire watershed	Periodically review current sewer service area facilities plan to provide sewerage services to urban areas of the watershed as necessary; maintain onsite sewage disposal systems; adoption of sanitary district powers by Pretty Lake Protection and Rehabilitation District	- -	Town of Ottawa, Pretty Lake Protection and Rehabilitation District, School Section Lake Management District
	Urban nonpoint source controls	Entire watershed	Promote sound urban housekeeping and yard care practices through informational programming	- -[a]	Waukesha County, Town of Ottawa, Pretty Lake Protection and Rehabilitation District
	Developing area nonpoint source controls	New clustered developments in conservation subdivisions	Develop stormwater management systems where appropriate densities exist	- -	Waukesha County, Town of Ottawa
	Rural nonpoint source controls	Entire watershed	Promote sound rural land management practices to reduce soil loss and contaminant loadings through preparation and implementation of farm conservation plans in accordance with the county land and water resource management plan	- -	USDA, WDATCP, Waukesha County
Lake Management Measures	Lake level control; drain tiles	Western portion of the watershed	Acquisition of lands riparian to the western drain tile	- -	Pretty Lake Protection and Rehabilitation District and Kettle Moraine Conservation Foundation, Inc.
	Lake level control, water level augmentation	Entire Lake	Continued operation of high capacity well during periods of extreme low water levels; reduced operations at other times	- -	Pretty Lake Protection and Rehabilitation District
Shoreline Protection	Maintain structures	Entire Lake	Maintain existing structures; replace hardened structures with vegetative structures as possible	- -	Pretty Lake Protection and Rehabilitation District and private property owners

Table 10 (continued)

Plan Element	Subelement	Location	Management Measures	Initial Estimated Cost	Management Responsibility
Aquatic Plant Management	Manual harvesting	Localized areas of shoreline	Harvest nuisance plants, including Eurasian water milfoil and purple loosestrife, as required around docks and piers; collect plant fragments arising from boating and harvesting activities	- -[a]	Pretty Lake Protection and Rehabilitation District and individuals
	Chemical controls	Localized areas of the Lake, especially in proximity to docks and piers	Control aquatic plants through limited use of herbicides in spring; manual removal, as noted above, is recommended during summer and fall	$ 5,000	Pretty Lake Protection and Rehabilitation District
	Eurasian water milfoil control	Entire Lake	Control nonnative, invasive species through limited use of herbicides in spring; Town of Ottawa should reduce motorized boat traffic in areas of dense Eurasian water milfoil infestation	$10,000	Town of Ottawa, Pretty Lake Protection and Rehabilitation District and individuals
	Public informational programming	Direct drainage area tributary to Pretty Lake	Continue public awareness and information programming; continue monitoring of aquatic plant communities	$ 1,500[b,c]	Pretty Lake Protection and Rehabilitation District and Kettle Moraine Conservation Foundation, Inc.
Recreational Use Management	Recreational use zoning	Entire Lake	Protect native aquatic plant communities, fish breeding and habitat areas, and designated environmentally sensitive areas as set forth in the adopted lake protection plan	$ 500	Pretty Lake Protection and Rehabilitation District, Town of Ottawa and WDNR
	Lakewide nonnative species management program	Eurasian water milfoil control zone, purple loosestrife and zebra mussel control	Prevent the spread of nonnative plants and animals through cleaning of boats, trailers and related facilities throughout the Lake; limited use of herbicides in spring, manual removal during summer and fall, is recommended	- -	Pretty Lake Protection and Rehabilitation District, Town of Ottawa and WDNR
	Fisheries management	Entire Lake	Conduct periodic fisheries surveys and creel census surveys; stock lake as appropriate		Wisconsin Department of Natural Resources
Public Informational programming	Public informational programming	Direct drainage area tributary to Pretty Lake	Continue public awareness and information programming	- -	Pretty Lake Protection and Rehabilitation District and Kettle Moraine Conservation Foundation, Inc.

[a]*Measures recommended generally involve low or no cost and would be borne by private property owners. Cost is included under public informational and educational component.*

[b]*Partial funding available through the Wisconsin Department of Natural Resources grant programs.*

[c]*Periodic additional surveys are recommended at five- to 10-year intervals.*

Source: SEWRPC.

