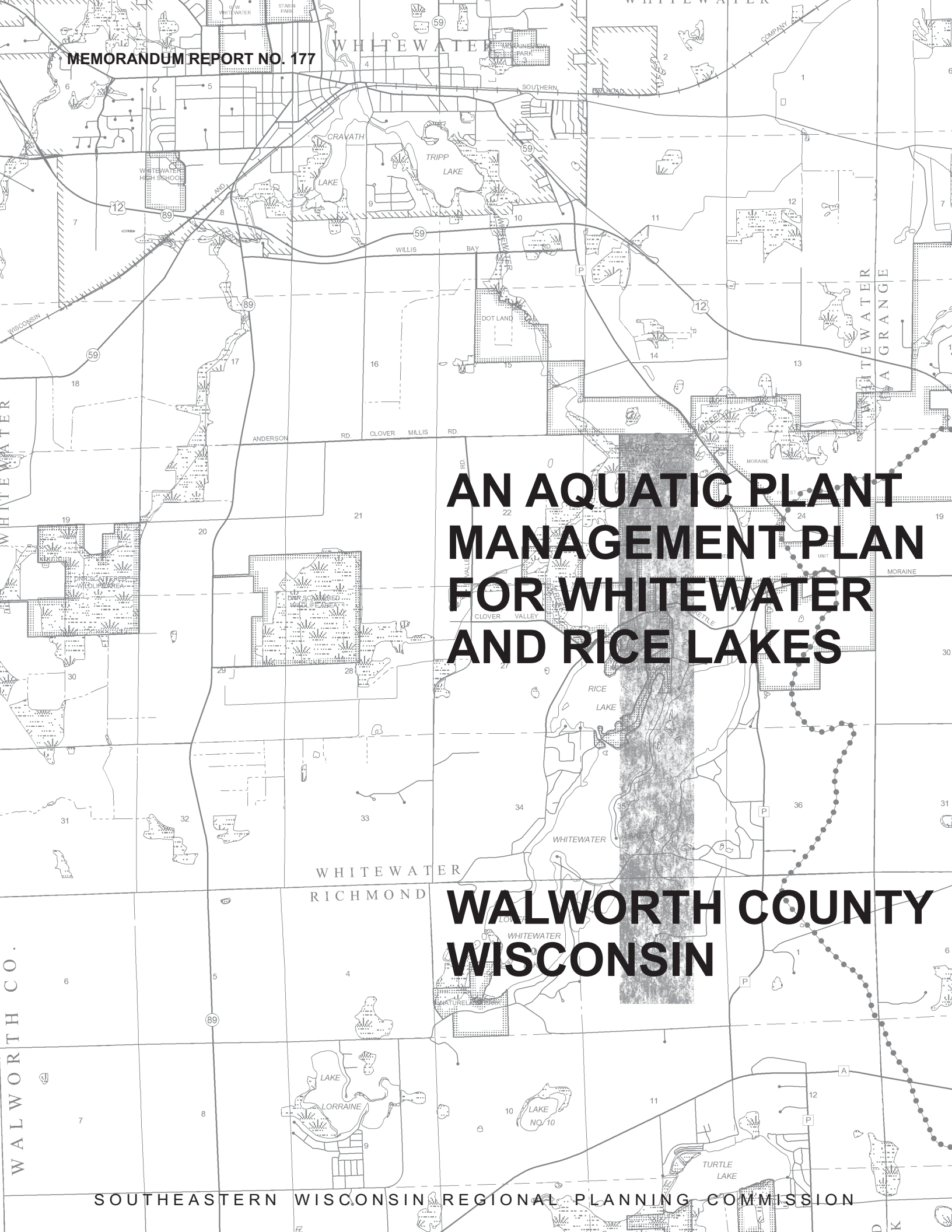
MEMORANDUM REPORT NO. 177



AN AQUATIC PLANT MANAGEMENT PLAN FOR WHITEWATER AND RICE LAKES

WALWORTH COUNTY WISCONSIN

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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MEMORANDUM REPORT
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WALWORTH COUNTY, WISCONSIN

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Chapter I

INTRODUCTION

Whitewater Lake, located in the Towns of Whitewater and Richmond, Walworth County, Wisconsin, is a 640-acre drainage lake which discharges intermittently into Rice Lake, a 137-acre drainage lake located in the Town of Whitewater, that collectively form the headwaters of Whitewater Creek, a tributary stream to the Bark River. The Lakes are located within U.S. Public Land Survey Township 3 North, Range 15 East, Sections 2 and 3, Town of Richmond, and Township 4 North, Range 15 East, Sections 25, 26, 27, 34 and 35, Town of Whitewater, all in Walworth County.

The Lakes are a valuable natural resource offering a variety of recreational and related opportunities to the resident community and its visitors; the Kettle Moraine State Forest-Southern Unit, Whitewater Lake Recreation Area and associated campground being principal recreational features in the area. In recent years, the recreational and aesthetic values of Whitewater and Rice Lakes have been perceived to be adversely affected by excessive aquatic plant growths within portions of the Lakes, especially in Whitewater Lake, raising concern among the residents over possible degradation of water quality in the Lakes.

This lake-oriented community is served by the Whitewater-Rice Lakes Management District (WRLMD), a public inland lake protection and rehabilitation district, formed in 1986 pursuant to Chapter 33 of the *Wisconsin Statutes*. The District was formed to prepare and implement a program of lake rehabilitation and protection measures on the two Lakes. To this end, the District has undertaken the monitoring of the two Lakes, and has completed a comprehensive lake management plan for the Lakes.[1] In addition to its lake management planning activities, the WRLMD annually implements a program of aquatic plant management and public informational programming within this lake-focused community.

More recently, the Greater Whitewater Lake Property Owners Association (GWLPOA) has been organized as a nongovernmental organization for the purposes of representing the property owners of the Whitewater and Rice Lakes community in order to: promote, protect, and preserve the environment and quality of life; act as an advocate in promoting the interests of GWLPOA with governmental and private organizations; collect, channel and focus the concerns of the Members; act as a communications medium for the property owners; and, initiate and support those activities which will add to the overall enjoyment and well being of the Members. While these objectives are more narrowly focused than those of the WRLMD, the GWLPOA forms an advocacy group whose activities complement those of the special purpose unit of government.

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[1]*See SEWRPC Community Assistance Planning Report No. 224,* A Lake Management Plan for Whitewater and Rice Lakes, Walworth County, Wisconsin, *February 1997.*

Whitewater and Rice Lakes have been the subject of earlier lake management-related investigations carried out by the WRLMD in cooperation with the U.S. Geological Survey (USGS),[2] the Wisconsin Department of Natural Resources (WDNR),[3] the Southeastern Wisconsin Regional Planning Commission (SEWRPC),[4] and the University of Wisconsin-Whitewater. This report provides information on the condition of the aquatic plant communities in Whitewater and Rice Lakes during 2008, including relevant tributary area and waterbody data, and provides recommendations for management of aquatic plants within Whitewater and Rice Lakes. These data supplement the data set forth in the aforereferenced comprehensive lake management plan.

Specifically, this report represents part of the ongoing commitment of the Whitewater and Rice Lakes community, through the WRLMD and the Towns of Whitewater and Richmond, to sound planning with respect to the Lakes. The report sets forth inventories of the aquatic plant communities present within Whitewater and Rice Lakes. Those inventories were prepared by SEWRPC in cooperation with the WRLMD, and include the results of field surveys conducted by the Commission staff during the summer of 2008. The aquatic plant surveys were conducted by Commission staff using the modified Jesson and Lound transect method developed for use in Wisconsin lakes by the WDNR,[5] and previously utilized in the aquatic plant surveys associated with the formulation of the comprehensive lake management plan previously referenced. This survey was supplemented during 2009 by the results of an aquatic plant reconnaissance carried out by SEWRPC staff in cooperation with the WRLMD. The current planning program was funded, in part, through a Chapter NR 190 Lake Management Planning Grant awarded to the WRLMD and administered by the WDNR.

The scope of this report is limited to a consideration of the current water quality conditions and aquatic plant communities present within Whitewater and Rice Lakes, the documentation of historical changes in the plant communities based upon currently existing data and information, and the refinement of those management measures which can be effective in the control of aquatic plant growth in the Lake. Recommendations are made principally with respect to the potential management measures to be implemented by the WRLMD.

The aquatic plant management goals and objectives for Whitewater and Rice Lakes were developed by the WRLMD. The agreed goals and objectives are to:

1. Protect and maintain public health, and promote public comfort, convenience, necessity, and welfare, in concert with the natural resource, through the environmentally sound management of native vegetation, fishes, and wildlife populations in and around Whitewater and Rice Lakes;

2. Effectively control the quantity and density of aquatic plant growths in portions of the Whitewater and Rice Lakes basin to better facilitate the conduct of water-related recreation, improve the aesthetic value of the resource to the community, and enhance the natural resource value of the waterbody;

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[2]*U.S. Geological Survey Water Resources Investigation Report 44-410,* Hydrology and Water Quality of Whitewater and Rice Lakes in Southeastern Wisconsin, 1990-1991, *1994.*

[3]*Wisconsin Department of Natural Resources Publication No. PUBL-WT-280-98-REV,* Lower Rock River Basin: Water Quality Management Plan, *October 1998. See also Wisconsin Department of Natural Resources,* Ambient Lakes Monitoring Program – Macrophyte Survey: Whitewater Lake, *June 1990;* Whitewater Lake, Walworth County: Long-Term Trend Lake – 1986, *June 1990; and* Whitewater Lake, Walworth County: Long-Term Trend Lake – 1987, *June 1990.*

[4]*SEWRPC Community Assistance Planning Report No. 224,* A Lake Management Plan for Whitewater and Rice Lakes, Walworth County, Wisconsin, *February 1997.*

[5]*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.*

3. Effectively maintain the water quality of Whitewater and Rice Lakes 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; and,

4. Promote a quality, water-based experience for residents and visitors to Whitewater and Rice Lakes consistent with the policies and objectives of the WDNR as set forth in the regional water quality management plan, SEWRPC Planning Report No. 30, *A Regional Water Quality Management Plan for Southeastern Wisconsin—2000*, adopted by the Regional Planning Commission on July 12, 1979, and, as refined in SEWRPC Memorandum Report No. 93, *A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995, and SEWRPC Community Assistance Planning Report No. 224, *A Lake Management Plan for Whitewater and Rice Lakes, Walworth County, Wisconsin*, February 1997.

The inventory and aquatic plant management plan elements presented in this report conform to the requirements and standards set forth in the relevant *Wisconsin Administrative Codes.*[6] Implementation of the recommended actions set forth herein should continue to serve as an important step in achieving the stated lake use objectives over time.

[6]*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."*

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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 in the lake management planning process. Accordingly, this chapter provides pertinent information on the physical characteristics of Whitewater Lake and Rice Lake, and their shared tributary area, land use conditions, and the chemical and biological environments of the Lakes, as well as past and present management practices and the recreational uses and facilities of Whitewater and Rice Lakes. Chapter III presents alternative and recommended aquatic plant management practices.

WATERBODY CHARACTERISTICS

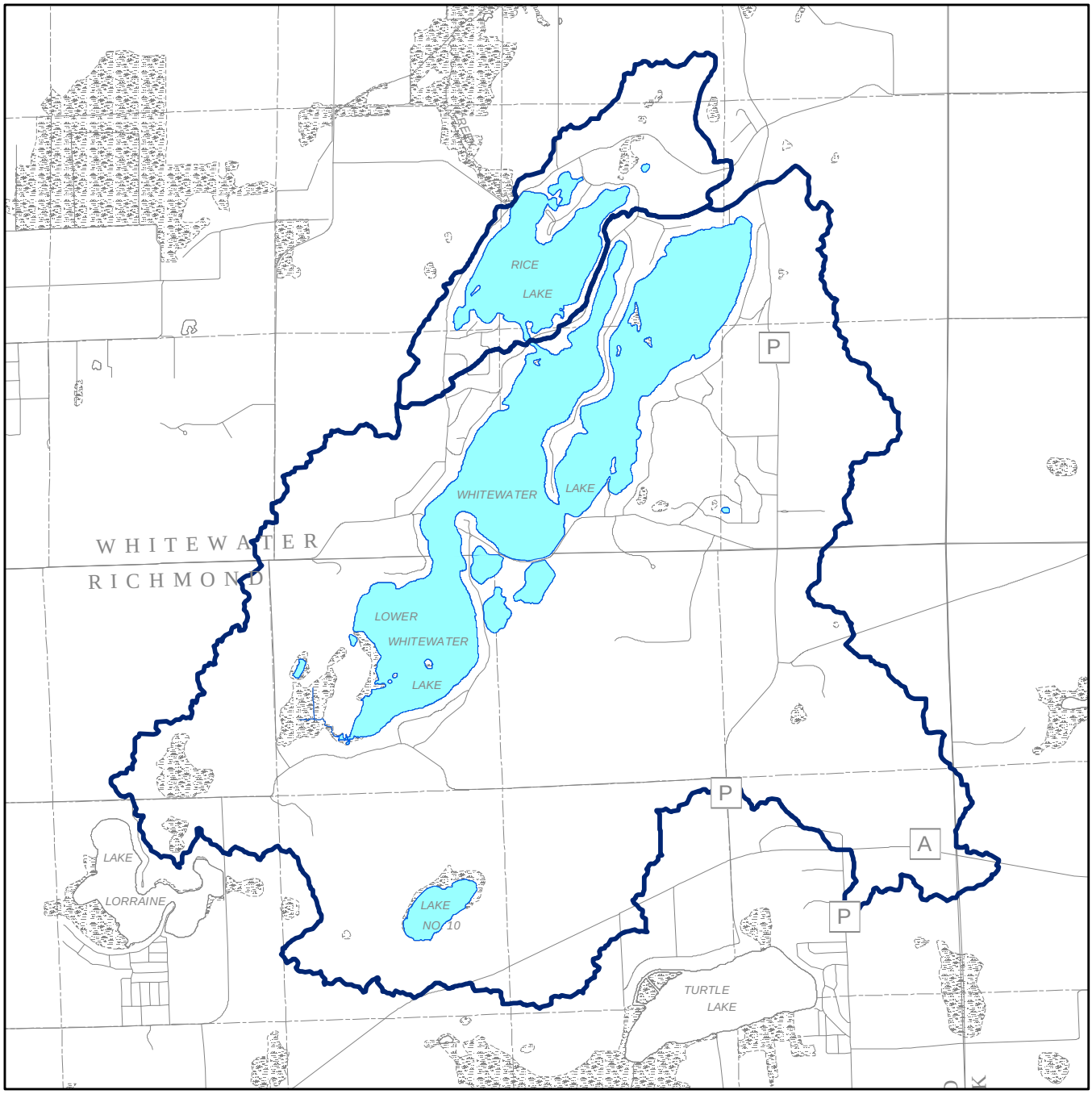
Whitewater and Rice Lakes are located to the southeast of the City of Whitewater, in the Towns of Whitewater and Richmond, in Walworth County, Wisconsin, as shown on Map 1. The Wisconsin Department of Natural Resources (WDNR) has classified both lakes as drainage, or through flow, lakes having a defined inflow and a defined outflow, although Whitewater Lake may be better described as a drained lake, having only a defined outflow. The Lakes depend primarily on water delivered through inflowing streams, together with direct precipitation onto the lake surfaces. Whitewater Lake discharges through a short stretch of intermittent stream into Rice Lake. Rice Lake, in turn, discharges to Whitewater Creek, and ultimately to the Bark River, a tributary stream to the Rock River drainage system. Water levels in both lakes have been augmented by impoundments. The hydrographical characteristics of Whitewater and Rice Lakes are set forth in Table 1. The bathymetry of Whitewater Lake is shown on Map 2, and bathymetry of Rice Lake is shown on Map 3.

Whitewater Lake, a 640-acre impounded drainage lake, was created in 1947 by the damming of Whitewater Creek. The dam is currently owned and operated by Walworth County. This action increased the surface water elevation by approximately 10 feet and linked together a chain of three smaller, preexisting lakes: Bass Lake, Kettle or Round Lake, and Whitewater Lake.[1] Collectively these lakes also are known as Upper Whitewater Lake. Although discharge over the Whitewater Lake dam occurs infrequently, the Lake effectively forms the headwaters of Whitewater Creek. Whitewater Lake is oriented in an approximately northeast-southwest orientation. The Lake

[1] *Wisconsin Conservation Department,* Surface Water Resources of Walworth County*, 1961.*

Map 1

LOCATION OF WHITEWATER AND RICE LAKES



Total Tributary Area Boundary

Surface Water

Source: SEWRPC.

N

0 2,000 4,000 Feet

Table 1

HYDROLOGY AND MORPHOMETRY OF WHITEWATER AND RICE LAKES: 2008

Parameter	Whitewater Lake	Rice Lake
Size		
Surface Area of Lake[a]	640 acres	137 acres
Total Tributary Area[a]	5,006 acres	536 acres
Lake Volume	5,806 acre-feet	930 acre-feet
Residence Time[b]	0.82 year	1.86 years
Shape		
Length of Lake	2.6 miles	1.0 mile
Width of Lake	0.6 mile	0.5 mile
Length of Shoreline	10.0 miles	3.3 miles
Shoreline Development Factor[c]	2.7	1.8
General Lake Orientation	NE-SW	NE-SW
Depth		
Mean Depth	8.3 feet	5.8 feet
Maximum Depth	38.0 feet	10.0 feet
Area of Lake Less than Five Feet	24 percent	N/A
Area of the Lake Less than 10 Feet	88 percent	N/A

[a]*The surface areas and total tributary areas for Whitewater and Rice Lakes have been variously recorded in earlier reports. The current measurements are based on elevation refinements made possible through Commission digital terrain modeling analysis.*

[b]*Residence time is estimated as the time period required for a volume of water equivalent to the volume of the lake to enter the lake during years of normal precipitation.*

[c]*Shoreline development factor is the ratio of the shoreline length to the circumference of a circular lake of the same area.*

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

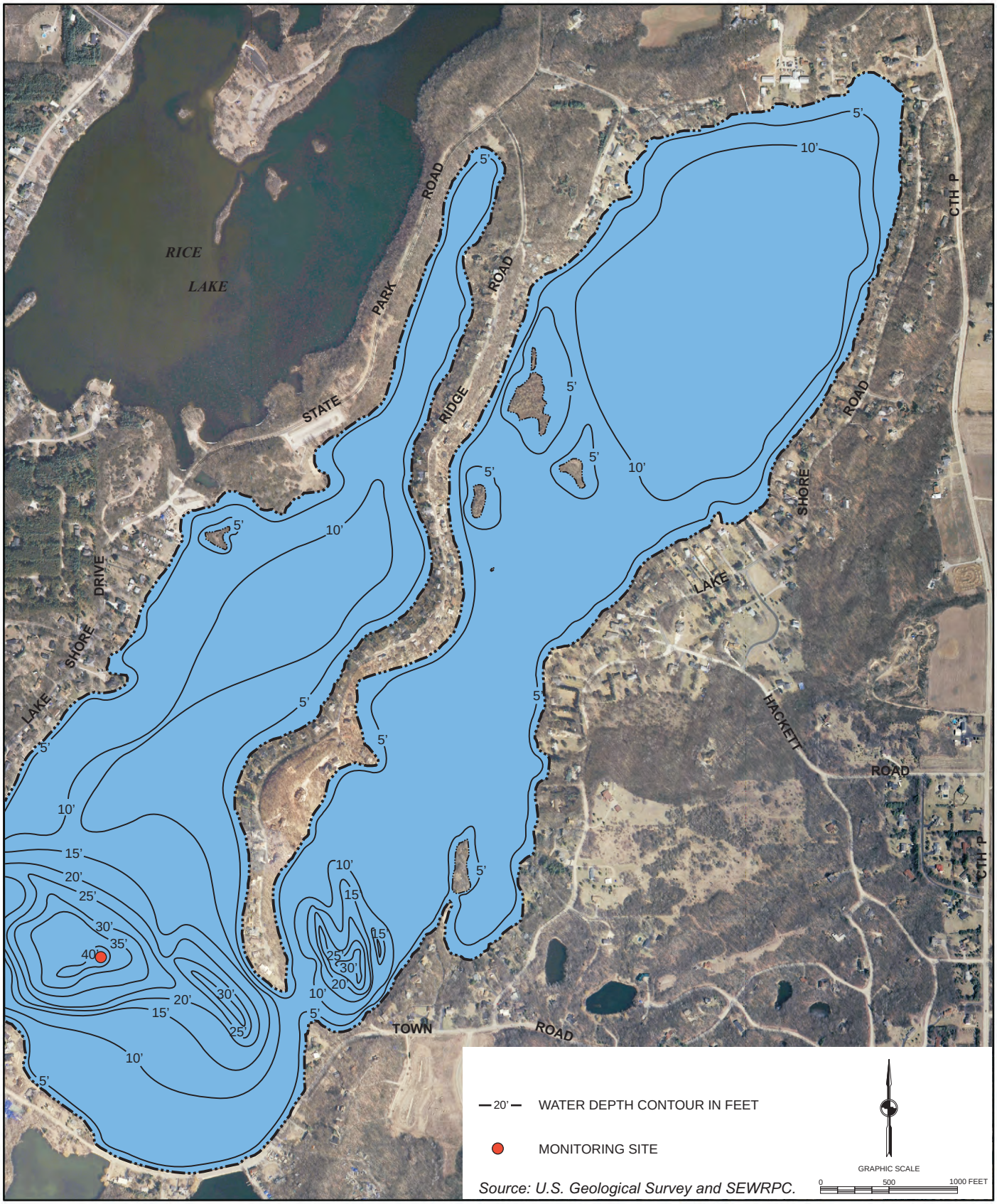
has a maximum depth of approximately 38 feet, a mean depth of just over eight feet, and a volume of about 5,806 acre-feet. Whitewater Lake is approximately 2.6 miles long, with the Lake shoreline being about 10 miles in length; the Lake has a shoreline development factor of 2.7, indicating that, due to its elongate shape, the shoreline is more than two and one-half times longer than that of a perfectly circular lake of the same area.[2] The bottom contours of Whitewater Lake, shown on Map 2, reveal large areas of generally uniform contour at the distal portions of the Lake, with three distinct basins located closer to the central portion of the Lake basin.

Besides the extent of its littoral zone, other physical factors such as bottom sediment composition and basin contours also impact the amount of biological activity in a lake. Whitewater Lake has large areas of shallows and some areas of soft sediment; however, there is a preponderance of firm nearshore bottom sediments consisting of

[2]*Shoreline development factor (SDF) is important because it is often related to the amount of littoral zone (the shallow, nearshore area of a lake usually rich in plant and animal life) in a lake. The greater a lake's shoreline development factor, the more irregular its shoreline and, therefore, the greater the likelihood of the lake containing an extensive littoral zone area with habitat suitable for plant and animal life. For comparative purposes, Silver Lake to the south has a shoreline development factor of 1.2 and is nearly circular in shape; the Lauderdale Lakes to the east, have a shoreline development factor of 3.9, reflecting that waterbody's highly irregular shoreline.*

Map 2

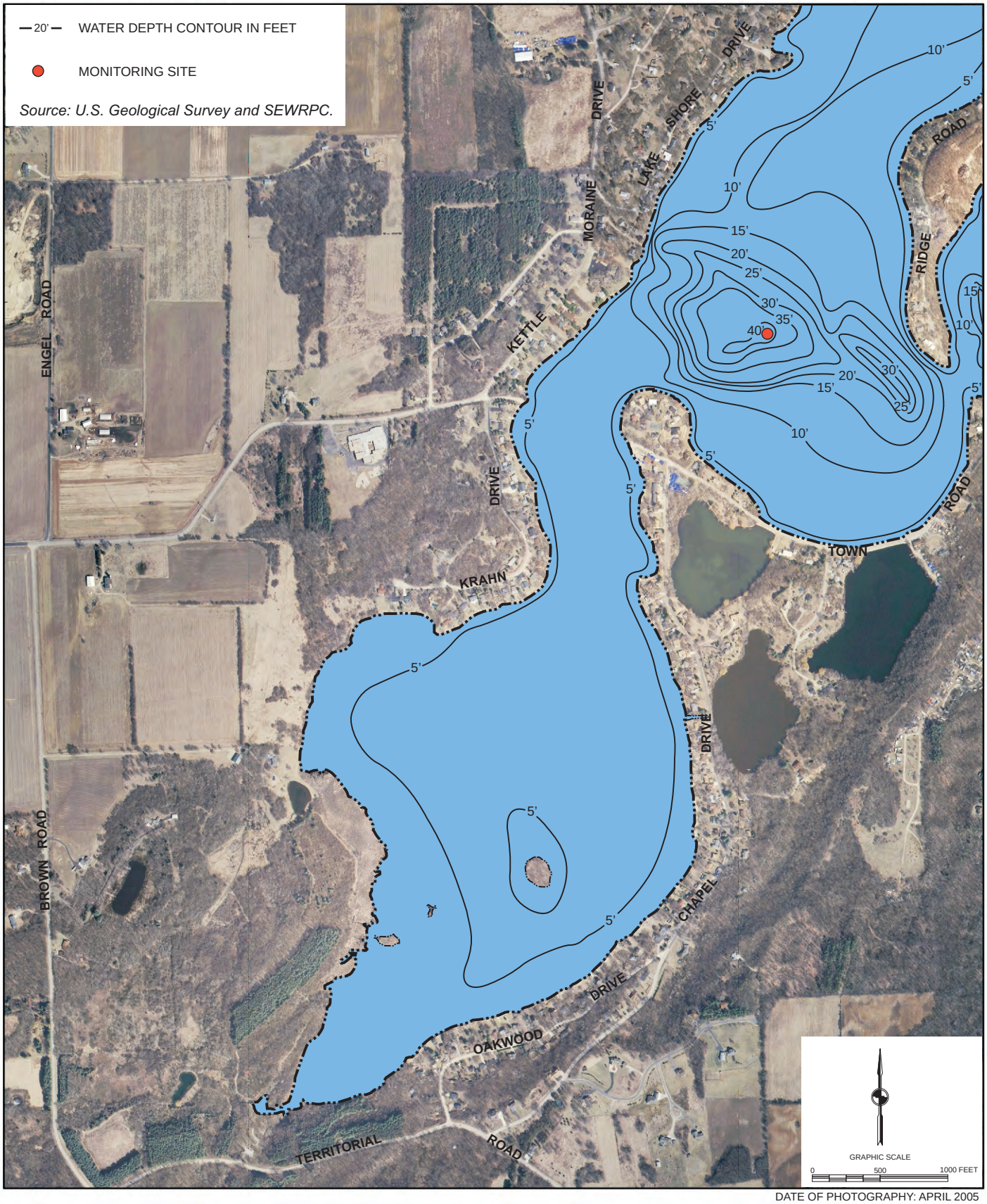
BATHYMETRIC MAP OF WHITEWATER LAKE



Source: U.S. Geological Survey and SEWRPC.

DATE OF PHOTOGRAPHY: APRIL 2005

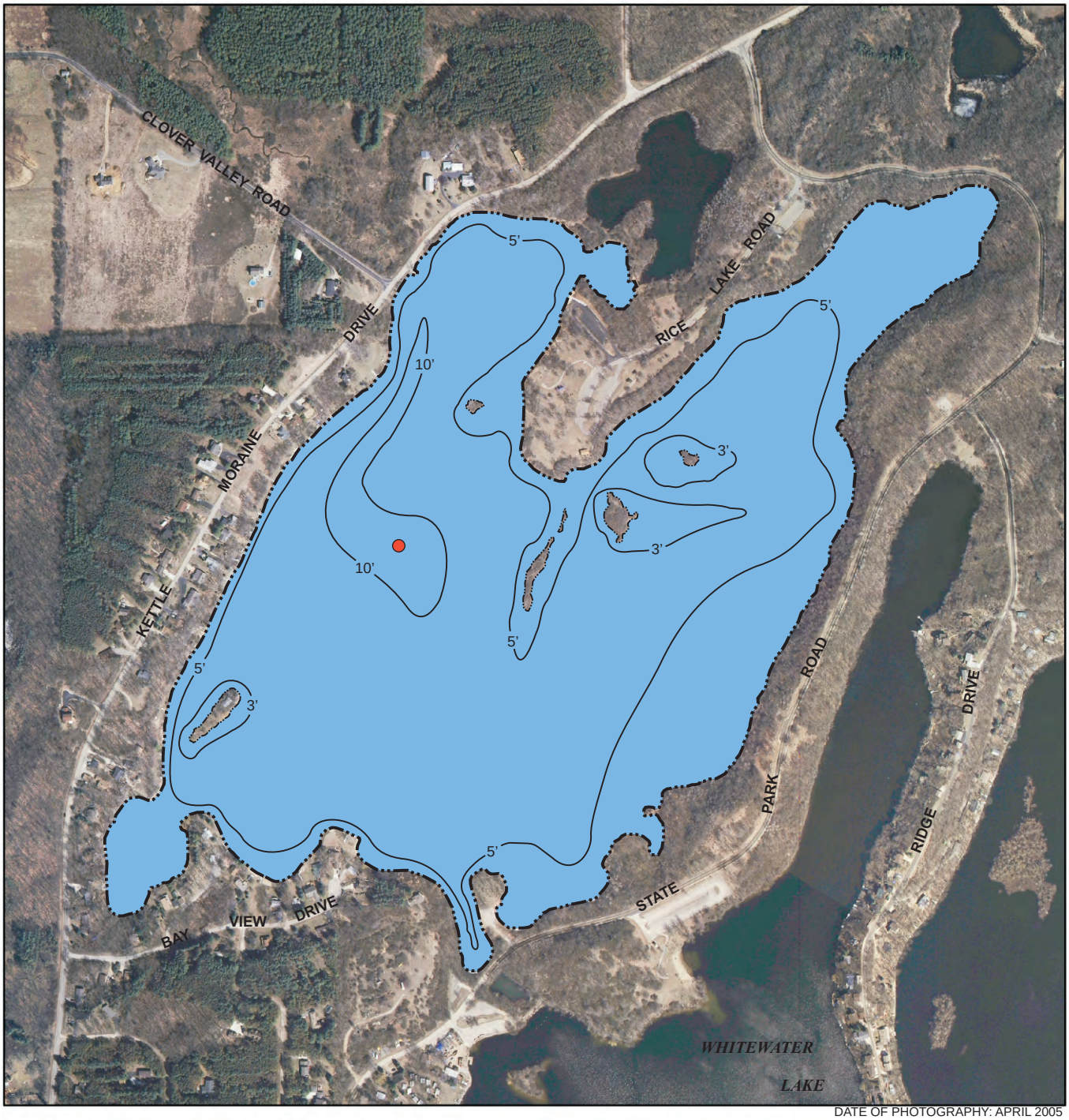
Map 2 (continued)



DATE OF PHOTOGRAPHY: APRIL 2005

Map 3

BATHYMETRIC MAP OF RICE LAKE



DATE OF PHOTOGRAPHY: APRIL 2005

—5'— WATER DEPTH CONTOUR IN FEET

MONITORING SITE

Source: U.S. Geological Survey and SEWRPC.

GRAPHIC SCALE

0 350 700 FEET

sand-silt mixtures, sand, gravel, and rocky sediments. Lakes with large areas of sand, gravel and rocky substrates do not generally exhibit many symptoms typically associated with enriched conditions, although, in the case of Whitewater Lake, such conditions can be observed in the nearshore areas at the extreme southern end of the Lake, in the deeper portions of the northeastern lobe of the Lake known locally as Bass Lake, and in the area around the small island in Bass Lake, where soft silty sediments form good rooting substrate for a variety of aquatic plants.

The 137-acre Rice Lake, also known as Lower Whitewater Lake, lies immediately (about 300 feet) downstream of Whitewater Lake. The Rice Lake dam, built in 1954 and operated by the WDNR, increased the water surface elevation of Whitewater Creek within the impoundment by approximately eight feet. Water from Rice Lake flows northwesterly into Whitewater Creek, which ultimately discharges into the Bark River, a tributary to the Rock River, in Jefferson County. Rice Lake has a maximum depth of 10 feet, a mean depth of about six feet, and a volume of about 930 acre-feet. Rice Lake has a total length of about one mile and a shoreline length of 3.3 miles. The shoreline development factor of Rice Lake is 1.8.