7. The continuation by the Pretty Lake Protection and Rehabilitation District and riparian communities of educational and informational programming within the aquatic plant management program for the Lake is recommended. Such programming can provide students and householders with information on the types of aquatic plants in Pretty Lake and the value of and the impacts of these plants on water quality, fish, and on wildlife; and on alternative methods for controlling existing nuisance plants, including the positive and negative aspects of each method. An organized aquatic plant identification "day" is one method of providing effective informational programming to lake residents. Other sources of information and technical assistance include the WDNR Aquatic Plant Monitoring Program and the University of Wisconsin-Extension Service. The aquatic plant illustrations provided in Appendix A may assist individuals interested in identifying plants near their residences. Residents should be encouraged to observe and document changes in the abundance and types of aquatic plants in their part of the Lake on an annual basis.

The primary objective of the management program is to accommodate recreational uses of the Lake, and to enhance the public perceptions of the Lake, without inflicting irreparable damage to the structure and functioning of the lake ecosystem.

Buoyage

The size of the Lake generally precludes the need for specialized buoys, except as they are required for the control of boating traffic.

Precautions to Protect Wildlife, Fish, and Ecologically Valuable Areas

Areas considered as being important for fish spawning, areas of three feet or less in depth, should be excluded from aquatic plant management operations, especially during the fish breeding season from approximately May 1st to June 30th, annually. Further, it is recommended that the District continue to publish periodic refinements of the aquatic plant management element of this lake protection plan. It recommended that a further inventory be prepared in two to three years to confirm that the changes in the plant community are for reasons other than annual variability. It should be noted that 2002 has been described as an "unusual" year in the Southeastern Wisconsin Region, with milfoil being well-above expected levels in historic milfoil lakes and algal problems being more widespread.

RECREATIONAL USE MANAGEMENT

Recreational Boating

Recommended actions for the management of ecologically valuable areas and aquatic plants should be effected by the Town of Ottawa through its existing boating ordinance. It is recommended that the Town reduce motorized boat traffic, within those areas where Eurasian water milfoil is dense, to essential traffic only and define watercraft transit speeds and lanes consistent with those milfoil infestation areas and established patterns of recreational boating usage on the Lake. Such regulation may require buoyage depending on the sufficiency of the signage and notices provided to lake users and the level of compliance achieved. Copies of such an ordinance must be placed at the public access site as set forth in Section 30.77(4) of the *Wisconsin Statutes*.

Fisheries

As is noted above, fishing is a popular pastime on Pretty Lake; however, few data on the fisheries of Pretty Lake are available. Pretty Lake appears to be able to provide a suitable habitat for a warmwater fishery with adequate water quality and dissolved oxygen levels that can contribute to the maintenance of a fish population that is dominated by desirable sport fish. To this end, a more rigorous fisheries survey should be considered in order to better identify fish population composition, length-weight distributions, community age structure, and related life history information, such as proportion of available spawning habitat, spawning success, and juvenile recruitment, that will be important for making stocking-related decisions. Assistance in stocking programs and fisheries management is available through the WDNR, as well as privately available from local commercial hatcheries. Fish stocking may require a WDNR permit.

In addition to manipulation of the fish community itself, a range of conservation measures can be considered that are designed to maintain existing fish spawning habitat. These measures include restricting recreational and other intrusions into gravel-bottomed shoreline areas during the spawning season (for bass this is spring, mid-April to mid-June), use of natural vegetation in shoreland management zones, and other "soft" shoreline protection options that aid in habitat protection. These latter measures also contribute to shoreline protection and management.

Species composition management refers to a group of conservation and restoration measures that include the stocking of desirable species designed to enhance the angling resource value of a lake. The mixture of species is determined by the stocking objectives. These are usually to: supplement an existing population, maintain a population that cannot reproduce itself, add a new species to a vacant niche in the food web, replace species lost to a natural or human-induced disasters, or establish a fish population in a depopulated lake. Enforcement of state fishing regulations is important to the success of any sound fish management program. Such requirements provide an opportunity for both game and forage fish population to reach a sustainable level.

In addition, the conduct of periodic creel surveys using volunteer monitors can provide a cost-effective means of obtaining additional data on the fish populations and fisheries in Pretty Lake. Alternative approaches to the conduct of this type of survey could include creel census-takers stationed at the boat access site, the distribution of questionnaires to riparian households, and similar voluntary reporting mechanisms.

PUBLIC INFORMATIONAL PROGRAMMING

It is the policy of the Pretty Lake Protection and Rehabilitation District, the Kettle Moraine Conservation Foundation, Inc., and the Town of Ottawa to maintain an active dialogue with the community. This is done through the public press and through public meetings and other scheduled hearings. In addition, it is recommended that a public education and information program continue to be conducted. This program should discourage human disturbances in ecologically valuable areas, except as may be necessary to provide riparian residents with a reasonable level of access to the main body of the Lake, and encourage lake residents and visitors to be made aware of the invasive nature of species such as purple loosestrife and Eurasian water milfoil. This effort should also include awareness of zebra mussel control and related efforts to minimize the further spread of other exotic or nonnative species. Posting appropriate signage at public recreational boating access sites around the Lake is recommended. In addition, citizens and visitors should be encouraged to participate in citizen-based control programs coordinated by the WDNR and University of Wisconsin-Extension. Where necessary, personal contacts with homeowners should be made, most likely through the Pretty Lake Protection and Rehabilitation District.

An ongoing campaign of community information will support the lake management program by encouraging the use of shoreland buffer strips, the responsible use of household and garden chemicals, and the adoption of environmentally friendly household and garden practices to minimize the input of nutrients from these riparian areas is recommended. Lake 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. Removal of aquatic vegetation can reduce or eliminate fish and wildlife habitat to the detriment of both active and passive recreational uses of the lake. Thus, public information is an important component of a lake management program. Posters and pamphlets are available from the University of Wisconsin-Extension and WDNR 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. Similar information is available to support good urban yard care practices which directly affect the generation and transport of nutrients and other contaminants from riparian lands to a lake. The actions recommended to be supported by a public informational campaign can be undertaken by individual householders and landowners within the drainage area tributary to Pretty Lake, and will directly contribute to the lake protection program being implemented by the Pretty Lake Protection and Rehabilitation District.

SUMMARY

This plan, which documents the findings and recommendations of a study requested by the Pretty Lake Protection and Rehabilitation District, is a refinement of the lake management measures recommended in the adopted lake protection plan for Pretty Lake.

The refined Pretty Lake protection plan, shown on Map 9 and summarized in Table 10, recommends actions to be taken to limit further human impacts on the Lake, and to reduce human impacts on the ecologically valuable areas adjacent to the lake and in its watershed. To this end, the ongoing maintenance of onsite sewage disposal systems is recommended. Further, consideration should be given to ensuring provision of adequate force main capacity within the public sewerage system serving a proposed subdivision located to the north of the Lake. To action this recommendation, the public inland lake protection and rehabilitation district should consider adoption of sanitary district powers, or work with the Town to create a town sanitary or utility district to serve either or both the Pretty Lake and School Section Lake communities, as a means of providing the necessary financing to cover the incremental cost of the larger force main. Acquisition by purchase or easement of lands within which the drain tile and ditch system located to the west of the Lake basin should be considered as a means of providing for the extension of sewerage services, as well as for the purposes of maintaining lake levels and forming part of a proposed Pretty-Section trail system linking Ottawa Lake State Park to the Ice Age Trail system. Support for the conservation of lands within the primary environmental corridors to ensure the protection and preservation of ecologically valuable areas within the drainage area tributary to Pretty Lake is also recommended.

With respect to water levels, the District should consider ongoing, if somewhat limited, operation of the high-capacity well installed for this purpose. It should be noted that the well will continue to contribute calcium carbonate to the Lake, leading to the creation of flocculent accumulations of marl, which, over time, will diminish lake depths and contribute to a disturbed aquatic plant community within the Lake.