In Rice Lake, soft sediments are common in the extreme northern ends of the western and eastern lobes of the Lake and in the nearshore areas along the eastern and southeastern portions of the Lake. Sand, gravel and rock are dominant bottom types in the nearshore areas of the western lobe of Rice Lake. Additionally, much of the lake bottom is shallow and flat, as shown on Map 3, although detailed bottom contour information for Rice Lake was not available. A preponderance of soft bottom sediments and flat bottom contours are conditions consistent with lakes of higher biological productivity.

TRIBUTARY AREA AND LAND USE CHARACTERISTICS

As shown on Map 4, the area tributary to Whitewater Lake, as well as the Lake itself, is situated within the Towns of Whitewater and Richmond, with a small portion of the tributary area being in the Town of Sugar Creek, all in Walworth County. Rice Lake, and the area tributary to it, is located entirely in the Town of Whitewater. The area directly tributary to Whitewater Lake is approximately 5,006 acres, or about 7.8 square miles, in areal extent. As noted in the comprehensive lake management plan,[3] the results of a hydrologic study conducted by the USGS in 1990 and 1991 indicated that, due to the multiple depressions associated with the hilly terrain and other topographical features and soils in the area, there were normally only about 900 acres or about 1.4 square miles of land surface which actually contributed drainage to Whitewater and Rice Lakes under all but extremely high periods of rainfall. Further, as noted by the USGS and in the comprehensive lake management plan, there is normally no flow over the dam at the outlet of Whitewater Lake, limiting the tributary area to Rice Lake to the 536-acre area directly tributary to the Lake downstream of Whitewater Lake.

Population

The resident population and the numbers of year-round housing units within the tributary area to Whitewater and Rice Lakes have generally increased since 1960, as shown in Table 2. In the area directly tributary to Whitewater Lake, the resident population increased most rapidly between 1960 and 1970, but between 1970 and 1980 actually declined by about 2.5 percent before increasing again in recent years. A similar pattern is reflected in data for the area directly tributary to Rice Lake. There was a large increase in population and numbers of households between 1960 and 1970, then a small decrease over the next decade before a recovery and continuing upward trend.

While there is a resident community, a large proportion of these lake-oriented communities remain seasonal. The seasonal use nature of the two waterbodies is reflected in the year 2000 data for the number of households: in 2000, about 40 percent of all housing units located within the Whitewater Lake tributary area were occupied seasonally, while, in the Rice Lake tributary area, the ratio of seasonal housing units to total housing units was about the same.

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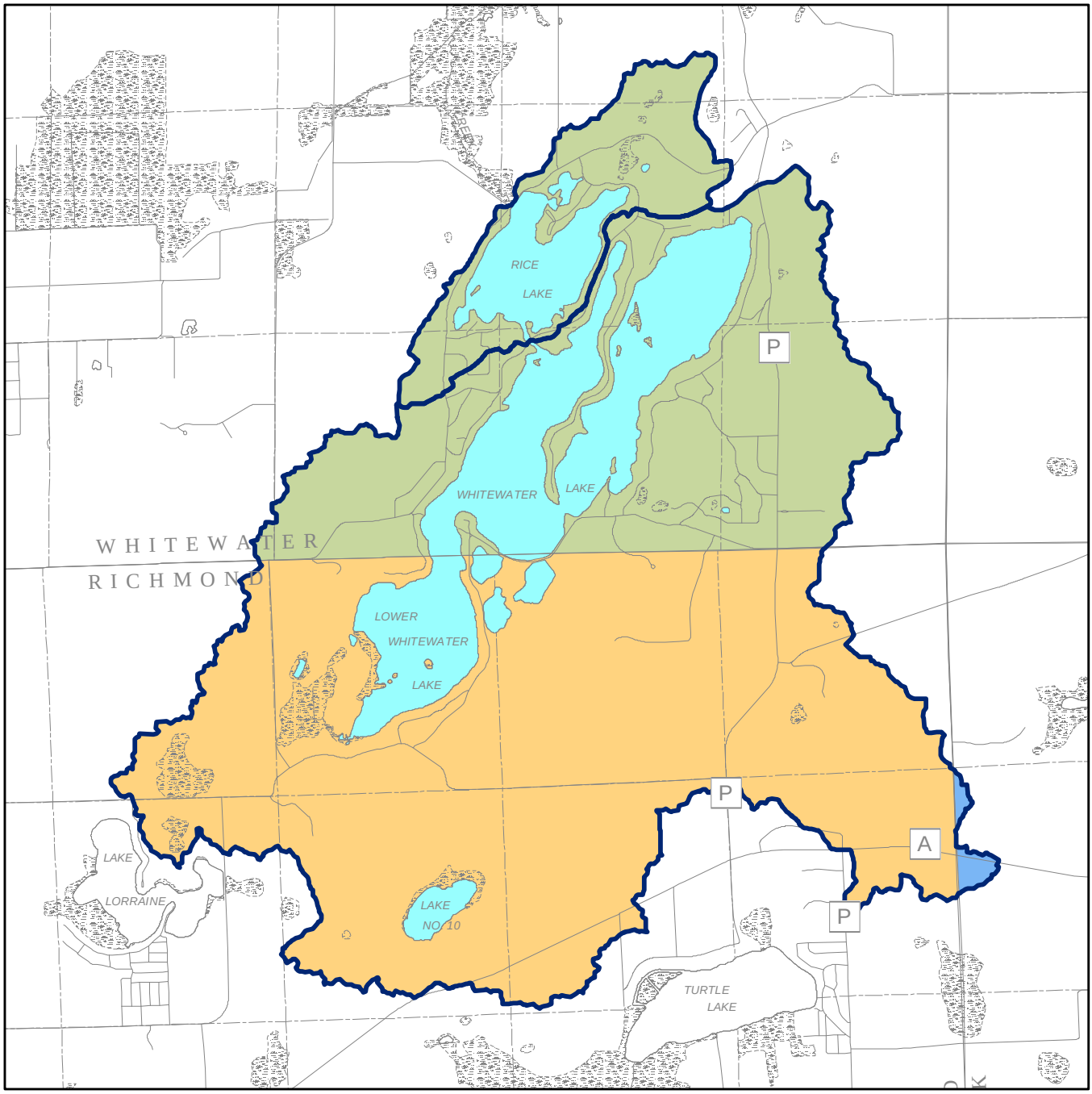
[3] *SEWRPC Community Assistance Planning Report No. 224,* A Lake Management Plan for Whitewater and Rice Lakes, Walworth County, Wisconsin, *February 1997.*

Map 4

CIVIL DIVISION BOUNDARIES WITHIN THE AREA TRIBUTARY TO WHITEWATER AND RICE LAKES



Source: SEWRPC.

Table 2

POPULATION AND HOUSEHOLDS WITHIN THE AREAS DIRECTLY TRIBUTARY TO WHITEWATER AND RICE LAKES: 1960-2000

Year	Whitewater Lake		Rice Lake	
	Population	Households	Population	Households
1960	195	62	- -	- -
1970	844	219	45	18
1980	823	293	38	14
1990	869	337	52	18
2000	1,116	446	69	29

NOTE: Seasonal housing units, and any population associated with them, are not included in the figures in this table. In 2000, there were 752 total housing units in the Whitewater Lake tributary area and 48 total housing units in the Rice Lake tributary area.

Source: U.S. Bureau of the Census and SEWRPC.

Land Uses

Map 5 shows the existing land uses within the tributary areas to Whitewater and Rice Lakes as of 2000. Existing and planned year 2035 land uses in the tributary area to Whitewater Lake are summarized in Table 3, while the existing and planned year 2035 land uses in the tributary area to Rice Lake are shown in Table 4. The land uses within the areas tributary to Whitewater and Rice Lakes are primarily rural, with agricultural uses being the dominant rural land use in the Whitewater Lake tributary area, and woodland being the dominant rural land use in the Rice Lake tributary area. Much of the area is contained within the Southern Unit of the Kettle Moraine State Forest. In contrast to the watershed, the shoreline of Whitewater Lake is almost entirely developed for residential uses, while the shoreline of Rice Lake is primarily in park and open space use. There is some residential development, however, located along the southwestern and southern shorelines of Rice Lake.

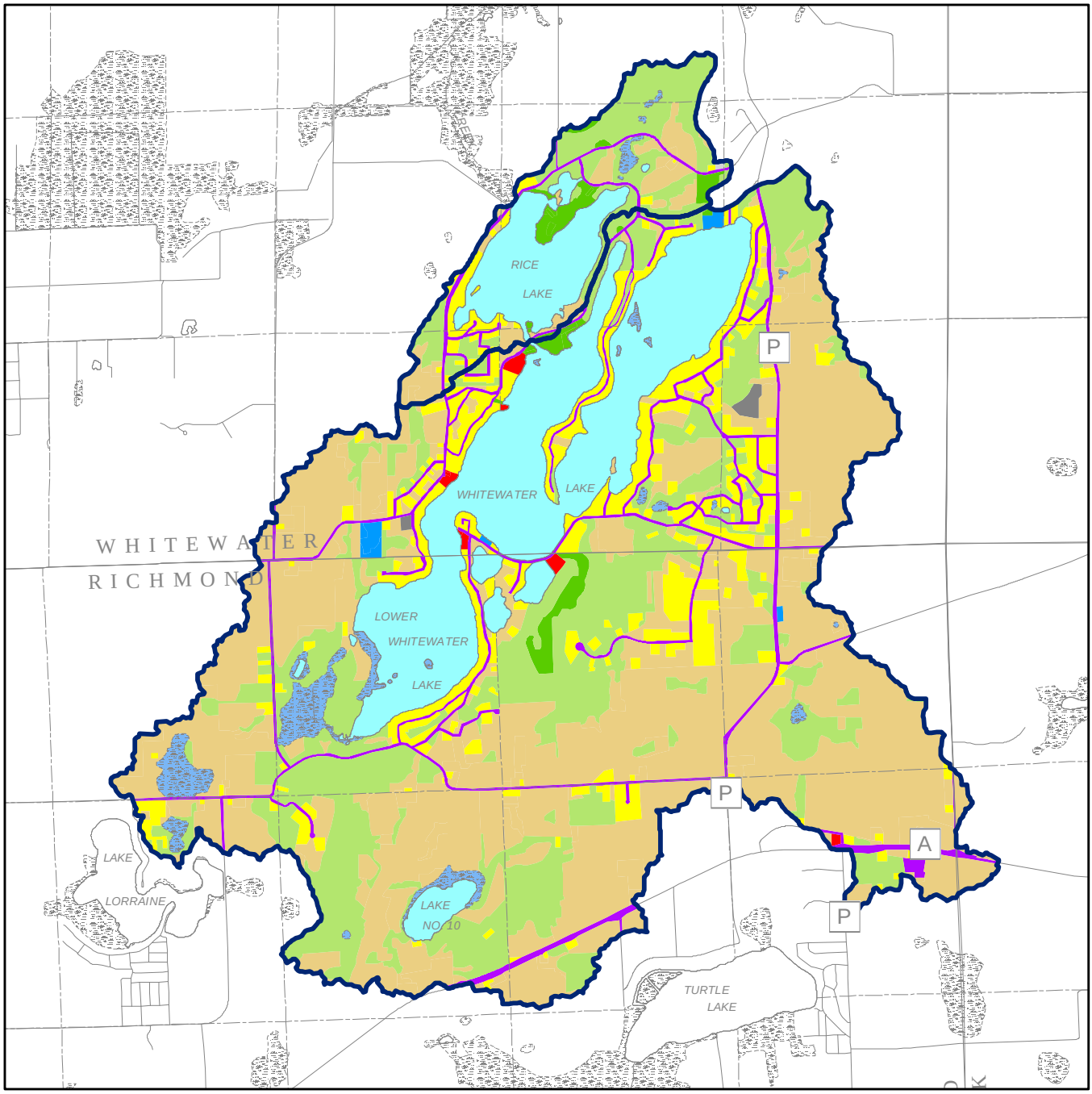
Future changes in land use within the areas tributary to the Lakes may include limited further urban development, infilling of already platted lots, and the possible redevelopment of existing properties. Under proposed year 2035 conditions, as shown on Map 6 and summarized in Table 3, urban land uses are expected to increase in the Whitewater Lake tributary area, from about 15 percent of the land coverage in 2000 to about 20 percent of the land coverage in 2035. In the Rice Lake tributary area, as shown on Map 6 and summarized in Table 4, urban land uses are expected to increase from about 17 percent of the land coverage in 2000 to about 30 percent of the land coverage in 2035. Conversely, agricultural uses in the Whitewater Lake tributary area are anticipated to decrease from about 84 percent of the land coverage in the year 2000 to about 79 percent of the land coverage under planned year 2035 conditions; in the Rice Lake tributary area, a similar change in agricultural land uses is anticipated, with a decrease from about 82 percent of the land uses in 2000 to about 70 percent of the land uses in 2035. These land use changes have the potential to modify the nature and delivery of nonpoint source contaminants to the Lake, with concomitant impacts on the aquatic plant communities within the waterbodies.

SHORELINE PROTECTION STRUCTURES

Erosion of shorelines results in the loss of land, damage to shoreline infrastructure, and interference with lake access and use. Wind-wave erosion, ice movement, and motorized boat traffic usually cause such erosion. A survey of the shoreline of Whitewater and Rice Lakes was conducted by Southeastern Wisconsin Regional Planning Commission (SEWRPC) staff as part of the inventory process leading to the formulation of the

Map 5

EXISTING LAND USE WITHIN THE AREA TRIBUTARY TO WHITEWATER AND RICE LAKES: 2000



SINGLE-FAMILY RESIDENTIAL
COMMERCIAL
INDUSTRIAL
TRANSPORTATION, COMMUNICATIONS, AND UTILITIES
GOVERNMENT AND INSTITUTIONAL
RECREATION
WETLANDS
WOODLANDS
SURFACE WATER
AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS
EXTRACTIVE AND LANDFILL

N
0 2,000 4,000 Feet

Source: SEWRPC.

Table 3

EXISTING AND PLANNED LAND USE WITHIN THE AREA DIRECTLY TRIBUTARY TO WHITEWATER LAKE: 2000 AND 2035

Land Use Categories[a]	2000		2035	
	Acres	Percent of Tributary Area	Acres	Percent of Tributary Area
Urban				
Residential	504	10.0	682	13.6
Commercial	13	0.3	18	0.4
Industrial	- -	- -	- -	- -
Governmental and Institutional	16	0.3	16	0.3
Transportation, Communication, and Utilities	222	4.4	290	5.8
Recreational	37	0.7	40	0.8
Subtotal	792	15.8	1,046	20.9
Rural				
Agricultural and Other Open Lands	2,267	45.4	2,010	40.2
Wetlands	106	2.1	106	2.1
Woodlands	1060	21.2	1,052	21.0
Surface Water	772	15.4	772	15.4
Extractive	7	0.1	20	0.4
Landfill	2	- -	- -	- -
Subtotal	4,214	84.2	3,960	79.1
Total	5,006	100.0	5,006	100.0

[a]*Parking included in associated use.*

Source: SEWRPC.

comprehensive lake management plan.[4] At that time, about three miles, or about 30 percent, of the shoreline of Whitewater Lake were in a natural condition, including reaches of sand beach, while the remaining seven miles were protected by some type of shore protection structure, including bulkheads, revetments, and riprap. The shoreline of Rice Lake was, at that time, mostly in a natural state especially along the eastern and northern shorelines of the Lake; several short stretches of riprap, beach, and bulkhead were present mostly in the southwestern corner of the Lake.

During the current study, Commission staff conducted shoreline surveys on both Lakes during the summer of 2008, the results of which are shown on Maps 7 and 8 for Whitewater and Rice Lakes, respectively. These more recent surveys indicated no significant large-scale changes in the state of the shorelines compared to the earlier surveys. On Whitewater Lake, as shown on Map 7, some small stretches of bulkhead had been converted to riprap and a few small stretches of riprap and/or bulkhead had been converted to a more natural state. There were no severe erosion-related problems observed during the current surveys on either Lake.

WATER QUALITY

Water quality data on Whitewater and Rice Lakes have been collected intermittently since the early 1970s. Data were acquired under the auspices of various programs, including: the U.S. Environmental Protection Agency (USEPA) National Eutrophication Survey; the WDNR Long-Term Trend monitoring study; the WDNR Self-Help

[4]Ibid.

Table 4

EXISTING AND PLANNED LAND USE WITHIN THE AREA DIRECTLY TRIBUTARY TO RICE LAKE: 2000 AND 2035

Land Use Categories[a]	2000		2035	
	Acres	Percent of Tributary Area	Acres	Percent of Tributary Area
Urban				
Residential	34	6.3	80	14.9
Commercial	- -	- -	5	0.9
Industrial	1	0.2	1	0.2
Governmental and Institutional	- -	- -	- -	- -
Transportation, Communication, and Utilities	28	5.2	40	7.5
Recreational	31	5.8	32	6.0
Subtotal	94	17.5	158	29.5
Rural				
Agricultural and Other Open Lands	84	15.7	20	3.7
Wetlands	8	1.5	8	1.5
Woodlands	182	34.0	182	34.0
Surface Water	168	31.3	168	31.3
Extractive	- -	- -	- -	- -
Landfill	- -	- -	- -	- -
Subtotal	442	82.5	378	70.5
Total	536	100.0	536	100.0

[a]*Parking included in associated use.*

Source: SEWRPC.

Monitoring Program, now the University of Wisconsin-Extension (UWEX) Citizen Lake Monitoring Network (CLMN) program, and, the U.S. Geological Survey (USGS) Trophic State Index (TSI) monitoring program. Of these, the CLMN data gathering effort focused on measuring water clarity, while the other programs included a range of other water quality parameters including water clarity measurements.

Water Clarity

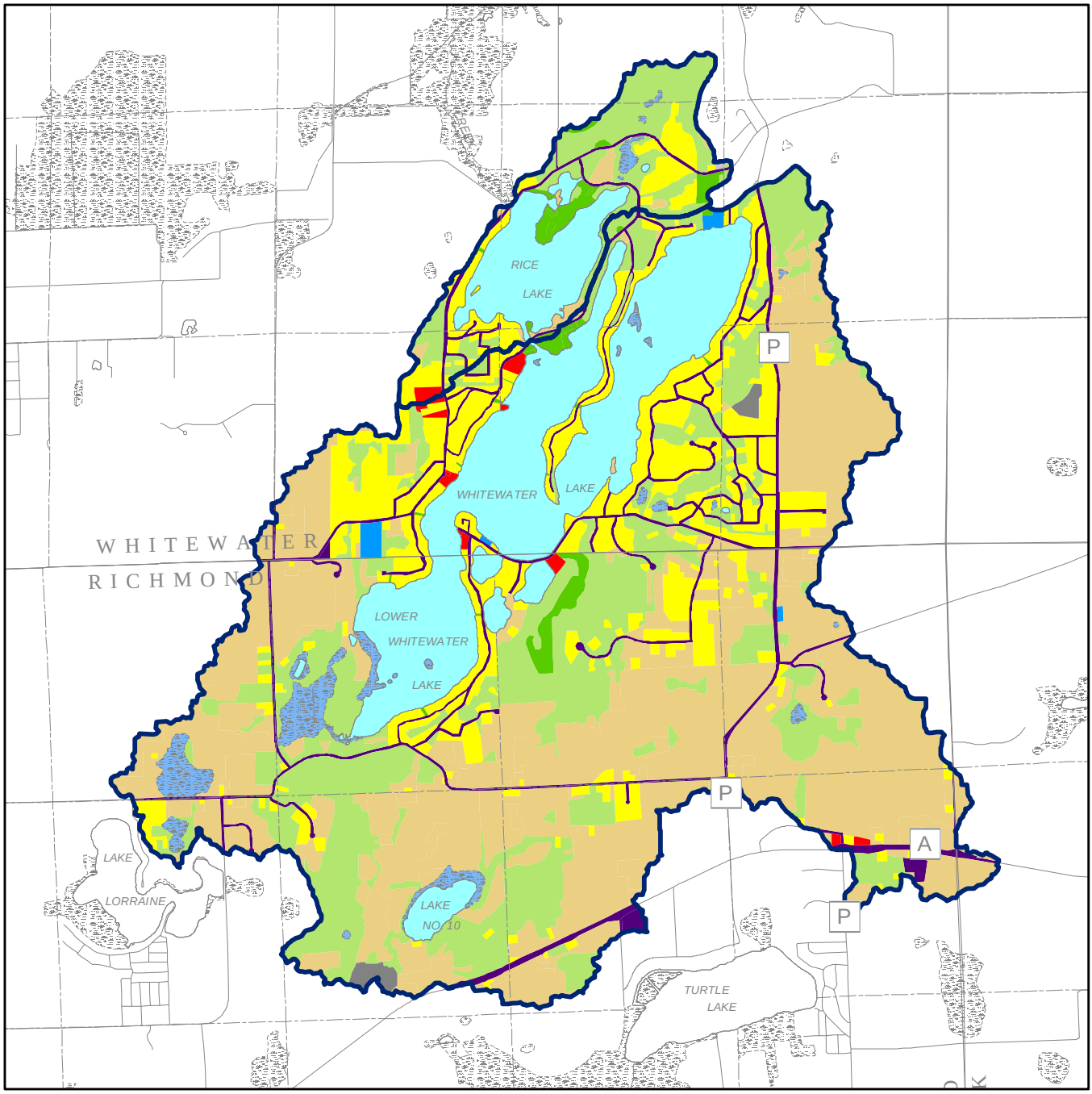
Water clarity, or transparency, is often used as an indication of water quality. Transparency can be affected by physical factors, such as water color and suspended particles, and by various biologic factors, including seasonal variations in planktonic algal populations living in the lake. Water clarity is measured typically with a Secchi disk: a black-and-white, eight-inch-diameter disk, which is lowered into the water until a depth is reached at which the disk is no longer visible. This depth is known as the "Secchi-disk reading." Such measurements comprise an important part of the aforementioned CLMN program in which citizen volunteers assist in lake water quality monitoring efforts throughout the State. Volunteer monitors have acquired water clarity data on Whitewater and Rice Lakes under the auspices of the UWEX CLMN program (formerly the WDNR Self-Help Monitoring Program) since 1986 and 1987, respectively.

Secchi-Disk Data

During the previous Commission study, water clarity was reported to be variable over the 1987 to 1994 period of record, with Secchi-disk readings almost always exceeding one foot, and exceeding three feet during much of the study period. Greatest water clarity was observed during winter and least clarity during summer. The USGS conducted comprehensive water quality samplings at three locations in Whitewater Lake, in: 1) the south bay, 2) the north bay (Bass Lake), and 3) the main basin deep hole (referred to as the Heart Prairie monitoring site), during their 1990 through 1991 study period. Sampling also occurred at a single site in the main basin of Rice

Map 6

PLANNED LAND USE WITHIN THE AREA TRIBUTARY TO WHITEWATER AND RICE LAKES: 2035



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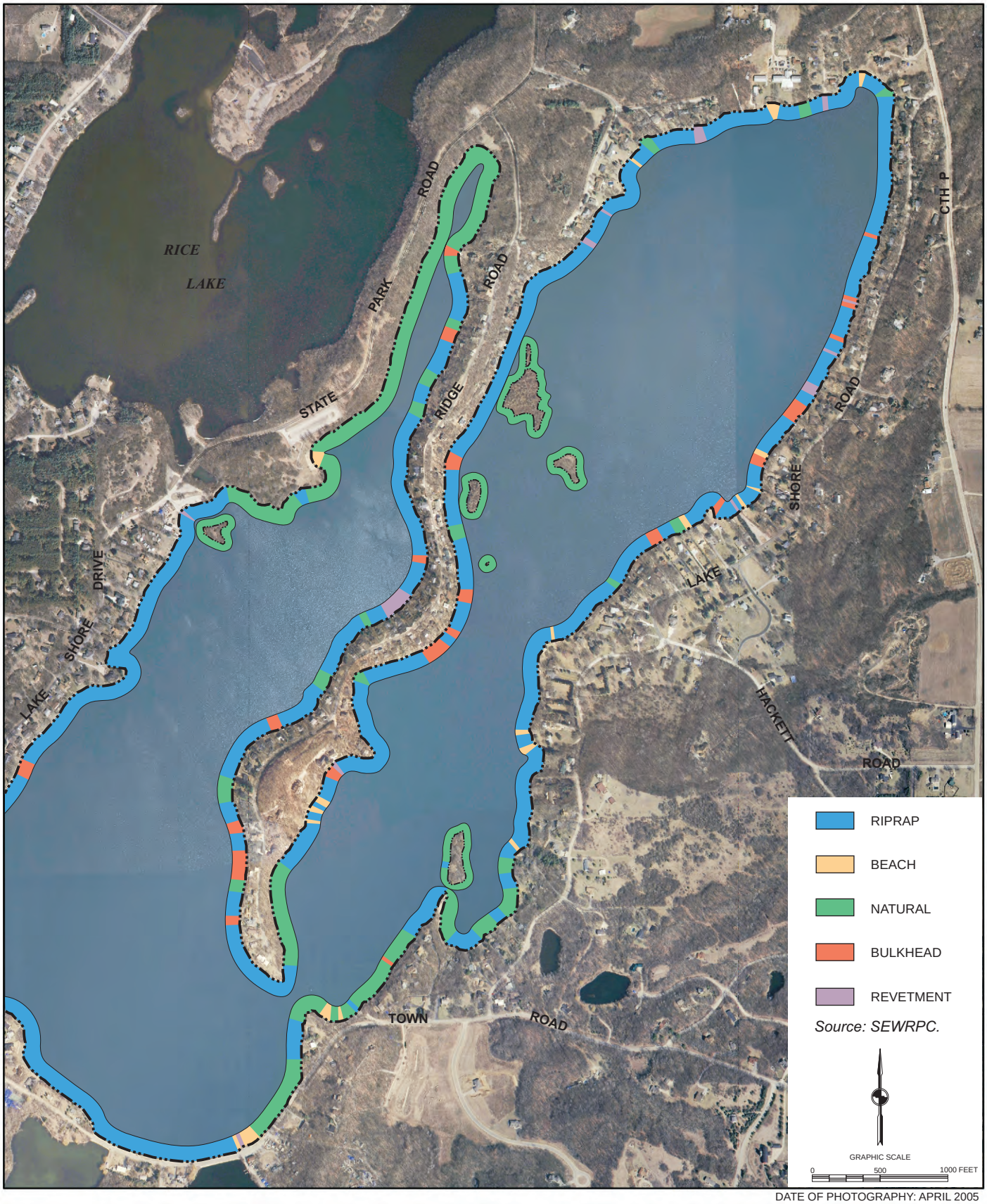
WOODLANDS
SURFACE WATER
AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS
EXTRACTIVE AND LANDFILL

Source: SEWRPC.

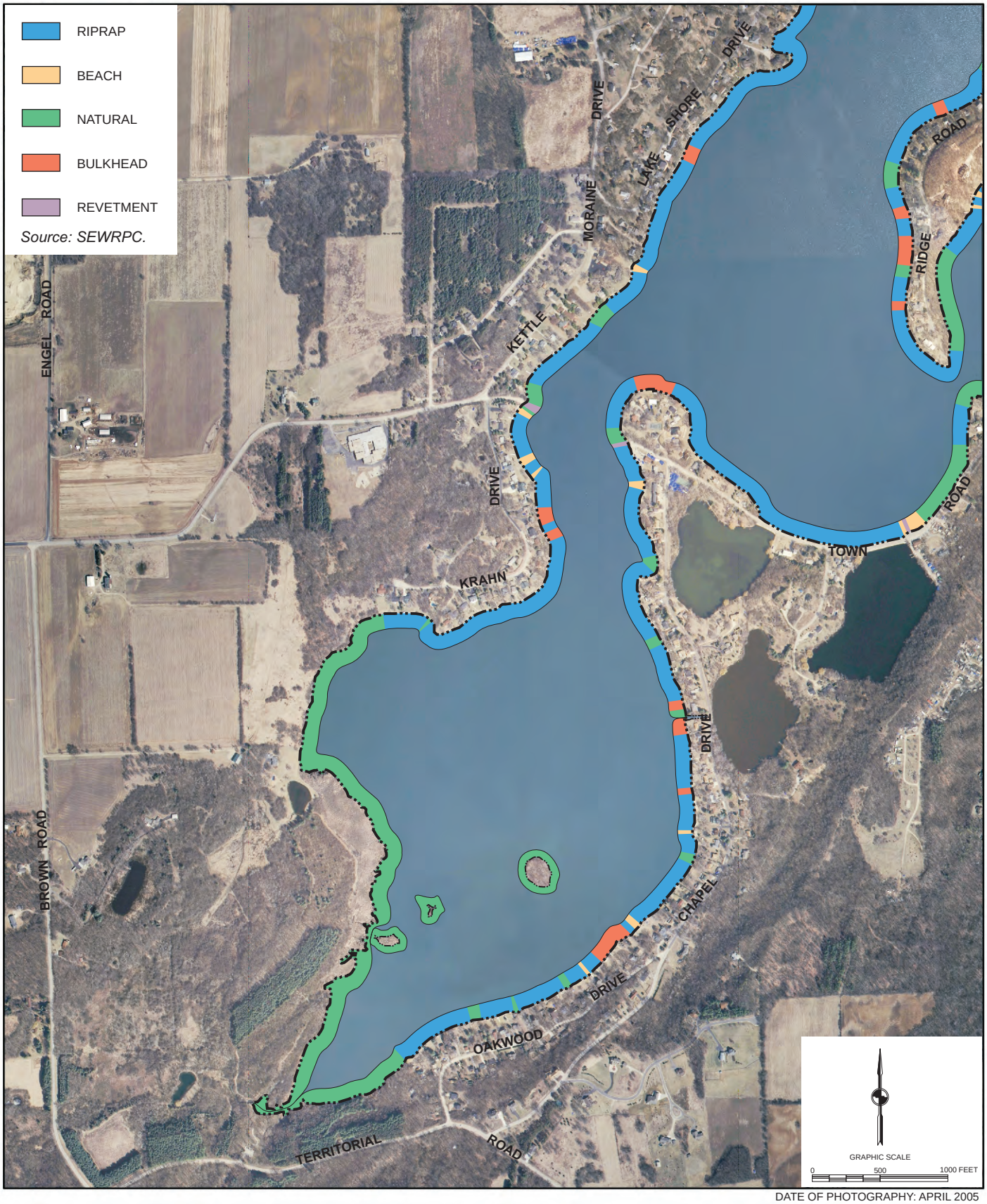
Map 7

SHORELINE PROTECTION STRUCTURES ON WHITEWATER LAKE: 2008



DATE OF PHOTOGRAPHY: APRIL 2005

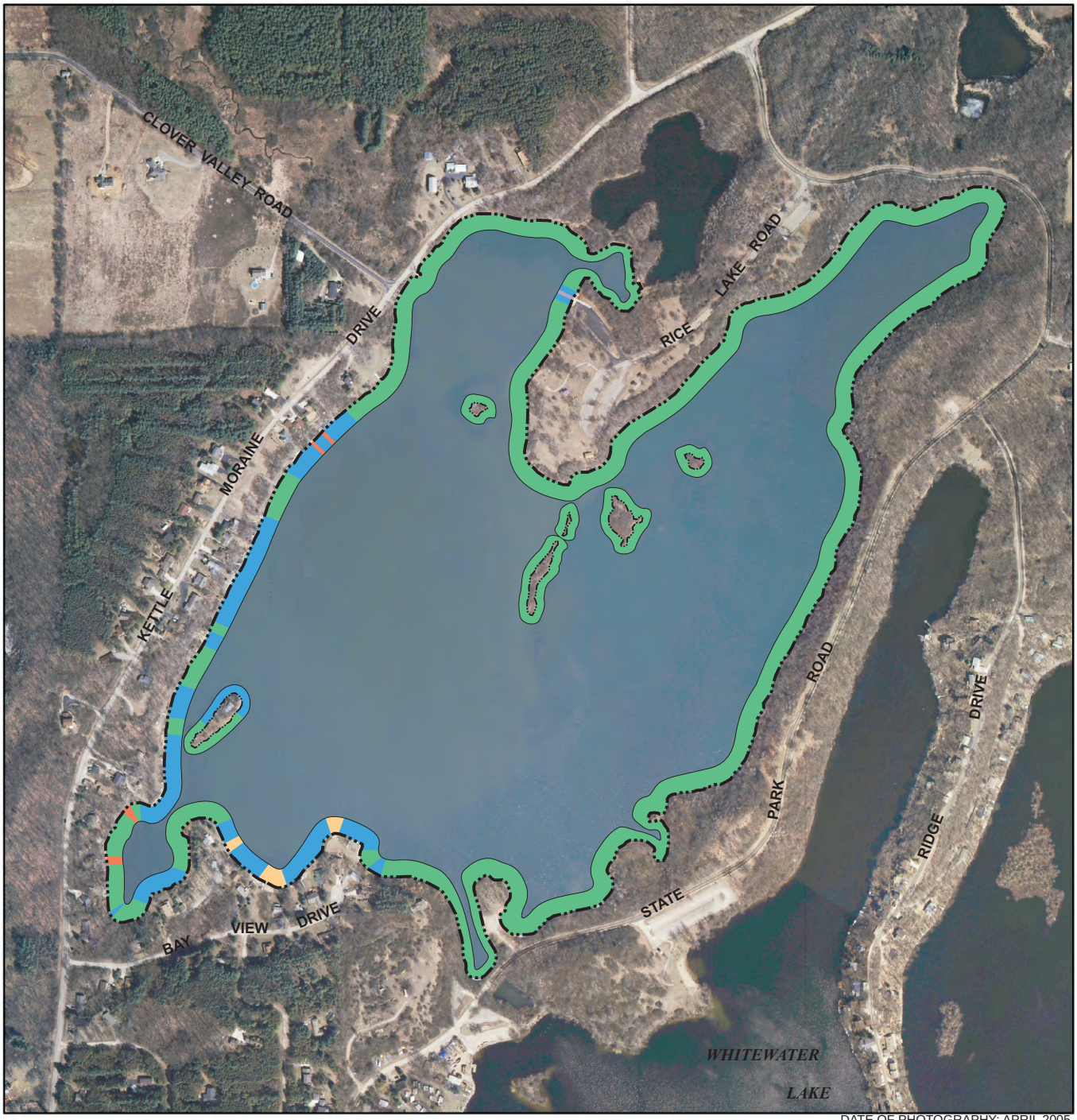
Map 7 (continued)



DATE OF PHOTOGRAPHY: APRIL 2005

Map 8

SHORELINE PROTECTION STRUCTURES ON RICE LAKE: 2008



DATE OF PHOTOGRAPHY: APRIL 2005

RIPRAP

BEACH

NATURAL

BULKHEAD

REVETMENT

GRAPHIC SCALE

0 350 700 FEET

Source: SEWRPC.

Lake. Summer transparencies measured by the USGS during this period averaged between 3.1 feet and 4.25 feet in the various subbasins of Whitewater Lake, and 1.4 feet in Rice Lake.[5] These values were considered to be about average for lakes in southeastern Wisconsin.[6] During the current study period, Secchi-disk transparencies in Whitewater Lake averaged about three feet, and in Rice Lake about two feet.

Remote Sensing Data

In addition to direct in-lake measurements of water clarity using a Secchi disk, transparency in many Wisconsin lakes has been measured using remote sensing technology. The Environmental Remote Sensing Center (ERSC), established in 1970 at the University of Wisconsin-Madison campus, was one of the first remote sensing facilities in the United States. Using data gathered by satellite remote sensing over a three-year period, the ERSC has generated a map based on a mosaic of satellite images showing the estimated water clarity of the largest 8,000 lakes in Wisconsin. Of these, the WDNR, through its volunteer Self-Help Monitoring Program (now the UWEX CLMN program), was able to gather water clarity measurements from about 800 lakes, or about 10 percent of Wisconsin's largest lakes. Based upon the comparison of the observed Secchi disk transparencies and the predicted satellite data, the ERSC determined that the satellite remote sensing technology was able to accurately estimate water clarity in lakes. For the period from 1999 through 2005, the ERSC remote sensing program estimated the average water clarity of Whitewater Lake to be 5.3 feet, a value indicative of generally fair water quality, and, for Rice Lake, the average water clarity to be 3.2 feet, indicating generally poor water quality. Such data are essentially consistent with the aforementioned WDNR Self-Help Monitoring Program and UWEX CLMN Secchi-disk data for the same time period.

Zebra Mussel Impacts

As of April 2008, neither Whitewater Lake nor Rice Lake was listed by the WDNR as having established populations of zebra mussels (*Dreissena polymorpha*). The Lakes have been monitored for zebra mussels by the WDNR and CLMN volunteers since 2002, with the result that no zebra mussel larvae having been found through the 2009 sampling. Zebra mussels, a nonnative species of shellfish with known negative impacts on native benthic organism populations, can disrupt the food chain by removing significant amounts of bacteria and smaller phytoplankton which serve as food for a variety of other aquatic organisms, including larval and juvenile fishes and many forms of zooplankton. As a result of the filter feeding proclivities of these animals, many lakes have experienced improved water clarity, which, in turn, has led to increased growths of rooted aquatic plants, including Eurasian water milfoil. Curiously, within the Southeastern Wisconsin Region, zebra mussels have been observed attaching themselves to the stalks of the Eurasian water milfoil plants, dragging the stems out of the zone of light penetration due to the weight of the zebra mussel shells, and interfering with the competitive strategy of the Eurasian water milfoil plants. This has contributed to improved growths of native aquatic plants in some cases, and to the growths of filamentous algae too large to be ingested by the zebra mussels in others. Regardless of these seemingly beneficial impacts, the overall effect of these and other invasive species on lakes is increased environmental, aesthetic, and economic costs to water users. Consequently, ongoing vigilance to prevent these species from entering Whitewater and Rice Lakes remains a priority action that should be considered, and participation in the UWEX Clean Boats-Clean Waters monitoring and awareness program is recommended (see Chapter III, "Public Informational and Educational Programming").

Dissolved Oxygen

Dissolved oxygen levels are one of the most critical factors affecting the living organisms of a lake ecosystem. Generally, dissolved oxygen levels are higher at the surface of a lake, where there is an interchange between the

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[5]*These data are set forth in U.S. Geological Survey Water-Resources Investigations Report No. 94-4101,* Hydrology and Water Quality of Whitewater and Rice Lakes in Southeastern Wisconsin, 1990-91*, 1994.*

[6]*R.A. Lillie and J.W. Mason, Wisconsin Department of Natural Resources Technical Bulletin No. 138,* Limnological Characteristics of Wisconsin Lakes*, 1983*.

water and atmosphere, stirring by wind action, and production of oxygen by plant photosynthesis. Dissolved oxygen levels are usually lowest near the bottom of a lake, where decomposer organisms and chemical oxidation processes, collectively known as biochemical oxygen demand, utilize oxygen in the decay process. When a lake becomes stratified, that is, when a thermal and/or chemical gradient of sufficient intensity produces a barrier separating upper waters, called the epilimnion, from lower waters, known as the hypolimnion, the surface supply of oxygen to the hypolimnion is cut off. Eventually, if there is not enough dissolved oxygen to meet the demands from the bottom dwelling aquatic life and decaying organic material, the dissolved oxygen levels in the bottom waters may be reduced to zero, a condition known as anoxia or anaerobiasis.

During the previous study, data on the dissolved oxygen levels in Whitewater and Rice Lakes, collected by USGS during their 1990 through 1991 study period, showed that dissolved oxygen levels were indeed generally higher at the surfaces of the Lakes and lowest in their bottom waters. The main basin site in Whitewater Lake displayed oxygen-depth profiles generally consistent with those recorded from other lakes of similar depth in the Region: oxygen levels at shallow depths of less than 10 feet were mostly well above the 5.0 milligrams per liter (mg/l) necessary to support many species of fish and other aquatic life, but, in bottom waters, at depths greater than 10 feet, summer dissolved oxygen levels dropped to zero. Temperature-depth profiles from the Whitewater Lake main basin monitoring site, also collected by the USGS during their 1990 through 1991 study period, indicated that these anoxic conditions coincided with the thermal stratification that occurred during this period. Such stratification is consistent with that of a dimictic lake. Hypolimnetic anoxia also can occur during winter stratification. In Rice Lake, these gradients developed over a much reduced depth of water, with stratification occurring at depths of between five feet and 15 feet, but the stratification was less persistent, with more frequent mixing during the study period, suggesting that this Lake was polymictic.

As oxygen levels in the hypolimnion become depleted, fish tend to move upward, nearer to the surface of the lake, where higher dissolved oxygen concentrations exist. This migration, when combined with temperature, can select against some fish species that prefer the cooler water temperatures that generally prevail in the lower portions of the lakes. When there is insufficient oxygen at these depths, these fish are susceptible to summer-kills, or, alternatively, are driven into the warmer water portions of the lake where their condition and competitive success may be severely impaired. During winter, the presence of ice cover may limit the exchange of atmospheric oxygen in the surface waters of a lake, exacerbating the effects of low dissolved oxygen concentrations. This condition can result in winter-kills. Notwithstanding, fish kills have not been reported from these Lakes.

In addition to these biological consequences, the lack of dissolved oxygen at depth can enhance the development of chemoclines, or chemical gradients, with an inverse relationship to the dissolved oxygen concentration. For example, the sediment-water exchange of elements, such as phosphorus, iron, and manganese, is increased under anaerobic conditions, resulting in increased hypolimnetic concentrations of these elements. Under anaerobic conditions, changes in iron and manganese oxidation states enable the release of phosphorus from the iron and manganese complexes to which they were bound under aerobic conditions. This “internal loading” can affect water quality significantly if these nutrients and salts are mixed into the epilimnion, especially during early summer, when these nutrients can become available for algal and rooted aquatic plant growth. In the case of Rice Lake, internal loading is likely to be minimal due to the frequent mixing of this lake, but internal loading may occur in Whitewater Lake, depending upon the rate of wind-induced mixing—the more rapid the mixing, the more likely it would be that internal loading could occur.[7]

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[7]*See, for example, R.D. Robarts, P.J. Ashton, J.A. Thornton, H.J. Taussig, and L.M. Sephton, “Overturn in a hypertrophic, warm, monomictic impoundment (Hartbeespoort Dam, South Africa),”* Hydrobiologia*, Volume 97, 1982, pp. 209-224.*

Chlorophyll-*a*

Chlorophyll-*a* is the major photosynthetic ("green") pigment in algae. The amount of chlorophyll-*a* present in the water is an indication of the biomass or amount of algae in the water. The mean chlorophyll-*a* concentration for lakes in the Southeastern Wisconsin Region is about 43.3 micrograms per liter (μg/l), with a median concentration of about 9.9 μg/l.[8] Chlorophyll-*a* levels above about 10 μg/l result in a green coloration of the water that may be severe enough to impair recreational activities, such as swimming or waterskiing.[9] Chlorophyll-*a* concentrations in the Lakes were reported in the previous Commission plan to range from 3.0 μg/l to 62 μg/l in Whitewater Lake, and from 3.0 μg/l to 147 μg/l in Rice Lake.

Nutrient Characteristics

Aquatic plants and algae require such nutrients as phosphorus and nitrogen for growth. In hard-water alkaline lakes, most of these nutrients are generally found in concentrations that exceed the needs of growing plants. However, in lakes where the supply of one or more of these nutrients is limited, plant growth is limited by the amount of the nutrient that is available in the least quantity relative to all of the others. The ratio (N:P) of total nitrogen (N) to total phosphorus (P) in lake water indicates which nutrient is the factor most likely to be limiting aquatic plant growth in a lake. Where the N:P ratio is greater than 14:1, phosphorus is most likely to be the limiting nutrient, while, if the ratio is less than 10:1, nitrogen is most likely to be the limiting nutrient.[10] During the previous study period, the N:P ratio for Whitewater Lake was generally greater than 16:1, indicating aquatic plant growth at that time was consistently limited by phosphorus, which is common in most inland lakes in Wisconsin; nitrogen to phosphorus ratios were not computed for Rice Lake.

Total phosphorus and soluble phosphorus concentrations were measured for Whitewater and Rice Lakes during the previous study period. Soluble phosphorus, being dissolved in the water column, is readily available for plant growth; however, its concentration can vary widely over short periods of time as plants take up and release this nutrient. Total phosphorus concentrations, in contrast, include the phosphorus contained in plant and animal fragments suspended in the lake water, phosphorus bound to sediment particles, and phosphorus dissolved in the water column and are, therefore, usually considered a better indicator of nutrient status in a lake. For lakes, the guideline value set forth in the adopted regional water quality management plan is 20 μg/l of total phosphorus or less during spring turnover. This is the level considered as necessary to limit algal and aquatic plant growths to levels consistent with recreational water use objectives, as well as water use objectives for maintaining a warmwater fishery and other aquatic life.

During the previous study period, the total phosphorus concentrations in the surface waters of Whitewater and Rice Lakes averaged 37 μg/l and 75 μg/l, respectively, which would suggest that both Lakes are enriched, or eutrophic, waterbodies. Average total phosphorus concentrations in the bottom waters, or hypolimnion, of Rice Lake were about equal to the surface water concentrations, a condition consistent with well-mixed or frequently mixed shallow waterbodies; however, hypolimnetic concentrations of total phosphorus at the main basin site in Whitewater Lake averaged about 150 μg/l, making them significantly greater than the concentrations at the surface. Such disparities between surface and hypolimnetic concentrations of total phosphorus are indicative of the internal loading phenomenon described above.

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[8]Ibid.

[9]*J.R. Vallentyne, 1969 "The Process of Eutrophication and Criteria for Trophic State Determination." in* Modeling the Eutrophication Process—Proceedings of a Workshop at St. Petersburg, Florida, *November 19-21, 1969, pp. 57-67.*

[10]*M.O. Allum, R.E. Gessner, and T.H. Gakstatter, U.S. Environmental Protection Agency Working Paper No. 900,* An Evaluation of the National Eutrophication Data, *1976.*

POLLUTION LOADINGS AND SOURCES

Pollutant loads to lakes are generated by various natural processes and human activities that take place in the area tributary to a lake. These loads are transported to the lake through the atmosphere, across the land surface, and by way of inflowing streams. Pollutants transported by the atmosphere are deposited onto the surface of the lake as dry fallout and direct precipitation. Pollutants transported across the land surface enter the lake directly as surface runoff and, indirectly, as groundwater inflows, including drainage from onsite wastewater treatment systems. Pollutants transported by streams also enter a lake as surface water inflows.

In drainage lakes, like Whitewater Lake and Rice Lake, pollutant loadings transported by way of precipitation falling directly onto the lakes' surfaces, runoff from the tributary areas immediately surrounding the lakes, groundwater flowing into the lakes, and inflowing streams comprise the principal routes by which contaminants enter the waterbodies.[11] Currently, there are no significant point source discharges of pollutants into Whitewater and Rice Lakes. For this reason, the discussion that follows is based upon nonpoint source pollutant loadings to the Lake.

Nonpoint sources of water pollution include urban sources, such as runoff from residential, commercial, transportation, construction, and recreational activities; and rural sources, such as runoff from agricultural lands and onsite sewage disposal systems. In the cases of Whitewater and Rice Lakes, nonpoint source phosphorus, suspended solids, and urban-derived metals inputs to Whitewater and Rice Lakes were estimated using the Wisconsin Lake Model Spreadsheet (WILMS, version 3.0),[12] and the unit area load-based models developed for use within the Southeastern Wisconsin Region.[13] As previously noted, because of the intermittent nature of water flows over the dam at the Whitewater Lake outlet, the tributary area to Rice Lake is effectively limited to the 350-acre area downstream of Whitewater Lake.[14]

Phosphorus Loadings

During the current study, existing year 2000 phosphorus loads to Whitewater and Rice Lakes were identified and quantified using Commission land use inventory data.[15] As shown in Table 5, it was estimated that under year 2000 conditions the total phosphorus load to Whitewater Lake was about 2,275 pounds. Of the annual total phosphorus load, it was estimated that 2,005 pounds per year, or about 88 percent of the total loading, were contributed by runoff from rural lands, mostly agricultural, and 170 pounds per year, or about 8 percent, were contributed by runoff from urban lands, mostly from residential sources. About 100 pounds, or about 4 percent, were contributed by direct precipitation onto the lake surface.

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[11] *Sven-Olof Ryding and Walter Rast,* The Control of Eutrophication of Lakes and Reservoirs, *Unesco Man and the Biosphere Series, Volume 1, Parthenon Press, Carnforth, 1989; Jeffrey A. Thornton, Walter Rast, Marjorie M. Holland, Geza Jolankai, and Sven-Olof Ryding,* The Assessment and Control of Nonpoint Source Pollution of Aquatic Ecosystems, *Unesco Man and the Biosphere Series, Volume 23, Parthenon Press, Carnforth, 1999.*

[12] *John C. Panuska and Jeff C. Kreider, Wisconsin Department of Natural Resources Publication No. PUBL-WR-363-94,* Wisconsin Lake Modeling Suite Program Documentation and User's Manual, Version 3.3 for Windows, *August 2002.*

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

[14] *Whitewater Lake did discharge into Rice Lake during the 2008 summer season.*

[15] *SEWRPC Planning Report No. 48,* A Regional Land Use Plan for Southeastern Wisconsin: 2035, *June 2006.*

Table 5

ESTIMATED ANNUAL POLLUTANT LOADINGS TO WHITEWATER LAKE BY LAND USE CATEGORY: 2000

Land Use Category	Pollutant Loads			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential[a]	4.9	100.8	0.0	1.6
Commercial	5.1	15.6	2.9	3.0
Industrial	- -	- -	- -	- -
Governmental	4.1	21.6	1.1	24.8
Transportation	1.0	24.2	0.0	0.0
Recreational	0.4	10.0	0.0	0.0
Subtotal	15.5	172.4	4.0	29.4
Rural				
Agricultural	510.0	1,949.6	- -	- -
Wetlands	0.2	4.2	- -	- -
Woodlands	1.9	42.4	- -	- -
Water	72.5	100.4	- -	- -
Extractive	2.0	7.7	- -	- -
Subtotal	586.6	2,104.3	- -	- -
Total	602.1	2,276.7	4.0	29.4

[a]*Includes the contribution from onsite sewage disposal systems. The contribution from onsite sewage disposal systems, based upon the* per capita *phosphorus contribution contained within wastewater estimated within the WILMS model, could range from approximately 15.0 pounds per year to as much as about 393.0 pounds per year, depending upon soil type, system condition, and system locations. For purposes of this analysis, 123.0 pounds per year were used as that value provided the loading that was best correlated to the measured in-lake phosphorus concentration.*

Source: SEWRPC.

As shown in Table 6, it was estimated that under year 2000 conditions the total phosphorus load to Rice Lake was estimated to be 120 pounds. Of the annual total phosphorus load, it was estimated that 80 pounds per year, or about 67 percent of the total loading, were contributed by runoff from rural lands, mostly agricultural, and 20 pounds per year, or about 16.5 percent, were contributed by runoff from urban lands, mostly from residential sources. About 20 pounds, or about 16.5 percent, were contributed by direct precipitation onto the lake surface.

Phosphorus release from the lake bottom sediments, or internal loading, as discussed above, does appear to have been a significant contributing factor to the total phosphorus loading to Whitewater and Rice Lakes.

Under planned year 2035 conditions, as set forth in the adopted regional land use plan,[16] the annual total phosphorus load to the Lake is anticipated to diminish slightly as agricultural activities within the area tributary to Whitewater and Rice Lakes are replaced by urban residential land uses. Table 7 shows the estimated phosphorus loads to Whitewater and Rice Lakes under planned year 2035 conditions. The most likely annual total phosphorus load to Whitewater Lake under the planned conditions is estimated to be 2,115 pounds; of this total, 1,790 pounds per year, or about 85 percent of the total loading, are estimated to be contributed by runoff from rural land, and 225 pounds per year, or about 11 percent, from urban land. About 100 pounds, or about 5 percent, are expected to be contributed by direct precipitation onto the lake surface.

[16]Ibid.

Table 6

ESTIMATED ANNUAL POLLUTANT LOADINGS TO RICE LAKE BY LAND USE CATEGORY: 2000

Land Use Category	Pollutant Loads			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential[a]	0.3	6.8	0.0	1.6
Commercial	- -	- -	- -	- -
Industrial	0.4	1.2	0.2	1.5
Governmental	- -	- -	- -	- -
Transportation	0.1	3.1	0.0	0.0
Recreational	0.4	8.4	0.0	0.0
Subtotal	1.2	19.5	0.2	3.1
Rural				
Agricultural	18.9	72.2	- -	- -
Wetlands	<0.1	0.3	- -	- -
Woodlands	0.3	7.3	- -	- -
Water	15.8	21.8	- -	- -
Extractive	- -	- -	- -	- -
Subtotal	35.0	101.6	- -	- -
Total	36.2	121.1	0.2	3.1

[a]*Includes the contribution from onsite sewage disposal systems. The contribution from onsite sewage disposal systems, based upon the* per capita *phosphorus contribution contained within wastewater estimated within the WILMS model, could range from approximately 1.0 pound per year to as much as about 24.0 pounds per year, depending upon soil type, system condition, and system locations. For purposes of this analysis, 7.5 pounds per year were used as that value provided the loading that was best correlated to the measured in-lake phosphorus concentration.*

Source: SEWRPC.

The most likely annual total phosphorus load to Rice Lake under planned year 2035 conditions is estimated to be 83 pounds; of this total, 25 pounds per year, or about 30 percent of the total loading, are estimated to be contributed by runoff from rural land, and 36 pounds per year, or about 43 percent, from urban land, as shown in Table 8. About 22 pounds, or about 27 percent, are expected to be contributed by direct precipitation onto the lake surface.

Thus, it may be anticipated that not only will the amount of the phosphorus load to Whitewater and Rice Lakes decrease, but that the distribution of the sources of the phosphorus load to the Lakes will change: in Whitewater Lake, the amount of phosphorus being contributed from urban sources will increase from about 8 percent of the total in 2000 to about 11 percent of the total in 2035, while the amount of phosphorus from rural sources will decrease from 88 percent of the total in 2000 to about 85 percent of the total in 2035; for Rice Lake, the amount of phosphorus being contributed from urban sources will increase from about 16 percent of the total in 2000 to about 43 percent of the total in 2035, while the amount of phosphorus from rural sources would be expected to decrease from 67 percent of the total in 2000 to about 30 percent of the total in 2035.

The stormwater management requirements set forth in Chapter NR 151 of the *Wisconsin Administrative Code*, and the limits established by the Wisconsin Legislature on the use and sale of fertilizer containing phosphorus in turf fertilizers to be used in urban areas pursuant to 2009 Wisconsin Act 9 and on the amount of phosphorus in certain cleaning agents pursuant to 2009 Wisconsin Act 63, may be expected to further decrease the phosphorus loads to Whitewater Creek and its Lakes.

Table 7

ESTIMATED ANNUAL POLLUTANT LOADINGS TO WHITEWATER LAKE BY LAND USE CATEGORY: 2035

Land Use Category	Pollutant Loads			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential[a]	6.6	136.4	0.0	1.5
Commercial	7.0	21.6	4.0	3.0
Industrial	- -	- -	- -	- -
Governmental	4.1	21.6	1.1	24.8
Transportation	1.4	31.9	0.0	0.0
Recreational	0.5	10.8	0.0	0.0
Subtotal	19.6	222.3	5.1	29.3
Rural				
Agricultural	452.2	1,728.6	- -	- -
Wetlands	4.5	4.2	- -	- -
Woodlands	1.9	42.1	- -	- -
Water	72.5	100.4	- -	- -
Extractive	4.5	17.2	- -	- -
Subtotal	531.3	1,892.5	- -	- -
Total	550.9	2,114.8	5.1	29.3

[a]*Includes the contribution from onsite sewage disposal systems. The contribution from onsite sewage disposal systems, based upon the* per capita *phosphorus contribution contained within wastewater estimated within the WILMS model, could range from approximately 15.0 pounds per year to as much as about 393.0 pounds per year, depending upon soil type, system condition, and system locations. For purposes of this analysis, 123.0 pounds per year were used as that value provided the loading that was best correlated to the measured in-lake phosphorus concentration.*

Source: SEWRPC.

Finally, in an effort to evaluate the validity of the models used to forecast the phosphorus loads to Whitewater and Rice Lakes, the forecast year 2000 loads were used to calculate the predicted in-lake total phosphorus concentrations using the Organization for Economic Cooperation and Development (OECD) phosphorus loading relationship.[17] The estimated mean annual total phosphorus concentrations in the Lakes were calculated to be between 26 µg/l and 65 µg/l in Whitewater Lake—based upon the least likely and most likely phosphorus loads generated using the WILMS model—and between 41 µg/l and 92 µg/l in Rice Lake—based upon the most likely and highest likely phosphorus loads generated using the WILMS model. These forecasts are not dissimilar to the observed total phosphorus concentrations in the Lakes, reported by the U.S. Geological Survey during their 1990 study, which concentrations averaged between 31 µg/l and 46 µg/l in Whitewater Lake, and 68 µg/l in Rice Lake.[18]

[17]*Organisation for Economic Cooperation and Development,* Eutrophication of Waters: Monitoring, Assessment and Control*, OECD, 1982.*

[18]*U.S. Geological Survey Water-Resources Investigations Report 94–4101,* Hydrology and water quality of Whitewater and Rice Lakes in southeastern Wisconsin, 1990–91*, 1994.*

Table 8

ESTIMATED ANNUAL POLLUTANT LOADINGS TO RICE LAKE BY LAND USE CATEGORY: 2035

Land Use Category	Pollutant Loads			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential[a]	0.8	16.0	0.0	1.6
Commercial	2.0	6.0	1.1	3.0
Industrial	0.3	1.2	0.2	1.5
Governmental	- -	- -	- -	- -
Transportation	0.2	4.4	0.0	0.0
Recreational	0.4	8.6	0.0	0.0
Subtotal	3.7	36.2	1.3	6.1
Rural				
Agricultural	4.5	17.2	- -	- -
Wetlands	<0.1	0.3	- -	- -
Woodlands	0.3	7.3	- -	- -
Water	15.8	21.8	- -	- -
Extractive	- -	- -	- -	- -
Subtotal	20.6	46.4	- -	- -
Total	24.3	82.8	1.3	6.1

[a]*Includes the contribution from onsite sewage disposal systems. The contribution from onsite sewage disposal systems, based upon the* per capita *phosphorus contribution contained within wastewater estimated within the WILMS model, could range from approximately 1.0 pound per year to as much as about 24.0 pounds per year, depending upon soil type, system condition, and system locations. For purposes of this analysis, 7.5 pounds per year were used as that value provided the loading that was best correlated to the measured in-lake phosphorus concentration.*

Source: SEWRPC.

Sediment Loadings

Sediment loadings were not reported as part of the previous study. For the current study period, the estimated sediment loadings to Whitewater and Rice Lakes under existing year 2000 are shown in Tables 5 and 6, respectively. A total annual sediment loading of 602 tons was estimated to be contributed to Whitewater Lake, as shown in Table 5. Of the likely annual sediment load, it was estimated that 514 tons per year, or about 85 percent of the total loading, were contributed by runoff from rural lands, mostly from agricultural sources, and 16 tons, or about 3 percent, contributed by urban lands. Approximately 72 tons, or about 12 percent of the annual sediment load, were contributed by atmospheric deposition onto the lake surface. A total annual sediment loading of 36 tons was estimated to be contributed to Rice Lake, as shown in Table 6. Of the likely annual sediment load, it was estimated that 19 tons per year, or about 53 percent of the total loading, were contributed by runoff from rural lands, mostly from agricultural sources, and one ton, or about 3 percent, contributed by urban lands. Approximately 16 tons, or about 44 percent of the annual sediment load, were contributed by atmospheric deposition onto the lake surface.

Under 2035 conditions, as set forth in the adopted regional land use plan and as shown in Tables 7 and 8, the annual sediment load to the Lakes is anticipated to diminish. The annual sediment load to Whitewater Lake under buildout conditions is estimated to be 551 tons, as shown in Table 7. Of the forecast sediment load, 459 tons of sediment are estimated to be contributed to the Lake from rural sources and 20 tons from urban sources. It is estimated that 72 tons of sediment per year continue to be contributed by direct precipitation onto the lake surface. The annual sediment load to Rice Lake under buildout conditions is estimated to be 24 tons, as shown in Table 8.

Of the forecast sediment load, five tons of sediment are estimated to be contributed to the Lake from rural sources and four tons from urban sources. It is estimated that 15 tons of sediment per year continue to be contributed by direct precipitation onto the lake surface.

Urban Heavy Metals Loadings

Urbanization brings with it increased use of metals and other materials that contribute pollutants to aquatic systems.[19] The majority of these metals become associated with sediment particles[20] and, consequently, is likely to be encapsulated into the bottom sediments of a lake.

The estimated loadings of copper and zinc likely to be contributed to Whitewater and Rice Lakes under existing year 2000 and forecast year 2035 land use conditions are shown in Tables 5 through 8, respectively. In 2000, four pounds of copper and 29 pounds of zinc were estimated to be contributed annually to Whitewater Lake, as shown in Table 5, and about one-quarter pound of copper and three pounds of zinc were estimated to be contributed annually to Rice Lake, as shown in Table 6, all from urban lands. Under planned year 2035 conditions, as set forth in the adopted regional land use plan,[21] the annual heavy metal loads to the Lakes would be expected to increase in proportion to the increase, except for the zinc load, which would essentially be unchanged. In 2035, five pounds of copper and 29 pounds of zinc are estimated to be contributed annually to Whitewater Lake, as shown in Table 7, and one pound of copper and six pounds of zinc were estimated to be contributed annually to Rice Lake, as shown in Table 8, all from urban lands.

TROPHIC STATUS

Lakes are commonly classified according to their degree of nutrient enrichment, or trophic status. The ability of lakes to support a variety of recreational activities and healthy fish and other aquatic life communities is often correlated to the degree of nutrient enrichment that has occurred. There are three terms generally used to describe the trophic status of a lake: oligotrophic, mesotrophic, and eutrophic.

Oligotrophic lakes are nutrient-poor lakes. These lakes characteristically support relatively few aquatic plants and often do not contain very productive fisheries. Oligotrophic lakes may provide excellent opportunities for swimming, boating, and waterskiing. Because of the naturally fertile soils and the intensive land use activities, there are relatively few oligotrophic lakes in southeastern Wisconsin.

Mesotrophic lakes are moderately fertile lakes which may support abundant aquatic plant growths and productive fisheries. However, nuisance growths of algae and macrophytes are usually not exhibited by mesotrophic lakes. These lakes may provide opportunities for all types of recreational activities, including boating, swimming, fishing, and waterskiing. Many lakes in southeastern Wisconsin are mesotrophic.

Eutrophic lakes are nutrient-rich lakes. These lakes often exhibit excessive aquatic macrophyte growths and/or experience frequent algae blooms. If the lakes are shallow, fish winterkills may be common. While portions of such lakes are not ideal for swimming and boating, eutrophic lakes may support very productive fisheries. Although some eutrophic lakes are present in the Region, severely eutrophic lakes are rare, especially since the regionwide implementation of recommendations put forth in the regional water quality management plan. Severely enriched lakes are sometimes referred to as being hypertrophic.

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[19] *Jeffrey A. Thornton, et al.,* op. cit.

[20] *Werner Stumm and James J. Morgan,* Aquatic Chemistry: An Introduction Emphasizing Chemical Equilibria in Natural Waters, *Wiley-Interscience, New York, 1970.*

[21] *SEWRPC Planning Report No. 48,* op. cit.