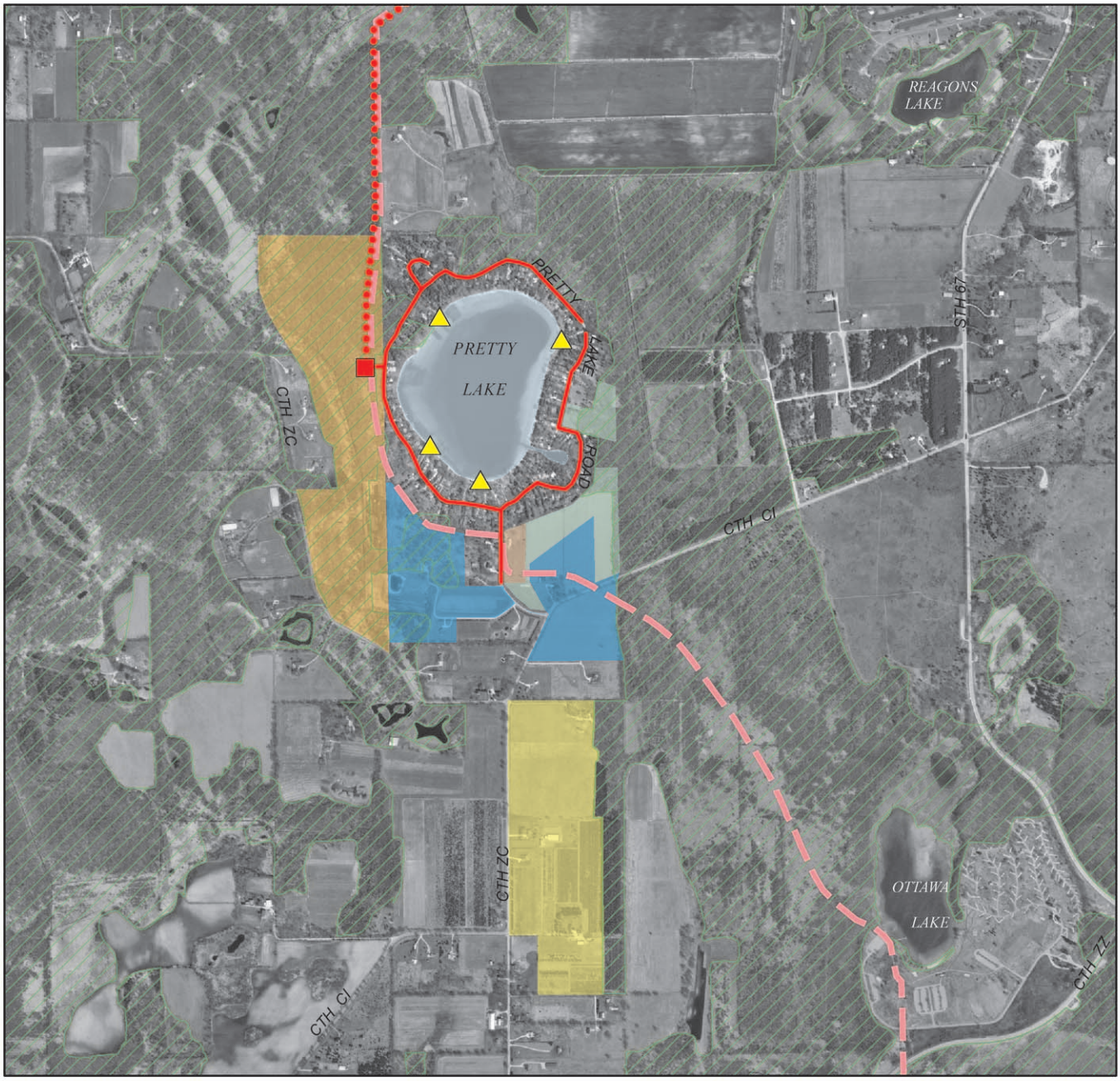
With respect to managing the aquatic plant community in the Lake, the plan recommends continued reliance on manual aquatic plant harvesting as the primary aquatic plant management measure employed on Pretty Lake. In addition to aquatic plant harvesting, the plan recommends only limited additional aquatic plant management actions, including selected manual removal and surveillance activities at this time, mainly in the cases where curly-leaf pondweed and Eurasian water milfoil are present, with the limited use of chemical treatment only to treat such species, if needed. Adoption of urban good housekeeping practices that limit the use of agro-chemicals, including phosphorus-containing fertilizers, within the shoreland area also will contribute to the control of undesirable growths of aquatic plants and algae by limiting inputs of nonpoint source nutrients and contaminants to the Lake. Installation and maintenance of shoreline buffer strips also will help to minimize runoff and the loss of agro-chemicals from the land surface.

Finally, the recommended plan includes the continuation of an ongoing program of public information and education being provided to both 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 Lake should be made available to riparian householders, thereby providing riparian residents with alternatives to traditional alternatives and activities. Informational programming on the control of nonnative or exotic species, such as Eurasian water milfoil, designed to limit their spread and onward transmission from Pretty Lake to other lakes within the southeastern Wisconsin region, is also recommended.

This recommended plan refines the adopted lake protection plan for Pretty Lake, and seeks to balance the demand for high-quality residential and recreational opportunities at Pretty Lake with the requirements for environmental protection.

Map 9

RECOMMENDED MANAGEMENT PLAN FOR PRETTY LAKE



PROTECT ENVIRONMENTALLY SENSITIVE AREA

MAINTAIN PUBLIC ACCESS SITE

LAND OWNED BY PRETTY LAKE PROTECTION AND REHABILITATION DISTRICT

LAND OWNED BY PRETTY LAKE ADVANCEMENT ASSOCIATION

LAND ACQUISITION

HIGH-PRIORITY

MEDIUM-PRIORITY

LOW-PRIORITY

WASTE WATER MANAGEMENT

PROPOSED PUMPING STATION

PROPOSED FORCE MAIN

PROPOSED GRAVITY SEWER

SHORELINE PROTECTION

- MAINTAIN AND REPAIR EXISTING STRUCTURES
- PROTECT UNSTABLE AREAS

LAND USE MANAGEMENT

PROPOSED PRETTY-SECTION RECREATIONAL TRAIL

DATE OF PHOTOGRAPHY: MARCH 2000

N

GRAPHIC SCALE

0 900 1,800 2,700 Feet

Source: SEWRPC.

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APPENDICES

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Appendix A

REPRESENTATIVE ILLUSTRATIONS OF AQUATIC PLANTS FOUND IN PRETTY LAKE

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Muskgrass (*chara vulgaris*)

Spiny Naiad (*najas marina*)

Bushy Pondweed (*najas flexilis*)

Eurasian Water Milfoil (*myriophyllum spicatum*)

Native Water Milfoil (*myriophyllum* sp.)

Sago Pondweed (*potamogeton pectinatus*)

Eel Grass / Wild Celery (*valisneria americana*)

Small Pondweed (*potamogeton pusillus*)

White-Stem Pondweed (*potamogeton praelongus*)

Coontail (*ceratophyllum demersum*)

Variable Pondweed (*potamogeton gramineus*)

Curly-Leaf Pondweed (*potamogeton crispus*)

Clasping-Leaf Pondweed
(*potamogeton richardsonii*)

Flat-Stem Pondweed (*potamogeton zosteriformis*)

Appendix B

BOATING ORDINANCES APPLICABLE TO PRETTY LAKE

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CHAPTER 20

LAKES AND BEACHES

20.01 BOAT TRAFFIC. (1) Sections 30.50 through 30.71 inclusive, and §30.80 (1) and (2), Wis. Stats., are hereby adopted by reference except where the provisions of this chapter are more restrictive and in that event the provisions of this chapter shall control.

(2) No person shall swim more than 150' from shore unless accompanied by an escort boat.

(3) All power boats must travel in counter-clockwise direction at all times.

(4) No motor boat shall operate at a speed in excess of slow-no-wake under the following conditions:

(a) Before 11 a.m. and after 6 p.m.

(b) When closer than 100' to any bathing beach or anchored boat.

(5) No person shall water ski between rafts and shorelines.

(6) No person shall operate any boat unless such boat shall be equipped with U.S. Coast Guard approved personal flotation devices as required under §NR 5.13, Wis. Adm. Code.

(7) All waterskiers shall wear U.S. Coast Guard approved life jackets, Type I, II or III, (PFD).

20.02 PUBLIC ACCESS POINTS. (1) PARKING. (a) Parking shall be prohibited on both sides of Pretty Lake Road at all times.

(b) Parking shall be permitted for 4 vehicles only at designated public access points leading to Pretty Lake between 6 a.m. and 10 p.m. Parking at points which are not designated and at all other times not specified herein is prohibited.