Several numeric "scales," based on one or more water quality indicators, have been developed to define the trophic condition of a lake. Because trophic state is actually a continuum from very nutrient poor to very nutrient rich, a numeric scale is useful for comparing lakes and for evaluating trends in water quality conditions. Care must be taken, however, that the particular scale used is appropriate for the lake to which it is applies. In this case, two indices appropriate for Wisconsin lakes have been used; namely, the Vollenweider-OECD open-boundary trophic classification system,[22] and the Carlson Trophic State Index (TSI),[23] with a variation known as the Wisconsin Trophic State Index value (WTSI).[24] The WTSI is a refinement of the Carlson TSI and is designed to account for the greater humic acid content—brown water color—present in Wisconsin lakes; it has been adopted by the WDNR for use in lake management investigations.

During the previous study, the TSI ratings for Whitewater and Rice Lakes were reported to range from about 44 to 71, and from about 47 to 66, respectively. The TSI ratings varied as a function of sampling date, but did not exhibit any particular trends over the periods of record. Based on these ratings, Whitewater and Rice Lakes were classified as eutrophic lakes. For the current study period, TSI values in Whitewater Lake varied between 53 and 64, while the TSI values in Rice Lake was reported to be about 62, as shown in Figures 1 and 2, respectively. These values continued to indicate that the Lakes were eutrophic or enriched with the plant nutrients, nitrogen and phosphorus, and capable of supporting abundant growths of aquatic plants and fishes.

Based upon data gathered during the aforementioned ERSC satellite remote sensing study, both Whitewater and Rice Lakes were estimated to have a TSI value in the range of 50 to 70, which is generally consistent with the observed data reported through the CLMN. A value above 50 is generally indicative of the enriched conditions associated with eutrophic lakes.

AQUATIC PLANTS: DISTRIBUTION AND MANAGEMENT AREAS

Previous surveys and inventories of the aquatic macrophyte communities in Whitewater and Rice Lakes were conducted in 1990 by the WDNR and in 1995 by SEWRPC. For the current study, Commission staff conducted an aquatic plant survey on Whitewater and Rice Lakes during July of 2008, the results of which are shown in Tables 9 and 10, respectively. A further aquatic plant reconnaissance was conducted by SEWRPC staff during July of 2009, which verified the field results obtained during the 2008 aquatic plant survey in Whitewater Lake. The combined species list compiled from the results of the 2008 Commission aquatic plant surveys in Whitewater and Rice Lakes, along with notes about the ecological significance of each plant on the list, is set forth in Table 11. Representative illustrations of these aquatic plants can be found in Appendix A. Maps 9 and 10 show the distribution of aquatic plants in Whitewater and Rice Lakes at the time of the 2008 aquatic plant survey.

The dominant submergent aquatic plant species in Whitewater Lake during the 2008 survey, as shown on Map 9, was coontail (*Ceratophyllum demersum*); also present in significant amounts relative to other species were bushy pondweed (*Najas flexilis*) and Sago pondweed (*Potamogeton pectinatus*). Other species reported as present were muskgrass (*Chara vulgaris*), Eurasian water milfoil (*Myriophyllum spicatum*), northern or native water milfoil (*Myriophyllum sibiricum*), curly-leaf pondweed (*Potamogeton crispus*), and waterweed (*Elodea canadensis*).

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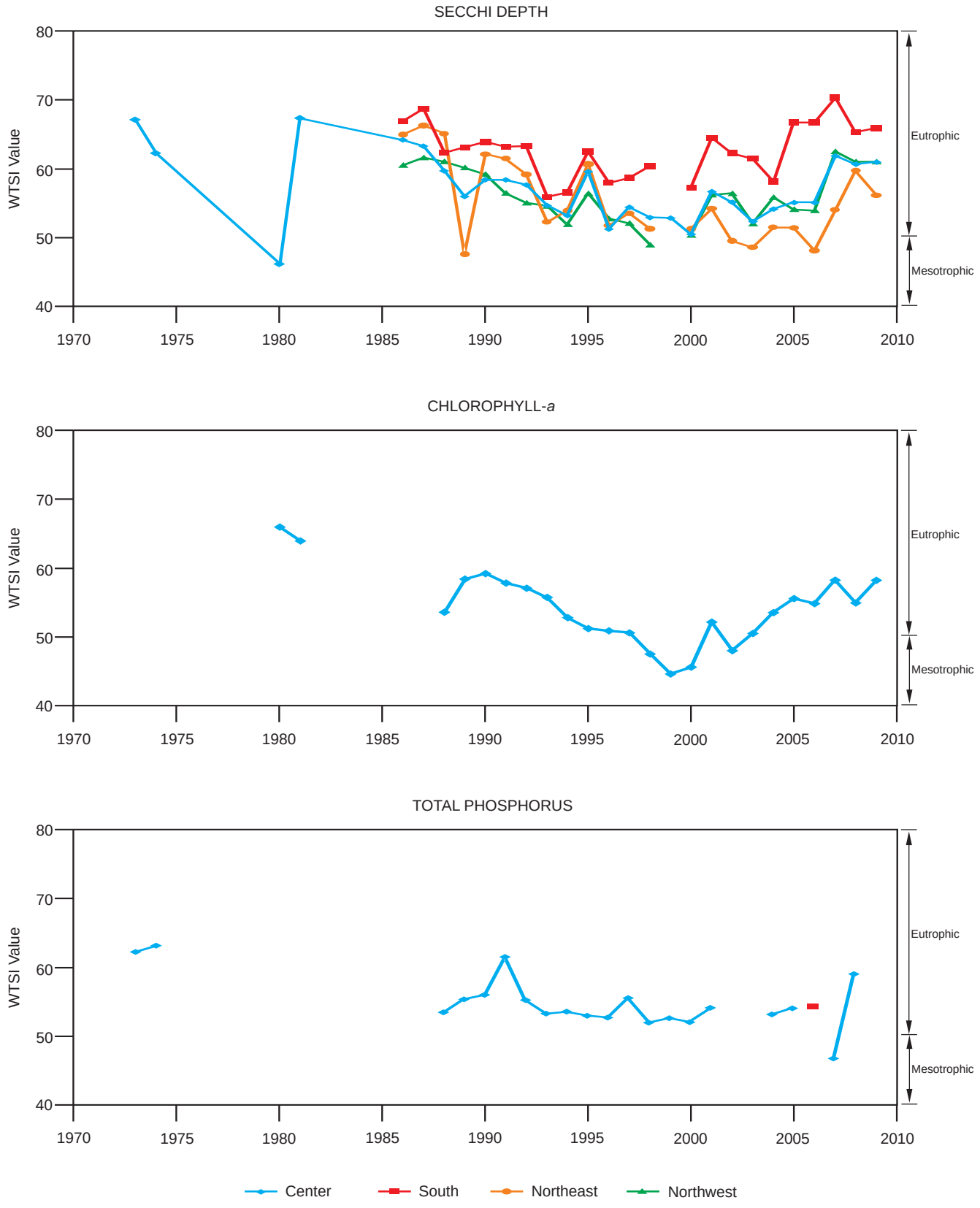
[22]*H. Olem and G. Flock, U.S. Environmental Protection Agency Report EPA-440/4-90-006,* The Lake and Reservoir Restoration Guidance Manual, Second Edition*, Walworth, D.C., August 1990.*

[23]*R.E. Carlson, "A Trophic State Index for Lakes,"* Limnology and Oceanography*, Vol. 22, No. 2, 1977.*

[24]*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.*

Figure 1

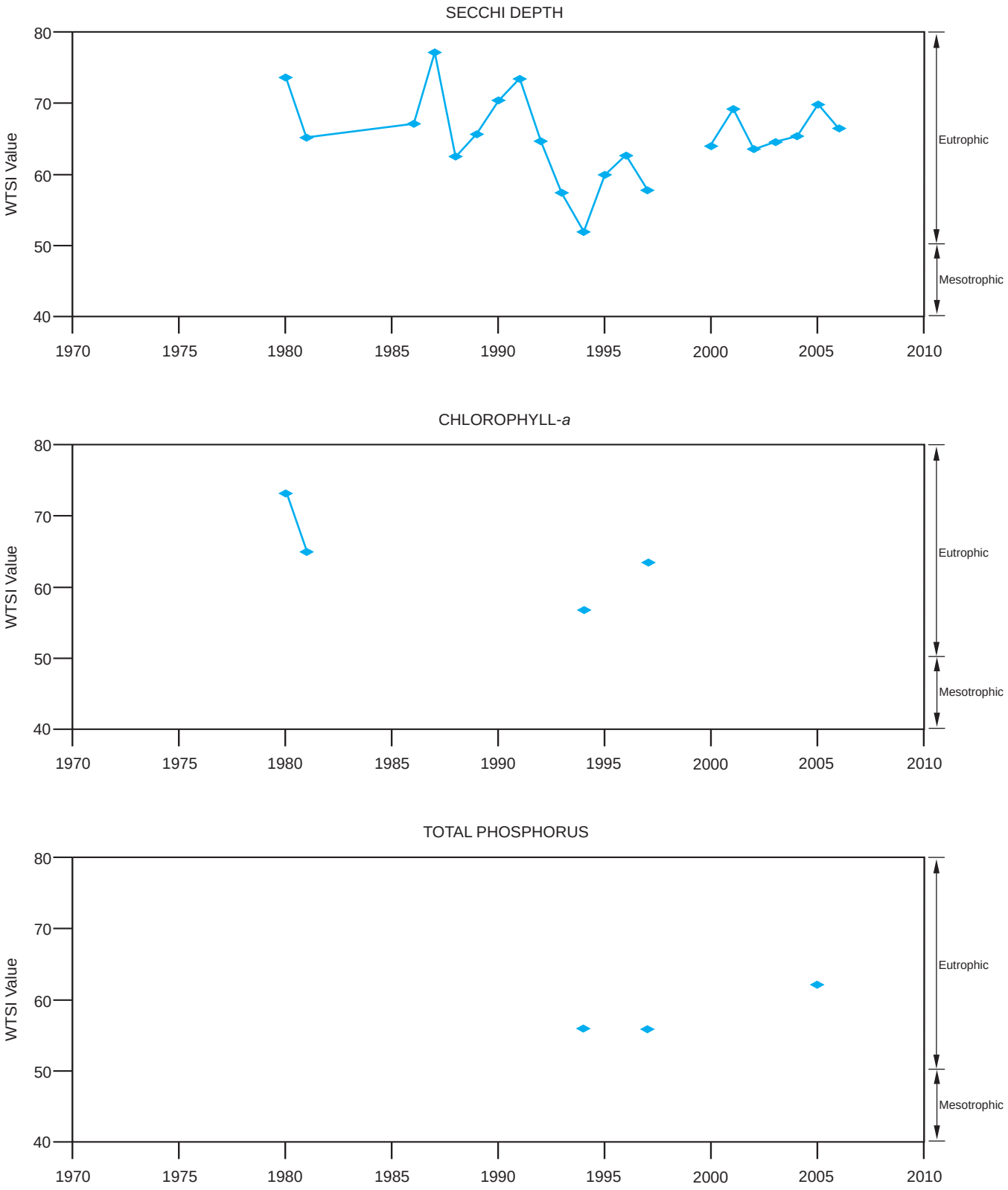
WISCONSIN TROPHIC STATE INDICES FOR SITES IN WHITEWATER LAKE: 1970-2010



Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure 2

WISCONSIN TROPHIC STATE INDICES IN RICE LAKE: 1970-2010



Source: Wisconsin Department of Natural Resources and SEWRPC.

Table 9

AQUATIC PLANT SPECIES OBSERVED IN WHITEWATER LAKE: 2008

Aquatic Plant Species	Number of Sites Found	Frequency of Occurrence[a]	Relative Density[b]	Importance Value[c]
Ceratophyllum demersum (coontail)	50	37.0	2.7	99.3
Chara vulgaris (muskgrass)	15	11.1	1.9	20.7
Elodea canadensis (waterweed)	2	1.5	2.0	3.0
Myriophyllum sibiricum (northern water milfoil)	7	5.2	1.3	6.7
Myriophyllum spicatum (Eurasian water milfoil)	14	10.4	1.5	15.6
Najas flexilis (bushy pondweed)	26	19.7	2.9	54.8
Potamogeton crispus (curly-leaf pondweed)	6	4.4	1.3	5.9
Potamogeton pectinatus (Sago pondweed)	20	14.8	2.2	32.6

NOTE: Sampling occurred at 135 sampling sites along 35 transects.

[a]*The percent frequency of occurrence is the number of occurrences of a species divided by the number of samplings 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.*

[b]*The average density is the sum of density ratings for a species divided by the number of sampling points with vegetation. The maximum density possible of 4.0 is assigned to plants that occur at all four points sampled at a given depth and is an indication of how abundant a particular plant is throughout a lake.*

[c]*The importance value is the product of the relative frequency of occurrence and the average density, expressed as a percentage. This number provides an indication of the dominance of a species within a community.*

Source: SEWRPC.

Table 10

AQUATIC PLANT SPECIES OBSERVED IN RICE LAKE: 2008

Aquatic Plant Species	Number of Sites Found	Frequency of Occurrence[a]	Relative Density[b]	Importance Value[c]
Ceratophyllum demersum (coontail)	31	44.9	2.7	121.7
Chara vulgaris (muskgrass)	1	1.5	3.0	4.4
Myriophyllum sibiricum (northern water milfoil)	7	10.1	1.1	11.6
Myriophyllum spicatum (Eurasian water milfoil)	16	23.2	1.8	42.0
Polygonum amphibian (water smartweed)	6	8.7	2.3	20.3
Potamogeton pectinatus (Sago pondweed)	2	2.9	4.0	11.6
Potamogeton zosteriformis (flat-stem pondweed)	3	4.4	1.0	4.4

NOTE: Sampling occurred at 69 sampling sites along 18 transects.

[a]*The percent frequency of occurrence is the number of occurrences of a species divided by the number of samplings 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.*

[b]*The average density is the sum of density ratings for a species divided by the number of sampling points with vegetation. The maximum density possible of 4.0 is assigned to plants that occur at all four points sampled at a given depth and is an indication of how abundant a particular plant is throughout a lake.*

[c]*The importance value is the product of the relative frequency of occurrence and the average density, expressed as a percentage. This number provides an indication of the dominance of a species within a community.*

Source: SEWRPC.

Table 11

POSITIVE ECOLOGICAL SIGNIFICANCE OF AQUATIC PLANT SPECIES PRESENT IN WHITEWATER AND RICE LAKES: 2008

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
Heteranthia dubia (water stargrass)	Provides food and shelter for fish
Myriophyllum sibiricum (northern water milfoil)	Provides food for waterfowl, insect habitat and foraging opportunities for fish
Myriophyllum spicatum (Eurasian water milfoil)	None known; nonnative species
Najas flexilis (bushy pondweed)	Stems, foliage, and seeds important wildfowl food and produces good food and shelter for fish
Polygonum amphibium (water smartweed)	Provides food for waterfowl, deer, and muskrat; leaves provide shelter and shade for fish
Potamogeton crispus (curly-leaf pondweed)	Provides some fish and invertebrate habitat during spring and winter, but midsummer die-off can result in release of nutrients and subsequent algae bloom; nonnative species
Potamogeton pectinatus (Sago pondweed)	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish
Potamogeton zosteriformis (flat-stem pondweed)	Provides some food for ducks

NOTE: 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.

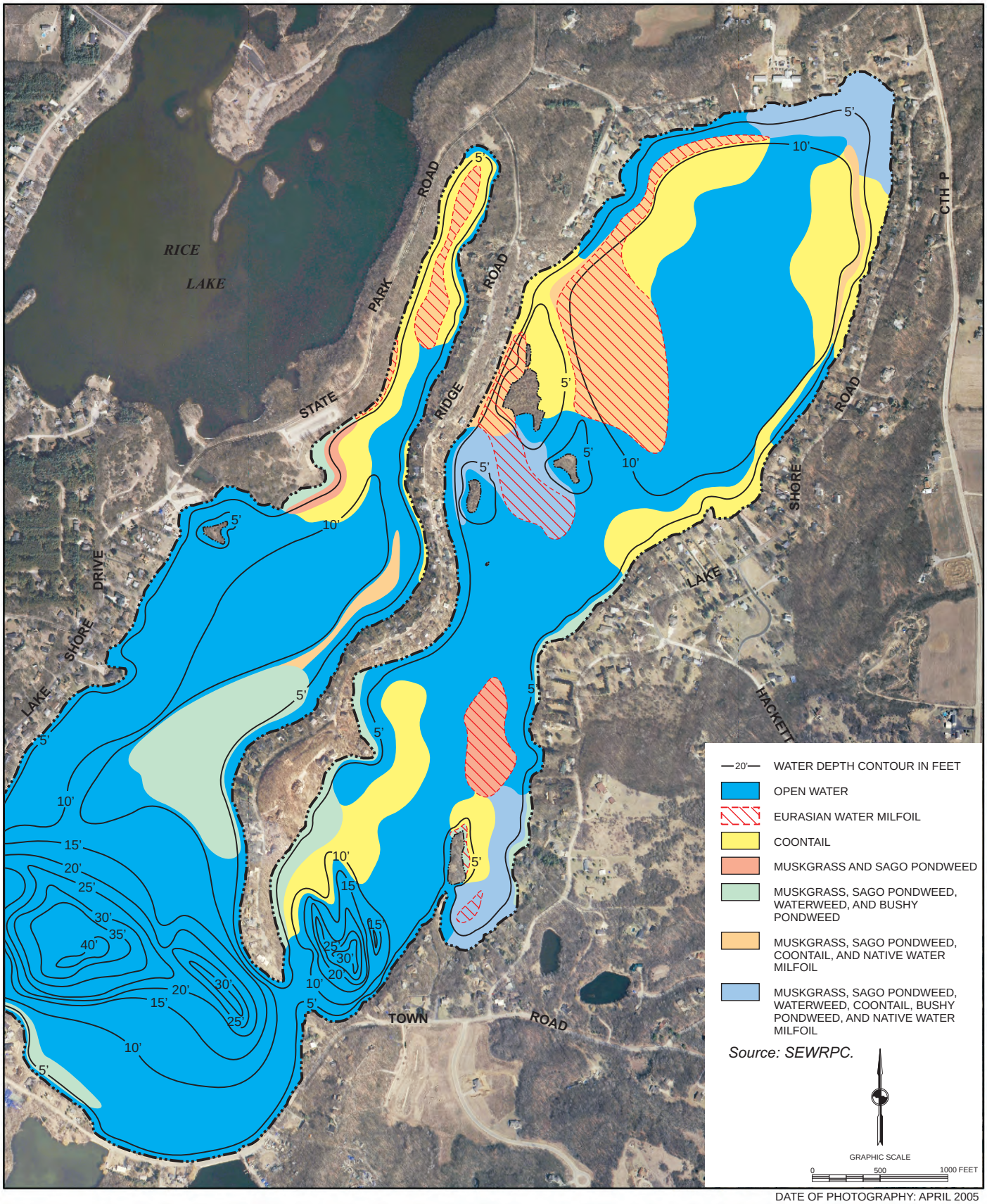
In Rice Lake, the 2008 survey indicated that the dominant aquatic species at the time of the 2008 survey, as shown on Map 10, also was coontail, although fairly significant amounts of Eurasian water milfoil were also present. Other species observed in Rice Lake included water smartweed (*Polygonum amphibian*), Sago pond-weed, northern water milfoil, flat-stem pondweed and muskgrass. Overall, aquatic plant growth was observed to be noticeably less than in other lakes in the area, an observation supported by comments from residents on the Lakes who remarked that plant growth on the Lakes was lower than in past years.

The 2008 aquatic plant survey of Whitewater and Rice Lakes was conducted using the modified Jesson and Lound transect method promulgated by the WDNR and utilized during the Commission's 1995 aquatic plant survey. This methodology, when utilized in successive aquatic plant surveys, allows statistical evaluation of changes in the aquatic plant community within the Lake.[25] A comparison of species and their frequencies of

[25]*Memo from Stan Nichols, to J. Bode, J. Leverence, S. Borman, S. Engel, D., Helsel, entitled "Analysis of Macrophyte Data for Ambient Lakes-Dutch Hollow and Redstone Lakes example," Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension, February 4, 1994.*

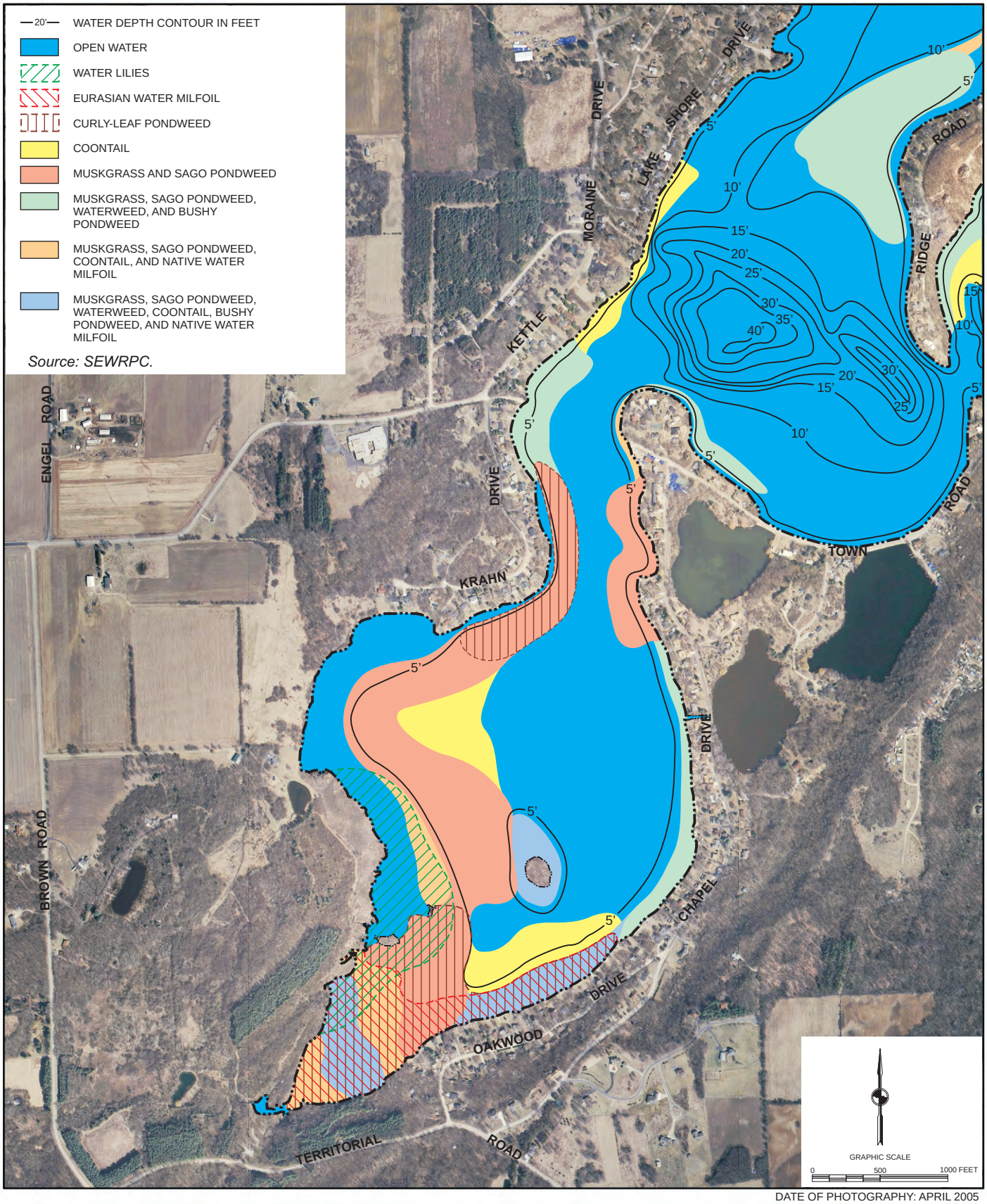
Map 9

AQUATIC PLANT COMMUNITY DISTRIBUTION IN WHITEWATER LAKE: 2008



DATE OF PHOTOGRAPHY: APRIL 2005

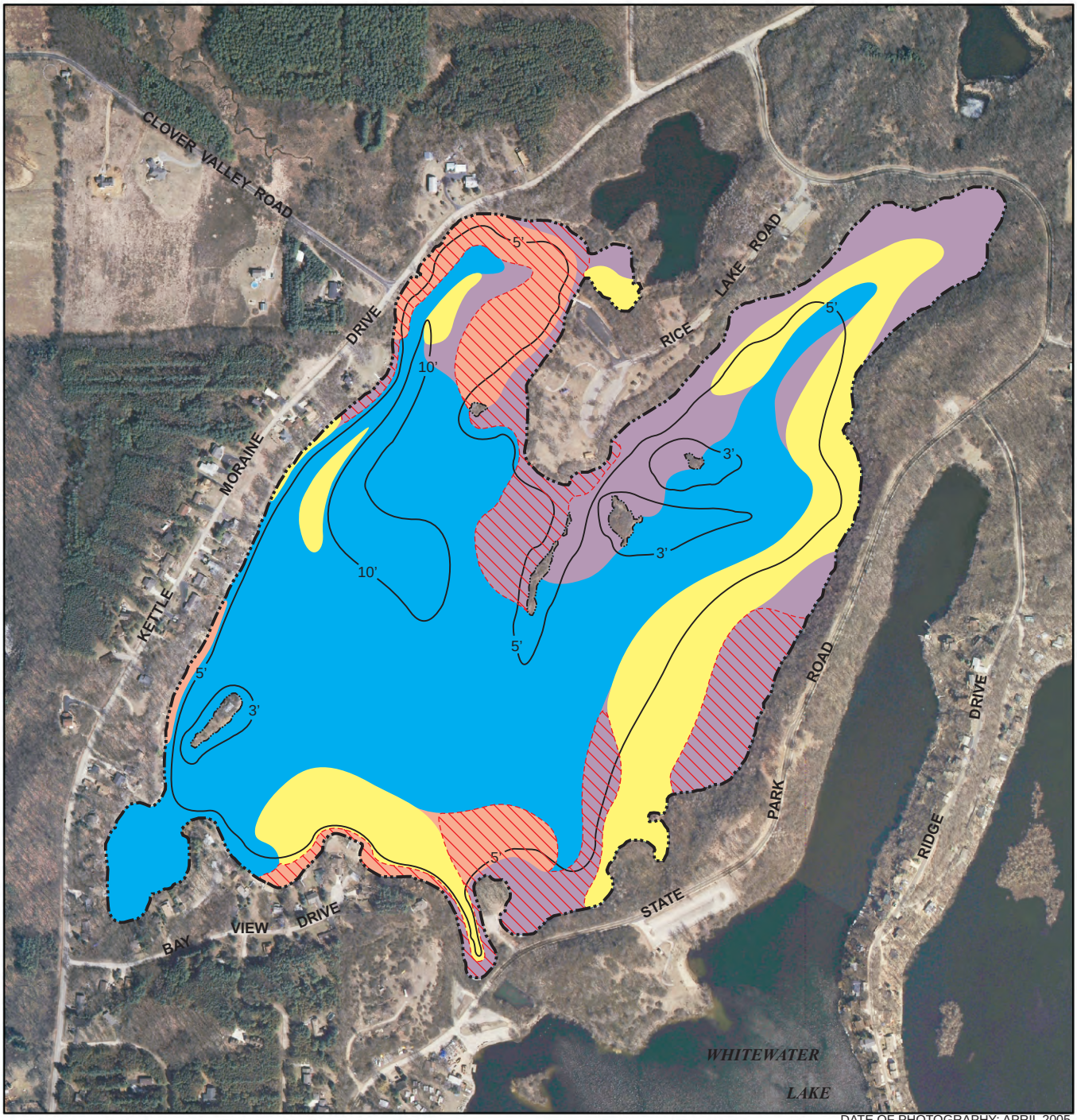
Map 9 (continued)



DATE OF PHOTOGRAPHY: APRIL 2005

Map 10

AQUATIC PLANT COMMUNITY DISTRIBUTION IN RICE LAKE: 2008



DATE OF PHOTOGRAPHY: APRIL 2005

—20'— WATER DEPTH CONTOUR IN FEET

OPEN WATER

EURASIAN WATER MILFOIL

COONTAIL

MUSKGRASS AND SAGO PONDWEED

COONTAIL, MUSKGRASS, SAGO PONDWEED, NATIVE WATER MILFOIL, WATER SMARTWEED, AND FLAT-STEM PONDWEED

GRAPHIC SCALE

0 350 700 FEET

Source: SEWRPC.

Table 12

FREQUENCY OF OCCURRENCE OF MAJOR PLANT SPECIES IN WHITEWATER LAKE: 1995 AND 2008

Aquatic Plant Species Present	Frequency of Occurrence[a]	
	1995	2008
Ceratophyllum demersum (coontail)	55.9	37.0
Chara vulgaris (muskgrass)	10.1	11.1
Elodea canadensis (waterweed)	31.2	1.5
Myriophyllum sibiricum (northern water milfoil)	36.7	5.2
Myriophyllum spicatum (Eurasian water milfoil)	40.4	10.4
Najas flexilis (bushy pondweed)	- -	19.7
Potamogeton crispus (curly-leaf pondweed)	36.7	4.4
Potamogeton pectinatus (Sago pondweed)	1.8	14.8
Potamogeton zosteriformis (flat-stem pondweed)	1.8	- -
Zosterella dubia (water stargrass)	0.9	- -

NOTE: Sampling occurred at 109 sites along 32 transects in 1995; at 135 sites along 35 transects in 2008.

[a]*The percent frequency of occurrence is the number of occurrences of a species divided by the number of samplings 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.*

Source: SEWRPC.

Table 13

FREQUENCY OF OCCURRENCE OF MAJOR PLANT SPECIES IN RICE LAKE: 1995 AND 2008

Aquatic Plant Species Present	Frequency of Occurrence[a]	
	1995	2008
Ceratophyllum demersum (coontail)	41.7	44.9
Chara vulgaris (muskgrass)	2.1	1.5
Elodea Canadensis (waterweed)	12.5	- -
Myriophyllum sibiricum (northern water milfoil)	41.7	10.1
Myriophyllum spicatum (Eurasian water milfoil)	14.6	23.2
Polygonum amphibian (water smartweed)	- -	8.7
Potamogeton crispus curly-leaf pondweed)	66.7	- -
Potamogeton natans (floating-leaf pondweed)	2.1	- -
Potamogeton pectinatus (Sago pondweed)	12.5	2.9
Potamogeton zosteriformis (flat-stem pondweed)	2.1	4.4

NOTE: Sampling occurred at 48 sites along 17 transects in 1995; at 69 sampling sites along 18 transects in 2008.

[a]*The percent frequency of occurrence is the number of occurrences of a species divided by the number of samplings 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.*

Source: SEWRPC.

occurrence observed during the 1995 and 2008 aquatic plant surveys of Whitewater and Rice Lakes is presented in Tables 12 and 13, respectively.

All aquatic plant communities undergo cyclical and periodic changes, which reflect, in part, seasonal changes as well as longer-term changes in response to evolving hydroclimatic conditions within a lake. These latter, inter-annual changes occur over a period of about seven to 11 years, and can reflect changes in long term nutrient

loading and sedimentation rates, climatic patterns, and shifts in species composition. Shorter term seasonal changes in species composition are often manifested in the changing species of pondweeds observed in lakes as the water warms from spring to summer, and cools during the autumnal period. In the case of Whitewater and Rice Lakes, the length of time between the aquatic plant surveys makes it difficult to determine with any certainty whether observed changes in abundance of the various species are seasonal or inter-annual in nature. Follow-up surveys at three- to five-year intervals, utilizing similar sampling methods, could provide data to make such a determination.