(2) RESTRICTIONS. No person shall do any of the following on public access points and areas leading to public access points within the Town:

(a) Consume beverages or food.

(b) Camp or picnic.

(c) Have pets or livestock including horses.

(d) Litter.

20.03 HENRIETTA LAKE AND UTICA LAKE. (1) APPLICATION. The provisions of this ordinance shall apply to the waters of Henrietta Lake and Utica Lake, within the jurisdiction of the Town of Summit and the Town of Ottawa. 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 Summit.

(2) STATE BOATING AND WATER SAFETY LAWS ADOPTED.

(a) 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 relating water activities in §§30.50 up to and including 30.71, 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 further additions, amendments, revisions or modifications of the statute 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.

(b) All rules and orders created by the Wisconsin Department of Natural Resources, modifying or supplementing the foregoing provisions of State Law or which may be adopted or made in the future, are hereby incorporated in and made a part of this ordinance by deferring to the same as if they are or were to be set out herein verbatim.

(3) OPERATION OF MOTOR BOATS. No motor boat shall be operated on Henrietta Lake and Utica Lake at any time at a speed in excess of slow no wake.

(4) SWIMMING REGULATIONS. No person, unless said person is engaging in activities and subject to the provisions of §30.70, Wisconsin Statutes, entitled Skin Diving, shall:

(a) Swim from any unmanned boat, unless such boat is anchored, or

(b) Swim more than 150 feet from the shoreline unless is a designated swimming zone or unless accompanied by a competent person in a boat, or

(c) Swim more than 150 feet from the shoreline between sunset and sunrise.

(5) PENALTY.

(a) STATE BOATING AND WATER SAFETY LAWS AND ALL OTHER VIOLATIONS AS SET FORTH IN §2 OF THIS ORDINANCE.

Any forfeiture for violation of the State statute, rule or order adopted by reference in §2 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 Bail 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 §§3, 4 and 5 OF THIS ORDINANCE.

Any person 16 years or older violating the provisions of this ordinance shall be subject to a forfeiture of not more than $500 plus court costs and penalty assessment. Failure to pay any forfeiture hereunder shall subject the violator to imprisonment in the County Jail or loss of license.

Any person 14 or 15 years of age shall be subject to a forfeiture of not less than $10 nor more than $25 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 §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.

(6) ENFORCEMENT.

(a) Enforcement Procedure. The statutory provisions of §§66.115, 66.119, 66.12, 30.29, 30.50 to 30.71, and Chapter 799, Wisconsin Statutes, are adopted and by reference made a part of this ordinance as if fully set herein. Any act required to be performed or prohibited by any 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 and enforcement of boating ordinance violations. Further, the Town of Summit and the Town of Ottawa specifically elect to use the citation method of enforcement.

(b) Deposits.

1. Schedule of Deposits. The schedule of cash deposits shall be as follows:

§2: Applicable sections of Uniform Wisconsin Deposit and Bail Schedule for Conservation, Boating, Snowmobile and ATV Violations plus current assessment fees and current court costs if applicable.

§§3, 4 and 5: $50 plus court costs and assessments plus current assessment fees and current court costs if applicable.

2. 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.

3. 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.

4. Depository. Deposits should be made in cash, money order, or certified check to the Clerk of Municipal Court, 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) Nonexclusivity.

1. Other Ordinances. Adoption of this ordinance does not preclude the Town Boards 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 Boards 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.

20.04 SCHOOL SECTION LAKE. (1) APPLICATION. The provisions of this ordinance shall apply to the waters of School Section Lake.

(2) OPERATION OF MOTOR BOATS.

(a) No boats shall be operated at a speed greater than slow, no wake, between the hours of sunrise and sunset.

(b) No motor boats whatsoever shall be allowed to operate between the hours of sunset and sunrise.

(3) ADDITIONAL RESTRICTIONS. The restrictions contained in this subsection are in addition to all other boating regulations contained within the Town of Ottawa Town Code. In the event there is a conflict between the restrictions contained in this subsection and restrictions contained elsewhere in the Town of Ottawa Town Code, the restrictions of this particular subsection shall apply.

20.05 PENALTY. Except as otherwise provided, any person who shall violate any provision of this chapter, or any regulation, rule or order made hereunder, shall be subject to a penalty as provided in §25.04 of this General Code.