Based on the data in Table 12, it would appear that in Whitewater Lake from 1995 to 2008, there was a decrease in the abundance of coontail, waterweed, northern water milfoil, Eurasian water milfoil, and curly-leaf pondweed, although it must be noted that 2008 was reported by residents to be a year of greatly depressed aquatic plant growth throughout Whitewater Lake; there was an increase in Sago pondweed and bushy pondweed over this time, while the amounts of muskgrass, flat-stem pondweed, and water stargrass stayed about the same. Notwithstanding, the 2009 reconnaissance found a similarly sparse aquatic plant population in Whitewater Lake. The reasons for this occurrence are unclear, but may be related to the higher water levels observed during these years; Whitewater Lake was reported to have actively spilled into the channel linking this Lake to Rice Lake during these years, and event that was noted to be intermittent in the comprehensive lake management plan and associated USGS hydrological study.[26]

In Rice Lake, as shown in Table 13, from 1995 to 2008 there was a decrease in waterweed, northern water milfoil, curly-leaf pondweed, and Sago pondweed; over this same time, there was an increase in abundance of Eurasian water milfoil and water smartweed; several species remained at about the same level of abundance, including coontail, muskgrass, and flat-stem pondweed.

Aquatic Plant Species of Special Significance

During the 2008 and earlier aquatic plant surveys on Whitewater and Rice Lakes, several aquatic plant species of special significance were observed: Eurasian water milfoil and curly-leaf pondweed, both of which are nonnative species considered detrimental to the ecological health of the Lake; and, muskgrass, a native species considered to have especially positive impacts on the ecological health of the Lake.

Native Aquatic Plants

As previously mentioned, muskgrass was the one native plant species observed in the 2008 survey and during the earlier aquatic plant surveys of the Lakes that has especially positive ecological value. Muskgrass, a macro-alga, is a favorite waterfowl food source and, as an effective bottom sediment stabilizer, benefits water quality. Its prevalence in the plant communities of a lake may be a significant contributing factor to establishing and maintaining good water quality of a lake and, consequently, in establishing water quality conditions that assist native plant species to successfully compete with nonnative species.

Nonnative Aquatic Plants

Of concern is the presence of the nonnative submergent aquatic plant species, Eurasian water milfoil, reported during the 2008 surveys on both Lakes. Eurasian water milfoil is an invasive plant species capable of explosive growth, resulting in an ability to outcompete important native aquatic plant species, leading to significant ecological disruptions in the aquatic plant community of a lake and degrading water quality and habitat for fish, invertebrates and other wildlife. Eurasian water milfoil and curly-leaf pondweed (*Potamogeton crispus*) are nonnative plants declared to be nuisance species identified in Chapter NR 109 of the *Wisconsin Administrative Code*. Eurasian water milfoil was first reported as being present in the Lake during the 1976 aquatic plant survey, but the growth was limited to only two areas and the amount was sparse in both areas; by 1995, Eurasian water

[26]*SEWRPC Community Assistance Planning Report No. 224,* op. cit.*; U.S. Geological Survey Water-Resources Investigations Report No. 94-4101,* op. cit.

milfoil was found in about 40 percent of the sites sampled on Whitewater Lake and about 15 percent of the sites sampled on Rice Lake; in 2008, a year in which overall plant growth was reported to be less than in years past on Whitewater Lake, Eurasian water milfoil was found in only about 10 percent of the sites in Whitewater Lake but had increased to about 23 percent of the sites sampled in Rice Lake.

Eurasian water milfoil is one of eight milfoil species found in Wisconsin and the only one known to be nonnative or *exotic*. Because of its nonnative nature, Eurasian water milfoil has few natural enemies that can inhibit its growth, which can be explosive under suitable conditions. The plant exhibits this characteristic growth pattern in lakes with organic-rich sediments, or where the lake bottom has been disturbed. It frequently has been reported as a colonizing species following dredging, unless its growth is anticipated and controlled. Eurasian water milfoil populations can 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 remove all vegetation from boats, trailers, and other equipment after removing them from the water and prior to launching in other waterbodies.

Another detrimental aquatic invasive species is curly-leaf pondweed, a plant that thrives in cool water and exhibits a peculiar split-season growth cycle that helps give it a competitive advantage over native plants. In late summer, the plant produces specialized over-wintering structures, or "turions". In late summer, the main body of the plant dies off and drops to the bottom where the turions lie dormant until the cooler fall water temperatures trigger the turions to germinate. Over the winter, the turions produce winter foliage that thrives under the ice. In spring, when water temperatures begin to rise again, the plant has a head start on the growth of native plants and quickly grows to full size, producing flowers and fruit earlier than its native competitors. Because it can grow in more turbid waters than many native plants, protecting or improving water quality is an effective method of control of this species; clearer waters in a lake can help native plants compete more effectively with curly-leaf pondweed.

Biodiversity

A critical element of the ability of an ecosystem, such as a lake, to maintain its ecological integrity is biological diversity. Conserving the biological diversity, or biodiversity, of an ecosystem helps not only to sustain the system, but preserves a spectrum of options for future decisions regarding the management of that system. During 2008, the aquatic plant communities of Whitewater and Rice Lakes demonstrated limited biodiversity, with the aquatic plant flora being comprised of only eight submergent aquatic plant species. Many lakes in the Region have communities of a dozen or more submergent aquatic plants, which provide a range of habitats for fish and other aquatic life.[27] While neither Lake had a high level of biological diversity prior to the 2008 survey, it is likely that the record volumes of precipitation experienced in southeastern Wisconsin during February and June 2008,[28] and the consequent increases in water surface elevations in the Lakes, may have resulted in the depauperate

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[27]*See, for example, SEWRPC Memorandum Report No. 143,* An Aquatic Plant Management Plan for the Lauderdale Lakes, Walworth County, Wisconsin, *August 2001; and, SEWRPC Memorandum Report No. 175,* An Aquatic Plant Management Plan for Lake Wandawega, Walworth County, Wisconsin, *April 2009.*

[28]*Fitzpatrick, F.A.; Peppler, M.C.; Walker, J.F.; Rose, W.J., Waschbusch, R.J., and Kennedy, J.L., U.S. Geological Survey Scientific Investigations Report 2008–5235,* Flood of June 2008 in Southern Wisconsin, *2008.*

aquatic plant community observed during July 2008 and July 2009. High water levels, and especially a rapid increase in water level at the time during which the aquatic plant community was germinating, may have further restricted the area of lakebed available for aquatic plant growth. The additional water volume, which resulted in water flowing over the Whitewater Lake dam during the summers of 2008 and 2009, would have shifted the zone of penetration of sunlight shoreward, into areas where the presence of aquatic plant root stocks and reproductive bodies were not present, reducing the numbers of species observed. The infrequent nature of the discharges over the outlet dam of Whitewater Lake was noted in the comprehensive lake management plan.[29]

Past and Present Aquatic Plant Management Practices

An aquatic plant management program has been carried out on Whitewater and Rice Lakes in a documented manner since 1950. Records of aquatic plant management efforts were first maintained by the WDNR beginning in 1950. Prior to 1950, aquatic plant management interventions are likely, but were not recorded. Currently, all forms of aquatic plant management are subject to permitting by the WDNR pursuant to authorities granted the Department under Chapters NR 107 and NR 109 of the *Wisconsin Administrative Code*.

Aquatic plant management activities in Whitewater Lake currently utilize a combination of mechanical harvesting and chemicals; the aquatic plant management activities in Rice Lake are currently chemical-based. Recorded chemical herbicide treatments that have been applied to Whitewater and Rice Lakes are shown in Tables 14 and 15, respectively.

As shown in Table 14, between 1950 and 1967, Whitewater Lake received a total of 55,920 pounds of sodium arsenite to control perceived nuisance growths of aquatic plants. Sodium arsenite was typically sprayed onto the surface of a lake within an area of up to 200 feet from the shoreline. Treatment typically occurred between mid-June and mid-July. The amount of sodium arsenite used was calculated to result in a concentration of about 10 mg/l sodium arsenite (about five mg/l arsenic) in the treated lake water. The sodium arsenite typically remained in the water column for less than 120 days. Although the arsenic residue was naturally converted from a highly toxic form to a less toxic and less biologically active form, much of the arsenic residue was deposited in the lake sediments. When it became apparent that arsenic was accumulating in the sediments of treated lakes, the use of sodium arsenite was discontinued in the State in 1969.

As shown in Tables 14 and 15, respectively, the aquatic herbicides endothall, diquat and 2,4-D have been applied to Whitewater and Rice Lakes, since 1968. Diquat and endothall are contact herbicides and kill plant parts exposed to the active ingredient. Diquat use is restricted to the control of duckweed (*Lemna* sp.), milfoil (*Mvriophvllum* spp .), and waterweed (*Elodea* sp .). However, this herbicide is nonselective and will kill many other aquatic plants such as pondweeds (*Potamogeton* spp.), bladderwort (*Utricularia* sp.), and naiads (*Naias* spp.). Endothall kills primarily pondweeds and does not control such nuisance species as Eurasian water milfoil (*Mvriophvllum spicatum*). The herbicide 2,4-D is a systemic herbicide which is generally used to control Eurasian water milfoil. 2,4-D is absorbed by the leaves and translocated to other parts of the plant, and is considered to be more selective than other herbicides. However, it will also kill more valuable species, such as water lilies (*Nymphaea* sp. and *Nuphar* sp.), known to be present in the Lakes.

At present, the Whitewater and Rice Lakes Management District holds State permits for chemical and mechanical control of aquatic plants required under Chapters NR 107 and NR 109 of the *Wisconsin Administrative Code*. Chemicals are applied annually on a contractual basis by a licensed local applicator. Herbicide applications usually take place in spring or early summer with, occasionally, a second treatment of a smaller area, if necessary, in late July or early August.

[29] *SEWRPC Community Assistance Planning Report No. 224,* op. cit.

Table 14

CHEMICAL CONTROL OF AQUATIC PLANTS IN WHITEWATER LAKE: 1950-2009

Year	Total Acres Treated	Algae Control			Macrophyte Control				
		Copper Sulfate (pounds)	Blue Vitriol (pounds)	Cutrine or Cutrine Plus (pounds)	Sodium Arsenite (pounds)	2,4-D (gallons)	Diquat (gallons)	Glyphosate (gallons)	Endothall/ Aquathol (gallons)
1950-1969	N/A	55,920	- -	- -	55,920[a]	- -	- -	- -	
1968	N/A	- -	- -	- -	- -	- -	- -	- -	64.2
1969	N/A	- -	- -	- -	- -	- -	- -	- -	150 lbs.
1970	119.0	1,500	- -	- -	- -	- -	- -	- -	45.0
1971	- -	- -	- -	- -	- -	- -	- -	- -	- -
1972	108.0	1,300	- -	- -	- -	- -	- -	- -	- -
1973	137.5	1,895	- -	- -	- -	- -	- -	- -	- -
1974	65.0	1,850	- -	- -	- -	- -	- -	- -	- -
1975	60.0	2,525	- -	- -	- -	- -	- -	- -	- -
1976-1983	- -	- -	- -	- -	- -	- -	- -	- -	- -
1984	8.9	- -	- -	- -	- -	42.5	- -	- -	15.0
1985-1986	- -	- -	- -	- -	- -	- -	- -	- -	- -
1987	0.9	- -	- -	2.0 gal.	- -	- -	- -	- -	2.0
1988	3.4	- -	- -	2.5 gal.	- -	2.0	0.5	- -	1.0
1989	5.6	- -	- -	- -	- -	17.5	- -	- -	- -
1990	40.3	- -	- -	1.0	- -	139.8 + 30.0 lbs.	1.0	- -	- -
1991	39.5	- -	- -	1.0 gal.	- -	236.0	24.8	- -	- -
1992	38.8	- -	- -	- -	- -	151.6	- -	- -	- -
1993	N/A	- -	- -	14.0	- -	5.0	10.0	- -	7.5
1994	- -	- -	- -	- -	- -	- -	- -	- -	- -
1995	26.4	- -	- -	- -	- -	100.5	- -	- -	- -
1996	19.5	- -	- -	- -	- -	70.0 + 550 lbs.	- -	- -	- -
1997	24.1	- -	- -	- -	- -	2,405 lbs.	- -	- -	- -
1998	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1999	41.2	1.2 gal.	- -	- -	- -	2,800 lbs.	1.1	- -	1.1
2000	35.0	- -	- -	- -	- -	3,520 lbs.	- -	- -	- -
2001	29.1	- -	- -	- -	- -	119.0	- -	- -	- -
2002	29.7	12.1 gal.	- -	- -	- -	30.0	12.1	- -	12.1
2003	61.9	28.8 gal.	- -	- -	- -	59.0	28.8	- -	28.8
2004	45.3	7.5 gal.	- -	- -	- -	108.0	7.5	- -	7.5
2005	17.0	- -	- -	- -	- -	1,700 lbs.	- -	- -	- -
2006	48.0	- -	- -	- -	- -	110.0	- -	- -	- -
2007	199.1	- -	- -	- -	- -	698.8 + 3,600 lbs.	- -	- -	- -
2008	164.8	- -	- -	- -	- -	708.3 + 3,600 lbs.	- -	- -	- -
2009	- -	- -	- -	- -	- -	152.7	- -	- -	73.0
Total	- -	64,990 + 49.6 gal.	- -	15.0 + 5.5 gal.	55,920	2,750.7 + 18,205 lbs.	85.8	- -	257.2 + 150 lbs.

[a]55,920 pounds of sodium arsenite ranks as the eleventh greatest amount of this chemical used on any lake in Wisconsin.

Source: Wisconsin Department of Natural Resources and SEWRPC.

In addition to the chemical herbicides used to control large aquatic plants, copper sulphate-based algicides also have been applied to both Whitewater and Rice Lakes to control the growths of algae. Like arsenic, copper, the active ingredient in many algicides, including Cutrine® and Cutrine Plus®, may accumulate in the bottom sediments, but generally have fewer undesirable effects on humans and other species.

As stated above, aquatic plant management activities in Whitewater Lake can be categorized primarily as mechanical control, with harvesting being used in concert with an annual herbicide treatment to control aquatic plant growth in the Lake. This dual control approach allows for herbicide use to be minimized and, when synchronized with mechanical harvesting, provides for maximum impact of the harvesting operations. Table 16

Table 15

CHEMICAL CONTROL OF AQUATIC PLANTS IN RICE LAKE: 1950-2009

Year	Total Acres Treated	Algae Control			Macrophyte Control				
		Copper Sulfate (pounds)	Blue Vitriol (pounds)	Cutrine or Cutrine Plus (pounds)	Sodium Arsenite (pounds)	2,4-D (gallons)	Diquat (gallons)	Glyphosate (gallons)	Endothall/ Aquathol (gallons)
1950-1967	- -	- -	- -	- -	- -	- -	- -	- -	- -
1968	N/A	- -	- -	- -	- -	30.0	- -	- -	- -
1969	- -	- -	- -	- -	- -	40.0	- -	- -	- -
1970-1981	- -	- -	- -	- -	- -	- -	- -	- -	- -
1982	11.3	- -	- -	5.0	- -	- -	5.0	- -	5.0
1983	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1984-1990	- -	- -	- -	- -	- -	- -	- -	- -	- -
1991	3.3	- -	- -	- -	- -	8.0	- -	- -	- -
1992	2.7	- -	- -	- -	- -	9.0	- -	- -	- -
1993	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1994	- -	- -	- -	- -	- -	- -	- -	- -	- -
1995	3.3	- -	- -	- -	- -	16.5	- -	- -	- -
1996	3.3	5.0 gal.	- -	- -	- -	- -	5.0	- -	5.0
1997	3.3	- -	- -	- -	- -	350 lbs.	- -	- -	- -
1998	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1999	9.0	- -	- -	- -	- -	900 lbs.	- -	- -	- -
2000	35.0	- -	- -	- -	- -	3,550 lbs.	- -	- -	- -
2001	1.0	- -	- -	- -	- -	- -	1.0	- -	1.0
2002	6.8	2.0 gal.	- -	- -	- -	16.0	2.0	- -	2.0
2003	5.0	1.3 gal.	- -	- -	- -	9.0	1.3	- -	1.3
2004	7.0	- -	- -	- -	- -	20.0	- -	- -	- -
2005	9.2	- -	- -	- -	- -	27.5	- -	- -	- -
2006	14.0	- -	- -	- -	- -	35.0	- -	- -	- -
2007	16.7	- -	- -	- -	- -	91.8	- -	- -	- -
2008	8.7	- -	- -	- -	- -	48.0	- -	- -	- -
2009	- -	- -	- -	- -	- -	36.7	- -	- -	- -
Total	- -	8.3 gal.	N/A	5.0	N/A	387.5 + 4,800 lbs.	14.3	N/A	14.3

Source: Wisconsin Department of Natural Resources and SEWRPC.

lists the number of harvester loads of aquatic plants removed from Whitewater Lake from 1994 through 2008. The drop in the number of harvester loads of plants removed from Whitewater Lake in 2007 and 2008 is consistent with the observations by Commission staff regarding the paucity of aquatic plants in the Lake at the time of the 2008 aquatic plant survey. The WDNR reports that, in 2007, approximately 741 tons of Eurasian water milfoil were harvested from Whitewater Lake and about 185 tons were harvested from Rice Lake.

FISHERIES AND WILDLIFE

The WDNR reports that, in Whitewater Lake, largemouth bass are considered to be "common", northern pike and walleye are considered to be "present", while panfish are considered to be "abundant"; in Rice Lake, panfish are considered common, while northern pike and largemouth bass are considered present.[30] Currently, the Lake is managed for largemouth bass, northern pike, and panfish. A fisheries survey conducted by the WDNR in 1991 recorded the presence of 17 species of fish representing six families; carp, although known to be present in Whitewater and Rice Lakes, did not represent a significant problem in the Lakes at that time. The most common fish found during this survey were black, brown, and yellow bullheads. Other species sampled included bluegill,

[30]*Wisconsin Department of Natural Resources Publication No. PUB-FH-800 2005,* Wisconsin Lakes, *2005.*

Table 16

NUMBER OF HARVESTER LOADS OF AQUATIC PLANTS REMOVED FROM WHITEWATER LAKE: 1994-2009

Year	Number of Loads
1994	306
1995	455
1996	469
1997	548
1998	460
1999	641
2000	495
2001	186
2002	334
2003	336
2004	581
2005	496
2006	504
2007	223
2008	79
2009	~42

Source: Whitewater and Rice Lakes Management District and SEWRPC.

largemouth bass, pumpkinseed, black crappie, warmouth, and yellow perch. Stocking of Whitewater Lake with walleye and northern pike has been intermittent since 1980, with known stockings being documented in Table 17. Stocking of fish into Rice Lake has taken place since 1978, as shown in Table 18.

With respect to wildlife, and given the land uses present around the shorelands of the Lake, only smaller animals and waterfowl would be expected to inhabit the Lakeshore areas. Muskrats, beaver, grey and fox squirrels, and cottontail rabbits are likely the most abundant and widely distributed fur-bearing mammals in the immediate riparian areas. Larger mammals, such as the whitetail deer, are likely to be confined to the larger wooded areas and the open meadows found within the tributary area of the Lake.

The Whitewater and Rice Lakes tributary area supports a significant population of waterfowl including mallards, wood duck, and blue-winged teal. During the migration seasons a greater variety of waterfowl may be present and in greater numbers.

Amphibians and reptiles are vital components of the Whitewater and Rice Lakes ecosystem, and include frogs, toads, and salamanders, and turtles and snakes, respectively. About 14 species of amphibians and 16 species of reptiles would normally be expected to be present in the Whitewater and Rice Lakes area.

WDNR-Designated Sensitive Areas

Within or around lakes, the WDNR identifies sites that have special importance biologically, historically, geologically, ecologically, or even archaeologically. Areas are identified as Sensitive Areas pursuant to Chapter NR 107 of the *Wisconsin Administrative Code* after a comprehensive examination and study is completed by WDNR staff from many different disciplines and fields of study. Sensitive areas are areas of aquatic vegetation identified by the WDNR as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water. Currently, there are no WDNR-designated Sensitive Areas in Whitewater and Rice Lakes.

SEWRPC-Designated Critical Species Habitat

Within the drainage area tributary to the Lakes, SEWRPC has identified important natural and critical species habitat areas.[31] In the vicinity of Whitewater and Rice Lakes, the following areas have been identified as containing intact native plant and animal communities of local significance, as shown on Map 11:

1. Rice Lake Dry Prairie: A WDNR-owned, one-acre small dry prairie remnant has been designated as NA-3, indicating it to be an area of local significance;

[31]*SEWRPC Planning Report No. 42*, A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, *September 1997.*

Table 17

FISH STOCKED INTO WHITEWATER LAKE

Year	Species Stocked	Number	Average Fish Length (inches)
1980	Northern pike	1,100,000	Fry
1985	Walleye[a]	3,700	3.00
1987	Walleye[b]	29,000	2.00-5.00
1988	Walleye[a]	9,000	4.00
1989	Walleye[b]	12,267	1.00-14.00
1991	Northern pike[a]	1,000	3.00-4.00
1991	Walleye	20,000	2.00-3.00
1992	Northern pike[a]	2,500	3.50
1993	Walleye	1,500	7.00
1994	Northern pike	1,280	7.50
1995	Walleye[a]	3,000	6.00
1997	Walleye	8,000	2.70
1999	Walleye	64,000	2.30
2000	Northern pike	1,280	8.00
2001	Walleye	32,000	1.30
2003	Walleye	32,000	1.80
2005	Walleye	32,000	1.40

[a]*Purchased by the Whitewater and Rice Lake Management District.*

[b]*The walleye stocked in 1987, and 11,500 walleye stocked in 1989 were cooperatively raised by the Wisconsin Department of Natural Resources and the Whitewater and Rice Lakes Management District.*

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table 18

FISH STOCKED INTO RICE LAKE

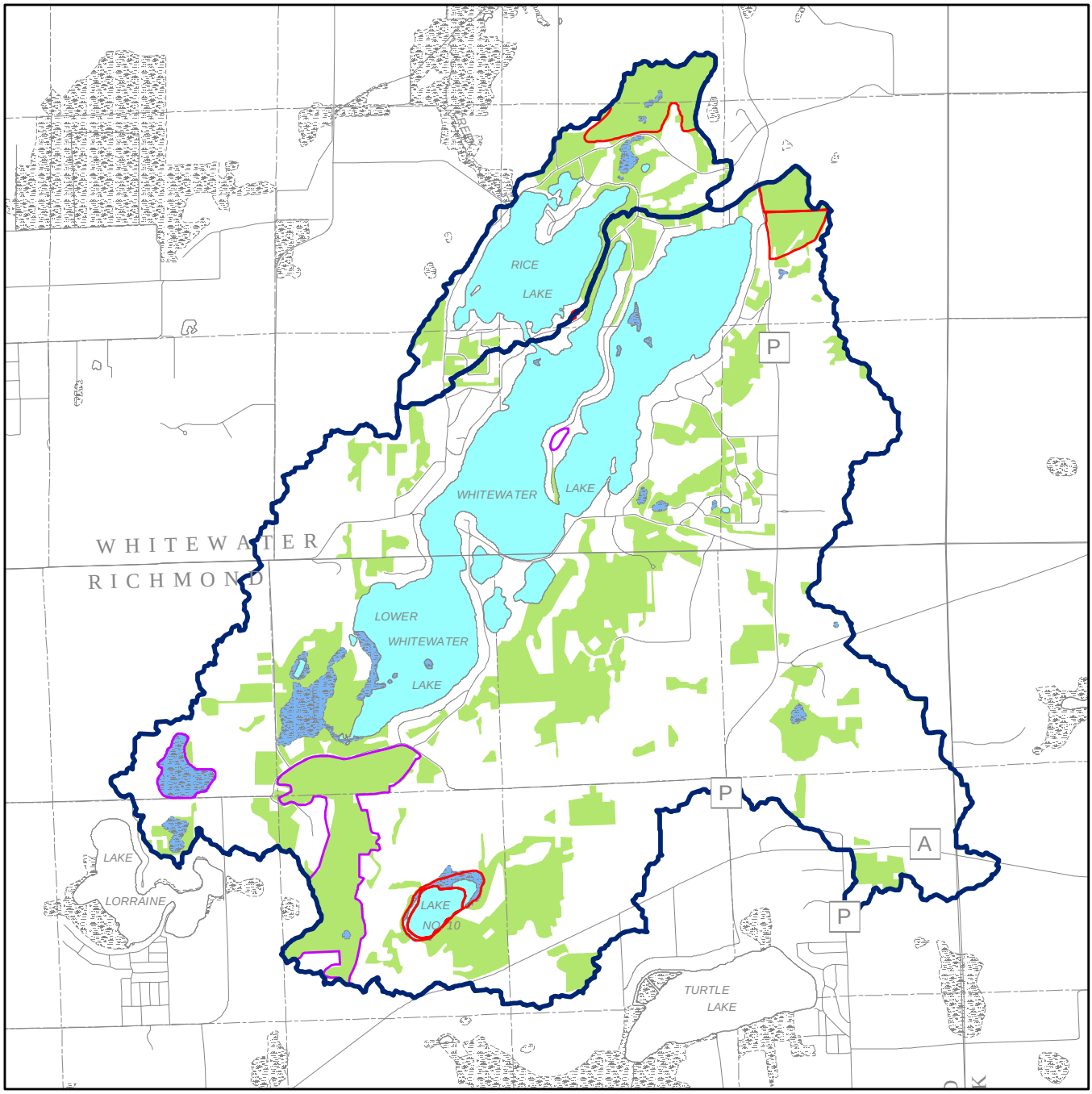
Year	Species Stocked	Number	Average Fish Length (inches)
1978	Northern pike	428,000	N/A
1978	Walleye	300,000	N/A
1982	Northern pike	270	9.00
1985	Northern pike	270	8.00
1989	Walleye	4,000	2.50
1991	Northern pike	600	8.00
1991	Northern pike[a]	500	3.50
1992	Northern pike	270	8.20
1994	Northern pike	274	7.50
1999	Northern pike	274	7.20
2001	Northern pike	137,000	N/A
2001	Northern pike	342	7.60
2005	Northern pike	342	8.50

[a]*Purchased by the Whitewater and Rice Lakes Management District.*

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map 11

NATURAL AREAS WITHIN THE AREA TRIBUTARY TO WHITEWATER AND RICE LAKES



Source: SEWRPC.

2. Whitewater Oak Woods: A partially WDNR-owned and privately owned, 240-acre xeric oak woodland has been designated as NA-3 (RSH), indicating it to be an area of local significance that supports rare, threatened, or endangered animal or plant species officially designated by the WDNR; and,

3. Whitewater and Rice Lakes: Both Lakes have received a rating of AQ-3(RSH), identifying them as waterbodies of local significance that support rare, threatened, or endangered animal or plant species officially designated by the WDNR.

RECREATIONAL USES AND FACILITIES

As set forth in the regional water quality management plan, Whitewater and Rice Lakes are multi-purpose waterbodies serving a variety of recreational and other uses.[32] Active recreational uses include boating, waterskiing, swimming, and fishing during the summer months, and cross-country skiing, snowmobiling, and ice-fishing during the winter. Public access to Whitewater Lake and Rice Lake is provided by WDNR-owned and operated paved launch facilities, both with paved parking areas. The Whitewater Lake launch site is located along State Park Road, approximately mid-way along the western shoreline of the Lake; the Rice Lake site is located just off State Park Road, on the peninsula of land located between the northwestern and northeastern lobes of Rice Lake. Whitewater and Rice Lakes currently are deemed to have adequate public access as defined in Chapter NR 1 of the *Wisconsin Administrative Code*. Chapter NR 1 establishes quantitative standards for determining the adequacy of public recreation boating access, and sets maximum and minimum standards based upon available parking facilities for car-top and car-trailer units.

The Lakes are used year-round as visual amenities with walking, bird watching, and picnicking being popular passive recreational uses of these waterbodies. Their locations, lying in the vicinity of the Southern Unit of the Kettle Moraine State Forest and within easy travel distance from the metropolitan areas of Milwaukee and Chicago, make these Lakes, especially Whitewater Lake, popular recreational destinations. Rice Lake is surrounded by the Southern Unit of the Kettle Moraine State Forest on the northern and eastern shorelines and lies within the Whitewater Lake Recreation Area, while Whitewater Lake lies adjacent to the Southern Unit of the Kettle Moraine State Forest on the western shore of the upper basin. Whitewater Lake incorporates a State park with a popular swimming beach along the western shoreline of the Lake's western lobe. Additionally, there is a Walworth County-owned and operated park, Natureland County Park, located at the southern tip of Whitewater Lake.

As part of the previous study, a WDNR rating used to characterize the recreational value of inland lakes was presented for the Lakes. Under this rating system, Whitewater Lake received a total of 47 out of a possible 72 points, indicating that moderately diverse recreational opportunities are provided by the Lake. Favorable features included the healthy fishery and boating opportunities provided; unfavorable features included relatively poor water quality and abundant aquatic macrophyte growth. A similar rating for Rice Lake indicated that it would receive a total of 43 points out of a possible 72, indicating that moderately diverse recreational opportunities are provided by that lake.

During the current study, boat surveys were conducted on Whitewater and Rice Lakes during the summer of 2008. At that time, about 970 boats were observed to be either moored in the water or stored on land in the shoreland areas around Whitewater Lake, and about 96 boats were observed similarly around Rice Lake, as shown in Table 19. On Whitewater Lake, 614 watercraft, or about 63 percent, of all watercraft observed moored or stored were motorized; of the motorized watercraft, power boats represented the largest group, with pontoon boats and personal watercraft the next most common categories, followed by fishing boats. Of the nonmotorized watercraft

[32] *SEWRPC Planning Report No. 30,* op.cit. *See also SEWRPC Memorandum Report No. 93,* op.cit.

Table 19

WATERCRAFT DOCKED OR MOORED ON WHITEWATER AND RICE LAKES: 2008[a]

Lake	Type of Watercraft									
	Powerboat	Fishing Boat	Pontoon Boat	Personal Watercraft	Canoe	Sailboat	Kayak	Paddle Boat	Row Boat	Total
Whitewater	258	46	205	105	87	36	92	82	59	970
Rice	10	2	16	2	20	1	13	17	15	96

[a]*Including trailered watercraft and watercraft on land observable during survey.*

Source: SEWRPC.

observed, kayaks, paddleboats, and canoes represented the most common types on the Lake, followed by rowboats and finally sailboats. On Rice Lake, about 30 of the 96 watercraft observed were motorized with pontoon boats comprising the largest category; on the nonmotorized watercraft, canoes, paddleboats, rowboats, and kayaks represented the largest groups. The types of watercraft found on the Lakes included power boats, fishing boats, pontoon boats, personal watercraft ("jetskis"®), canoes, sailboats, kayaks, paddleboats, and rowboats.

The types of motorized watercraft docked or moored on a lake, as well as the relative proportion of nonmotorized to motorized watercraft, reflect the attitudes of the primary users of the lake, the lake residents. Only about 31 percent of the watercraft on Rice Lake were motorized compared to about 63 percent of the watercraft on Whitewater Lake. Additionally, of the watercraft on Whitewater Lake, powerboats made up the largest proportion, comprising almost 27 percent, whereas, on Rice Lake, powerboats comprise only about 10 percent of all watercraft. On Rice Lake, the largest category of all watercraft was canoes, which comprised about 21 percent of all watercraft.

To assess the degree of recreational boat use on a lake, it has been estimated that, in southeastern Wisconsin, the number of watercraft operating on a lake at any given time is between 2 percent and 5 percent of the total number of watercraft docked and moored. On Whitewater Lake, this would amount to between 19 and 49 boats of all kinds, about two-thirds of which could be expected to be motorized; on Rice Lake, this would amount to between two and five boats, about one-third of which could be expected to be motorized.

The definition of what constitutes optimal boating density, or the numbers of acres of open water available in which to operate a boat on a lake, has evolved over time. For example, the regional park and open space plan suggested an area of 40 acres per boat as the minimum area necessary for safe operation of fast boats and for waterskiing.[33] The estimates of the densities of boats capable of high speeds on Whitewater and Rice Lakes, based on the counts of watercraft docked or moored around the Lake, would produce boating densities generally consistent with this guideline. Currently, State standards for recreational watercraft access are set forth in Chapter NR 1 of the *Wisconsin Administrative Code*, which establishes a minimum and maximum number of car-trailer unit parking spaces for lakes. For Rice Lake, these standards would require between five and 10 car-trailer unit parking spaces, plus one handicapped accessible space, and, for Whitewater Lake, these standards would require between 18 and 33 car-trailer unit parking spaces, plus at least one handicapped accessible space. Both Lakes have been deemed by the WDNR to have adequate public recreational boating access.

[33]*See SEWRPC Planning Report No. 27,* A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000, *November 1977.*

Table 20

WATERCRAFT IN USE ON WHITEWATER LAKE: 2008

Date and Time	Powerboat	Pontoon Boat	Fishing Boat	Personal Watercraft	Sailboat	Canoe/ Kayak	Wind Surf Board	Paddle Boat	Total
Sunday, August 17									
9:30 a.m. to 10:30 a.m.	7	5	12	0	1	7	0	2	34
1:30 p.m. to 2:30 p.m.	10	3	3	4	0	0	0	2	22
Thursday, August 7									
9:30 a.m. to 10:30 a.m.	7	6	13	0	1	7	0	2	36
1:30 p.m. to 2:30 p.m.	10	3	3	4	0	0	0	2	22
Tuesday, August 26									
10:00 a.m. to 11:00 a.m.	4	3	3	0	0	4	0	1	15
1:30 p.m. to 2:30 p.m.	1	2	4	3	0	0	0	0	10

Source: SEWRPC.

Table 21

WATERCRAFT IN USE ON RICE LAKE: 2008

Date and Time	Powerboat	Pontoon Boat	Fishing Boat	Personal Watercraft	Sailboat	Canoe/ Kayak	Wind Surf Board	Paddle Boat	Total
Sunday, August 17									
9:00 a.m. to 9:30 a.m.	0	0	0	0	0	0	0	0	0
1:00 p.m. to 1:30 p.m.	4	0	2	0	0	0	0	0	6
Thursday, August 7									
9:00 a.m. to 9:30 a.m.	0	0	0	0	0	0	0	0	0
1:00 p.m. to 1:30 p.m.	0	0	1	0	0	0	0	0	0
Tuesday, August 26									
9:30 a.m. to 10:00 a.m.	0	0	1	0	0	0	0	0	1
1:00 p.m. to 1:30 p.m.	0	0	0	0	0	0	0	0	0

Source: SEWRPC.

Another way to assess the degree of recreational boat use on a lake is through direct counts of boats actually in use on a lake at a given time. During 2008, surveys to assess the types of watercraft in use on a typical summer week day and a typical summer weekend day were conducted by Commission staff. The results of these surveys are shown in Tables 20 and 21 for Whitewater and Rice Lakes, respectively. As shown in these tables, power boats and fishing boats were the most popular types of watercraft in use on Whitewater and Rice Lakes during weekdays and weekends. Whitewater Lake especially experiences heavy use by recreational boaters during open-water periods.

On Whitewater Lake, pontoon boats, kayaks, and canoes were also popular types of watercraft in use, with mornings being an especially popular time for kayaking. Based on counts of boats actually in use during mornings and afternoons, both on week days and weekend days, the density of watercraft capable of high-speed on Whitewater Lake ranged from one boat for every 34 acres to one boat for each 49 acres. Rice Lake had much less watercraft activity in general than Whitewater Lake on the observation dates. In general, the high-speed watercraft densities observed on Whitewater and Rice Lakes are within those considered appropriate for the conduct of safe high-speed boating activities. It is noted, however, that the higher degree of boating activity that often occurs on regional lakes during holiday weekends may produce high-speed boating densities that temporarily exceed the guideline values.

Table 22

RECREATIONAL USE IN/ON WHITEWATER LAKE: 2008

Date and Time	Weekend Participants									
	Fishing from Shoreline	Pleasure Boating	Skiing/ Tubing	Sailing	Operating Personal Watercraft	Swimming	Fishing from Boats	Canoeing/ Paddle Boating	Park Goers	Total
Sunday, August 17										
9:30 a.m. to 10:30 a.m.	0	15	27[a]	0	6	4	18	7	4	81
1:30 p.m. to 2:30 p.m.	2	53	49	2	9	89	8	2	20	234
Total for the Day	2	68	76	2	15	93	26	9	24	315
Percent	1	22	24	1	5	31	8	3	5	100

Date and Time	Weekday Participants									
	Fishing from Shoreline	Pleasure Boating	Skiing/ Tubing	Sailing	Operating Personal Watercraft	Swimming	Fishing from Boats	Canoeing/ Paddle Boating	Park Goers	Total
Thursday, August 7										
9:30 a.m. to 10:30 a.m.	7	8	10	4	0	12	28	10	5	84
1:30 p.m. to 2:30 p.m.	3	20	29	0	4	54	6	4	15	135
Total for the Day	10	28	39	4	4	66	34	14	20	219
Percent	5	13	18	2	2	29	16	6	9	100
Tuesday, August 26										
10:00 a.m. to 11:00 a.m.	5	8	6	0	0	1	8	6	0	34
1:30 p.m. to 2:30 p.m.	2	21	0	0	6	7	10	0	30	76
Total for the Day	7	29	6	0	6	8	18	6	30	110
Percent	6	26	5	0	5	7	17	5	29	100

[a]*This number does not include approximately 25 members of a local water-ski club that practice from about 9:00-11:00 a.m. just offshore at the State park on Sunday mornings from May through Labor Day.*

Source: SEWRPC.

Tables 22 and 23, respectively, show how people were using Whitewater and Rice Lakes on a typical summer week day and a typical summer weekend in 2008. On Whitewater Lake, the most popular weekday recreational activities included swimming, pleasure boating, water skiing and tubing, and fishing from boats. Visiting the Southern Unit of the Kettle Moraine State Forest, which accounted for the vast majority of people swimming, also was a popular weekday activity. On Rice Lake, the most popular weekday activities included visiting the State Forest and fishing from shore, an activity mostly occurring in the State Forest on the two Lakes. Fishing from boats also was a popular activity on Rice Lake during the week. The most popular weekend recreational activities observed on Whitewater Lake were swimming—again, almost exclusively at the State Forest—as well as pleasure boating and waterskiing and tubing, as shown in Table 22. The most popular weekend activities on Rice Lake included going to the State Forest, water skiing and tubing, and fishing from boats, as shown in Table 23.

LOCAL ORDINANCES

Recreational boating activities on Whitewater and Rice Lakes are subject to a boating ordinance drafted mutually by the Town of Whitewater and the Town of Richmond. This ordinance is presented as Appendix B.

In addition, the Towns of Richmond and Whitewater have adopted the Walworth County ordinances with regard to general zoning, subdivision control ordinances, floodland zoning, shoreland or shoreland-wetland zoning, as set forth in Table 24. With regard to construction site erosion control/stormwater management controls, the Town of Whitewater has adopted the Walworth County ordinance, while the Town of Richmond administers one- and two-family erosion control regulations locally, other than within shoreland areas where the County ordinance is applicable.

Table 23

RECREATIONAL USE IN/ON RICE LAKE: 2008

Date and Time	Weekend Participants									
	Fishing from Shoreline	Pleasure Boating	Skiing/ Tubing	Sailing	Operating Personal Watercraft	Swimming	Fishing from Boats	Canoeing/ Paddle Boating	Park Goers	Total
Sunday, August 17										
9:00 a.m. to 9:30 a.m.	0	0	0	0	0	0	0	0	0	0
1:00 p.m. to 1:30 p.m.	0	2	17	0	0	2	4	0	12	37
Total for the Day	0	2	17	0	0	2	4	0	12	37
Percent	0	5	47	0	0	5	11	0	32	100

Date and Time	Weekday Participants									
	Fishing from Shoreline	Pleasure Boating	Skiing/ Tubing	Sailing	Operating Personal Watercraft	Swimming	Fishing from Boats	Canoeing/ Paddle Boating	Park Goers	Total
Thursday, August 7										
9:00 a.m. to 9:30 a.m.	0	0	0	0	0	0	0	0	0	0
1:00 p.m. to 1:30 p.m.	0	0	0	0	0	0	2	0	5	7
Total for the Day	0	0	0	0	0	0	2	0	5	7
Percent	0	0	0	0	0	0	29	0	71	100
Tuesday, August 26										
9:30 a.m. to 10:00 a.m.	3	0	0	0	0	0	2	0	3	8
1:00 p.m. to 1:30 p.m.	2	0	0	0	0	0	0	0	6	8
Total for the Day	5	0	0	0	0	0	2	0	9	16
Percent	31	0	0	0	0	0	13	0	56	100

Source: SEWRPC.

Table 24

LAND USE REGULATIONS WITHIN THE AREA TRIBUTARY TO WHITEWATER AND RICE LAKES IN WALWORTH COUNTY BY CIVIL DIVISION: 2007

Community	Type of Ordinance				
	General Zoning	Floodland Zoning	Shoreland or Shoreland-Wetland Zoning	Subdivision Control	Construction Site Erosion Control and Stormwater Management
Walworth County.....	Adopted	Adopted	Adopted and Wisconsin Department of Natural Resources approved	Adopted	Adopted
Town of Richmond.....	County ordinance	County	County	County ordinances	- -[a]
Town of Whitewater	County ordinance	County	County	County ordinances	County

[a]*The Town of Richmond administers one- and two-family erosion control regulations locally, other than within shoreland areas, where the County is responsible for enforcement.*

Source: SEWRPC.

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Chapter III

ALTERNATIVE AND RECOMMENDED AQUATIC PLANT MANAGEMENT PRACTICES

INTRODUCTION

Whitewater and Rice Lakes generally contained a relatively sparse submergent aquatic plant community during the current study period. While this aquatic plant community appears to be capable of supporting a warmwater fishery, albeit with periodic stocking required, some areas of the Lakes suffered from impaired recreational boating opportunities and other diminished lake-oriented activities due to a localized overabundance of aquatic macrophytes. For example, in those areas of the Lakes where Eurasian water milfoil (*Myriophyllum spicatum*) is abundant, certain recreational uses may be limited, the aesthetic quality of the Lake impaired, and in-lake habitat degraded. The plant primarily interferes with recreational boating activities by encumbering propellers, 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. Thus, without control measures, these areas can become problematic to navigation, fishing, and swimming. Many of the aquatic plant management measures set forth in the comprehensive lake management plan for Whitewater and Rice Lakes were targeted toward minimizing these concerns.[1]

In contrast, native aquatic plants, generally found at slightly deeper depths, pose fewer potential problems for navigation, swimming, and fisheries, and generally have attributes that sustain a healthy fishery. Many native aquatic plants provide fish habitat and food resources, and offer shelter for juvenile fishes and young-of-the-year fish. However, over-abundant populations of nonnative aquatic plants, such as Eurasian water milfoil, can impede the growths of these beneficial native plants. For this reason, some form of aquatic plant management in the Lakes is warranted.

In this chapter, alternative and recommended actions for the management of aquatic plants in Whitewater and Rice Lakes are presented. These measures are focused primarily on those measures which can be implemented by the Whitewater and Rice Lakes Management District (WRLMD), with lesser emphasis given to those measures which are applicable to other agencies having jurisdiction within the area tributary to the Lake. The management measures set forth below update and refine the aquatic plant management plan elaborated as Appendix C of the aforereferenced comprehensive lake management plan for Whitewater and Rice Lakes published in 1997.

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[1]*See SEWRPC Community Assistance Planning Report No. 224,* A Lake Management Plan for Whitewater and Rice Lakes, Walworth County, Wisconsin*, February 1997.*

AQUATIC PLANT MANAGEMENT MEASURES

As stated in Chapter II of this report, aquatic plant management activities in Whitewater and Rice Lakes can be categorized as limited, with harvesting being used in concert with an annual herbicide treatment to control aquatic plant growth in the Lakes. This dual control approach allows for herbicide use to be minimized and, when synchronized with mechanical harvesting, provides for maximum impact of the harvesting operations. In addition, individual householders on Whitewater and Rice Lakes are known to have engaged in manual harvesting and/or limited chemical control of aquatic plants in the vicinities of their piers and docks. All such actions require permits issued by the Wisconsin Department of Natural Resources (WDNR) pursuant to authorities set forth in Chapters NR 107 and NR 109 of the *Wisconsin Administrative Code*. For this reason, the shoreland and aquatic plant management elements considered in this plan are consistent with the permitting provisions of Chapters NR 107 and NR 109 of the *Wisconsin Administrative Code,* with the requirements of Chapters NR 1, NR 7 and NR 103 of the *Wisconsin Administrative Code* governing the management of recreational boating activities and shorelands adjacent to the waters of the State, and with Chapters NR 40 and NR 198 of the of the *Wisconsin Administrative Code* governing the control of nonnative aquatic species.

Array of Management Measures

Aquatic plant management measures can be classed into four groups: ***physical measures***, which include lake bottom coverings and water level management; ***biological measures***, which include the use of various organisms, including herbivorous insects and plantings of aquatic plants; ***manual*** and ***mechanical measures***, which include harvesting and removal of aquatic plants; and, ***chemical measures***, which include the use of aquatic herbicides. As noted, all control measures are stringently regulated and require a State of Wisconsin permit; chemical controls are regulated under Chapter NR 107 of the *Wisconsin Administrative Code,* and all other aquatic plant management practices are regulated under Chapter NR 109 of the *Wisconsin Administrative Code*. Placement of bottom covers, a physical measure, also requires a Wisconsin Department of Natural Resources (WDNR) permit under Chapter 30 of the *Wisconsin Statutes*. Each of these groups of aquatic plant management measures are described and discussed further below.

Physical Measures

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. Synthetic materials, such as polyethylene, polypropylene, fiberglass, and nylon, can provide relief from rooted plants for several years. However, such materials, known as bottom screens or barriers, generally have to be placed and removed annually. Such barriers also are susceptible to disturbance by watercraft propellers or the build-up of gasses from decaying plant biomass trapped under the barriers.

In the case of Whitewater and Rice Lakes, the need to encourage native aquatic plant growth while simultaneously controlling the growth of Eurasian water milfoil, suggests that the placement of lake bottom covers as a method to control aquatic plant growth does not appear to be warranted. Thus, such measures are not considered viable for Whitewater and Rice Lakes.

Biological Measures

Biological controls offer an alternative approach to controlling nuisance plants, particularly purple loosestrife (*Lythrum salicaria*), an invasive shoreland wetland plant, and, in some situations, Eurasian water milfoil. Classical biological control techniques have been successfully used to control both nuisance plants with herbivorous insects.[2] Recent evidence shows that *Galerucella pucilla* and *Galerucella calmariensis,* beetle

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[2]*B. Moorman, "A Battle with Purple Loosestrife: A Beginner's Experience with Biological Control,"* LakeLine, *Vol. 17, No. 3, September 1997, pp. 20-21, 34-3; see also, C.B. Huffacker, D.L. Dahlsen, D.H. Janzen, and G.G. Kennedy,* Insect Influences in the Regulation of Plant Population and Communities, *1984, pp. 659-696; and C.B. Huffacker and R.L. Rabb, editors,* Ecological Entomology, *John Wiley, New York, New York, USA.*

species, and *Hylobius transversovittatus* and *Nanophyes brevis*, weevil species, have potential as biological control agents for purple loosestrife.[3] Extensive field trials conducted by the WDNR in the Southeastern Wisconsin Region since 1999 have indicated that these insects can provide effective management of large infestations of purple loosestrife. In contrast, the few studies of Eurasian water milfoil control utilizing *Eurhychiopsis lecontei*, an aquatic weevil species, have resulted in variable levels of control, with little control being achieved on those lakes having extensive motorized boating traffic. Wind and wake action had the effect of washing weevils off the Eurasian water milfoil plants where they were extensively predated upon by fishes.

The use of grass carp, *Ctenopharyngodon idella*, an alternative biological control used elsewhere in the United States, is not permitted in Wisconsin. This voracious herbivore has been shown to denude lakes and ponds of aquatic vegetation, exposing lake bottom sediments to wind erosion and increased turbidity in lakes and ponds, and enhancing the likelihood of occurrence of nuisance algal blooms.

A variation on the theme of biological control is the introduction of aquatic plants into a waterbody as a means of encouraging or stimulating the growth of desirable native aquatic plant species in a lake. While few projects of this nature have been undertaken in the Southeastern Wisconsin Region, the Lac La Belle Management District, in partnership with the WDNR and University of Wisconsin-Milwaukee, did attempt to supplement the aquatic plant community of that Lake by selectively planting pondweeds (*Potamogeton* spp.).[4] Several hundred pondweeds were transplanted into Lac La Belle, and, while there is some evidence that a few of these transplants were successful, the net outcome of the project was disappointing. Few of the introduced plants were observed in subsequent years.[5]

Whitewater Lake was one of the experimental sites used by the WDNR in evaluating the potential role of Eurasian water milfoil weevils as biological control agents. The trial inoculation of the milfoil weevils onto Eurasian water milfoil plants in Whitewater Lake resulted in little effective control of the plants, most likely as a consequence of the weevils being washed off the plants by wind and wake action. Thus, while the use of insects as a means of shoreland wetland plant management is considered to be viable, the use of *Eurhychiopsis lecontei* as a means of aquatic plant management control is not considered a viable option for use on Whitewater and Rice Lakes at this time. Similarly, given the limited aquatic plant habitat present in much of the Whitewater Lake basin as a result of the relatively steeply sloping shorelines, supplemental plantings are not considered to be a viable aquatic plant management option for that Lake.

Manual and Mechanical Measures

The physical removal of specific types of vegetation by harvesting of plants provides a highly effective means of controlling the growths of nuisance aquatic plant species, including purple loosestrife and Eurasian water milfoil. The removal of aquatic plants from the waters of the State, whether by manual or mechanical means, typically requires a State permit pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*.

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[3]*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.*

[4]*Donald H. Les and Glenn Guntenspergen, "Laboratory Growth Experiments for Selected Aquatic Plants, Final Report, July 1989 – June 1990 (Year 1)," Report to the Wisconsin Department of Natural Resources, June 1990; Wisconsin Department of Natural Resources, Environmental Assessment: Improvement of the Water Quality and Fisheries Habitat of LacLaBelle [sic] and the Lower Oconomowoc River, s.d.*

[5]*At the 2003 annual meeting of the Lac La Belle Management District, a citizen reported observing a herbicide application in the vicinity of the planted area of the Lake. Such an application might explain the observed lack of success of this management measure. See SEWRPC Community Assistance Planning Report No. 47, 2nd Edition,* A Water Quality Management Plan for Lac La Belle, Waukesha County, Wisconsin, *May 2007.*

In the nearshore area, specially designed rakes are available to assist in the manual removal of nuisance aquatic plants, such as Eurasian water milfoil. The use of such rakes also provides a safe and convenient method of controlling aquatic plants in deeper nearshore waters around piers and docks. The advantage of the rakes is that they are relatively inexpensive, easy and quick to use, and immediately remove the plant material from the lake, without a waiting period. Removal of the plants from the lake avoids the accumulation of organic matter on the lake bottom, which adds to the nutrient pool that favors further plant growth. State permitting requirements for manual aquatic plant harvesting mandate that the harvested material be removed from the lake. Should the WRLMD acquire a number of these specially designed rakes, they could be made available for the riparian owners to use on a trial basis to test their operability before purchasing them.

Aquatic macrophytes also may be harvested mechanically with specialized equipment consisting of a cutting apparatus, which cuts up to about five feet below the water surface, and a conveyor system that picks up the cut plants. Mechanical harvesting can be a practical and efficient means of controlling plant growth as it removes the plant biomass and nutrients from a lake. Mechanical harvesting is particularly effective as a measure to control large-scale growths of aquatic plants. Narrow channels can be harvested to provide navigational access and "cruising lanes" for predator fish to migrate into the macrophyte beds to feed on smaller fish. The harvesting of water lilies and emergent native plants should be avoided.

Limited manual harvesting of aquatic plants within a 30-foot-wide corridor along a shoreline would be allowed without a WDNR permit, provided the area is outside of any sensitive area designated pursuant to Section NR 107.05(3)(i)1. and provided that any plant material is removed from the Lake pursuant to Section NR 109.06(2). Any other manual harvesting would require a State permit, unless employed in the control of designated nonnative invasive species, such as Eurasian water milfoil or curly-leaf pondweed, where the removal of these plants does not impact native aquatic plants in the waterbody.

"Clear cutting" aquatic plants and denuding the lake bottom of flora, using either manual or mechanical harvesting, should be avoided. However, top cutting of plants, such as Eurasian water milfoil, using mechanical harvesters, as shown in Figure 3, has proven to be beneficial in some lakes as a means of minimizing the competitive advantage of the Eurasian water milfoil plant and encouraging native aquatic plant growths.[6]

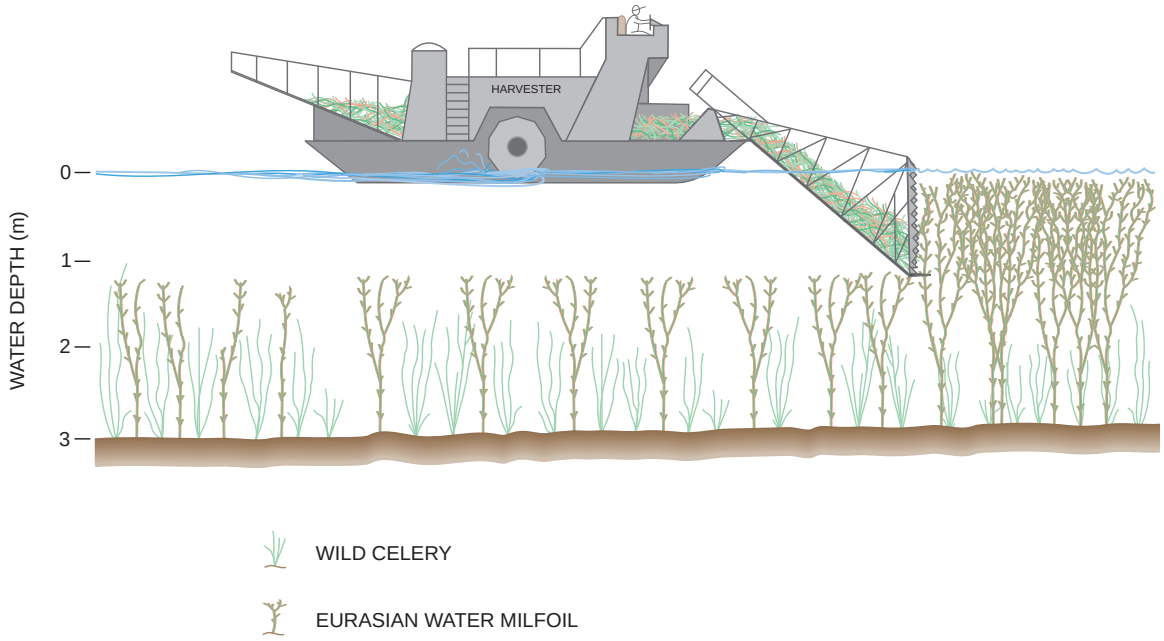
In the shoreland area, where purple loosestrife may be expected to occur, bagging and cutting loosestrife plants prior to the application of chemical herbicides, such as glyphosate, to the cut ends of the stems, can be an effective control measure for small infestations of this plant. Loosestrife management programs, however, should be followed by an annual monitoring and control program for up to 10 years following the initial control program to manage the regrowth of the plant from seeds. Manual removal of such plants is recommended for isolated stands of purple loosestrife when and where they occur.

An advantage of mechanical aquatic plant harvesting is that the harvester typically leaves enough plant material in the lake to provide shelter for fish and other aquatic organisms, and to stabilize the lake bottom sediments. Aquatic plant harvesting also has been shown to facilitate the growth of native aquatic plants in harvested areas by allowing light penetration to the lakebed. Many native aquatic plants are low-growing species that are less likely to interfere with human recreational and aesthetic uses of a lake. A disadvantage of mechanical harvesting is that the harvesting operation may cause fragmentation of plants and, thus, unintentionally facilitate the spread of some plants that utilize fragmentation as a means of propagation, namely Eurasian water milfoil. Harvesting may also disturb bottom sediments in shallower areas where such sediments are only loosely consolidated, thereby increasing turbidity and resulting in deleterious effects, including the smothering of fish breeding habitat and nesting sites. Disrupting the bottom sediments also could increase the risk that an exotic species, such as

[6]*See SEWRPC Memorandum Report No. 143*, An Aquatic Plant Management Plan for the Lauderdale Lakes, Walworth County, Wisconsin, *August 2001*.

Figure 3

PLANT CANOPY REMOVAL WITH AN AQUATIC PLANT HARVESTER



NOTE: Selective cutting or seasonal harvesting can be done by aquatic plant harvesters. Removing the canopy of Eurasian water milfoil may allow native species to reemerge.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Eurasian water milfoil, may colonize the disturbed area since this is a species that tends to thrive under disturbed bottom conditions. To this end, most WDNR-issued permits do not allow harvesting in areas having a water depth of less than three feet. Nevertheless, if done correctly and carefully, harvesting has been shown to be of benefit in ultimately reducing the regrowth of nuisance plants when used under conditions suitable for this method of control.

Mechanical harvesting has been employed on Whitewater and Rice Lakes for a number of years. Both manual and mechanical harvesting techniques continue to be considered as viable options for control of aquatic plants in Whitewater and Rice Lakes. Hand-pulling of stems, where they occur in isolated stands, provides an alternative means of controlling plants, such as Eurasian water milfoil, in the Lake, and purple loosestrife, on the lakeshore. Because this is a more selective measure, the rakes being nonselective in their harvesting, manual removal of Eurasian water milfoil is considered a viable option in Whitewater and Rice Lakes, where practicable and feasible.

Chemical Measures

Chemical treatment with herbicides is a short-term method of controlling heavy growths of nuisance aquatic plants. Chemicals are generally applied to the growing plants in either a liquid or granular form. The advantages of using chemical herbicides to control aquatic macrophytes growth are the relatively low-cost and the ease, speed, and convenience of application. The disadvantages associated with chemical control include unknown long-term effects on fish, fish food sources, and humans; a risk of increased algal blooms due to the eradication of macrophyte competitors; an increase in organic matter in the sediments, possibly leading to increased plant growth, as well as anoxic conditions which can cause fish kills; adverse effects on desirable aquatic organisms; loss of desirable fish habitat and food sources; and, finally, a need to repeat the treatment the following summer

due to existing seed banks and/or plant fragments. Widespread chemical treatments can also provide an advantage to less desirable, invasive, introduced plant species to the extent that such treatments may produce conditions in which nonnative species can outcompete the more beneficial, native aquatic plant species. Hence, this is seldom a feasible management option to be used on a large scale.

To minimize the possible impacts of deoxygenation, loss of desirable plant species, and contribution of organic matter to the sediments, early spring or late fall applications should be considered. Such applications also minimize the concentration and amount of chemicals used due to the facts that colder water temperatures enhance the herbicidal effects, while the application of chemical herbicides during periods when most native aquatic plants species are dormant limit the potential for collateral damage. Use of chemical herbicides in aquatic environments is stringently regulated and requires a WDNR permit and WDNR staff oversight during applications.

Widespread chemical treatment is not considered a viable option for Whitewater and Rice Lakes, although limited chemical control is often a viable technique for the control of the relatively small-scale infestations of aquatic plants, such as Eurasian water milfoil, or shoreland plants, such as purple loosestrife. Continued use of early spring or late fall chemical controls,[7] especially in those shoreline areas where mechanical harvesting would not be deemed viable, targeting growths of Eurasian water milfoil, curly leaf pondweed, and purple loosestrife in and around the Lake, is considered a viable option for Whitewater and Rice Lakes.

Recommended Management Measures

The most-effective plans for managing aquatic plants rely on a combination of methods and techniques, such as those described above. Therefore, to enhance the recreational uses of Whitewater and Rice Lakes, while maintaining the quality and diversity of the biological communities, the following recommendations are made:

- Manual harvesting around piers and docks is the recommended means of controlling nonnative nuisance species of plants in those areas. In this regard, the WRLMD could consider purchasing several specialty rakes designed for the removal of vegetation from shoreline property and make these available to riparian owners. This would allow the riparian owners to use the rakes on a trial basis before purchasing their own. Although the rakes do not require a permit for use along a 30-foot width of shoreline, State requirements for manual aquatic plant harvesting mandate that the harvested material be removed from the lake. Where feasible and practicable, hand-pulling of stems, where they occur in isolated stands, is also recommended as an alternative means of controlling Eurasian water milfoil, curly-leaf pondweed, and purple loosestrife. Manual control should target nonnative species.

- It is recommended that the use of chemical herbicides be limited to controlling nuisance growths of exotic species, particularly Eurasian water milfoil, curly leaf pondweed, and purple loosestrife. It is recommended that chemical applications, if required, be made by licensed applicators in early spring or late fall, subject to State permitting requirements to maximize their effectiveness on nonnative plant species while minimizing impacts on native plant species and acting as a preventative measure to reduce the development of nuisance conditions. Such use should be evaluated annually and the herbicide applied only on an as-needed basis. Only herbicides that selectively control Eurasian water milfoil, such as 2,4-D, should be used;[8] for the control of purple loosestrife, the use of glyphosate

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[7]*Currently, fall applications of aquatic herbicides are considered experimental in Wisconsin. For this reason, such applications are not recommended until and unless they are determined to be a viable means of minimizing the growths of nonnative aquatic plants during the year following the application of the herbicides.*

[8]*2,4-D will also control desirable species, such as* Nymphaea *sp.; see Wisconsin Department of Natural Resources PUBL-WR-236 90,* Chemical Fact Sheet: 2,4-D*, May 1990.*

could be considered for application to the cut stems of the plants after the seed heads have been bagged and cut.[9]

- The use of algicides, such as Cutrine Plus, is not recommended generally because there are few significant, recurring filamentous algal or planktonic algal problems in Whitewater and Rice Lakes and valuable macroscopic algae, such as *Chara* and *Nitella,* are killed by this product.[10] Where and when such growths occur, the use of copper sulphate-based algicides could be considered. Maintenance of shoreland areas around docks and piers remains the responsibility of individual property owners.

- Mechanical harvesting, used in concert with an annual herbicide treatment, should be considered as the primary method of aquatic plant management in Whitewater and Rice Lakes. Due to the nature of the dual approach to aquatic plant control employed on the Lakes, specific control measures are recommended to be applied in various areas of the Lakes, as summarized below.

- Few lakes in southeastern Wisconsin lack aquatic plant growth, and Whitewater and Rice Lakes are no exception. However, some areas of the Lakes could benefit from a greater diversity of native aquatic plants, especially where low-growing plants, such as muskgrass (*Chara* spp.), could provide food and shelter for fish and waterfowl. Because of their low-growing height, these species are often outcompeted by the nonnative Eurasian water milfoil. Eurasian water milfoil grows rapidly to the lake surface, capturing the available sunlight and shading out the native species. Thus, the use of mechanical harvesting of the Eurasian water milfoil canopy to a depth of five to seven feet, as shown in Figure 3, is likely to provide one means of promoting the growth of native plants, and is recommended for Whitewater and Rice Lakes.

- Through informational programming, riparian owners should be encouraged to monitor their shoreline areas, as well as open-water areas of the Lake, for new growths of nonnative nuisance plants and report such growths immediately to the WRLMD so that a timely and effective response can be executed.

- It also is recommended that the WRLMD consider the conduct of in-lake aquatic plant surveys at about three- to five-year intervals, depending upon the observed degree of change in the aquatic plant communities. In addition, information on the aquatic plant control program should be recorded and should include descriptions of major areas of nuisance plant growth and areas chemically treated.

- Additional periodic monitoring of the aquatic plant community is recommended for the early detection and control of future-designated nonnative species that may occur. Such control could be effected with the assistance of funds provided under the Chapter NR 198, aquatic invasive species control grant program, and should be undertaken as soon as possible once the presence of a nonnative, invasive species is observed and confirmed, reducing the risk of spread from waters where they are present and restoring native aquatic communities. Control of currently designated invasive

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[9]*See Wisconsin Department of Natural Resources PUBL-WR-239 90,* Chemical Fact Sheet: Glyphosate, *May 1990.*

[10]*See Wisconsin Department of Natural Resources PUBL-WR-238 90,* Chemical Fact Sheet: Copper Compounds, *May 1990.*

species, designated pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, using appropriate control measures,[11] is recommended throughout the Lake.

ANCILLARY PLAN RECOMMENDATIONS

Shoreline Protection

Shoreline protection measures refer to those management measures designed to reduce and minimize shoreline loss due to erosion by waves, ice, or related action of the water. As was described in Chapter II, currently, most of the shoreline of Rice Lake and a significant portion of the shoreline of Whitewater Lake are in a natural state. Where structural shoreline protection management measures have been installed on the Lakes, most were in a good state of repair and no severe erosion-related problems were observed, although ongoing maintenance of shoreline protection structures is recommended.

Array of Management Measures

Four shoreline erosion control techniques are commonly used: vegetative buffer strips, rock revetments, wooden and concrete bulkheads, and beach. Maintenance of a vegetated buffer strip immediately adjacent to the Lake is the simplest, least costly, and most natural method of reducing shoreline erosion. This technique employs natural vegetation, rather than maintained lawns, in the first five to 10 feet back from the waterline along with the establishment of native emergent aquatic vegetation from the waterline out to two to six feet lakeward. The use of such natural shorescaping techniques is generally required pursuant to Chapter NR 328 of the *Wisconsin Administrative Code*, except in moderate- to high-energy shorelines where more-robust structural approaches may be required. A worksheet is provided within Section NR 328.08 Table 1 as a means of assisting property owners who wish to install or modify existing shoreline protection structures.

Desirable plant species that may be expected and encouraged to form an effective buffer strip, or which could be planted, include arrowhead (*Sagittaria latifolia*), cattail (*Typha* spp.), common reed (*Phragmites communis*), water plantain (*Alisma plantago-aquatica*), bur-reed (*Sparganium eurycarpum*), and blue flag (*Iris versicolor*) in the wetter areas; and jewelweed (*Impatiens biflora*), elderberry (*Sambucus canadensis*), giant goldenrod (*Solidago gigantea*), marsh aster (*Aster simplex*), red-stem aster (*Aster puniceus*), and white cedar (*Thuja occidentalis*) in the drier areas. In addition, trees and shrubs, such as silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), black willow (*Salix nigra*), and red-osier dogwood (*Cornus stolonifera*) could become established. These plants will develop a more extensive root system than lawn grass and the aboveground portion of the plants will protect the soil against the erosive forces of rainfall and wave action. A narrow path to the Lake could be maintained as lake access for boating, swimming, fishing, and other activities. A vegetative buffer strip would also serve to trap nutrients and sediments washing into the Lake via direct overland flow. This alternative would involve only minimal cost.

Rock revetments, or riprap, are a highly effective method of shoreline erosion control applicable to many types of erosion problems, especially in areas of low banks and shallow water. These structures are already in place along a few isolated portions of the shoreline of Rice Lake and in numerous portions of Whitewater Lake. The technique involves the shaping of the shoreline slope, the placement of a porous filter material, such as sand, gravel, or pebbles, on the slope and the placement of rocks on top of the filter material to protect the slope against the actions of waves and ice. The advantages of rock revetments are that they are highly flexible and not readily weakened by movements caused by settling or ice expansion, they can be constructed in stages, and they require little or no maintenance. The disadvantages of rock revetments are that they limit some uses of the immediate

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[11]*Appropriate control measures include, but are not limited to, any permitted aquatic plant management measure, placement of signage, and use of buoys to isolate affected areas of the Lake. Such measures as may be appropriate should be determined in consultation with WDNR staff and conducted in accordance with required permits under Chapters NR 107, NR 109, and NR 198, among others, of the* Wisconsin Administrative Code.

shoreline. The rough, irregular rock surfaces are unsuitable for walking; require a relatively large amount of filter material and rocks to be transported to the lakeshore; and can cause temporary disruptions and contribute sediment to the lake. If improperly constructed, revetments may fail because of washout of the filter material.

Vertical bulkheads, which form barriers to wildlife and amphibians, are not generally recommended. Beaches, and the use of sand blankets for the control of aquatic plants within the shoreland zone, also are not generally recommended, although maintenance of the few existing beach areas on the Lakes is warranted, given the current intensity of use of these areas by the community.

Recommended Management Measures

The use of vegetative buffer strips and riprap, as shown in Figure 4, are recommended measures. These alternatives were selected because they can be constructed, at least partially, by local residents; because most of the construction materials involved are readily available; because the measures would, in most cases, enable the continued use of the immediate shoreline; and because the measures are visually "natural" or "semi-natural" and should not significantly affect the aesthetic qualities of the lake shoreline. In those portions of the Lake subject to direct action of wind waves and ice scour, the use of riprap would provide a more robust means of stabilizing shorelines, while elsewhere along the lakeshore creation of vegetated buffer strips would provide, not only shoreline erosion protection, but also enhanced shoreland habitat for fish and wildlife. In this regard, it should be noted that the selection of appropriate shoreland protection structures is subject to the provisions of Chapter NR 328 of the *Wisconsin Administrative Code*.

Water Quality Management

Water quality is one of the key parameters used to determine the overall health of a waterbody. The importance of good water quality can hardly be underestimated, as it impacts not only various recreational uses of a lake, but also nearly every facet of the natural balances and relationships that exist in a lake between the myriad of abiotic and biotic elements present. Because of the importance water quality plays in the functioning of a lake ecosystem, careful monitoring of this lake element represents a fundamental management tool.

Array of Management Measures

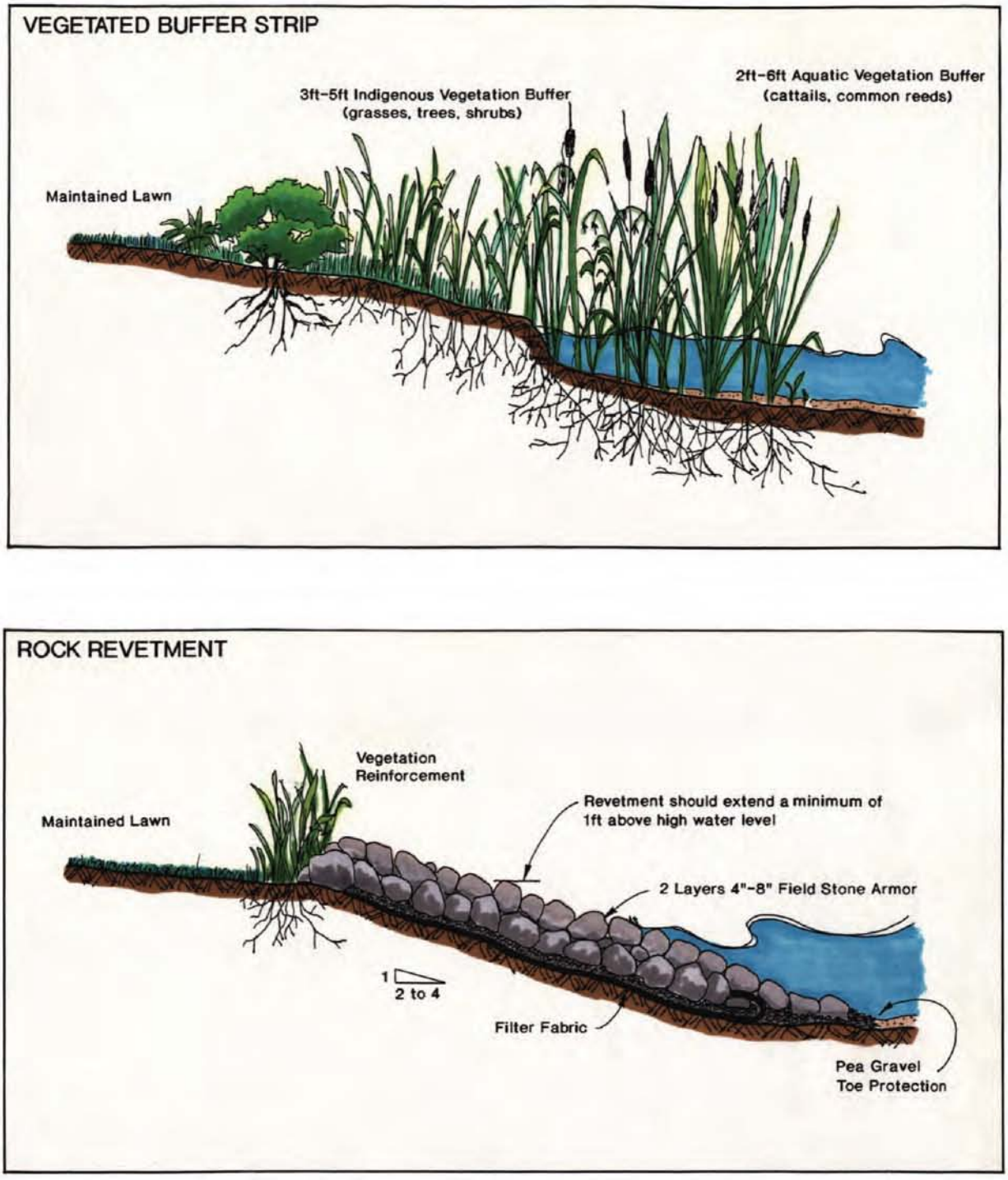
The University of Wisconsin-Extension (UWEX) operates the Citizen Lake Monitoring Network (CLMN), formerly the WDNR Self-Help Monitoring Program. Volunteers enrolled in this program gather data at regular intervals on water clarity through the use of a Secchi disk. Because pollution tends to reduce water clarity, Secchi-disk measurements are generally considered one of the key parameters in determining the overall quality of a lake's water, as well as a lake's trophic status. Secchi-disk measurement data are added to the WDNR-sponsored data base, accessible on-line through the WDNR website, containing lake water quality information for most of the lakes in Wisconsin. This program continues to be implemented on both Lakes.

The UWEX also offers an Expanded Self-Help Monitoring Program that involves collecting data on several key physical and chemical parameters in addition to the Secchi-disk measurements. Under this program, samples of lake water are collected by volunteers at regular intervals and analyzed by the State Laboratory of Hygiene (SLOH). Data collection is more extensive and, consequently, places more of a burden on volunteers. Because of the additional information to be garnered through this expanded program, participation in the expanded program by the Whitewater Lake and Rice Lake citizen volunteers in recommended.

In addition to the UWEX volunteer-based CLMN program, the University of Wisconsin-Stevens Point (UW-SP) also offers several volunteer-conducted water quality sampling programs. Under these latter programs, volunteers collect water samples and send them to the UW-SP Water and Environmental Analysis Laboratory (WEAL) for analysis. The U.S. Geological Survey (USGS) also offers an extensive water quality monitoring program under their Trophic State Index (TSI) monitoring program. The WRLMD has utilized this program in previous years. Under the TSI monitoring program, USGS field personnel conduct a series of approximately five monthly samplings beginning with the spring turnover. Samples are analyzed by the SLOH for an extensive array of physical and chemical parameters.

Figure 4

RECOMMENDED 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.

The basic UWEX CLMN program is available at no charge, but does require volunteers to be committed to taking Secchi disk measurements at regular intervals throughout the spring, summer, and fall. The Expanded Self-Help Program requires additional commitment by volunteers to take a more-extensive array of measurements and samples for analysis, also on a regular basis. The WDNR offers Small Grant cost-share funding within the Chapter NR 190 Lake Management Planning Grant Program that can be applied for to defray the costs of laboratory analysis and sampling equipment. As with any volunteer-collected data, despite the implementation of standardized field protocols, individual variations in levels of expertise due to background and experiential differences, can lead to variations in data and measurements from lake-to-lake and from year-to-year for the same lake, especially when volunteer participation changes. The UW-SP turnover sampling program requires only a once-a-year sampling, thereby requiring a smaller time commitment by the volunteers, but, there is a modest charge for the laboratory analysis, and, because sampling is performed by volunteers, is subject to those variations identified above. Additionally, since samples need to be taken as closely as possible to the actual turnover period, which occurs only during a relatively short window of time, volunteers need to monitor lake conditions as closely as possible to be able to determine when the turnover period is occurring. In contrast, the USGS program does not require volunteer sampling. All sampling and analysis is provided by USGS personnel using standardized field techniques and protocols. As a result, a more standardized set of data and measurements may be expected. However, the cost of the USGS program is significantly higher than the UW-SP program. State cost-share funds may be available to the WRLMD under the Chapter NR 190 Lake Management Planning small grant program.

Recommended Management Measures

It is recommended that the WRLMD continue regular participation in the CLMN program sponsored by the UWEX. Data gathered as part of this program should be presented annually by the volunteers at meetings of the WRLMD, where the citizen monitors could be given some recognition for their work. The Lake Coordinator of the WDNR, Southeast Region, could assist in enlisting more volunteers in this program. The information gained at first-hand by the public from participation in this program can increase the credibility of the proposed changes in the nature and intensity of use to which the Lake is subjected.

It is further recommended that the WRLMD consider participating in one of the other more comprehensive water quality programs: the UWEX Expanded Self-Help Program on an annual basis, or, either the UW-SP WEAL lake sampling program or USGS program on a periodic basis every three to five years. The use of either the UW-SP or USGS programs would be especially valuable as a means to attain a comprehensive water quality determination on a periodic basis while maintaining yearly CLMN data.

Recreational Use Management

As described in Chapter II, recreational boating activities on Whitewater and Rice Lakes are subject to a boating ordinance drafted mutually by the Town of Whitewater and the Town of Richmond. This ordinance is presented as Appendix B.

Current public recreational boating standards as set forth in Sections NR 1.91(4) and NR 1.91(5) of the *Wisconsin Administrative Code*, establish minimum and maximum standards for public boating access development, respectively, to qualify waters for resource enhancement services provided by the WDNR. As noted in Chapter II, there are currently public boating access sites on Whitewater and Rice Lakes, both of which are deemed to provide adequate public access. These sites should continue to be periodically monitored to ensure consistency with public recreational boating access standards.

Recommended Management Measures

Periodic review of boating ordinances governing recreational boating on Whitewater and Rice Lakes should be undertaken by the Towns of Whitewater and Richmond. In addition to the existing public recreational boating access, it is recommended that appropriate signage at the public recreational boating access sites be provided to alert users of Eurasian water milfoil, zebra mussels, and other nonnative invasive species. Such information should also be included in the WRLMD informational programming, consistent with the aquatic plant management measures set forth in this plan.

Public Informational and Educational Programming

As part of the overall citizen informational and educational programming to be conducted in the Whitewater and Rice Lakes communities, residents and visitors in the vicinity of the Lake should be made aware of the value of the ecologically significant areas in the overall structure and functioning of the ecosystems of the Lakes. Specifically, informational programming related to the protection of ecologically valuable areas in and around the Lake should focus on the need to minimize the spread of nuisance aquatic invasive species, such as purple loosestrife and Eurasian water milfoil.

With respect to aquatic plants, distribution of posters and pamphlets, available from the UWEX and the 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 is recommended. Currently, many lake residents seem to view all aquatic plants as "weeds" and residents often spend considerable time and money removing desirable plant species from a lake without considering their environmental impact. Inclusion of specific public informational and educational programming within the activities of the Towns of Whitewater and Richmond and the WRLMD is recommended. These programs should focus on the value and 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. These programs can be incorporated into the comprehensive informational and educational programs that also would include information on related topics, such as water quality, recreational use, fisheries, and onsite sewage disposal systems. The District also should consider participating in the UWEX-sponsored "Clean Boats-Clean Waters" Program.

Educational and informational brochures and pamphlets, of interest to homeowners and supportive of the lake management program, are available from the UWEX, the WDNR, the Walworth County Offices, and many Federal government agencies. These brochures could be provided to homeowners through local media, direct distribution, or targeted library/civic center displays. Alternately, they could be incorporated into the newsletters produced and distributed by the WRLMD. Many of the ideas contained in these publications can be integrated into ongoing, larger-scale activities, such as anti-littering campaigns, recycling drives, and similar pro-environment activities.

Other informational programming offered by the WDNR, Walworth County, and the UWEX Lakes Program, such as the Project WET (Water Education Training) curriculum, can contribute to an informed public, actively involved in the protection of ecologically valuable areas within the area tributary to Whitewater and Rice Lakes. Citizen monitoring and awareness of the positive value of native aquatic plant communities are important opportunities for public informational programming and participation that are recommended for the Lake.

Lake Management District Board Continuing Education

As part of their commitment to the effective managing of Whitewater and Rice Lakes, the WRLMD board members should avail themselves of opportunities to learn about current developments and issues involving lake management. There are numerous publications, writings, newsletters, seminars and conventions available through governmental, educational and other organizations and agencies dealing with the subject of lake management. UW-SP, Walworth County, UWEX, the Wisconsin Association of Lakes (WAL), the North American Lake Management Society (NALMS), and WDNR, all produce written material and conduct meetings and seminars dealing with lake management issues. Publications, such as *Lake Tides*, published by the Wisconsin Lakes Partnership and available from UWEX, are also readily available and deal with a wide range of lake-related topics. Additionally, the statewide Lakes Convention, held annually (in Green Bay, Wisconsin), provides valuable opportunities to learn about important and timely developments in lake management and learn about lake issues from experts in their fields, while the Southern Wisconsin Lakes Workshop provides a locally relevant learning experience. Participation in activities that will further understanding of lake management issues is deemed an important part of the lake management experience.

SUMMARY

This plan documents the findings and recommendations of a study of the aquatic plant communities of Whitewater and Rice Lakes, requested by the WRLMD and conducted during 2008, that examined certain existing and anticipated conditions in the Lakes and their tributary areas as well as current and potential aquatic plant management problems on Whitewater and Rice Lakes. The plan sets forth recommended actions and management measures for the resolution of those problems. The recommended plan is summarized in Table 25 and shown on Map 12.

Whitewater and Rice Lakes were found to be eutrophic lakes of below average water quality. Consequently, Walworth County and the Towns of Whitewater and Richmond, together with the WRLMD, should support appropriate land management practices designed to reduce nonpoint source pollutant discharges in stormwater runoff into the Lake. Further, the Towns and WRLMD should promote appropriate shoreline management practices, including the use of riprap and vegetative buffer strips, where applicable. To this end, preservation of environmental corridor lands, especially within the shoreland areas situated immediately adjacent to the Lakes, is recommended.

The shoreland protection and aquatic plant management elements of this plan recommend actions be taken that would reduce human impacts on ecologically valuable areas in and adjacent to the Lake, encourage a biologically diverse community of native aquatic plants, and limit the spread of nonnative invasive plant species. The plan recommends the use of mechanical harvesting of nuisance plants in those areas where depth of water and bottom substrate are sufficient to support such activity, limited use of chemical herbicides mainly in areas where nuisance levels of nonnative invasive species are present, and manual harvesting aquatic plants around piers and docks with subsequent removal of cut material from the Lakes. Monitoring of invasive species populations on a three- to five-year basis also is recommended, to monitor changes in the aquatic plant community and assess effectiveness of aquatic plant management techniques.

The plan recommends regular participation in the UWEX CLMN volunteer water quality monitoring program with consideration of participation in the Expanded Self-Help Program, and periodic conduct of USGS, or equivalent, comprehensive water quality surveys at intervals. With regard to recreational uses of Whitewater and Rice Lakes, the plan recommends maintaining the public access site in a manner consistent with Chapter NR 1 standards and Chapter NR 7 guidelines, as well as maintaining signage regarding aquatic and other invasive species.

The conduct of a regular informational program, focusing on providing riparian residents and lake users with an improved understanding of the lake ecosystem, is recommended as part of the WRLMD annual meeting, supplemented with periodic informational mailings and articles in the District newsletter. For example, additional options regarding household chemical use, lawn and garden care, onsite sewage disposal system operation and maintenance, shoreland protection and maintenance, and recreational use of the Lake could be presented and promoted. Finally, the recommended plan includes continuation of an ongoing program of public information and education, made available to riparian property owners, thereby providing riparian residents with alternatives to traditional and other lake management-related events, and educational opportunities.

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

Table 25

RECOMMENDED MANAGEMENT PLAN ELEMENTS FOR WHITEWATER AND RICE LAKES

Plan Element	Subelement	Management Measures	Management Responsibility
Aquatic Plant Management Measures	Aquatic Plant Management	Conduct periodic in-lake reconnaissance surveys of aquatic plant communities and update aquatic plant management plan every three to five years	WRLMD
		Mechanically harvest nuisance plants pursuant to Chapter NR 109 permit requirements to maintain boating access, promote public safety, enhance angling opportunities, and encourage growths of native plants Limit the use of aquatic herbicides pursuant to Chapter NR 107 permit requirements for control of nuisance nonnative aquatic plant growths where necessary; specifically target purple loosestrife, Eurasian water milfoil and curly leaf pondweed[a] Encourage growths of native plants in and around Whitewater and Rice Lakes; use vegetated buffer strips along shorelines pursuant to Chapter NR 328 guidelines as necessary	WDNR and WRLMD
		Monitor invasive species populations Conduct additional periodic monitoring of the aquatic plant community for the early detection and control of future-designated nonnative species that may occur	WDNR, WRLMD, and private landowners
		Manually harvest around piers and docks as necessary, pursuant to Chapter NR 109 permit requirements[b] Collect floating plant fragments from shoreland areas to minimize rooting of Eurasian water milfoil and deposition of organic materials in Lake	Private landowners
Ancillary Management Measures	Shoreline Protection Management	Maintain existing shoreline structures and repair as necessary using vegetative means insofar as practicable; reconstruction may require WDNR Chapter 30 permits	Walworth County, Towns of Whitewater and Richmond, WDNR, and private landowners
	Water Quality Management	Continue participation in UWEX CLMN program and consider participation in the Expanded Self-Help, and periodic participation in U.S. Geological Survey TSI or similar programs	UWEX, USGS/UW-SP, WRLMD
	Recreational Use Management	Maintain recreational boating access from the public access site pursuant to Chapter NR 1 and Chapter NR 7 guidelines Maintain signage at public access sites regarding invasive species and UWEX Clean Boats-Clean Waters Program; provide disposal containers for disposal of plant material removed from watercraft	WDNR, UWEX, Town of Whitewater
	Public informational and educational programming	Continue to provide informational material and pamphlets on lake-related topics, especially the importance of aquatic plants and the protection of ecologically significant areas; consider offering public informational programming on topics of lake-oriented interest and education	WRLMD, GWLPOA, WDNR, and UWEX
		Encourage inclusion of lake studies in environmental curricula (e.g., Pontoon Classroom, Project WET)	Area school districts, UWEX, WDNR, and WRLMD
		Encourage riparian owners to monitor their shoreline areas as well as open-water areas of the Lake for new growths of nonnative plants and report same immediately to WRLMD	WRLMD

Table 25 (continued)

Plan Element	Subelement	Management Measures	Management Responsibility
Ancillary Management Measures (continued)	Lake district board continuing education	Maintain awareness of current developments in the area of lake management through informative publications such as “Lake Tides” (available free through UWEX) and attendance at lake education conventions, workshops, and seminars	WRLMD

NOTE: The following abbreviations have been used:

GWLPOA = Greater Whitewater Lake Property Owners Association
WRLMD = Whitewater-Rice Lakes Management District
WDNR = Wisconsin Department of Natural Resources
UWEX = University of Wisconsin-Extension Wisconsin Lakes Partnership
USGS = U.S. Geological Survey
UW-SP = University of Wisconsin-Stevens Point Water and Environment Laboratory
TSI = Trophic State Index water quality monitoring program
CLMN = Citizen Lake Monitoring Network
Project WET = Water Education Training

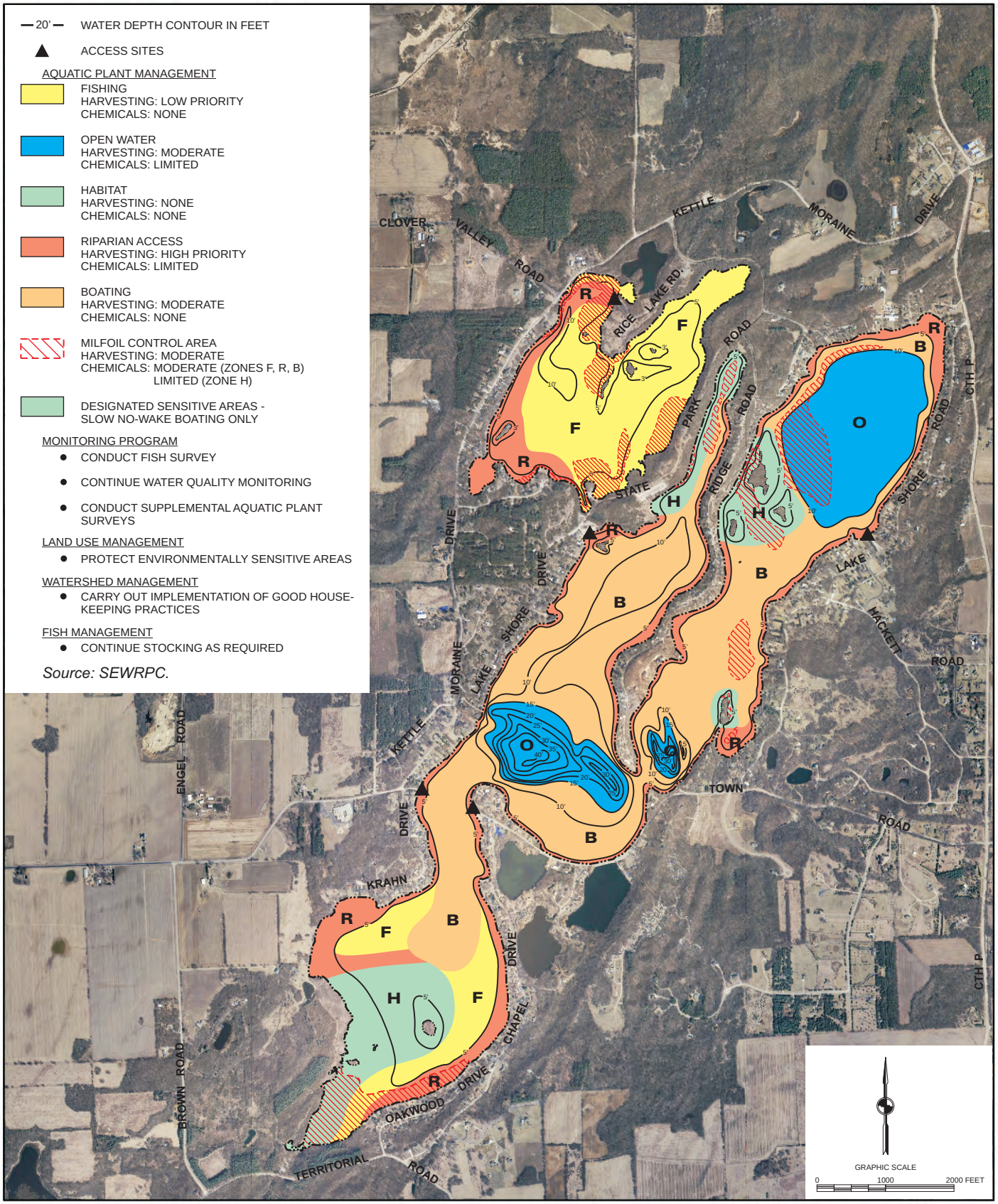
[a]*Use of aquatic herbicides requires a WDNR permit pursuant to Chapter NR 107 of the* Wisconsin Administrative Code.

[b]*Manual harvesting beyond a 30- foot linear-width of shoreline, outside of designated Chapter NR 107 sensitive areas, is subject to WDNR individual permitting pursuant to Chapter NR 109 of the* Wisconsin Administrative Code.

Source: SEWRPC.

Map 12

RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN FOR WHITEWATER AND RICE LAKES



APPENDICES

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Appendix A

REPRESENTATIVE ILLUSTRATIONS OF AQUATIC PLANTS FOUND IN WHITEWATER AND RICE LAKES

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Bushy Pondweed (*najas flexilis*)

Coontail (*ceratophyllum demersum*)

Curly-Leaf Pondweed (*potamogeton crispus*)
Exotic Species (nonnative)

Eurasian Water Milfoil (*myriophyllum spicatum*)
Exotic Species (nonnative)

Flat-Stem Pondweed (*potamogeton zosteriformis*)

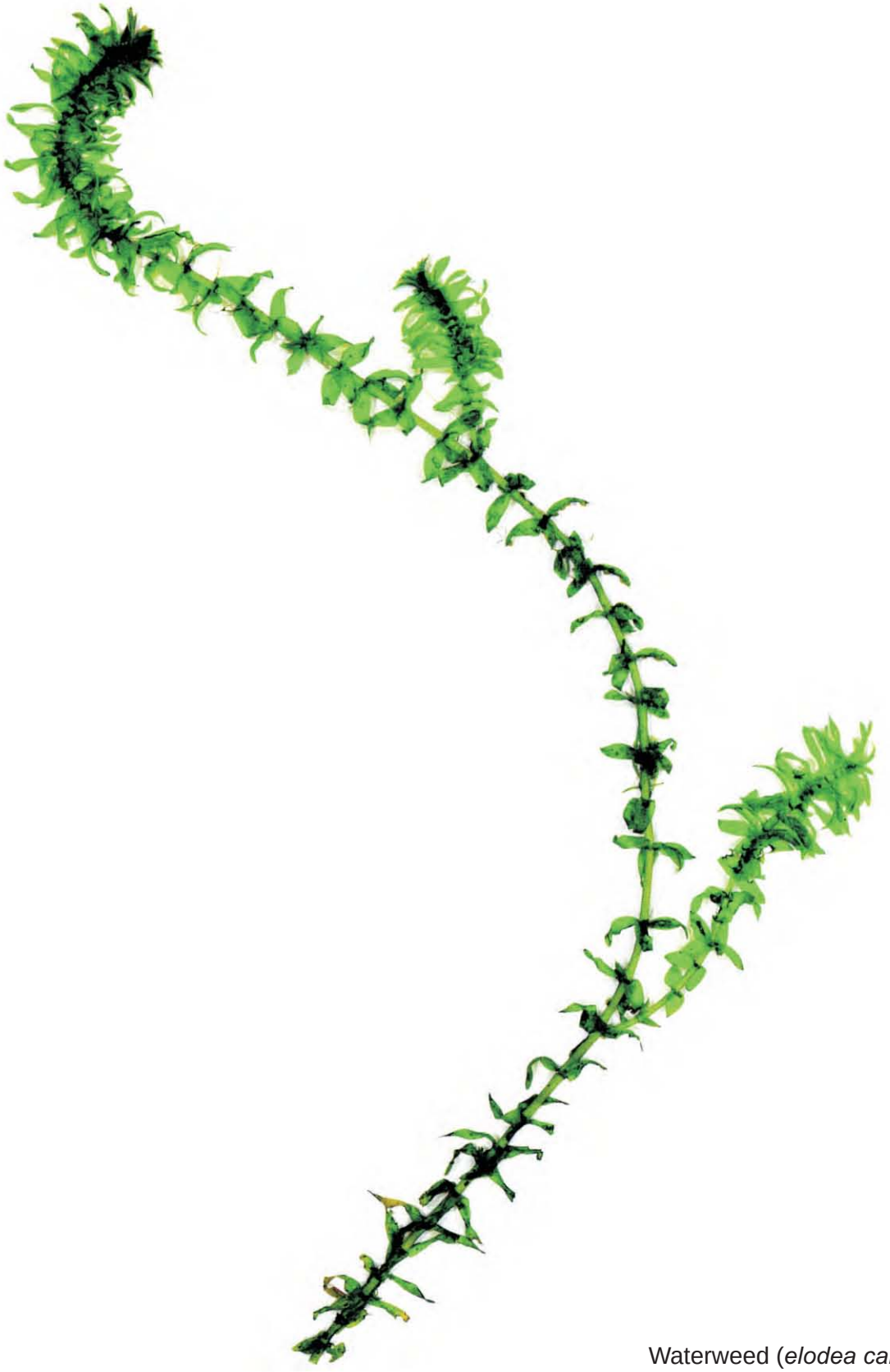
Muskgrass (*chara vulgaris*)

Native Water Milfoil (*myriophyllum* sp.)

Sago Pondweed (*potamogeton pectinatus*)

Water Smartweed (*polygonum amphibium*)

Water Stargrass (*zosterella dubia*)



Waterweed (*elodea canadensis*)

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Appendix B

TOWN OF RICHMOND BOATING ORDINANCE APPLICABLE TO WHITEWATER LAKE

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Town Ordinances

Chapter 58 WATERWAYS*

***Cross references:** Water patrol, § 2-206 et seq.; buildings and building regulations, ch. 10; parks and recreation, ch. 34; streets, sidewalks and other public places, ch. 42; vegetation, ch. 54.

ARTICLE I. IN GENERAL

Sec. 58-1. State boating and water safety laws adopted.

The statutory provisions describing and defining regulations with respect to water traffic, boats, boating and related water activities in the following enumerated sections of the statutes, exclusive of any provisions therein relating to the penalties to be imposed or the punishment for violation of the statutes, are hereby adopted and by reference made a part of this article as if fully set forth. Any act required to be performed or prohibited by the provisions of the statutes incorporated by reference in this article is required or prohibited by this section as follows:

Sec. 58-131 Intent

Sec. 58-132 Applicability; Enforcement

Sec. 58-133 Forfeitures and deposits.

Any reference in the index and/or Chapter headers shall be indicated as "reserved".

Section 2. All ordinances of a general and permanent nature enacted on or before July 9, 2002, and not included in the Code or recognized and continued in force by reference therein, are repealed.

Section 3. The repeal provided for in section 2 hereof shall be construed to revive any ordinance or part thereof that has been repealed by a subsequent ordinance that is repealed by this ordinance.

Section 4. Unless another penalty is expressly provided, every person convicted of a violation of any provision of the Code or any ordinance rule or regulation adopted or issued in pursuance thereof shall be punished by a fine upon conviction of such violation, forfeit not less than $5.00 nor more than $500.00 together with the costs of prosecution, and in default of payment of the forfeiture and costs of prosecution shall be imprisoned in the county jail until such forfeiture and costs are paid but not to exceed 90 days. Each violation and each day a violation continues or occurs shall constitute a separate offense. Nothing in the ordinance shall preclude the town from maintaining any appropriate action to prevent or remove a violation of any ordinance. In addition to the above, the town may enforce the judgment in the same manner as a judgment in an ordinary civil action. The penalty provided by this section, unless another penalty is expressly provided, shall apply to the amendment of any Code section, whether or not such penalty is reenacted in the amendatory ordinance.

Section 5. The Town Board having reviewed the Code as prepared by the Municipal Code Corporation hereby adopts the following changes and/or additions:

Added as an addition to the Ordinances as passed above is the following addition:

TABLE INSET:

Wisconsin Statutes	
Placing illegal fill, sand blanket or structure or six months or both.	30.12
Obstruct navigable water.	30.15
Failure to display registration number or decal on boat.	30.523(2) or (3)
Operate boat between sunset and sunrise without required lights.	30.61
Moored boats and structures beyond 200 feet from shore without lights.	30.61(6)(a)
Operate a personal watercraft from sunset to sunrise.	30.61(10)
Failure to provide proper number of personal floatation devices (PFD).	30.62(3)
Fail to wear a personal floatation device on a personal watercraft.	30.62(3)(b)
Failure to have required fire extinguishing equipment aboard.	30.62(4)
Operate at speed greater than slow no wake on lakes 50 acres or less.	30.635
Fail to stop for officer.	30.64(3)
Improper passing when meeting "head to head."	30.65(1)(a)
Failure to yield right-of-way.	30.65(1)(b)
Failure to yield right-of-way to sailboat or rowboat.	30.65(1)(d)
Failure to yield right-of-way when overtaking or passing.	30.65(1)(e)
Unreasonable or imprudent speed.	30.66(1)
Operate at speed in excess of posted notice.	30.66(2)
Operate motorboat within 100 feet of dock, raft or pier at a speed in excess of slow no wake speed.	30.66(3)
Operate a personal watercraft greater than slow no wake speed within 100 feet of another boat.	30.66(3)(b)
Creating hazardous wake or wash.	30.68(4)
Operating in circular course.	30.68(5)
Riding on decks or gunwales.	30.68(6)
Illegal mooring buoys (daily).	30.68(8m)
Overloading.	30.68(9)
Operating boat towing water skier without observer.	30.69(1)(a)
Operating boat towing water skier between sunset & sunrise.	30.69(1)(a)
Operate a personal watercraft not designed for three people while towing a water skier.	30.69(1m)(c)
Water skiing, within 100 feet of restricted area.	30.69(3)
Within 100 feet of a personal watercraft.	30.69(3)(b)
Fail to render aid at boating accident or 0--6 months or both.	30.67(1)
Operate boat in reckless or negligent manner or 0--6 months or both.	30.68(2)
Operate a motorboat while intoxicated (B-10). (Second offense within five years, and five days to six months.) (Third or more offenses within five years, and 30 days to one year.)	30.681(1)(a)
Operate motorboat with alcohol concentration above 0.10 percent (B-10). (Second offense within five years, and five days to six months.) (Third or more offenses within five years, and 30 days to one year.)	30.681(1)(b)
Cause injury by intoxicated operation of motorboat 30 days to one year.	30.681(2)
Refuse to take test, intoxicated motorboat operation (B-36) (Second offense within five years and five days to three months.) (Third or more offenses within five years, and 30 days to one year.)	330.684(5)

Sec. 58-2. Adoption of state bond schedule.

The town board does hereby adopt the state January 1, 1988, bond schedule for violation of this chapter.

Sec. 58-3. Citation; nature, issuance, release of accused.

(a) *Nature.* A citation under this section is a directive, issued by a law enforcement officer, that a person appear in court and answer charges. A citation is not a criminal complaint and may not be used as a substitute for a criminal complaint.

(b) *Authority to issue; effect.* A law enforcement officer may issue a citation to any person whom he has reasonable grounds to believe has committed a violation of this chapter. A citation may be issued in the field or at the headquarters or precinct station of the officer instead of or subsequent to a lawful arrest. If a citation is issued, the person cited shall be released on his own recognizance. In determining whether to issue a citation, the law enforcement officer may consider whether:

(1) The accused has given proper identification.

(2) The accused is willing to sign the citation.

(3) The accused appears to represent a danger of harm to himself, another person or property.

(4) The accused can show sufficient evidence of ties to the community.

(5) The accused has previously failed to appear or failed to respond to a citation.

(6) Arrest or further detention appears necessary to carry out legitimate investigative action in accordance with law enforcement agency policies.

(c) *Contents.* The citation shall do all of the following:

(1) Identify the offense and section which the person is alleged to have violated, including the date, and if material, identify the property and other persons involved.

(2) Contain the name and address of the person cited, or other identification if that cannot be ascertained.

(3) Identify the officer issuing the citation.

(4) Direct the person cited to appear for his initial appearance in a designated court, at a designated time and date.

(d) *Service.* A copy of the citation shall be delivered to the person cited, and the original must be filed with the district attorney.

(e) *Review by district attorney.* If the district attorney declines to prosecute, he shall notify the law enforcement agency which issued the citation. The law enforcement agency shall attempt to notify the person cited that he will not be charged and is not required to appear as directed in the citation.

(f) *Citation no bar to criminal summons or warrant.* The prior issuance of a citation does not bar the issuance of a summons or a warrant for the same offense.

(g) *Preparation of form.* The judicial conference shall prescribe the form and content of the citation under Wis. Stats. § 758.171.

Sec. 58-4. Failure of defendant to appear.

(a) If the person so arrested for violation of this chapter and released fails to appear personally or by an authorized attorney or agent before the court at the time fixed for the hearing, the money deposited by the accused pursuant to the provisions in section 58-5 shall be retained and used for the payment of the forfeiture, which forfeiture may be imposed either with or without cost as determined by the court after the ex parte hearing upon the accused. The excess, if any, shall be returned to the person who makes the deposit upon his making application for such excess. If the accused is found not guilty, then the entire amount of the deposit shall be returned to the depositor.

(b) Any person violating any of the terms of this chapter shall be subject to arrest whether at the time of the arrest he is on the waterways or upon the shore, and any water patrol office may pursue the offender ashore to enforce the terms of this chapter.

Sec. 58-5. Bond.

The law enforcement officer or any town police officer may accept money or bond deposits from any person charged with a violation of this chapter, and upon receipt of the bond shall issue a receipt for the bond received to the person. The law enforcement officer or town police officer or the county court shall deliver forfeited bond deposits to the town treasurer upon order of the county court and within seven days after the court issues the order.

Sec. 58-6. Lake accesses.

(a) *Intent.* It is the intent of this section to provide for safe public use of the accesses held in trust by the town and to preserve the natural resources in these areas.

(b) *Penalties.* Citations for violations of this section shall follow the procedure listed in Wis. Stats. §§ 66.119 and 66.12. Cash deposit for violation shall be a minimum of $35.00 for the first violation and shall not exceed $200.00 for succeeding offenses.

(c) *Improvements.* As provided in Wis. Stats. § 236.16, nothing in this section shall require the town to improve the land provided for public access.

(d) *General use.* The general public may use the accesses for getting fishing, boating and recreational equipment to the lake on those accesses where terrain and soil conditions make possible safe and reasonable movement of such equipment from the nearest public highway to the lake. No use of the lake access that is in violation of state, federal or county statutes shall be permitted.

(e) *Special uses.* Special uses of the lake accesses shall include but not be limited to: research groups, weed harvesting and chemical treatment operators, sea wall construction operators, and heavy equipment operators.

(f) *Special use permits.*

(1) Special use operators shall file with the town clerk an application for a special lake accesses use permit. Such application shall describe the date of the beginning and ending of the operation, the special equipment to be used, provisions for public safety provided, evidence of liability insurance adequate to cover all possible accidents or damage to other persons, equipment or to terrain or vegetation on the access, provision for restoring the access to its condition at the start of the operation, evidence of state, county or federal permits required, an agreement to cease operation and remove equipment within 48 hours of an order of the town board, and the nature of and length of time any materials will be stored on the access. The town board may require a bond to be posted by the applicant for possible costs in restoring the site to its condition prior to the special use. The town may require the applicant to sign a statement freeing the town from liability to other users while the special use is in progress or as a result of that special use.

(2) The town board in open meeting shall review the application for special use of the accesses. The town board shall approve or disapprove the application. In the event of approval, the town board will designate which accesses may be used, the time of each use and shall direct the clerk to issue the permit. This permit must be displayed on the accesses while the work is in progress. As the work progresses, the town board may inspect or cause to be inspected, the operation. If upon inspection the operation is not deemed to be in the public interest or violates any town ordinance or any of the terms or conditions of the permit, it may require the operator to cease and desist in the operation and restore the accesses to the condition that existed at the start of the operation. The town board may require the operator to surrender his permit for the operation.

(g) *Parking.* Parking shall be permitted on the access in designated areas only between the hours of 6:00 a.m. to 11:00 p.m. If parking areas are not designated, all parking shall be done in such a manner that the public may have unimpeded access to the lake at all times. The town may designate no parking areas when such areas are in the best public interest. Stopping or standing a vehicle on the access shall be only for short periods of time and shall be done in a sharing manner with other access users.

(h) *Storage.* Storage of any material, equipment, weeds or bog material shall be for a minimal length of time. Any storage shall be allowed only after a special use permit has been issued to the person needing to store materials on the access in order to perform lake-oriented services. Such permit shall be for the shortest possible storage period. Materials stored on the lake accesses shall be only of those materials necessary for lake projects such as, but not limited to, weed harvesting, bog removal, chemicals for authorized treatment of aquatic nuisances, materials for erosion and eutrophication control, and navigation and traffic control devices and research equipment.

(i) *Alteration and encroachment.* No person shall alter the natural terrain of the access by drainage, planting or cultivating vegetation without special permit issued by the town board after acquiring assurance in writing from state and county agencies that such alteration is not in violation of state and county statutes and ordinances. No person shall encroach upon any access by alteration of boundaries, construction of buildings, drainage of liquids, or deposition of solid waste materials.

Sec. 58-7. Boat launching.

(a) *Purpose and intent.* The purpose and intent of this section is to promote the public health, safety and general welfare of the people of the town by setting rules for the use of the town-owned and unmanned boat launches on the northwest shore of Turtle Lake, the south shore of Lake Lorraine or the south shore of Whitewater Lake.

(b) *Activities regulated.* At any of the boat launches referred to in subsection (a) of this section, it shall be unlawful for any person to:

(1) Dock or moor a boat for any period of time longer than is necessary to launch a boat into or remove a boat from the lake;

(2) Use these areas for the purpose of camping, sleeping or living;

(3) Start or maintain any fires, including campfires or barbecues;

(4) Place, deposit or leave upon such grounds any paper, garbage, refuse, trash or other discarded thing, substance or article;

(5) Park vehicles or trailers overnight;

(6) Use the boat launching area on such premises for swimming.

(c) *Penalty.* Any person violating the terms of this section shall forfeit not less than $50.00 nor more than $500.00, together with the costs of prosecution thereof, and in default of payment of such forfeiture and costs of prosecution shall be imprisoned in the county jail until such forfeiture and costs are paid, but not exceeding 30 days.

Secs. 58-8--58-70. Reserved.

ARTICLE II. TURTLE LAKE

Sec. 58-71. Repeal of conflicting ordinances.

All ordinances regulating water traffic, boats or water sports upon the waters covered by this article and all ordinances and parts of ordinances in conflict with this article heretofore enacted by the town, are hereby repealed.

Sec. 58-72. Intent.

The intent of this article is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public rights and interests and the capability of the water resource.

Sec. 58-73. Applicability and enforcement.

The provisions of this article shall apply to the waters of Turtle Lake lying within the corporate limits of the town. The provisions of this article shall be enforced under the jurisdiction of the town board.

Sec. 58-74. Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Boat means every description of watercraft other than a seaplane on the water.

Motorboat means any boat propelled by machinery.

Operate means, when used with reference to a motorboat or boat, to navigate, steer, sail, row or otherwise to move or exercise physical control over the movement of such boat.

Owner means the person who has lawful possession of a boat by virtue of legal title.

Cross references: Definitions generally, § 1-2.

Sec. 58-75. Capacity plate on boat.

(a) Every vessel less than 26 feet in length and designed to carry two or more persons shall if made or sold in this state have affixed permanently thereto a capacity plate.

(b) A capacity plate shall bear the following information:

(1) The total weight of persons, gear and other articles placed aboard which the vessel is capable of carrying.

(2) The recommended number of persons commensurate with the weight capacity of the vessel and the presumed weight in pounds of each such person. In no case shall such presumed weight be less than 150 pounds per person.

(3) Clear notice that the information appearing on the capacity plate is applicable under normal conditions only.

(4) In the case of vessels designed for use with outboard motor, the maximum horsepower of the motor the vessel is designed to accommodate. In this case, also the weight of the motor is considered to be part of the weight capacity.

Sec. 58-76. Operation of unnumbered boats prohibited.

No person may operate, and no owner may give permission for the operation of, any motorboat or any sailboat over 12 feet in length on the waters of this state unless the motorboat or sailboat either is covered by a valid certificate of number issued pursuant to this chapter or is exempt from the numbering requirements.

Sec. 58-77. Certificate of number.

(a) A motorboat principally used in this state shall be numbered in this state.

(b) Numbering periods shall run for three years, commencing April 1 of the year in which the certificate is issued and expiring on March 31 of the third year thereafter.

(c) A fee of $4.50 shall be paid to the department for the issuance of a certificate of number or renewal thereof.

Sec. 58-78. Certificate number to be displayed on boat; certificate to be carried.

(a) Upon being issued a certificate of number and decals, the owner of the boat shall paint on or attach the identification number and attach the decals to each side of the bow.

(b) The certificate of number shall be available at all times for inspection on the boat for which issued, whenever such boat is in use.

Sec. 58-79. Transfer of ownership of number.

(a) Whenever the owner of a boat covered by a certificate of number transfers all or any part of his interest in such boat, he shall notify the department of such transfer and return the certificate of registration to the department.

(b) The transferee shall make application for a new certificate of number as prescribed by the department.

Sec. 58-80. Notice of abandonment or destruction of boat or change of address.

(a) If a boat covered by a certificate of number is destroyed or abandoned, the owner shall notify the department within 15 days.

(b) Whenever any person moves, after applying for or receiving a certificate of number, he shall notify the department in writing of both his old and new address within 15 days.

Sec. 58-81. Classification of motorboats.

Motorboats shall be classified as follows:

(1) Class A: Those motorboats less than 16 feet.

(2) Class 1: Those motorboats 16 feet or over but less than 26 feet.

(3) Class 2: Those motorboats 26 feet or over but less than 40 feet.

(4) Class 3: Those motorboats 40 feet or over.

Sec. 58-82. Lighting equipment.

(a) *Lights required; prohibited*

(1) No person shall operate any motorboat at any time from sunset to sunrise unless such motorboat carries the lighting equipment required by this section and such equipment is lighted.

(2) No person shall exhibit from or on any motorboat, when under way at any time from sunset to sunrise, any light which may be mistaken for those required by this section.

(b) *Classes A and 1 motorboats.* All motorboats of classes A and 1 when under way at any time from sunset to sunrise shall have lighted the following:

(1) One lamp aft showing a white light all around the horizon.

(2) One combined lamp in the fore part of the motorboat and lower than the white light aft, showing green to starboard and red to port and so fixed that each side of the combined lamp throws a light from directly ahead to two points abaft the beam on its respective side.

(c) *Classes 2 and 3 motorboats.* All motorboats of classes 2 and 3 when under way at any time from sunset to sunrise have lighted the following lamps:

(1) One lamp in the fore part of the boat showing an unbroken white light over an arc of the horizon of 20 points and fixed to throw light from directly ahead to two points abaft the beam.

(2) One lamp aft showing a white light all around the horizon and higher than the lamp forward.

(3) Two side lamps, green to starboard and red to port, both fitted with inboard screens to prevent them from being seen across the bow and both constructed to show an unbroken light over an arc of ten points and fixed to throw the light from directly ahead to two points abaft the beam on its side.

(d) *Sailboats with motors.* Sailboats equipped with motors and propelled in whole or part by such motors must comply with subsections (b) or (c) of this section according to their classification. Whenever such a sailboat is being propelled entirely by sail at any time from sunset to sunrise, it shall show the colored lights which fit its class but not the white lights and shall carry a lantern showing a white light in time to avert collision.

(e) *Sailboats and rowboats without motors.*

(1) Every boat propelled by muscular power and every sailboat not equipped with a motor, when under way at any time from sunset to sunrise, shall carry a lantern, showing a white light in time to avert collision.

(2) Moored, anchored and drifting boats and other fixed and floating structures outside of designated anchorages or beyond 200 feet from the shoreline shall be lighted from sunset to sunrise by a white light visible all around the horizon.

(f) *Visibility.* Every white light prescribed by this section shall be of such character as to be visible at a distance of at least two miles on a dark night with clear atmosphere. Every colored light shall be visible at one mile on a dark night with clear atmosphere.

Sec. 58-83. Other equipment.

(a) No person shall operate any boat on the waters of this state unless such boat is equipped as required by this section.

(b) The engine of every motorboat shall be equipped with a muffler.

(c) Every boat shall carry at least one life preserver or other device of the sort prescribed by the regulations for each person on board or being attended by such boat.

(d) Every motorboat, except outboards of open construction, shall be provided with such fire extinguishers as shall be capable of extinguishing burning gasoline. Specifications shall be as prescribed by rules of the department.

(e) Every motorboat with an inboard motor using gasoline shall have the carburetors fitted with a device for arresting backfire. Specifications shall be as prescribed by rules of the department.

(f) Every motorboat, except open boats, fueled by a volatile liquid shall be provided with a ventilation system capable of removing explosive gases.

(g) Every motorboat equipped with storage batteries shall be provided with suitable supports and shields for such batteries.

Sec. 58-84. Patrol boats exempt from certain traffic regulations.

The operator of a duly authorized patrol boat, when responding to an emergency call, or when in pursuit of an actual or suspected violator of the law, need not comply with state or local regulations fixing maximum speed limits and, if a siren is being sounded, need not comply with state, or local boat traffic regulations governing meeting, passing or right-of-way.

Sec. 58-85. Traffic rules.

Every person operating a boat shall comply with the following traffic rules:

(1) When two motorboats are approaching each other "head and head" or so nearly so as to involve risk of collision, each boat shall bear to the right and pass the other boat on its left.

(2) When two motorboats are approaching each other obliquely or at right angles, the boat which has the other on its right shall yield right-of-way to the other.

(3) When a motorboat and a boat propelled entirely by sail or muscular power are proceeding in such a direction as to in involve risk of collision, the motorboat shall yield the right-of-way to the other boat.

(4) A boat may overtake and pass another boat on either side if it can be done with safety but the boat doing the overtaking shall yield the right-of-way to the boat being overtaken.

(5) A boat granted the right-of-way by this section shall maintain its course and speed, unless to do so would probably result in a collision.

Sec. 58-86. Speed restrictions.

(a) No person shall operate a motorboat at a speed greater than is reasonable and prudent under the conditions. The speed of a motorboat shall be so controlled as to avoid colliding with any person, boat or other conveyance.

(b) In addition to complying with subsection (a) of this section, no person shall operate a motorboat at a speed in excess of posted notice as established by regulatory markers.

(c) No person may operate a motorboat within 100 feet of any dock: raft, pier or buoyed restricted area on any lake at a speed in excess of slow no wake speed.

Sec. 58-87. Accidents and accident reports.

(a) *Duty to assist.* Insofar as he can do so without serious danger to his own boat or to persons on board, the operator of a boat involved in an accident shall stop his boat and render assistance to other persons involved and shall give his name and address and identification of his boat to any person injured and to the owner of any property damaged.

(b) *Duty to report.*

(1) If the accident results in death or injury to any person or total property damage amounting to $100.00, every operator of a boat involved shall give

notice of the accident to a conservation warden or law enforcement officer and file a written report thereof with the department within ten days.

(2) If the operator is physically incapable of complying with subsection (b)(1) of this section and there was another occupant in the boat at the time of the accident the other occupant shall comply.

Sec. 58-88. Distress signal flags.

(a) Insofar as is possible the operator of a boat observing an orange flag 18 inches by 30 inches shall render to the boat or person displaying the signal such assistance as may be practical and necessary.

(b) No person shall display such a flag unless such person is in need of assistance to prevent bodily injury or destruction of property.

Sec. 58-89. Prohibited operation.

(a) *Under influence of intoxicant or controlled substance.* No person may operate a boat or use water skis or a similar device upon the waters of this state while under the influence of an intoxicant or a controlled substance.

(b) *Careless, negligent or reckless operation.* No person may operate a boat or use water skis or a similar device upon the waters of this state in a careless, negligent or reckless manner so as to endanger the life or property of himself or another.

(c) *Operation by an incapacitated person.*

(1) No person shall knowingly permit a boat of which he is in charge to be operated by any person who by reason of physical or mental disability is incapable of operating such boat safely.

(2) No person under the age of ten years may operate a motorboat. Persons at least ten and less than 12 years of age may operate a motorboat only if they are either accompanied in the boat by a parent or guardian or a person at least 18 years of age designated by a parent or guardian. Persons at least 12 and less than 16 years of age may operate a motorboat of any horsepower; but only if they are either accompanied by a parent or guardian or a person at least 18 years of age designated by a parent or guardian, or are in possession of a certificate issued under Wis. Stats. § 30.74(1).

(d) *Creating a hazardous wake.*

(1) No person shall operate a motorboat so as to approach or pass another boat in such a manner as to create a hazardous wake or wash.

(2) An operator of a motorboat is liable for any damage caused by the wash or wake of such a motorboat.

(e) *Operation near other boats, swimmers and water skiers.* No person may operate a motorboat repeatedly in a circuitous course within 200 feet of another boat or a swimmer nor shall any boat or water skier operate closer than 100 feet to any skin diver's flag or swimmer.

(f) *Manner of riding.* No person operating a motorboat shall allow any person to ride or sit on the gunwales, tops of seat backs or sides or on the decking over the bow of the boat while underway.

(g) *Operation in swimming area prohibited.* No person shall operate a boat within a water area, which has been clearly marked by buoys or some other device as a swimming area.

(h) *Anchoring unattended boat.* No person may anchor any unattended boat, raft, float or similar structure in the traveled portion of any river or in any traffic lane.

(i) *Loading capacity.* No boat shall be loaded with passengers or cargo beyond its safe carrying capacity.

(j) *Motor capacity.* No boat shall be equipped with any motor beyond its safe power capacity.

(k) *Unnecessary sounding of horns, whistles, etc.* No person shall, unnecessarily sound a horn, whistle or other device on any boat while at anchor or under way.

(l) *Tampering with navigational aids.* No unauthorized person shall move, remove, molest, tamper with, destroy or attempt to destroy or moor or fasten a boat to any navigation aids or regulatory markers.

Sec. 58-90. Water skiing.

(a) No person may operate a motorboat towing a person on water skis, or similar device, unless there is in the boat a competent person in addition to the operator in a position to observe the progress of the person being towed. An observer shall be considered competent if he can in fact observe the person being towed and relay any signals to the operator. This observer requirement does not apply to motorboats classified as class A motorboats by the department, actually operated by the persons being towed and so constructed as to be incapable of carrying the operator in or on the motorboat. No person may engage in water skiing or similar activity at any time from sunset to sunrise. This restriction does not prevent restrictions of the hours of water skiing between sunrise and sunset by local ordinances enacted pursuant to Wis. Stats. § 30.77(3).

(b) There shall be no more than two persons using such tow lines as a means of water skiing or similar sport; the persons being towed must be equipped with an approved life jacket, or similar life saving device. No tow line shall exceed 75 feet in length.

(c) Any boat engaged in towing a person on water skis, aquaplane or similar device must conform to all sections of this article and, in addition, must operate in a counterclockwise pattern on the lake and inlet and outlet in the traffic lane.

Sec. 58-91. Skindiving.

(a) No person may engage in skindiving or, scuba diving in waters other than marked swimming areas or within 150 feet of shoreline unless the location of such diving is distinctly marked by a diver's flag, not less than 12 inches high and 15 inches long, displaying one diagonal white stripe three inches wide on a red background and high enough above the water to be clearly visible at a distance of 100 yards. Anyone so diving shall not rise to the surface outside a radius of 50 feet from such flag.

(b) No persons engaged in such diving shall interfere with anyone fishing, block any boat from proceeding to its destination, nor engage in such diving in established traffic lanes.

Sec. 58-92. Boats equipped with toilets.

No person shall operate any boat equipped with toilets on inland waters of this state unless the toilet wastes are retained for shore disposal by means of facilities constructed and operated in accordance with rules adopted by the department of health and social services.

Sec. 58-93. Traffic lane defined.

A traffic lane is established embracing the surface of Turtle Lake within the corporate limits of the town in its entirety, excepting therefrom that portion of the waters lying between the shoreline and a line parallel to and 175 feet from the shoreline and such greater distance as shall be necessary to clear projecting piers, wharfs and any other similar structures a distance of 100 feet from the projecting extremities thereof.

Cross references: Definitions generally, § 1-2.

Sec. 58-94. Speed restrictions.

(a) The maximum speed between the shore and the 175 feet from shoreline marked by buoys shall be slow no wake.

(b) All persons operating power driven boats upon the waters of Turtle Lake located in the town shall not operate such power driven boats at speed greater than slow no wake between the hours of 2:00 p.m. through 10:00 a.m. on weekends and holidays nor shall they operate at speed greater than slow no wake between the hours of 6:00 p.m. through 10:00 a.m. on any day.

(c) "Slow no wake" is defined as the slowest possible speed so as to maintain steerage.

Sec. 58-95. Swimming regulations.

(a) *Swimming from drifting boats prohibited.* No person shall swim from any boat unless such boat is anchored.

(b) *Distance from swimmer to base.* No person shall swim more than 175 feet from the shore or more than 50 feet from any pier, anchored raft or boat unless he is accompanied by a boat manned by a competent person trained in lifesaving techniques and having a ring buoy. Such boat shall stay reasonably close to and guard such swimmer. If there is more than one swimmer in the water, each shall be accompanied by a separate boat as described in this subsection.

(c) *Hours limited.* No person shall swim in the traffic lane as marked by buoys during the hours from sunset to sunrise.

Sec. 58-96. Water skiing regulations.

(a) No person shall operate a boat for the purpose of towing a water skier or engage in water skiing or other similar sport from 2:00 p.m. through 10:00 a.m. on weekends and holidays nor shall they do so from 6:00 p.m. through 10:00 a.m. on any other day.

(b) There shall be no more than two persons using such tow lines as a means of water skiing or similar sport; the persons being towed must be equipped with an approved life jacket, life belt or similar life saving device.

(c) Any boat engaged in towing a person on water skis, aquaplane or similar device must conform to all sections of this article.

(d) There shall be no water skiing, aquaplaning or similar sport, outside the traffic lane.

Sec. 58-97. Markers, navigation, mooring buoys; posting of article.

Duly appointed law officers are authorized and directed to place and maintain authorized markers, navigation aids and signs as shall be appropriate to advise the public of the provisions of this article and to post and maintain a copy of this article at all public access points within the jurisdiction of the town.

(1) *Standard markers.* All markers or buoys placed by any person upon the waters of the lake shall comply with the regulations of the state conservation commission.

(2) *Mooring, buoys.* Any person placing mooring buoys upon the waters of the lake shall make application for permit for such buoys, with the town clerk, stating the location of the buoy and the boat license number to correspond with the number on the buoy. Applications are to be approved by the town board. Such permit shall be for a three-year period at a fee of $3.00.

Sec. 58-98. Aircraft prohibited.

No aircraft of any kind capable of landing on water shall land, take off, or be berthed on the waters covered by this article except for emergency landing.

Sec. 58-99. Littering waters prohibited.

No person shall deposit, place or throw from any boat, raft, pier, platform or similar structure or from the shore; cans, bottles, debris, refuse, solid or liquid waste or paper on or into the water of the lake.

Cross references: Solid waste, ch. 38.

Sec. 58-100. Penalties and deposits.

(a) Any person violating section 58-1 shall be fined not more than $200.00 or imprisoned not more than six months or both.

(b) Any person violating any provision of this article for which a penalty is not provided by subsection (a) of this section shall be fined not more than $50.00 or imprisoned not more than 30 days, or both, for the first offense; and fined not more then $100.00 or imprisoned not more than 90 days, or both, upon conviction of the same offense a second or subsequent time within one year.

Secs. 58-101--58-130. Reserved.

ARTICLE III. WHITEWATER LAKE

Sec. 58-131. Intent.

It is the intent of this article to provide free access to Whitewater Lake for all users and further provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public needs and the capacity of the water resource. To this end, the Township of Whitewater and the Township of Richmond, Walworth County, Wisconsin, sets forth the provisions of this article.

Sec. 58-132. Applicability; enforcement.

(a) This article shall apply to the waters of Whitewater Lake and adjoining channels and lying within the corporate limits of the Towns of Richmond and Whitewater, Walworth County, Wisconsin. The provisions of this article shall be enforced by a patrol officer or officers appointed by and under the jurisdiction of the Towns of Richmond and Whitewater, Walworth County, Wisconsin.

(b) Officers patrolling the waters as part of a water safety patrol unit may stop and board any boat for the purpose of enforcing Wis. Stats. §§ 30.50--30.80 or any rules promulgated or ordinances enacted under Wis. Stats. §§ 30.50--30.80 and for conducting search and rescue operations, if the officers have reasonable cause to believe there is a violation of the sections, rules or ordinances or the stopping and boarding of any boat is essential to conduct a search and rescue operation.

Sec. 58-133. Forfeitures and deposits.

Any person who shall violate the provisions of this article and the provisions adopted by reference in section 58-1 shall upon conviction thereof, forfeit not more than $200.00 or less than $10.00 together with the costs of prosecution.